ALASKA

DEPARTMENT OF TRANSPORTATION

AND

PUBLIC FACILITIES

STANDARD

SPECIFICATIONS

FOR

HIGHWAY CONSTRUCTION

2020 Edition

Questions or Comments?

Should you have questions, comments, or suggestions regarding the specifications in this book, contact the Standard Specifications Engineer at the address below, or by phone at (907) 465-8962.

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PREFACE

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This book provides a compilation of approved Standard Specifications for use in the Department's highway construction contracts.

These Standard Specifications have been prepared and adopted under the authority of Alaska Statute 19.10.160 and conform as closely as practicable to the Guide Specifications for Highway Construction published by the American Association of State Highway and Transportation Officials.

These specifications are intended for use only with contracts designed in United States Customary (English) units.

These specifications will be incorporated by reference into each highway construction contract and will be supplemented, as necessary, by Standard Modifications and Special Provisions included in the contract being advertised for bids.

A summary of changes to this edition of the Standard Specifications for Highway Construction is available for information purposes only through the DOT&PF Statewide Design & Engineering Services Division. The information contained in the summary does not modify or supersede the contents of this book.

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DIVISION 100–GENERAL PROVISIONS

SECTION 101
DEFINITIONS AND TERMS

101-1.01 GENERAL. The following terms and definitions apply in these Specifications. If a term is not defined, the ordinary, technical, or trade meanings for that term shall apply, within the context in which it is used.

Titles and headings of sections, subsections, and subparts are intended for convenience of reference and will not govern their interpretation.

Cited publications refer to the most recent issue, including interim publications, in effect on the date of the Invitation To Bid, unless specified by year or date.

These Specifications are written to the Bidder or Contractor. Unless otherwise noted, all actions required by the specifications are to be performed by the Bidder, the Contractor, or the Contractor's agent.

Beginning in Division 200 we use imperative mood and active voice to communicate the Contractor's responsibilities in a direct and concise manner. Omission of words or phrases such as “a,” “an,” “the,” “the Contractor shall,” “unless otherwise specified,” or “unless otherwise directed” is intentional. Interpret the Contract as if they were included.

Beginning in Division 200 whenever anything is, or is to be, done, if, as, or, when, or where “acceptable, accepted, approval, approved, authorized, determined, designated, directed, disapproved, ordered, permitted, rejected, required, satisfactory, specified, submit, sufficient, suitable, suspended, unacceptable, unsatisfactory, or unsuitable,” the expression is to be interpreted as if it were followed by the words “by the Engineer” or “to the Engineer.”

101-1.02 ACRONYMS. Acronyms used in the Contract include the following (publications and plans are italicized):

AAC *Alaska Administrative Code*
AASHTO American Association of State Highway and Transportation Officials
ACI American Concrete Institute
AITC American Institute of Timber Construction
ANSI American National Standards Institute
AKOSH Alaska Occupational Safety and Health
AS *Alaska Statute*
ASDS *Alaska Sign Design Specifications*
ASME American Society of Mechanical Engineers
ASTM American Society for Testing & Materials
ATM *Alaska Test Method (see Alaska Test Methods Manual*)
ATSSA American Traffic Safety Services Association
AWPA American Wood Protection Association
AWG American Wire Gage
AWS American Welding Society
AWWA American Water Works Association
CFR *Code of Federal Regulations*
CRSI Concrete Reinforcing Steel Institute
DOLWD Alaska Department of Labor and Workforce Development
DOT&PF Alaska Department of Transportation and Public Facilities
EEI Edison Electrical Institute
EIA Electronic Industries Association
FHWA Federal Highway Administration

FM Factory Mutual
FOP Field Operating Procedure (see *Alaska Test Methods Manual*)
FSS Federal Specifications and Standards, General Services Administration
IMSA International Municipal Signal Association
ICEA Insulated Cable Engineers Association
ITE Institute of Transportation Engineers
MRP *Mining and Reclamation Plan*
MUTCD *Manual on Uniform Traffic Control Devices*
NEC *National Electrical Code*
NESC *National Electrical Safety Code*
NEMA National Electrical Manufacturers Association
SAE Society of Automotive Engineers
SSHC *DOT&PF Standard Specifications for Highway Construction*
SSPC Steel Structures Painting Council
SWPPP *Storm Water Pollution Prevention Plan*
UL Underwriters Laboratory
VAC Voltage Alternating Current
WAQTC Western Alliance for Quality Transportation Construction (see *Alaska Test Methods Manual*)

101-1.03 DEFINITIONS.

ADDENDA. Clarifications, corrections, or changes to the Plans, Specifications, or other Contract documents issued graphically or in writing by the Department after the advertisement but prior to bid opening.

ADVERTISEMENT. The public announcement, as required by law, inviting bids for specified work or materials.

AGREED PRICE. An amount negotiated between the Department and the Contractor after Contract award for additional work performed or additional materials supplied under the Contract.

ALASKA STANDARD PLAN. Detail drawing adopted by the Department for repetitive use, showing details to be used where appropriate. Alaska Standard Plans are adopted as Alaska's accepted standards, in accordance with AS 19.10.160(a), and for use in conformity with 12 AAC 36.185(a)(2).

ALASKA TEST METHODS MANUAL. The materials testing manual used by the Department. Contains Alaska Test Methods, WAQTC Test Methods, WAQTC FOPs for AASHTO Test Methods, and Alaska Standard Practices for evaluating test results, calibrating testing equipment.

AWARD. Acceptance of the successful bid by the Department. The award is effective upon execution of the Contract by the Contracting Officer.

BASE COURSE. One or more layers of specified material placed on a subbase or subgrade to support a surface course.

BID (OR PROPOSAL). The bidder's offer, on the prescribed forms, to perform the specified work at the prices quoted.

BID BOND. A type of bid guaranty.

BIDDER. An individual, firm, corporation, joint venture, or any acceptable combination of individuals and entities submitting a bid for the advertised work.

BID FORMS. Department-furnished forms that a bidder must complete and submit when making a bid in response to an advertised project. Bid forms may include a bid schedule, certification forms, acknowledgment forms, and other documents.

BID GUARANTY. The security furnished with a bid to guarantee that the bidder will enter into a contract if the Department accepts the bid.

BRIDGE. A structure, including supports, erected over a depression or an obstruction, such as water, highway, or railway; and having a track or passageway for carrying traffic or other moving loads and a length measured along the roadway center of more than 20 feet between undercopings of abutments or spring lines of arches or extreme ends of openings of multiple boxes. The length of a bridge structure is the overall length measured along the line of survey stationing between backs of abutment backwalls or between ends of the bridge floor.

CALENDAR DAY. Every day shown on the calendar, beginning and ending at midnight.

CHANGE ORDER. A written order by the Department to the Contractor making changes to the Contract, within its general scope, and establishing the basis of payment and time adjustment, if any, for the work affected.

COMPLETION DATE. The date on which all Contract work is specified to be completed.

CONSTRUCTION. Physical activity by the Contractor or any Subcontractor using labor, materials or equipment within the Project, or within material sources planned for use on the Project.

CONTINGENT SUM. A method for paying for a Contract bid item reserved by the Department for specified contingencies. The Contractor shall perform Contingent Sum work only upon the Directive of the Engineer. The basis of payment for Contingent Sum work shall be specified in the Contract or the Directive.

CONTRACT. The written agreement between the Department and the Contractor setting forth the obligations of the parties for the performance and completion of the work.

The Contract includes the Invitation To Bid, Bid Form, Standard Specifications, Standard Modifications, Special Provisions, Plans, Bid Schedule, Contract Forms, Contract Bonds, Addenda, and any Change Orders, Interim Work Authorizations, Directives, or Supplemental Agreements that are required to complete the work in an acceptable manner, all of which constitute one instrument.

CONTRACTING OFFICER (PROCUREMENT OFFICER). The person authorized by the Commissioner of the Department to enter into and administer the Contract on behalf of the Department. The Contracting Officer has authority to make findings, determinations, and decisions with respect to the Contract and, when necessary, to modify or terminate the Contract. The Contracting Officer is identified on the Invitation To Bid.

CONTRACT ITEM (PAY ITEM). A specifically described item of Contract work listed on the Bid Schedule or in a Change Order.

CONTRACTOR. The individual, firm, corporation, joint venture, or any acceptable combination of individuals and entities contracting with the Department for performance of the Contract.

CONTRACT TIME. The time allowed under the Contract, including authorized time extensions, for the completion of all work by the Contractor.

CONTROLLING ITEM. Any feature of the work considered at the time by the Engineer: (1) essential to the orderly completion of the work and (2) a feature which, if delayed, will delay the

time of completion of the Contract (such as an item of work on the critical path of a network schedule).

COST. Amounts actually incurred by the Contractor in the performance of the Contract that are (a) actually reflected in contemporaneously maintained accounting or other financial records and (b) supported by original source documentation. Costs are to be stated in U.S. dollars.

CULVERT. Any structure not classified as a bridge that provides an opening under the embankment.

DAY. Calendar day unless preceded by the word “working”.

DEPARTMENT. The State of Alaska Department of Transportation and Public Facilities.

DIGITAL SIGNATURE. An electronic signature that conforms to the Uniform Electronic Transactions Act, AS 09.80.010 et seq.

DIRECTIVE. A written communication to the Contractor from the Engineer enforcing or interpreting a Contract requirement or ordering commencement or suspension of an item of work already established in the Contract.

ELECTRONIC BID. A bid that a bidder (i) prepares on the Department’s bid forms accessed through the Department’s approved online bidding service and (ii) submits to the Department through use of that bidding service’s online submittal process.

ELECTRONIC MAIL (EMAIL). A system for sending messages from one person to another via telecommunications links between computers or terminals using dedicated software.

ENGINEER. The authorized representative of the Department's Contracting Officer. The Engineer is responsible for administration of the Contract.

EQUIPMENT. All machinery, tools, apparatus, and supplies necessary to preserve, maintain, construct, and complete the work.

EQUITABLE ADJUSTMENT. An increase or decrease in Contract price or time calculated according to the terms of this Contract.

EXTRA WORK. An item of work not provided for in the Contract as awarded but found essential by the Engineer for the satisfactory completion of the Contract within its intended scope.

HIGHWAY, STREET, OR ROAD. A general term denoting a public way used by vehicles and pedestrians, including the entire area within the right-of-way.

HOLIDAYS. State of Alaska legal holidays are:

1. New Year's Day - January 1
2. Martin Luther King, Jr. Day - Third Monday in January
3. Presidents' Day - Third Monday in February
4. Seward's Day - Last Monday in March
5. Memorial Day - Last Monday in May
6. Independence Day - July 4
7. Labor Day - First Monday in September
8. Alaska Day - October 18
9. Veteran's Day - November 11
10. Thanksgiving Day - Fourth Thursday in November
11. Christmas Day - December 25
12. Every Sunday

13. Every day designated by public proclamation by the President of the United States or the Governor as a legal holiday.

If a holiday listed above falls on a Saturday, Saturday and the preceding Friday are both legal holidays for officers and employees of the State. If the holiday falls on a Sunday, except (12) above, Sunday and the following Monday are both legal holidays.

INSPECTOR. The Engineer's representative authorized to make detailed inspections of Contract performance and materials.

INTERIM WORK AUTHORIZATION. A written order by the Engineer initiating changes to the Contract, within its general scope, until a subsequent Change Order is executed.

INVITATION TO BID. The advertisement for bids for all work or materials on which bids are required.

MAJOR CONTRACT ITEM. A Contract item for which the Contractor's bid amount is 5 percent or more of the total Contract award amount. Determination of a Major Contract Item is made at the time of Award.

MANUAL BID. A bid that a bidder (i) prepares on the Department's bid forms accessed either through the Department's approved online bidding service or obtained from the Department's Regional Contracts Office and (ii) submits to the Department in physical paper form by hand delivery, U.S. Mail, or courier service.

MATERIALLY UNBALANCED BID. A mathematically unbalanced bid that either (a) gives rise to a reasonable doubt that it will ultimately result in the lowest overall cost to the Department, even though it may be the lowest bid or (b) is so unbalanced as to be tantamount to allowing a significant advance payment.

MATERIALS. Substances specified for use in the construction of the project.

MATERIALS CERTIFICATION LIST (MCL). A list of materials for which certifications must be submitted to the Engineer. The MCL will also designate electrical products requiring listing by an approved independent electrical testing laboratory. The MCL is included in the Contract documents as an appendix.

MATHEMATICALLY UNBALANCED BID. A bid (a) where each pay item fails to carry its share of the cost of the work plus the bidder's overhead and profit, or (b) based on nominal prices for some pay items and enhanced prices for other pay items.

MEDIAN. The portion of a divided highway separating the traveled ways.

MINOR CONTRACT ITEM. A Contract item with a total value of less than 5 percent of the Contract award amount.

NOTICE OF INTENT TO AWARD. The written notice by the Department announcing the apparent successful bidder and establishing the Department's intent to award the Contract when all required conditions are met.

NOTICE TO PROCEED. Written notice to the Contractor to begin the Contract work.

ORIGINAL GROUND (OG). The ground surface prior to the start of work.

PATHWAY. A paved or unpaved path for multiple uses.

PAVEMENT STRUCTURE. The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute the traffic load to the roadbed.

PAYMENT BOND. The security furnished by the Contractor and the Contractor's Surety to guarantee payment of all persons who supply labor and material in prosecution of the work provided for in the contract.

PERFORMANCE BOND. The security furnished by the Contractor and the Contractor's Surety to guarantee performance and completion of the work provided for in the contract.

PLANS. The Department's contract drawings, profiles, typical cross sections, Alaska Standard Plans, and supplemental drawings or reproductions showing the location, character, dimensions, and details of the work.

PRECONSTRUCTION CONFERENCE. A meeting between the Contractor and the Engineer to discuss the project before the Contractor begins the work.

PROFILE. The vertical elevation of the surface of the layer at the location indicated. On a roadbed it is typically indicated at the longitudinal centerline of the top layer of pavement. On a material or fabrication it may be used to indicate a thickness of material or thickness of a coating.

PROJECT. (a) The specific section of the highway or other property and related facilities on which construction is to be performed, or (b) the work that is to be performed under the Contract whether completed or partially completed.

QUALIFIED PRODUCTS LIST. A list of products that the Department has found conforms to the SSHC, except for Buy America and Alaska Agricultural/Wood Products. The Department makes no guarantee that any product on the *Qualified Products List* meets the requirements of the Buy America Act, Buy America Provision, or Alaska Agricultural/Wood Products.

RESOURCES. Labor, equipment, materials, supplies, tools, transportation, and supervision necessary to perform the work.

RESPONSIBLE BIDDER. A bidder that the Department determines has the skill, ability, financial resources, legal capacity to contract, equipment, required licenses, integrity, satisfactory record of performance and that is otherwise fully capable of performing the Contract.

RESPONSIVE BID. A bid that the Department determines conforms in all material respects with the solicitation for bids.

RETAINAGE. A percentage of a payment established in advance under a contract or subcontract to be withheld from a progress payment due on the contract or subcontract. Payment or a percentage of payment withheld for unsatisfactory performance is not retainage.

RIGHT-OF-WAY. Land or property or an interest in property available for a project. The uses allowed in portions of right-of-way may be restricted.

ROADBED. Graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.

ROADSIDE. A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also be considered roadside.

ROADWAY. Portion of a highway including shoulders, for vehicular use.

SHOULDER. Portion of the roadway adjacent to the traveled way for accommodation of stopped vehicles for emergency use, and for lateral support of base and surface courses.

SIDEWALK. Portion of the project constructed for the exclusive use of pedestrians.

SPECIAL PROVISION. Addition or revision that amends or supersedes the Standard Specifications or Standard Modifications, and is applicable to an individual project.

SPECIALTY ITEM. A Contract item identified in the Contract that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract.

SPECIFICATIONS. General term applied to all Contract terms, conditions, directions, provisions, and requirements.

STANDARD MODIFICATION. Addition or revision that amends or supersedes the Standard Specification, and is approved by the Department for general application and repetitive use.

STANDARD SPECIFICATIONS. A book or electronic file of specifications approved by the Department for general application and repetitive use.

STATE. The State of Alaska, acting through its authorized representative.

STATION. A distance of 100 feet measured horizontally, usually along centerline.

STRUCTURE. Bridge, culvert, catch basin, drop inlet, retaining wall, cribbing, manhole, endwall, building, sewer, service pipe, underdrain, foundation drain, or other similar feature that may be encountered in the work.

SUBBASE. Layer of specified material between the subgrade and base course.

SUBCONTRACTOR. Individual or legal entity to whom or to which the Contractor sublets part of the Contract.

SUBGRADE. The soil or embankment upon which the pavement structure is constructed.

SUBSIDIARY. Work or material not measured or paid for directly. Compensation for such work is included in the payment for other items of work.

SUBSTANTIAL COMPLETION. The point at which the project (1) can be safely and effectively used by the public without further delays, disruption, or other impediments; and (2) pavement structure, shoulder, drainage, sidewalk, permanent signing and markings, guardrail and other traffic barrier, safety appurtenance, utilities, lighting and all bridge deck and parapet work is complete.

For projects that will not be opened to the traveling public or are being built in phases, the work is substantially complete when it is ready for the subsequent project.

SUBSTRUCTURE. All portions of a bridge below the bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, including backwalls, wingwalls, and wing protection railings.

SUPERINTENDENT. The Contractor's authorized representative in responsible charge of the work.

SUPERSTRUCTURE. The entire bridge structure above the substructure.

SUPPLEMENTAL AGREEMENT. Negotiated written agreement between the Department and the Contractor authorizing performance of work beyond the general scope of, but in conjunction with, the original Contract. Supplemental agreements are new procurements under the State Procurement Code, AS 36.30.

SURETY. Corporation, partnership, or individual, other than the Contractor, executing a bond furnished by the Contractor.

SURFACE COURSE. Top homogenous layer of the pavement structure. It is designed to withstand the wear of traffic and the disintegrating effects of climate. Sometimes called the wearing course.

TRAFFIC CONTROL PLAN (TCP). One or more project-specific plans detailing the routing of vehicular or pedestrian traffic through or around a construction area including the location of all traffic control devices.

TRAIL. An unpaved path for multiple uses.

TRAVELED WAY. Portion of the roadway designed for vehicle use, excluding shoulders.

UTILITY. Line, facility, or system for producing, transmitting, or distributing communications, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water not connected with highway drainage, or other similar commodity, including a publicly owned fire or police signal system, street lighting system, or railroad which directly or indirectly serves the public. Also means a utility company, inclusive of any subsidiary.

WORK. Depending on the context, (a) The act of furnishing all resources for the project and performing all duties and obligations required by the Contract or (b) the physical construction, facility or end–product that is contemplated under the Contract, whether completed or partially completed.

WORKING DAYS. Calendar days, except Saturdays and state holidays.

WORKING DRAWINGS. Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, wiring diagrams and schematics, traffic control plans, night work lighting plans, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for approval.

SECTION 102
BIDDING REQUIREMENTS AND CONDITIONS

102-1.01 QUALIFICATION OF BIDDERS. A bidder shall:

1. When requested, submit a completed Contractor's Questionnaire (Form 25D-8) stating previous experience in performing comparable work, business and technical organization, financial resources, and equipment available to be used in performing the work;

2. On wholly state-funded projects, submit evidence of a valid Department of Commerce, Community, and Economic Development certificate of Contractor Registration (Contractor Registration), under AS 08.18, and submit evidence of a valid Alaska Business License prior to award under AS 36.30.110; and

3. On federal-aid projects, submit evidence of Alaska Business License and Contractor Registration prior to award.

All firms desiring to participate in DOT&PF construction projects must register annually by submitting a completed Bidder Registration (Form 25D-6).

102-1.02 CONTENTS OF BID PACKAGE. Upon request, the Department will furnish prospective bidders with a bid package, at the price stated in the Invitation To Bid.

The bid package includes the following:

1. Location and description of the project;
2. Estimates of quantities of work and materials to be furnished;
3. Schedule of contract items for which bid prices are invited;
4. Time in which the work must be completed;
5. Amount of the bid guaranty;
6. Date, time, and place for the bid opening;
7. Plans and specifications; and
8. Bid forms.

Unless otherwise stated in the bid package, the Plans, Standard Specifications, Standard Modifications, Special Provisions, permits, forms and any other documents designated in the bid package are considered a part of the bid whether attached or not.

102-1.03 INTERPRETATION OF QUANTITIES IN BID SCHEDULE. Bid prices shall be based on the estimated quantities shown in the bid schedule. Quantities of work to be done and materials to be furnished are approximate and are prepared only for the comparison of bids. These quantities may increase, decrease, or be eliminated as provided. Payment for unit price items will be made for the actual accepted quantities of work performed and materials furnished under the Contract, as determined using the method of measurement specified in the Contract.

102-1.04 EXAMINATION OF PLANS, SPECIFICATIONS, SPECIAL PROVISIONS, AND WORK SITE. Bidders shall examine the work site and all Contract documents before preparing a bid. Submitting a bid is a binding representation that the bidder has examined the work site, is aware of the conditions to be encountered, and has examined and understands all of the Contract documents.

Department records of subsurface and hydrological investigations, including but not limited to, boring logs, test results, soil investigation reports, material reports, and other supplemental information are made available for information purposes only. These records are not part of the Contract. These records indicate subsurface conditions only at specific locations at the time sampled, and only to the depths penetrated. They do not necessarily reflect frozen state, or variations in soil, rock or hydrology that may exist between or outside such locations or at other

times. Actual conditions, including ground water levels and saturation, may differ from what is shown in the records.

Material sources referenced in Department records may not contain materials of sufficient quantity or quality to meet project requirements. Sources may be subject to operational restrictions. The availability of these records does not constitute approval, nor guarantee suitability of soils or sources, or the right to use sources referenced in these records for this project. Department records shall not substitute for independent investigation, interpretation, or judgment of the bidder. The Department is not responsible for any interpretation or conclusion drawn from its records by the bidder. Bidders shall examine Subsection 106-1.02 Material Sources for further information.

Geotechnical reports referenced in the Notice to Bidders, or otherwise made available, may contain data, discussions, and references to material sources. The inclusion of material source information in these reports does not mean they are a Mandatory, Designated, or Available Source as described in Subsection 106-1.02. For a material source to be considered Mandatory, Designated, or Available, it must be included in the Special Provisions, or so described on the Plans.

Any questions about bidding procedures, site conditions, or Contract requirements must be submitted in writing according to the Invitation To Bid (Form 25D-7). Questions must be submitted in sufficient time to get a reply before submitting a bid. No oral responses or other oral statements are binding on the Department. Any response to a material question shall be issued by addendum sent to all bidders.

102-1.05 PREPARATION OF BID. A bidder shall prepare its bid using either the Department approved bid preparation software or the Department provided bid forms or legible copies of the Department's forms. All entries shall be legible and in ink or type. Bidders shall:

1. Enter all prices required on the Bid Schedule, in figures;

2. Enter a unit price for each contract item for which a quantity is given;

3. Enter the products of the respective unit prices and quantities in the column provided;

4. Enter lump sum prices for lump sum contract items in the column(s) provided; and

5. Enter the total amount of all contract items for the basic bid and, when specified, any alternates.

When a bid item contains a choice to be made by the bidder, the bidder shall indicate a choice according to the Specifications for that item. No further choice is permitted.

The bid must be signed in ink or by a digital signature by the person or persons authorized to sign the Contract for the bidder. If a bidder is a corporation, the bid must be signed by a corporate officer or agent with authority to bind the corporation. If a bidder is a partnership, a partner must sign. If the bidder is a joint venture, each principal member must sign. If a bidder is a sole proprietorship, the owner must sign. Each person signing the bid must initial any changes made to entries on the bid forms.

A bidder submitting an electronic bid agrees that its digital signature constitutes a binding signature.

The bidder shall make no claim against the Department in the event it is unable to submit its bid through approved online bidding service and/or approved online bidding service is unable to submit the bid(s) to the Department. The Department reserves the right to postpone the public bid opening in the event of technical problems.

For multiple-project bid openings, the bidder may limit the total dollar amount or number of projects to be accepted by completing and attaching the following statement with its bid for at least one of the projects. The Department will then determine which of the low bids it will accept, up to the total indicated.

"We wish to disqualify all of our successful bids at this bid opening which exceed the total of $_____ or ____ contracts and hereby authorize the Department to determine which bids to disqualify, based on this limit."

102-1.06 NONRESPONSIVE BIDS.

1. A bid shall be rejected as nonresponsive if it:

   a. Is not properly signed by an authorized representative of the bidder and in a legally binding manner;

   b. Contains unauthorized additions, conditional or alternative bids, or other irregularities that make the bid incomplete, indefinite, or ambiguous;

   c. Includes a reservation of the right to accept or reject any award, or to enter into a contract pursuant to an award, except for an award limitation under Subsection 102-1.05;

   d. Fails to include an acceptable bid guaranty with the bid;

   e. Is materially unbalanced; or

   f. Fails to meet any other material requirement of the Invitation To Bid.

2. A bid may be rejected as nonresponsive, in the Department's discretion, if it:

   a. Is not typed or completed in ink;

   b. Fails to include an acknowledgement of receipt of each addendum by assigned number and date of issue; or

   c. Is missing a bid price for any pay item, except when alternate pay items are authorized.

102-1.07 BID GUARANTY. Bids shall be accompanied by a bid guaranty in the amount specified on the Invitation To Bid. The guaranty shall be unconditionally payable to the State of Alaska and shall be in the form of an acceptable paper Bid Bond (Form 25D-14), an electronic bid bond acceptable to the Department and verified through its online bidding service, a certified check, a cashier's check, or a money order.

The surety of a Bid Bond may be any corporation or partnership authorized to do business in Alaska as an insurer under AS 21.09. A legible power of attorney shall be included with each paper Bid Bond (Form 25D-14).

An individual surety will not be accepted as a bid guaranty.

102-1.08 DELIVERY OF BIDS. Bids shall be submitted electronically through the online bidding service, or shall be submitted in a sealed envelope. When bids are submitted in a sealed envelope, the envelope shall clearly indicate its contents and the designated address, as specified on the Invitation to Bid. Bids for other work may not be included in the envelope. In the event of a bid delay, electronic bidders that have already submitted their bid prior to the bid delay must resubmit their bid utilizing all Bid Forms EBSX Files or their bid will not be received.

The Department will not accept a bid submitted by email or fax unless specifically called for in the Invitation to Bid.

102-1.09 WITHDRAWAL OR REVISION OF BIDS. Manual Bids may be withdrawn or revised in writing delivered by mail, fax, or email , provided that the designated office receives the withdrawal or revision before the deadline stated in the in the Invitation To Bid. Withdraw requests must be signed and submitted by the bidder's duly appointed representative who is legally authorized to bind the bidder. Revisions shall include both the modification of the unit bid price and the total modification of each item modified but shall not reveal the amount of the total original or revised bids.

Electronic Bids may be withdrawn or resubmitted through the online bidding service. Revisions to electronic bids delivered by mail, fax, or email will not be permitted. If electronic bid withdrawal is unsuccessful, electronic bids may be withdrawn in writing delivered by mail, fax, or email provided that the designated office receives the withdrawal before the deadline stated in the Invitation To Bid. Written withdrawal requests must be signed and submitted by the bidder's duly appointed representative who is legally authorized to bind the bidder.

102-1.10 PROTEST OF INVITATION TO BID. An interested party, as defined in AS 36.30.699, may protest an Invitation to Bid before the bid opening in accordance with AS 36.30.560 and AS 36.30.565. Submit a protest to the Contracting Officer.

102-1.11 ADDENDA REQUIREMENTS. The Department will issue addenda if it determines, in its discretion, that clarifications or changes to the Contract documents or bid opening date are needed. The Department may send addenda by any reasonable method such as fax, email, or may post the addenda on its website or online bidding service. Unless picked up in person or included with the bid documents, addenda or notice that an addendum has been issued will be addressed to the individual or company to whom bidding documents were issued and sent to the address or fax number on the plan holders' list. Notwithstanding the Department's efforts to distribute addenda, bidders are responsible for ensuring that they have received all addenda affecting the Invitation To Bid. Bidders must acknowledge all addenda on the Bid Forms, by fax, or by email before the deadline stated in the Invitation to Bid.

102-1.12 RECEIPT AND OPENING OF BIDS. The Department will only consider bids, revisions, and withdrawals received before the deadline stated in the Invitation to Bid.

The Department will assemble, open, and publicly announce bids at the time and place indicated in the Invitation to Bid, or as soon thereafter as practicable. The Department is not responsible for prematurely opening or failing to open bids that are improperly addressed or identified.

102-1.13 RESPONSIBILITY OF BIDDERS. The Department may find a bidder is nonresponsible for any one of the following reasons, but is not limited in its responsibility analysis to the following factors:

1. Evidence of bid rigging or collusion;

2. Fraud or dishonesty in the performance of previous contracts;

3. More than one bid for the same work from an individual, firm, or corporation under the same or different name;

4. Unsatisfactory performance on previous or current contracts;

5. Failure to pay, or satisfactorily settle, all bills due for labor and material on previous contracts;

6. Uncompleted work that, in the judgment of the Department, might hinder or prevent the bidder's prompt completion of additional work, if awarded;

7. Failure to reimburse the State for monies owed on any previous contracts;

8. Default under previous contracts;

9. Failure to submit evidence of registration and licensing;

10. Failure to comply with any qualification requirements of the Department;

11. Engaging in any activity that constitutes a cause for debarment or suspension under the State Procurement Code (AS 36.30) or submitting a bid during a period of debarment;

12. Failure to satisfy the responsibility standards set out in state regulations;

13. Lack of skill, ability, financial resources, or equipment required to perform the contract; or

14. Lack of legal capacity to contract.

Nothing contained in this section deprives the Department of its discretion in determining the lowest responsible bidder.

102-1.14 ELECTRONIC MAIL. Within its submitted bid, a bidder must include a current electronic mail (email) address of bidder's representative who possesses authority to receive, process, and respond to Department emails regarding the advertised project.

The Department may send notices and information to a bidder by using the furnished email address of the bidder's authorized representative.

A bidder shall notify the Department if the bidder requests the Department to send email notices or information to an address different from the email address initially provided in its bid forms. The bidder shall notify the Department of such change by sending a request in writing to the Contract's point of contact identified on the Invitation to Bid that is signed by a representative who is authorized and empowered to legally bind the bidder.

Delivery of an email sent by the Department is complete upon receipt in the addressee's email account. An email sent after 4:30 pm shall be deemed to have occurred at the opening of business on the next working day.

If needed, the Department may demonstrate proof of email delivery by affidavit or certification that includes the following:

1. The date and time that the Department sent the email message;

2. The email address from which the Department sent the message;

3. The name and email address to which the Department sent the message;

4. A statement that the Department sent the email message and that the person signing the affidavit or certification believes the transmission to have been complete and without error; and

5. An attached copy of the subject email

SECTION 103
AWARD AND EXECUTION OF CONTRACT

103-1.01 CONSIDERATION OF BIDS. After the bids are opened and read, the bids will be mathematically checked and compared on the basis of the sum of the products of the bid schedule quantities and the unit bid prices. The unit bid prices govern if there is an error in extending the unit bid prices, or in totaling the extensions, or if an extension is missing. The results of the bid comparisons will be made available to the public as soon as practicable.

Until the Award, the Department may reject any or all bids, waive minor informalities or advertise for new bids without liability to any bidder if the Department, in its discretion, determines that to do so is in the best interests of the State.

A bidder may request withdrawal of a bid after opening and before the Award only in accordance with AS 36.30.160(b) and State procurement regulations. Submit the request to the Contracting Officer.

An interested party, as defined in AS 36.30.699, may protest a proposed Award of contract as per AS 36.30.560 and AS 36.30.565. Submit the protest to the Contracting Officer.

WHOLLY STATE-FUNDED PROJECTS. On wholly state-funded projects, determination of the low bidder will include bidder preferences as required under AS 36.30.321, according to subsections 1-3 below. Alaska Bidder Preferences, Alaska Veteran Preference, and Alaska Product Preference are not applicable on projects with federal funding.

1. Alaska Bidder Preference: A bidder claiming this preference shall provide with their bid an Alaska Bidder Preference Certification, certifying they qualify as an Alaska bidder eligible for Alaska Bidder Preference according to AS 36.30.

   If the bidder qualifies as an Alaska Bidder, a five percent (5%) preference will be applied to the price of the bid. "Alaska bidder" means a person who:

   a. holds a current Alaska business license;

   b. submits a bid for goods, services, or construction under the name as appearing on the person's current Alaska business license;

   c. has maintained a place of business within the state staffed by the bidder or an employee of the bidder for a period of six months immediately preceding the date of the bid;

   d. is incorporated or qualified to do business under the laws of the state, is a sole proprietorship and the proprietor is a resident of the state, is a limited liability company organized under AS 10.50 and all members are residents of the state, or is a partnership under former AS 32.05, AS 32.06, or AS 32.11 and all partners are residents of the state; and

   e. If a joint venture, is composed entirely of ventures that qualify under (a) through (d), above.

2. Alaska Veteran Preference: A bidder claiming this preference shall provide an Alaska Veteran Preference Certification, certifying they qualify as an Alaska bidder eligible for Alaska Veteran Preference according to AS 36.30.

   If a bidder qualifies as an Alaska bidder and is a qualifying entity, an Alaska Veteran Preference of 5 percent shall be applied to the bid price. The preference may not exceed $5,000 (AS 36.30.321). A “qualifying entity” means a:

   a. sole proprietorship owned by an Alaska veteran;

b. partnership under AS 32.06 or AS 32.11 if a majority of the partners are Alaska veterans;

c. limited liability company organized under AS 10.50 if a majority of the members are Alaska veterans; or

d. corporation that is wholly owned by individuals, and a majority of the individuals are Alaska veterans.

A preference under this section is in addition to any other preference for which the bidder qualifies.

To qualify for this preference, the bidder must add value by the bidder itself actually performing, controlling, managing and supervising a significant part of the services provided or the bidder must have sold supplies of the general nature solicited to other state agencies, governments, or the general public.

An Alaska veteran is a resident of Alaska who:

(1) served in the Armed forces of the United States, including a reserve unit of the United States armed forces; or the Alaska Territorial Guard, the Alaska Army National Guard, the Alaska Air National Guard, or the Alaska Naval Militia; and

(2) was separated from service under a condition that was not dishonorable.

3. Alaska Product Preference: A bidder claiming this preference shall complete and sign the Alaska Products Preference Worksheet, according to the worksheet instructions, and submit the completed worksheet with their bid.

Except for timber, lumber and manufactured lumber products used in the construction project under AS 36.30.322(b), an Alaska products preference will be given as required under AS 36.30.326 - 36.30.332 when the bidder designates the use of Alaska products.

If the successful bidder/contractor proposes to use an Alaska product and does not do so, a penalty will be assessed against the successful bidder/contractor according to AS 36.30.330(a).

Each Alaska product declared on the Alaska Product Preference Worksheet must have an “Approval” date on the Alaska Product Preference Program List, that is on or before the bid opening date for this contract, and that does not expire before the bid opening date for this contract.

103-1.02 SUBCONTRACTOR LIST. The apparent low bidder shall submit a completed Subcontractor List, Form 25D-5, within five working days following receipt of written notification by the Department that it is the low bidder.

An apparent low bidder who fails to submit a completed Subcontractor List form within the time allowed will be declared nonresponsible and may be required to forfeit the bid security. The Department will then consider the next lowest bidder for award of the Contract.

If a bidder fails to list a subcontractor, or lists more than one subcontractor for the same portion of work, and the value of that work is in excess of one-half of one percent of the total bid amount, the bidder agrees to perform that portion of work without a subcontractor and represents that it is qualified to perform that work.

A bidder who lists as a subcontractor another contractor who, in turn, sublets the majority of the work required under the Contract, violates this subsection.

On federal-aid projects, subcontractors must obtain an Alaska business license and certificate of contractor registration prior to award of the Contract.

On wholly state-funded projects, all subcontractors listed by the Contractor shall have a valid Alaska business license and a valid certificate of registration as a contractor, as defined in AS 08.18, at the time the bid is opened. If a subcontractor listed by the Contractor does not have a valid business license and certificate of registration at the time the bid is opened, the Contractor shall replace the subcontractor with a subcontractor that had a valid Alaska business license and a valid certificate of registration as a contractor under AS 08.18 at the time the bid was opened.

A bidder or Contractor may, without penalty, replace a listed subcontractor who:

1. Fails to comply with licensing and registration requirements of AS 08.18;
2. Fails to obtain a valid Alaska business license;
3. Files for bankruptcy or becomes insolvent;
4. Fails to execute a subcontract for performance of the work for which the subcontractor was listed, and the bidder acted in good faith;
5. Fails to obtain bonding acceptable to the Department;
6. Fails to obtain insurance acceptable to the Department;
7. Fails to perform the subcontract work for which the subcontractor was listed;
8. Must be replaced to meet the bidder's required state or federal affirmative action requirements;
9. Refuses to agree or abide with the bidder's labor agreement; or
10. Is determined by the Department to be not responsible.

In addition to the circumstances described above, a Contractor may in writing request permission from the Department to add a new subcontractor or replace a listed subcontractor. The Department will approve the request if it determines in writing that allowing the addition or replacement is in the best interest of the State.

A bidder or Contractor shall submit a written request to add a new subcontractor or replace a listed subcontractor to the Contracting Officer a minimum of five working days before the date the new subcontractor is scheduled to begin work on the construction site. The request must state the basis for the request and include supporting documentation acceptable to the Contracting Officer.

If a bidder violates this subsection, the Contracting Officer may:

1. Cancel the Contract after Award without any damages accruing to the Department; or
2. After notice and a hearing, assess a penalty on the bidder in an amount not exceeding 10 percent of the value of the subcontract at issue.

103-1.03 AWARD OF CONTRACT. The Department will award the Contract to the lowest responsible and responsive bidder unless it rejects all bids. The Department will notify all bidders in writing via email, fax, or U.S. Mail of its intent to award.

The Department will notify the successful bidder in writing of its intent to award the Contract and request that certain required documents, including the Contract Form, bonds, and insurance be

submitted within the time specified. The successful bidder's refusal to sign the Contract and provide the requested documents within the time specified may result in cancellation of the notice of intent to award and forfeiture of the bid security.

If an award is made, it will be made as soon as practicable and usually within 40 days after bid opening. Award may be delayed due to bid irregularities or a bid protest, or if the award date is extended by mutual consent. Bids shall be valid for 120 days after bid opening, and may be extended by mutual consent.

103-1.04 RETURN OF BID GUARANTY. The Department will return bid guaranties, other than bid bonds:

1. To all except the two lowest responsive and responsible bidders, as soon as practicable after the opening of bids; and

2. To the two lowest responsive and responsible bidders immediately after Contract award.

103-1.05 PERFORMANCE AND PAYMENT BONDS. The successful bidder shall furnish all required Performance and Payment Bonds on forms provided by the Department for the sums specified in the Contract. If no sum is specified, the successful bidder shall comply with AS 36.25.010. The Surety on each bond may be any corporation or partnership authorized to do business in the state as an insurer under AS 21.09 or two individual sureties approved by the Contracting Officer.

If individual sureties are used, two individual sureties must each provide the Department with security assets located in Alaska equal to the penal amount of either the performance bond or the payment bond. Any costs incurred by the Contractor and the individual Surety are subsidiary and shall be borne by the Contractor or the individual Surety. In no event will the Department be liable for these costs.

Individual sureties shall provide security by one, or a combination, of the following methods:

1. Escrow Account, with a federally insured financial institution, in the name of the Department. Acceptable securities include, but are not limited to, cash, treasury notes, bearer instruments having a specific value, or money market certificates.

2. Irrevocable letters of credit, from a financial institution approved by the Contracting Officer, with the Department named as beneficiary.

3. Cashier's or certified check made payable to the State of Alaska issued by financial institutions approved by the Contracting Officer.

These bonds and security assets, as applicable, shall remain in effect for 12 months after the date of final payment or, if longer, until all obligations and liens under this Contract are satisfied, including, but not limited to, obligations under Subsection 107-1.19.

The Department may, in its discretion, notify the bonding company or Surety of any potential default or liability.

The Contractor shall substitute, within five working days, another bond or surety acceptable to the Department if an individual Surety or the Surety on any bond furnished in connection with the Contract:

1. Becomes insolvent or is declared bankrupt;
2. Loses its right to do business in any state affecting the work;
3. Ceases to meet Contract requirements;
4. Fails to furnish reports of financial condition upon request; or

5. Otherwise becomes unacceptable to the Department.

When approved by the Contracting Officer, the Contractor may replace:

1. An individual surety with a corporate surety; or
2. Posted collateral with substitute collateral.

Failure to maintain the specified bonds or to provide substitute bonds when required under this section may be grounds for withholding contract payments until substitute bonding is obtained, and may, in the Department's discretion, be grounds for declaring the Contractor in default.

103-1.06 INSURANCE REQUIREMENTS. The Contractor shall provide evidence of insurance with an insurance carrier or carriers satisfactory to the Department covering injury to persons and property suffered by the State of Alaska or by a third party as a result of operations under this contract by the Contractor or by any subcontractor. The Contractor's insurance shall provide protection against injuries to all employees of the Contractor and the employees of any subcontractor engaged in work under this Contract. All insurance policies shall be issued by insurers that (1) are permitted to transact the business of insurance in the State of Alaska under Title 21 of the Alaska Statutes and (2) have a financial rating acceptable to the Department. A certificate of insurance must be furnished to the Department prior to award. The certificate of insurance must provide for notice of cancellation or non-renewal in accordance with policy provisions.

Where specific limits and coverages are shown, it is understood that they shall be the minimum acceptable. The requirements of this subsection shall not limit the Contractor's indemnity responsibility under Subsection 107-1.13. Additional insurance requirements specific to this contract are contained in the Special Provisions, when applicable.

The Contractor shall maintain the following policies of insurance with the specified minimum coverages and limits in force at all times during the performance of the Contract:

1. Workers' Compensation: as required by AS 23.30.045, for all employees of the Contractor engaged in work under this Contract. The Contractor shall be responsible for Workers' Compensation Insurance for any subcontractor who performs work under this Contract. The coverage shall include:

    a. Waiver of subrogation against the State;

    b. Employer's Liability Protection at $500,000 each accident/each employee and $500,000 policy limit;

    c. "Other States" endorsement if the Contractor directly utilizes labor outside of the State of Alaska;

    d. United States Longshore and Harbor Workers' Act Endorsement, whenever the work involves activity over or about navigable water; and

    e. Maritime Employer's Liability (Jones Act) Endorsement with a minimum limit of $1,000,000, whenever the work involves activity from or on a vessel on navigable water.

2. Commercial General Liability: on an occurrence policy form covering all operations, including contractual liability and products-completed operations, with combined single limits not less than:

    a. $1,000,000 Each Occurrence;

    b. $1,000,000 Personal Injury;

c. $2,000,000 General Aggregate; and

d. $2,000,000 Products-Completed Operations Aggregate.

3. Automobile Liability: covering all vehicles used in Contract work, with combined single limits not less than $1,000,000 each occurrence.

4. Umbrella Coverage: for Contract amounts over $5,000,000 not less than $5,000,000 umbrella or excess liability. Umbrella or excess policy shall include products-completed operations coverage and may be subject to $5,000,000 aggregate limits. Further, the umbrella or excess policy shall contain a clause stating that it takes effect (drops down) in the event the primary limits are impaired or exhausted.

The State of Alaska shall be named as an additional insured on policies required by items 2 thru 4 above. All of the above insurance coverages shall be considered to be primary and non-contributory to any other insurance carried by the State of Alaska, whether through self-insurance or otherwise.

In any contract or agreement with subcontractors performing work, the Contractor shall require that all indemnities and waivers of subrogation it obtains, and any stipulation to be named as an additional insured it obtains, shall also be extended to waive rights of subrogation against the State of Alaska and to add the State of Alaska as an additional named indemnitee and as an additional insured.

The apparent low bidder shall furnish evidence of insurance to the Department before award of the Contract. The evidence shall be issued to the Department and shall be either a certificate of insurance or the policy declaration page with all required endorsements attached and must:

1. Denote the type, amount, and class of operations covered;

2. Show the effective (and retroactive) dates of the policy;

3. Show the expiration date of the policy;

4. Include all required endorsements;

5. Be executed by the carrier's representative; and

Provide that the Department shall receive written notice of cancellation or non-renewal in accordance with policy provisions.

The Department’s acceptance of deficient evidence of insurance does not constitute a waiver of Contract requirements.

Failure to maintain the specified insurance or to provide substitute insurance if an insurance carrier becomes insolvent, is placed in receivership, declares bankruptcy, or cancels a policy may be grounds for withholding Contract payments until substitute insurance is obtained, and may, in the Department's discretion, be sufficient grounds for declaring the Contractor in default.

103-1.07 EXECUTION AND APPROVAL OF CONTRACT. The successful bidder shall execute and return the Contract Form and all other required documents to the Department within the time specified, or within 15 days after receipt by the bidder if no time is specified. A contract is awarded only after it has been signed by the Contracting Officer.

103-1.08 FAILURE TO EXECUTE CONTRACT. If the successful bidder fails to appropriately execute and return the Contract Form and other documents within time specified, as required above, the Department may cancel the intent to award and keep the bid guaranty. The

Department will then, in its discretion, award the Contract to the next lowest responsive and responsible bidder or readvertise the work.

103-1.09 ORAL STATEMENTS. The written terms of the Contract are binding. No oral statement of any person shall, in any manner or degree, modify or otherwise affect, change, or amend the terms of the Contract.

103-1.10 INTEGRATED CONTRACT. This Contract is an integrated document and contains the complete agreement and understanding of the parties. There are no unwritten agreements or understandings between the parties. Changes ordered or agreed upon, Directives given, or Equitable Adjustments issued under this Contract, and all other matters affecting the Contract, must be in writing in order to be binding and effective.

SECTION 104
SCOPE OF WORK

104-1.01 INTENT OF CONTRACT. The intent of the Contract is to provide for the construction and completion of every detail of the described work. The Contractor shall furnish all labor, material, supervision, equipment, tools, transportation, supplies, and other resources required to complete the work in the time specified and in accordance with the Contract.

The Contractor is responsible for the means, methods, techniques, sequence, and procedures of construction, safety, and quality control, and is responsible to perform and furnish the work in accordance with the Contract documents and any applicable federal, state, and local laws, rules, regulations, and ordinances.

104-1.02 CHANGES.

1. Within Contract Scope. The Engineer may order changes within the general scope of the Contract at any time, and without notice to sureties, including altering, ordering additions to, or ordering deletions of quantities of any item or portion of the work. These changes shall be made by a written Change Order and shall not invalidate the Contract or release the sureties.

    a. If the change does not materially differ in character or unit cost from specified Contract work, the Contractor shall perform the work at the original contract measurement methods and prices, subject to the provisions of Subsection 109-1.04.

    b. If the change is materially different in character or unit cost from that specified in the Contract, a new Contract Item will be established, and an equitable adjustment to Contract price and Contract time shall be calculated by one of the following methods:

        (1) The Engineer and Contractor agree upon an adjustment to Contract price and Contract time, and the Engineer issues a change order for the described work;

        (2) The Engineer requires the Contractor to proceed with the described work, with an adjustment to contract price and contract time, calculated by time and materials basis under Subsection 109-1.05, and the Engineer issues a change order for the work. The Contractor shall keep complete daily records of the cost of such work; or

        (3) The Engineer may issue a unilateral Change Order requiring the Contractor to proceed with the work with an adjustment to the payment amount or Contract time based on the Engineer's estimate of reasonable value. The Contractor shall keep complete daily records of the cost of such work.

    c. If the Engineer eliminates a Contract item, the Contractor shall accept compensation under Subsection 109-1.09.

2. Outside Contract Scope. Changes determined to be outside the general scope of the Contract shall be made only by Supplemental Agreement issued in accordance with AS 36.30 and the State's procurement regulations. Additional bonding or insurance may be required.

3. Cost and Pricing Data. Before a Change Order or Supplemental Agreement covering work for which there is no established Contract price will be written, the Contractor shall submit detailed cost or pricing data regarding the changed work. The cost or pricing data shall include an itemization of production rates and all costs including labor, materials, and equipment required for the work. The Contractor shall certify that the data submitted are, to the best of its knowledge and belief, accurate, complete, and current as of a mutually agreed date and that the data will continue to be accurate and complete during the performance of the changed work.

4. Time Analysis. Before a Change Order or Supplemental Agreement that adds or subtracts time from the Contract will be written, the Contractor shall provide an analysis and documentation demonstrating changes to controlling items of work that affect Contract time. The Contractor shall certify that the data submitted are, to the best of its knowledge and belief, accurate, complete, and current as of a mutually agreed date and that the data will continue to be accurate and complete during the performance of the changed work.

104-1.03 DIFFERING SITE CONDITIONS. If, during the progress of the work, a differing site condition is discovered, the party discovering the differing site condition shall promptly notify the other party in writing of the specific differing conditions. The written notification shall occur before the site is further disturbed and before the affected work is performed. A differing site condition is defined as:

1. Subsurface or latent physical conditions at the site, differing materially from those shown in the Contract documents, that could not have been discovered by a careful examination of the site; or

2. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

When the Contractor is the discovering party, failure of the Contractor to give the Engineer prompt written notice of the alleged differing site condition as required under this section constitutes a waiver of any future claim arising from or relating to the alleged differing site condition.

Unless otherwise directed by the Engineer, the Contractor shall leave the affected area undisturbed and suspend work in that area until the Engineer investigates the conditions.

The Engineer will notify the Contractor of the determination whether or not an adjustment of the contract is warranted. If the Engineer finds that such conditions differ materially and increase or decrease the cost of, or the time required for, performance of the Contract, the Engineer will prepare a Change Order for an Equitable Adjustment to the Contract. The Contractor shall cooperate with the Engineer's preparation of the Change Order, and submit data for actual costs and time to perform differing site work according to Subsection 104-1.02.

The Change Order will provide an equitable adjustment to Contract price and Contract time, as agreed, to perform the work under a differing site condition. The Change Order will not include expected reimbursement, or anticipated profits suffered or claimed, for the work affected by the differing site condition.

If the Contractor and the Engineer are unable to reach an agreement concerning the alleged differing site condition, the Contractor may file a claim under Subsection 105-1.17.

The Contractor shall keep accurate and detailed records of the actual cost of the work done as a result of the alleged differing site condition and shall allow the Engineer access to those records. Failure to keep records, to provide the Engineer with access to those records, or to give the notice required above will bar any recovery for the alleged differing site condition.

104-1.04 USE OF MATERIALS FOUND ON THE WORK. Before using borrow, the Contractor shall utilize Useable Excavation to construct the selected material layers on the project. For the purposes of this subsection, Useable Excavation is material encountered in the excavation that meets the requirements of Subsection 703-2.07 Selected Material. For excavating the Useable Excavation and constructing the selected material layers with Useable Excavation, the Contractor shall be paid only the unit bid price for excavation. Hauling, placing, compacting and other activities required to construct the selected material layers with Useable Excavation shall be

subsidiary to excavation, and the Contractor shall not be paid additional sums for those activities. The Engineer may approve the use of borrow when Useable Excavation is not available.

The Engineer may authorize the Contractor to use the Useable Excavation for Contract items other than construction of the selected material layers on the project, and the Contractor shall be paid both for the excavation of the Useable Excavation and for the other Contract item for which it is acceptably used. If this action results in a shortage of material for the selected material layers:

1. The Contractor shall replace Useable Excavation used for other Contract items on a yard for yard basis with borrow acceptable to the Engineer; and

2. This replacement shall be at the Contractor's expense and at no additional cost to the Department. The Contractor shall pay any royalties required for the borrow.

The Contractor shall not excavate or remove any material that is within the right-of-way but outside the slope and grade lines described in the Contract, without written authorization from the Engineer.

In the event the Contractor has processed material from state-furnished sources in excess of the quantities required for performance of the Contract, the Department may retain possession of the surplus processed materials, including any unsuitable material produced as a by-product, without obligation to pay the Contractor for processing costs. When the surplus materials are in a stockpile, the Engineer may direct the Contractor to leave the materials in the stockpile, level the stockpile(s) or remove the materials and restore the premises to a satisfactory condition at no additional cost to the Department. This provision does not apply to material specifically produced under Section 305, Stockpiled Material.

The Contractor may temporarily use material from a structure that is designated to be removed to erect a new structure, but shall not cut or otherwise damage such material without the Engineer's approval.

104-1.05 CLEANUP. The Contractor shall remove all rubbish, temporary structures, excess materials, and equipment from the project site, from state owned materials sources, and from all work areas before project completion.

104-1.06 VALUE ENGINEERING CHANGE PROPOSALS BY CONTRACTOR.

1. Purpose and Scope. The purpose of this section is to encourage the Contractor to propose changes to Contract designs, materials, or methods based on the Contractor's experience and ingenuity. The Value Engineering Change Proposals (VECPs) contemplated are those that may result in immediate savings to the Department under this Contract without impairing essential functions and characteristics of the Project, including, but not limited to: service life, economy of operation, ease of maintenance, desired appearance, and safety. Cost savings on this project resulting from VECPs offered by the Contractor and accepted by the Department shall be shared equally between the Contractor and the Department.

2. Submitting Proposals. All VECPs must be in writing. The Contractor shall submit the following with each VECP:

    a. A statement that the proposal is submitted as a VECP under Subsection 104-1.06;

    b. A description of the difference between the existing Contract requirements and the proposed change, stating the comparative advantages and disadvantages of each, including effects on service life, economy of operations, ease of maintenance, desired appearance, and safety;

c. Drawings or specifications that show the proposed revisions relative to the original Contract requirements. The Contractor may submit schematics for conceptual approval of the proposal;

d. A detailed and complete cost estimate comparing the original estimated costs for performing the work under the existing Contract and under the proposed VECP;

e. A summary of the Contractor's development costs for the VECP, including costs for designing, testing, preparing and submitting the VECP;

f. A description and estimate of added costs the Department may incur in implementing the VECP, such as review, testing and evaluation of the VECP and Contract administration costs;

g. A date by which the Department must make a decision to obtain the cost savings projected in the VECP. The date identified must allow a reasonable time for the Department to conduct an adequate review and evaluation of the VECP and process a Change Order without affecting the Contractor's schedule;

h. A statement of the probable effect the VECP would have on the Contract completion time. The Department's approval of the VECP shall not change the Contract completion date unless a change to the completion date is specifically provided for in the Change Order authorizing the VECP; and

i. A description of any previous use or testing of the proposed change and the conditions and results. If the proposal was previously submitted on another Department project, indicate the date, project name and number, and the action taken by the Department.

3. Conditions. VECPs will be considered only when all of the following conditions are met:

a. The Contractor has not based any bid prices on the anticipated acceptance of a VECP. If the VECP is rejected, the Contractor shall complete the work at the Contract prices.

b. VECPs, regardless of their approval status, become the property of the Department. The Contractor shall submit VECPs without use or disclosure restrictions. The Department shall have the right to use, duplicate or disclose the VECP and any data necessary to use the VECP on the Project, on any other project, and on any other Contracts. The Contractor shall identify any trade secret information, patented materials or proprietary processes that restrict use of the VECP.

c. The Department is the sole judge as to whether a VECP qualifies for consideration and evaluation. It may reject any VECP that does not allow a reasonable time for adequate review and evaluation by the Department or that requires excessive time or costs for review, evaluations, or investigations, or which is not consistent with the Department's design standards and policies, safety considerations, land use restrictions, permit stipulations, right-of way limitations, or other essential criteria for the project. The Department may reject a VECP without obligation to the Contractor if it contains proposals that are already under consideration by the Department or that have already been authorized for the Contract.

d. If additional information is needed to evaluate a VECP, the Contractor shall provide it in a timely manner. Failure to do so may result in rejection of the VECP.

e. The Contractor may submit VECPs for an approved subcontractor if the Department makes reimbursement to the Contractor.

f. If the Contractor hires a design professional to prepare the proposal, they must be registered in the State of Alaska. That professional must seal the documents and provide evidence of Professional Liability Insurance with limits acceptable to the Department.

g. The Contractor shall not implement proposed changes before the Department accepts the VECP.

h. The Department shall not consider VECPs to share in cost savings due to changes previously ordered or authorized under other Contract sections or for work already done.

i. The Engineer shall reject all unsatisfactory work resulting from an accepted VECP. The Contractor shall remove all rejected work or materials, and shall reconstruct the work under the original Contract at the Contractor's sole expense under Subsection 105-1.11.

j. Reimbursement for modifications to the VECP to adjust field or other conditions is limited to the total amount of the original Contract bid prices.

k. The Department shall not be held liable for costs or delays due to the rejection of a VECP, including but not limited to the Contractor's development costs, anticipated profits and increased material, labor or overhead costs.

4. Processing.

a. The Engineer shall accept or reject the VECP, in writing, by the date the Contractor specifies, unless extended by mutual consent. If rejected, the Engineer will explain the reasons for rejection. A VECP may be rejected if the Contractor allows the Department insufficient time to adequately review and evaluate it.

b. The Contractor may withdraw or modify a VECP at any time before it is accepted.

c. If the VECP is approved in concept (without final drawings and specifications), the Department may either undertake the re-design itself or issue the Contractor a limited notice to proceed, subject to mutual agreement, authorizing the final design. The notice to proceed will include reference to any pertinent design criteria, Department policies, and other limitations on the design or construction methods. Approval in concept does not constitute acceptance of the VECP and will not obligate the Department to accept or pay for the final design.

d. If the final VECP is accepted, the Engineer will issue a Change Order under Subsection 104-1.02 incorporating the VECP into the Contract.

5. Payment. If the Department accepts the VECP, payment will be authorized as follows:

a. The Department will make a direct payment for the changed work at the unit or lump sum agreed prices in the Change Order. Such prices will include reimbursement of the Contractor's costs to develop and submit the VECP, including overhead and profit.

b. In addition, the Department will share the net savings with the Contractor. The amount of the VECP incentive will be equal to 50 percent of the net savings to the Department. The net savings are the difference between the original Contract price for the affected work and the cost of the revised work. For the purpose of this calculation, the cost of the revised work will include costs the Department may incur as a result of the VECP, such as review of the proposal, testing and evaluation, and added Contract administration costs. These costs will be estimated and agreed to in the Change Order.

c. The VECP Incentive will be paid on a prorated basis as the revised work is performed.

SECTION 105
CONTROL OF WORK

105-1.01 AUTHORITY OF THE ENGINEER. The Engineer has immediate charge of the engineering details of the project and is responsible for Contract administration. The Engineer has authority to reject defective material and suspend work not performed in accordance with the Contract. The Engineer has authority to accept completed work, issue Directives, Interim Work Authorizations, and Change Orders, and recommend Contract payments.

The Engineer will decide all questions about the quality and acceptability of the materials furnished and whether the work performed by the Contractor was in accordance with the Contract, the Contractor's rate of progress, Contract interpretation and all other questions relating to Contract compliance.

The Engineer has authority to suspend work for reasons listed under Subsection 108-1.06. If the suspension of work is to protect the traveling public from imminent harm, the Engineer may orally order the suspension of work. Following an oral order of suspension, the Engineer will promptly give written notice of suspension to the Contractor. In other circumstances, the Engineer will give the Contractor written notice of suspension before suspension of work. A notice of suspension will state the defects or reasons for a suspension, the corrective actions required to stop suspension, and the time allowed to complete corrective actions. If the Contractor fails to take the corrective action within the specified time, the Engineer may:

1. Suspend the work until it is corrected; and

2. Employ others to correct the condition and deduct the cost from the Contract amount.

The Engineer may, at reasonable times, inspect any part of the plant or place of business of the Contractor or any subcontractor that is related to Contract performance, including private or commercial plants, shops, offices, or other places of business.

The Engineer may audit all books and records related to performance of the Contract, whether kept by the Contractor or a subcontractor, including cost or pricing data submitted under Subsection 104-1.02.

105-1.02 PLANS AND WORKING DRAWINGS. The Department shall provide the Contractor at least two full size sets of the conformed Plans and Contract including Special Provisions. If cross-sections are available, one set will be provided if requested in writing by the Contractor. The Contractor shall keep a complete set of these documents available on the project site at all times.

The Contractor shall supplement structure plans with working drawings that include all details that may be required to adequately control the work and that are not included in the Plans furnished by the Department. The Contractor shall not perform work or order materials until the working drawings for such work, or for changes, are approved by the Engineer. The Engineer's approval of working drawings or changes shall not be deemed a determination that the working drawings or changes comply with federal, state or local laws, rules, regulations and ordinances. It is Contractor's duty to insure the working drawings comply with the Contract and any applicable federal, state or local laws, rules, regulations, and ordinances.

The Contractor shall submit to the Engineer for approval any required preliminary detail or working drawings. The project name and number shall be stated in the title block for all drawings, as shall the state bridge number, when applicable. The Contractor shall submit drawings in either an electronic or paper format that is acceptable to the Engineer. When paper copies are submitted, provide three sets.

The Contractor shall submit drawings to the Engineer in time to allow for review and correction before beginning the work detailed in the drawing. The Engineer shall return one set of these

drawings, either approved or marked with corrections to be made, and shall retain the other sets. The Engineer's approval of working drawings does not change the Contract requirements or release the Contractor of the responsibility for successful completion of the work.

The Contractor is responsible for the accuracy of dimensions and details and for conformity of the working drawings with the Plans and Specifications. The Contractor shall indicate clearly on the working drawings any intended deviations from the Plans and Specifications and itemize and explain each deviation in the Contractor's transmittal letter. The Engineer may order the Contractor to comply with the Plans and Specifications at the Contractor's sole expense if the approved working drawings deviate from the Plans and Specifications and the Contractor failed to itemize and explain the deviations in the Contractor's transmittal letter.

Once the Contractor receives approval of the working drawings, the Contractor shall furnish to the Engineer:

1. Enough additional copies to provide eight approved sets of prints;

2. One set of reproducible transparencies (polyester film); and

3. If requested, an electronic file in AutoCAD drawing interchange format (.DXF).

The Contractor shall include the cost of furnishing all working drawings in the Contract price.

105-1.03 CONFORMITY WITH PLANS AND SPECIFICATIONS. Work performed and materials furnished shall conform to the Plans and Specifications and approved Working Drawings and be within specified tolerances. When tolerances are not specified, the Engineer will determine the limits allowed in each case.

All work or material not conforming to the Plans and Specifications and approved Working Drawings is considered unacceptable unless the Engineer finds that reasonably acceptable work has been produced. In this event, the Engineer may allow non-conforming work or material to remain in place, but at a reduced price. The Engineer will document the basis of acceptance and payment by Change Order, unless the contract specifies a method to adjust the price of that item.

The failure of the Department to strictly enforce the Contract in one or more instances does not waive its right to do so in other or future instances.

105-1.04 COORDINATION OF PLANS, SPECIFICATIONS, AND SPECIAL PROVISIONS. These Standard Specifications, the Alaska Standard Plans, Standard Modifications, Plans, Special Provisions, and all supplementary documents are essential parts of the Contract. They are intended to complement each other and describe and provide for a complete project. A requirement occurring in one is as binding as if occurring in all.

In case of conflict, calculated dimensions will govern over scaled dimensions. In the event that any of the following listed contract documents conflict with another listed contract document, the order of precedence is:

1. Special Provisions
2. Plans
3. Standard Modifications
4. Standard Specifications
5. Alaska Standard Plans.

The Contractor shall not take advantage of any apparent error or omission in the Contract documents. The Contractor may not base a claim for additional compensation or Contract time on a patent error, omission, or conflict in the Contract documents. The Contractor shall notify the

Engineer immediately of any apparent errors or omissions in the Contract documents. The Engineer will make any corrections or interpretations necessary to fulfill the intent of the Contract.

105-1.05 COOPERATION BY CONTRACTOR. The Contractor shall give the work the constant attention necessary for its progress, and shall cooperate fully with the Engineer, Department staff, and other contractors in every way possible.

Either the Contractor's Superintendent or an acting Superintendent with authority to represent and act for the Contractor shall be available within the proximity of the project whenever work is occurring. The Contractor shall employ, as its agent, a competent superintendent thoroughly experienced in the type of work being performed and capable of reading and thoroughly understanding the Plans and Specifications. The Contractor shall provide 24-hour contact information for the Superintendent. The Contractor shall ensure that the superintendent is available at all times to receive and execute Directives and other instructions from the Engineer, to supervise workers and to coordinate the work of subcontractors. The Contractor shall give the superintendent full authority to supply the resources required. The Contractor shall furnish superintendence regardless of the amount of work sublet.

105-1.06 UTILITIES.

1. Bid Considerations. Bidders shall include in their bid the cost of:

    a. All utility work that is specified in the Contract as work to be performed by the Contractor;

    b. Working around or through all permanent and temporary utilities shown on the Plans, in both their present and adjusted positions;

    c. Accommodating the removal, adjustment, or relocation of utilities shown on the Plans by entities other than the Contractor;

    d. Construction and removal of temporary utilities, to provide temporary utility service during the construction or repair of a permanent utility; and

    e. Other utility work not specifically identified as compensable in Subparagraph 4 Compensation.

    The Department will show the approximate locations of utilities it knows to be within the work zone on the Plans. Bidders shall expect that the location, elevation and nature of utilities may vary from what is shown on the Plans and shall factor those contingencies into the bid price. Additional utilities may exist that are not shown on the Plans. Compensation related to utilities not shown on the plans will only be available in accordance with Subparagraph 4 Compensation.

    When an entity other than the Contractor is to remove, adjust, or relocate any utility, or perform other utility related work within the project boundaries, the applicable completion dates or specific calendar days to complete the removal, adjustment, relocation, or other utility related work may be stated in Section 651. If no date is stated, the Contractor shall work cooperatively with the utility owner during the Project.

2. Cooperation with Utility Owners. The Contractor assumes the obligation of coordinating their activities with utility owners, and shall cooperate with utility owners to facilitate removal, adjustment, or relocation operations, avoid duplication of work, and prevent unnecessary interruption of services. When a utility owner is identified in the Contract as being responsible for removing, adjusting, or relocating a utility, the Contractor shall give the utility owner 15 days advance written notice regarding the dates when the utility owner is required to begin and end operations.

The Contractor shall cooperate with utility owners to determine a utility progress schedule for all parties' utility work. The Contractor shall submit the schedule to the Engineer before beginning that portion of utility work. The Contractor shall update the utility progress schedule monthly and shall note time delays and their cause.

Utility owners are not required to work in more than one location at a time, and shall be allowed to complete a specific section of work prior to commencing another section. Utility owners will not normally perform adjustment or relocation of underground utilities when the ground is frozen. Utility owners may prohibit the Contractor, through the Engineer, from working near utilities when the ground is frozen.

The Department has sole discretion to grant permits for utility work within the state right-of-way. The Contractor shall allow parties with utility permits to work and make excavations in the project**.**

If utility owners do not complete their work in a timely manner, the Engineer may direct the Contractor to temporarily relocate the utilities, to construct new utilities, or to make necessary repairs to complete the utility work.

3. Utility Work. The Contractor shall:

   a. Make all necessary arrangements with utility owners to locate all utilities that may be within an area of work before excavation in that area, in accordance with AS 42.30.400;

   b. Provide right-of-way staking and construction staking with lines and grades before excavation in that area;

   c. Prevent damage to utilities or utility property within or adjacent to the project;

   d. Carefully uncover utilities where they intersect the work;

   e. Immediately stop excavating in the vicinity of a utility and notify the Engineer and the utility owner if an underground utility is discovered that was not field marked or was inaccurately field marked;

   f. Promptly notify the utility owner and the Engineer in the event of accidental interruption of utility service, and cooperate with the utility owner and the Engineer until service is restored;

   g. Take all precautions necessary to protect the safety of workers and the public when performing work involving utilities;

   h. Follow an approved traffic control plan;

   i. Keep the length of open trench excavation to a minimum, backfill trenches as work is completed;

   j. Cover open trenches with metal plates capable of bearing traffic where traffic will cross trenches;

   k. Maintain continuous utility service and install temporary utility systems where needed;

   l. Ensure all excavation conforms to AS 42.30.400 – 42.30.490;

   m. Ensure all excavation and utility work conforms to excavation requirements in 29 CFR 1926, Subpart P, and confined space requirements in 29 CFR 1926.21(b)(6);

n. Ensure all work undertaken near energized high voltage overhead electrical lines or conductors conforms to AS 18.60.670, AS 18.60.675, AS 18.60.680 or other applicable law;

o. Ensure all work undertaken near energized high voltage underground electric lines or conductors conforms to all applicable laws and safety requirements of the utility owner;

p. When required by the utility owner, provide for a cable watch of overhead power, underground power, telephone, and gas;

q. Obtain plan approval from the local fire authority, and provide for the continued service of fire hydrants, before working around fire hydrants;

r. Do all pressure testing or camera testing required to verify utility acceptance in a timely manner; and

s. Coordinate the Storm Water Pollution Prevention Plan (SWPPP) (Section 641) with their work and the utility companies' work.

4. Compensation.

a. Except as otherwise specifically provided in this Subparagraph 4, no equitable adjustment will be paid by the Department:

(1) Due to any variations in location, elevation, and nature of utilities shown on the Plans, or the operation of removing, adjusting, or relocating them;

(2) For any delays, inconvenience, or damage sustained as a result of interference from utility owners, interference from utilities, or interference from the operation of removing, adjusting, or relocating utilities; or

(3) For any adjustments or relocations of utilities requested for the Contractor's convenience.

b. Except as otherwise specifically provided in this Subparagraph 4, the Engineer will issue a Change Order with equitable adjustment if:

(1) Utilities not shown on the Plans require removal, adjustment, or relocation;

(2) Conflicts occur between utilities not shown on the Plans and other necessary work; or

(3) Conflicts due to the required elevation of a utility occur between new and existing utilities that are both shown on the Plans.

c. When the Contractor damages utilities, the utility owner may choose to repair the damage or require the Contractor to repair the damage. When the Contractor damages utilities:

(1) No equitable adjustment will be paid by the Department, and the Contractor shall be solely responsible for repair costs and expenses, when:

(a) The Contractor failed to obtain field locates before performing the work that resulted in the damage;

(b) The utility was field located by the utility owner or operator, and the field locate is accurate within 24 horizontal inches if the utility is buried 10 feet deep or less, or the field locate is accurate within 30 horizontal inches if the utility is buried deeper than 10 feet;

(c) The plan profile or the field locate does not indicate or inaccurately indicates the elevation of a buried utility;

(d) The utility is visible in the field; or

(e) The Contractor could otherwise reasonably have been aware of the utility.

(2) The Engineer will issue a Change Order with an equitable adjustment for the cost of repairing damage if:

(a) The field locate by the owner or operator of a buried utility erred by more than 24 horizontal inches if the utility is buried 10 feet deep or less, or 30 horizontal inches if the utility is buried deeper than 10 feet;

(b) The utility was not shown on the Plans or other Contract documents, and the Contractor could not reasonably have been expected to be aware of the utility's existence; or

(c) The Contractor made a written request for a field locate in accordance with AS 42.30.400, the utility owner did not locate the utility in accordance with AS 42.30.410, and the Contractor could not reasonably have been expected to be aware of the utility's existence or location.

d. If a delay is caused by a utility owner, is beyond the control of the Contractor, and is not the result of the Contractor's fault or negligence, the Engineer may issue a Change Order with an equitable adjustment to contract time, but no equitable adjustment will be made for the cost of delay, inconvenience or damage. Additional contract time may be granted if the cause of delay is because a utility owner is to perform utility work:

(1) By dates stated in the Special Provisions, and the utility work is not completed by the dates stated; or

(2) In cooperation with the Contractor, and the utility owner does not complete the work in a timely manner, based on a written progress schedule agreed upon by the Contractor and the utility owner.

e. If the Engineer orders the Contractor to make necessary construction or repairs due to incomplete utility work by utility owners, the Contractor will be paid as specifically provided for in the Contract, or the Engineer will issue a Change Order with equitable adjustment.

105-1.07 COOPERATION BETWEEN CONTRACTORS. The Department may, at any time, contract for and perform other or additional work on or near the Project. The Contractor shall allow other contractors reasonable access across or through the Project.

The Contractor shall cooperate with other contractors working on or near the Project, and shall conduct work without interrupting or inhibiting the work of other contractors. All contractors working on or near the Project shall accept all liability, financial or otherwise, in connection with their Contract. No claim shall be made by the Contractor or paid by the Department for any inconvenience, delay, damage or loss of any kind to the Contractor due to the presence or work of other contractors working on or near the Project.

The Contractor shall coordinate and sequence the work with other contractors working within the same project limits. The Contractor shall properly join the work with work performed by other contractors and shall perform the work in the proper sequence to that of the others. The Contractor shall arrange, place, and dispose of materials without interfering with the operations of other contractors on the same project. The Contractor shall defend, indemnify and save harmless

the Department from any damages or claims caused by inconvenience, delay, or loss that the Contractor causes to other contractors.

105-1.08 SURVEY CONTROL. The Department will provide sufficient horizontal and vertical control data to establish the planned lines, grades, shapes, and structures. The Contractor shall provide all additional survey work to maintain control during the project.

105-1.09 DUTIES OF THE INSPECTOR. The Department's inspectors are authorized to examine all work done and materials furnished, but cannot approve work or materials. Only the Engineer can approve work or materials. The inspectors can reject work or materials until any issues can be referred to and decided by the Engineer. The inspectors may not alter or waive any Contract requirements, issue instructions contrary to the Contract or act as foremen for the Contractor.

105-1.10 INSPECTION OF WORK. All materials and each part and detail of the work shall be subject to inspection by the Department for compliance with the Contract. The Contractor shall allow safe access to all parts of the work and provide information and assistance to the Engineer to ensure a complete and detailed inspection.

Any work done or materials used without inspection by an authorized Department representative may be ordered removed and replaced at the Contractor's expense, unless the Department failed to inspect after being given reasonable written notice that the work was to be performed.

The Contractor shall remove and uncover portions of finished work when directed. After inspection, the Contractor shall restore the work to Contract requirements. The cost to uncover and restore work shall be at the Contractor's expense, except the Department will pay the cost to uncover and restore work if (1) an authorized Department representative had previously inspected the work or the Contractor had provided reasonable prior written notice that the work was to be performed and (2) the Department finds the uncovered work to be acceptable. If the Department finds the uncovered work to be unacceptable, the cost to correct the work, or remove and replace the work, shall be at the Contractor's expense.

Representatives of Contract funding agencies have the right to inspect the work. This right does not make that entity a party to the Contract and does not interfere with the rights of parties to the Contract.

The Department's observations, inspections, tests and approvals shall not relieve the Contractor from properly fulfilling its Contract obligations and performing the work in accordance with the Contract. Work that has been inspected but contains latent or hidden defects shall not be deemed acceptable even though it has been inspected and found to be in accordance with the Contract.

105-1.11 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK. All work that does not conform to the requirements of the Contract shall be deemed unacceptable by the Engineer, unless otherwise determined acceptable under Subsection 105–1.03. The Contractor shall correct, or remove and replace, work or material that the Engineer deems unacceptable, as ordered by the Engineer and at no additional cost to the Department.

The Contractor shall establish necessary lines and grades before performing work. Work done before necessary lines and grades are established, work done contrary to the Department's instructions, work done beyond the limits shown in the Contract, or any extra work done without authority, will be considered as unauthorized and shall not be paid for by the Department, and may be ordered removed or replaced at no additional cost to the Department.

If the Contractor fails to promptly correct, remove, or replace unacceptable or unauthorized work as ordered by the Engineer, the Engineer may employ others to remedy or remove and replace the work and will deduct the cost from the Contract payment.

105-1.12 LOAD RESTRICTIONS. The Contractor shall comply with all vehicle legal size and weight regulations of 17 AAC 25 and the *Administrative Permit Manual,* and shall obtain permits from the DOT&PF Division of Measurement Standards & Commercial Vehicle Enforcement before moving oversize or overweight equipment on a state highway.

The Engineer may permit oversize and overweight vehicle movements within the project limits provided the Contractor submits a written request and an acceptable Traffic Control Plan under Subsection 643-1.03. No overloads will be permitted on a pavement, base or structure that will remain in place in the completed project. The Contractor shall be responsible for all damage done by their equipment due to overloads, and for damage done by a load placed on a material that is curing and has not reached adequate strength to support the load.

105-1.13 MAINTENANCE DURING CONSTRUCTION. The Contractor shall maintain the entire highway and related highway facilities located within the project (between the beginning of project and end of project shown on the Plans) from the date construction begins until the Contractor receives a letter of project completion. The Contractor shall maintain these areas continually and effectively on a daily basis, with adequate resources to keep them in satisfactory condition at all times. The Contractor shall maintain those areas outside the project that are affected by the work, such as haul routes, detour routes, structures, material sites, and equipment storage sites during periods of their use.

The Engineer may relieve the Contractor of this maintenance responsibility for specified portions of the project for any of the following:

1. During a seasonal suspension of work (Subsection 643-3.07)

2. Following partial completion (Subsection 105-1.14)

3. Following project completion (Subsection 105-1.15).

The Department is responsible for routine snow removal and ice control only on those portions of the project that the Department accepts for maintenance and that are open for public use.

The Contractor shall maintain previously constructed work until a subsequent course, layer, or structure covers that work. The Contractor shall repair damage done to the work as described in Subsection 107-1.15.

All costs of maintenance work shall be subsidiary to the prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

If in the Engineer's opinion, the Contractor at any time fails to provide adequate maintenance, the Engineer will notify the Contractor of such noncompliance. The notification will specify the areas or structures for which there is inadequate maintenance, the corrective maintenance required, and the time allowed to complete corrective maintenance. If the Contractor fails to take the corrective action within the specified time, the Engineer may:

1. Suspend the work until corrective maintenance is completed;

2. Assess a traffic price adjustment against the Contract Amount when an adjustment rate is specified in the Contract; and

3. Employ others for corrective maintenance and deduct the cost from the Contract amount.

105-1.14 PARTIAL COMPLETION. The Contractor may submit a written request for partial acceptance of a substantially complete geographically separate portion of the project. The Engineer will accept the portion in writing before project completion and relieve the Contractor of further maintenance responsibility for the completed work except for work specified for Period of

Establishment under Section 621 if the Engineer inspects the portion and finds that it is substantially complete to Contract requirements, and acceptance is in the best interest of the State.

Partial completion of the portion neither voids nor alters any Contract terms.

105-1.15 PROJECT COMPLETION. The Contractor shall notify the Engineer, in writing, upon substantial completion of all work provided for under the Contract. The Engineer will then schedule and conduct the final inspection. If the inspection discloses that any work is incomplete or unsatisfactory, the Engineer will give the Contractor a list of work items that must be completed or corrected to reach substantial completion and to reach final completion. The Contractor shall promptly complete or correct any work determined unsatisfactory by the final inspection and request a re-inspection.

The Engineer will identify the date of substantial completion in a letter of substantial completion. The letter of substantial completion will relieve the Contractor of further maintenance responsibility of the completed work. The letter of substantial completion will not stop Contract time or relieve the Contractor of the obligation to fully complete the work as required by the Contract specifications.

When all physical work and cleanup provided for under the Contract is found to be complete, except for work specified for Period of Establishment under Section 621, the Engineer will issue a letter of project completion. Project completion stops the Contract time, but does not relieve the Contractor of any other Contract obligations.

105-1.16 FINAL ACCEPTANCE AND RECORD RETENTION. The Department will issue the letter of Final Acceptance after all of the following:

1. Project completion;

2. Receipt of all certificates, as-builts, warranties, and other required documents;

3. Receipt of the Contractor's Release, with no exceptions;

4. Certification of payment of payroll and revenue taxes by DOLWD and State Department of Revenue; and

5. Final payment under the Contract.

Final Acceptance will release the Contractor from further Contract obligations, except those:

1. Specified under Subsection 107-1.19;

2. Required by law or regulation; or

3. Continuing obligations established by provisions of this Contract, such as warranty, guaranty, indemnity, insurance, or bond.

The Contractor and the subcontractors shall maintain all books and records relating to performance of the Contract for three years after the date of final payment of the Contract and each subcontract.

105-1.17 CLAIMS. The Contractor shall notify the Engineer as soon as the Contractor becomes aware of any act or occurrence that may form the basis of a claim for additional compensation or an extension of Contract time or of any dispute regarding a question of fact or interpretation of the Contract. The Engineer has no obligation to investigate any fact or occurrence that might form the basis of a claim or to provide any additional compensation or extension of Contract time unless

the Contractor notifies the Engineer in a timely manner of all facts the Contractor believes form the basis for the claim.

If the Contractor believes that he is entitled to an extension of Contract time, the Contractor must state the contract section on which the extension request is based, provide the Engineer with sufficient information to demonstrate that the Contractor has suffered excusable delay, and show the specific amount of time to which the Contractor is claiming entitlement. The Department will not grant an extension of Contract Time if the Contractor does not timely submit revised schedules in accordance with Subsection 108-1.03.

If the basis of claim or dispute is not resolved by agreement within seven days of the date the Engineer is notified by the Contractor, the Contractor shall within the next fourteen days submit a Contractor Intent to Claim (Form 25D-18) to the Engineer. Failure to submit a Contractor Intent to Claim as required under this section constitutes a waiver of any future claim arising from or relating to the alleged act or occurrence.

If the Contractor believes additional compensation or time is warranted, the Contractor shall immediately begin keeping complete, accurate, and specific daily records concerning every detail of the potential claim including actual costs incurred, and shall give the Engineer access to any such records and furnish the Engineer copies, if requested. Equipment costs must be based on the Contractor's internal rates for ownership, depreciation, and operating expenses and not on published rental rates. In computing damages, or costs claimed for a change order, or for any other claim against the Department for additional time, compensation or both, the contractor must establish actual damages based on internal costs for equipment, labor or efficiencies. Total cost, modified total cost or jury verdict forms of presentation of damage claims are not permitted. Labor inefficiencies must be shown to actually have occurred and can be proven solely based on job records. Theoretical studies are not a permissible means of showing labor inefficiencies. Home office overhead will not be allowed as a component of any claim against the Department.

The Contractor shall submit a written claim to the Contracting Officer within 90 days after the date the Contractor became aware of the basis of the claim or should have known of the basis of the claim, whichever is earlier. Any Claim not filed within this 90-day period will be deemed irrevocably waived by the Contractor, regardless of whether the requested relief is sought for the ultimate benefit of the Contractor or its subcontractor(s). The Contracting Officer will issue a written acknowledgement upon receipt of the claim.

The Contractor waives any right to claim if the Engineer was not notified properly or afforded the opportunity to inspect conditions or monitor actual costs or if the Claim is not filed on the date required.

1. The written Claim must include all of the following:

    a. The act, event, or condition giving rise to the claim;

    b. The Contract provisions that apply to the claim and that provide for the requested relief;

    c. The item or items of Contract work affected and how they were affected;

    d. The specific relief requested, including Contract time if applicable, and the basis upon which it was calculated;

    e. Revised progress schedules under Subsection 108–1.03; and

    f. A certification signed by the Contractor that to the best of the contractor's knowledge and belief, the data submitted is accurate, complete, and current and is the actual cost to the contractor or additional time for performing the additional work or supplying the additional materials.

2. The claim, in order to be considered, must show:

   a. That the Contractor suffered damages or delay;

   b. The damages or delay were caused by the act, event, or condition listed in the claim; and

   c. That the Contract entitled the Contractor for relief due to the act, event, or condition specified in the Claim.

The Department may request the Contractor to provide additional information relating to the claim at any time before issuing a decision. The Contractor shall provide the Department with the requested additional information within 30 days of receiving a request. Failure to furnish the additional information may be regarded as a waiver of the claim.

The Contracting Officer will issue a decision within 90 days of receipt of all information relating to the claim. The time for the Contracting Officer to issue a decision may be extended in accordance with AS 36.30.620.

The Contracting Officer's decision is final and conclusive unless the Contractor delivers a notice of appeal to the Commissioner within 14 days of receipt of the decision. The Contractor shall also serve a copy of the notice of appeal on the Contracting Officer.

Appeals from a Contracting Officer’s decision shall be decided in accordance with the State Procurement Code’s appeal procedures, including AS 36.30.625, AS 36.30.627, AS 36.30.630, and AS 36.30.631.

Criminal and civil penalties authorized under AS 36.30.687 (including, but not limited to, forfeiture of all claimed amounts) may be imposed on the Contractor if the Contractor makes or uses a misrepresentation in support of a claim, or defrauds or attempts to defraud the Department at any stage of prosecuting a claim under this Contract.

105-1.18 WARRANTIES (RESERVED).

SECTION 106
CONTROL OF MATERIAL

106-1.01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS. The Contractor shall furnish all materials required to complete the work except those specified to be furnished by the Department. The Contractor shall supply materials that are new and that meet Contract requirements.

The Contractor shall notify the Engineer of proposed sources of materials at least 30 days before shipment, and shall submit to the Engineer and to the Department's State Materials Engineer a complete list of materials to be purchased from suppliers sufficiently in advance of fabrication or shipment to permit the Department to inspect the materials.

The Department's inspectors may inspect any materials, including those originating outside Alaska, at the supply source or other locations. Materials may be conditionally approved at the supply source or other location, but are subject to field inspection and may be ordered removed under Subsection 105-1.11 if they do not conform to Contract requirements. Inspectors are authorized to reject materials that do not conform to specifications. Inspectors will report their actions to the Engineer.

The Contractor shall submit a certificate of compliance for each item listed on the Material Certification List. The Engineer may authorize the use of materials based on a certificate of compliance, see Subsection 106-1.05. Materials incorporated into the project on the basis of a certificate of compliance may be tested at any time, whether in place or not, and, if they do not conform to Contract specifications, they may be rejected and ordered removed under Subsection 105-1.11.

The Engineer may authorize the use of materials listed in the Department's *Qualified Products List*. Materials incorporated into the project on the basis of the *Qualified Products List* may be tested at any time, whether in place or not, and, if they do not conform to Contract specifications, they may be rejected and ordered removed under Subsection 105-1.11.

The Contractor may request substitution of specified materials with equivalent materials. Requests for substitution shall be submitted to the Engineer, and shall include a manufacturer's statement that certifies, for each lot delivered:

1. Conformance to the specified performance, testing, quality or dimensional requirements; and

2. Suitability for the use intended in the Contract work.

The Engineer will determine the acceptability of a proposed substitute for use in the project. If a substitute is approved, a Change Order will be executed. The Department is never required to accept substitution. The Contractor shall not incorporate substitute materials into the project without written approval from the Engineer. The Engineer may test substitute materials at any time, whether in place or not, and, if the substitute materials do not meet Contract specifications, they may be rejected and ordered removed under Subsection 105-1.11.

BUY AMERICA PROVISION. On projects using federal funds, the Contractor shall comply with the requirements of 23 CFR 635.410, Buy America requirements, and shall submit a completed Material Origin Certificate, Form 25D-60, prior to award of the contract. When the Contractor becomes aware of a change from or error in a previously submitted Material Origin Certificate (Form 25D-60), the Contractor shall submit an updated Material Origin Certificate (Form 25D-60). All steel and iron products which are incorporated into the work, shall be manufactured in the United States except that minor amounts of steel and iron products of foreign manufacture may be used, provided the aggregate cost of such does not exceed one tenth of one percent (0.001) of the total contract amount, or $2,500, whichever is greater. For the purposes of this paragraph, the cost is the value of the products as they are delivered to the project including freight.

"Manufactured in the United States" means all manufacturing processes starting with the initial mixing and melting through the final shaping, welding, and coating processes must be undertaken in the United

States. The definition of “manufacturing process” is smelting or any subsequent process that alters the material’s physical form, shape or chemical composition. These processes include rolling, extruding, machining, bending, grinding, drilling, etc. The application of coatings, such as epoxy coating, galvanizing, painting or any other coating that protects or enhances the value of steel or iron materials shall also be considered a manufacturing process subject to the requirements of Section 106-1.01, Buy America Provision and of the Buy America Act.

Buy America does not apply to raw materials (iron ore), pig iron, and processed, pelletized and reduced iron ore. It also does not apply to temporary steel items (e.g., temporary sheet piling, temporary bridges, steel scaffolding, and falsework). Further, it does not apply to materials which remain in place at the Contractor’s convenience (e.g., sheet pilings, and forms).

The North American Free Trade Agreement (NAFTA) does not apply to the Buy America requirement. There is a specific exemption within NAFTA (article 1001) for grant programs such as the Federal-aid highway program.

When steel and iron products manufactured in the United States are shipped to a foreign country where non steel or iron products are installed on or in them (e.g., electronic components in a steel cabinet), the steel and iron is considered to meet the requirements of this subsection.

The Contractor shall ensure that all manufacturing processes for each covered product comply with this provision. Non-conforming products shall be replaced at no expense to the State. Failure to comply may also subject the Contractor to default and debarment.

Provide a Certificate of Buy America Act Compliance Form 25D-62 from the supplier for each steel or iron product and each component that is manufactured predominantly of steel or iron, prior to incorporating any steel or iron products or any components manufactured predominantly of steel or iron into the project. The supplier certifying Form 25D-62 may be the original manufacturer, fabricator, vendor, or subcontractor; provided the supplier has sufficient control and knowledge of the manufacturing process to accept responsibility and certify full and complete conformance with 23 CFR 635.410. Provide mill certificates when required by the Engineer. False statements may result in criminal penalties prescribed under AS 36.30.687 and Title 18 US Code Section 1001 and 1020.

ALASKA AGRICULTURAL/WOOD PRODUCTS. On wholly state-funded projects, agricultural/wood products harvested in Alaska shall be used pursuant to AS 36.15.050 and AS 36.30.322 whenever they are priced no more than seven percent above agricultural/wood products harvested outside the state and are of a like quality as compared with agricultural/wood products harvested outside the state.

The Contractor shall maintain records which establish the type and extent of agricultural/wood products utilized. When such products are not utilized, the Contractor shall document the efforts he made towards obtaining agricultural/wood products harvested in Alaska and include in this documentation a written statement that he contacted the manufacturers and suppliers identified on the Department of Commerce and Economic Development's list of suppliers of Alaska forest products concerning the availability of agricultural/wood products harvested in Alaska and, if available, the product prices. The Contractor shall complete this documentation at a time determined by the Contracting Officer.

The Contractor's use of agricultural/wood products that fail to meet the requirements of this Subsection shall be removed and replaced in accordance with Subsection 105-1.03, Conformity with Plans and Specifications.

106-1.02 MATERIAL SOURCES.

1. General. The Contractor shall:

    a. utilize Useable Excavation according to Subsection 104-1.04 before using material sources listed in Subsection 106-1.02.4. When there is insufficient useable excavation furnish additional

required materials from sources of the Contractor's choice, except that the Contractor shall use a mandatory source when identified in the Contract;

b. produce a sufficient quantity of materials meeting the specifications to complete the project;

c. as a subsidiary cost: clear and grub, strip, drill and blast, excavate, crush, sort, blend, screen, wash, stockpile, haul, and rehandle material as needed to produce and deliver the specified product;

d. determine the type of equipment and methods to be used;

e. expect variations in material quality within the deposits, and procure material only from acceptable portions of the deposit, regardless of source ownership; and

f. prevent erosion, sedimentation, and pollution within a materials source.

The Contractor agrees that:

g. the costs to explore and develop material sources, including all production effort, are subsidiary to the cost of providing the specified material;

h. the Engineer may order the Contractor to procure material only from certain portions of the source and may reject material from other portions of the source that does not conform to the specifications; and.

i. all material required may not be procurable from any one source and the Contractor may need to change between sources. That contingency is to be factored into the unit bid price for the Contract Item.

2. Inspection and Acceptance. The Contractor shall perform sampling and testing during materials processing and placement in accordance with its Quality Control Plan (Subsection 106-1.03, Testing and Acceptance) and shall obtain acceptable material samples from locations designated within the source.

The Department will sample and test materials to determine the quality of the source, at its expense, as part of its Acceptance Testing (106-1.03.2). The Department will reject materials when the samples do not meet specifications. The Department may reject a proposed materials site when samples do not meet specifications.

3. Awareness Training. The operator of the Contractor's sand and gravel surface mine or other similar materials source shall provide Site-Specific Hazard Awareness Training in compliance with 30 CFR 46.11 for all the Engineer's personnel before beginning operations. All other workers shall be given training in compliance with 30 CFR 46 before exposure to mine hazards. The training must be offered at each surface mine that will be used to supply processed aggregates. A qualified person must provide the training. The training shall be in accordance with the operator's written training plan approved by the Mine Safety and Health Administration, covering the following items:

a. Site-specific health and safety risks;

b. Recognition and avoidance of hazards;

c. Restricted areas;

d. Warning and evacuation signals;

e. Evacuation and emergency procedures;

f. Other special safety procedures; and

g. A site tour.

The Contractor shall require the Engineer's personnel to sign the *Visitor's Log Book* upon completion of the training to indicate that training was provided. Training is a subsidiary cost.

4. Type of Sources. When there is insufficient Useable Excavation, as defined in 104-1.04, the Contractor shall supply additional required material from one or more of the following sources:

a. Contractor-Furnished Sources. For a material source that is a commercial plant as defined in Subsection 108-1.01.4.a the Contractor shall:

(1) acquire the necessary rights and permits to obtain material from a commercial plant;

(2) pay as subsidiary costs all related costs to obtain and use material from the source; and

(3) be solely responsible for the quality and quantity of materials.

For all Contractor-Furnished sources that are not a commercial plant, the Contractor shall:

(4) Acquire the necessary rights and permits to take materials from the sources including state-owned sources that are not under the Department's control;

(5) Pay as subsidiary:

(a) all related costs to obtain, develop, and use the sources, including but not limited to permit and mineral royalties;

(b) the material costs identified in the Material Sales Agreement you obtain for State owned sources where an existing or draft Material Sales Agreement is not included in the contract; and

(c) the material costs identified in the Material Sales Agreement for material obtained from State owned sources for which an existing or draft Material Sales Agreement is included in the contract;

(6) Be solely responsible for quality and quantity of materials; and

(7) Obtain all necessary rights, permits, and plan approvals before clearing or disturbing the ground in the material source. The contractor shall certify in writing to the Engineer that all permits and clearances relating to the use of the material source have been obtained prior to any clearing or ground disturbance in the materials source.

No equitable adjustment or other compensation will be made for any additional costs, including increased length of haul, if the Contractor:

(8) Chooses to change material sources for any reason;

(9) Is unable to produce a sufficient quantity or quality of materials from Contractor-Furnished sources; or

(10) Encounters unexpected, unforeseen, or unusual conditions within Contractor-Furnished sources.

b. Mandatory Sources. The Department may identify material sources in the Contract from which the Contractor is required to take a specified quantity of material. No other source will be permitted for that portion of material unless prior approval is obtained from the Engineer. The Contract will specifically define these sources as Mandatory Sources and define rights and stipulations for each site. The Department will provide a materials report for these sources.

The Contractor acknowledges that samples from within a source may not be representative of the entire source. The Contractor must expect variations of quality and quantity within the source and shall factor that contingency into the unit bid price for the material. No equitable adjustment will be paid for variations encountered within the source.

When using a Mandatory Source, if it is found that the quality or quantity of material producible from the Mandatory Source does not meet project requirements, and a change of source is necessary for that reason alone, a Change Order with equitable adjustment will be made.

c. Designated Sources. The Department may identify material sources in the Contract which are available to the Contractor but which the Contractor is not required to use. The Contract will specifically define these sources as Designated Sources and define rights and stipulations for each site. The Department will provide a materials report for these sources.

The Contractor acknowledges that samples from within a source may not be representative of the entire source. The Contractor must expect variations of quality and quantity within the source and shall factor that contingency into the unit bid price for the material. No equitable adjustment will be paid for variations encountered within the source.

If the Contractor elects to use a Designated Source, and it is found that the quality or quantity of material producible from the Designated Source does not meet project requirements, and a change of source is necessary for that reason alone, a Change Order with equitable adjustment will be made. If the Contractor chooses to change between or among sources for any other reason than quantity or quality of material, no equitable adjustment will be paid.

d. Available Sources. The Department may identify other material sources that are available for use for the project by the Contractor. The Contract will specifically define these sources as Available Sources. The Department makes no guarantee as to quality or quantity of material in Available Sources. The Contractor is responsible for determining the quality and quantity of material, and if additional sources are needed. The Contractor shall be responsible for identifying the rights and stipulations for each site with the owner of the site.

When the Department furnishes copies of existing boring logs, test results, or other data in its possession concerning Available Sources, the Contractor is responsible for determining the accuracy and completeness of this data, for any assumptions the Contractor makes based on this data, and for exploring all Available Sources to the Contractor's satisfaction.

The Department makes no representation, guarantees, or warranty whatsoever, expressed or implied, as to:

(1) The quality or quantity of materials producible from an Available Source, even if such information is indicated in a Materials Report or Soils Investigation Report;

(2) Whether boring logs, test results or data reliably represent current existing subsurface conditions;

(3) Whether interpretations of the boring logs, test results, or other data are correct;

(4) Whether moisture conditions and indicated water tables vary from those found at the time borings were made;

(5) Whether the ground at the location of the borings was physically disturbed or altered after the boring was made; and

(6) The condition, materials, or proportions of the materials between borings, regardless of any subsurface information the Department may make available.

The availability of subsurface information from the Department shall not relieve the Contractor from any risks, or of any duty to make on-site examinations and investigations, or of any other responsibility under the Contract or as may be required by law.

No equitable adjustment will be made if the quality or quantity of material available from an Available Source is not as represented in any information provided by the Department, nor if a change of source is necessary for any other reason whatsoever. The use of Available Sources is entirely at the Contractor's option and the Contractor bears all risk associated with their decision to use an Available Source.

e. Excluded Material Sources. Department owned, managed, or permitted material sources not identified in the Contract are excluded from use for the project. This exclusion does not prevent the Contractor from considering material sources as provided for in Subsection 106-1.02.(4.)(a.) Contractor-Furnished Sources, unless the Contract specifically identifies a source as an Excluded Material Source, nor does it prevent post-award consideration of other material sources as provided under Subsection 104-1.06.

5. Rights, Permits and Plan Approvals for Material Sources. Before disturbing the site of a material source, the Contractor shall acquire and pay for all necessary rights, permits and plan approvals indicated in this Subsection and in Subsection 107-1.02. For each material site the Contractor shall:

   a. Acquire approval for a Mining and Reclamation Plan (MRP) or receive an exemption, in accordance with AS 27.19. The MRP shall include:

      (1) Plan and cross-sectional views of the site;

      (2) Applicable boundaries or property lines;

      (3) Areas and depths to be developed;

      (4) Locations of access roads, stripping, sorting, and unsuitable material piles, crushing and plant sites, stockpile sites, drainage features, erosion and pollution control features; and

      (5) Condition the Contractor will leave the site after the materials extraction is completed, including reseeding.

   b. Submit a SWPPP as required by Section 641.

6. Reclamation. After completing work in a materials source, the Contractor shall finish and grade work areas to a neat, acceptable condition in accordance with the approved MRP. Reclamation of a Contractor-furnished source will be in accord with the Contractor's MRP.

106-1.03 TESTING AND ACCEPTANCE. Materials are subject to inspection and testing by the Department at any time before, during, or after they are incorporated into the project. Use of untested materials is at the Contractor's risk. The Contractor shall remove and replace unacceptable material according to Subsection 105-1.11.

1. Quality Control. The Contractor is responsible for the quality of construction and materials used in the work. Quality control is process control, and includes all activities that ensure that a product meets Contract specifications. Quality control is subsidiary to the applicable items. The Contractor shall perform quality control as follows:

   a. Submit a Quality Control Plan no less than five working days before the preconstruction conference. Include, for each item being produced, the methods to be used for sampling and testing, the proposed testing frequency, personnel qualifications, and equipment descriptions. Include the use of control charts, chart update frequency, chart posting location, and criteria for corrective action.

b. Sample materials during manufacturing or processing and perform quality control tests, as needed, to ensure materials produced conform to the Contract Specifications. Document quality control tests and make them available to the Engineer on a daily basis.

c. Sample and test according to test methods required in the Specifications.

2. Acceptance Testing. The Department has the exclusive right and responsibility for determining the acceptability of the construction and incorporated materials.

The Department will sample materials and perform acceptance tests at its expense. Copies of tests will be furnished to the Contractor upon request.

The Contractor shall not rely on the Department's acceptance testing for its quality control. The Department's acceptance testing is not a substitute for the Contractor's quality control. The Engineer may retest materials that have failed the Department's acceptance test, but is not required to do so.

3. Quality Level Analysis (QLA). All statistical Quality Level Analysis (QLA) is computed using the Engineer's Price Adjustment program. The program calculates all intermediate values to 16 decimal places. Pay factors are rounded to the nearest 0.001. The basis of payment for production lots of selected pay items is adjusted using statistical analysis of acceptance test results. Analysis is based on an Acceptable Quality Level (AQL) of 90 percent. The AQL is the minimum Percent Within Limits (PWL) at which the material is considered fully acceptable and receives a 1.000 pay factor. As an incentive to produce quality material, a pay factor greater than 1.000 is possible. The maximum pay factor obtainable is 1.050.

The procedure for estimating the PWL uses the number (*n*), the arithmetic mean ($\bar{X}$), and the sample standard deviation (*s*), of acceptance test results as shown below. If the sample standard deviation is less than 0.001, then it is set at 0.001.

a. The arithmetic mean is computed: $$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

Where: X_i = test result for sublot i.
$\sum_{i=1}^{n}$ = sum of values from sublot 1 to n.

b. The sample standard deviation is computed: $$s = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \bar{X})^2}{(n-1)}}$$

The upper specification limit (USL) and lower specification limit (LSL) are equal to the Target Value (TV) plus and minus the allowable tolerances as defined in the pay item specification.

Quality Indexes are computed as shown below. The maximum Quality Index obtainable is 10.000.

c. The Upper Quality Index (Q_U) is computed: $$Q_U = \frac{USL - \bar{X}}{s}$$

d. The Lower Quality Index (Q_L) is computed: $$Q_L = \frac{\bar{X} - LSL}{s}$$

The computed Q_U and Q_L are used with AASHTO R 9 to determine the Percent Within Upper Limits (PWL_U) and Percent Within Lower Limits (PWL_L).

e. The PWL used in pay factor determination is: $$PWL = (PWL_U + PWL_L) - 100$$

When material requirements are one-sided, with only an upper or lower limit, then the PWL is equal to the percent within the side that has a limit. For example, if a material only has an upper specification

(maximum) limit, then PWL= PWL_U. Also, two-sided specification limits with one side that cannot be exceeded (like 100 percent passing) will be analyzed as if they are one-sided.

f. The pay factor (PF) is: $PF = 0.55 + \frac{PWL}{200}$

Where: PWL varies from 50.000 to 100.000.
When PWL is less than 50.000, the pay factor (PF) = zero

106-1.04 PLANT INSPECTION. The Department may periodically inspect manufacturing methods, manufactured lots and materials at the source of production. The Department may approve, conditionally approve, or reject them.

The Contractor shall:

1. Notify the Department of the production and fabrication schedule at least 30 days before beginning work on any item requiring inspection, and notify the Department 48 hours before beginning production or fabrication;

2. Give the inspector full and safe access to all parts of the plant used to manufacture or produce materials; and

3. Cooperate fully and assist the inspector during the inspection.

Materials may be rejected if the Department requests a plant inspection and the materials are produced or fabricated without a plant inspection. The materials may be tested at any time before final acceptance, whether in place or not, and whether approved at a plant inspection or not. If the materials do not meet Contract specifications, they may be rejected and ordered removed under Subsection 105-1.11. If rejected materials are incorporated into the project, the Department may require those materials to be removed and replaced at the Contractor's expense under Subsection 105-1.11.

106-1.05 CERTIFICATES OF COMPLIANCE. The submittal requirements of this subsection are in addition to the submittal requirements of 106-1.01 Buy America Provision.

The Engineer may authorize the use of certain materials or assemblies based on either a manufacturer's certification or based on a Contractor’s summary sheet with applicable documentation attached.

1. If by manufacturer’s certification, the certificate must include the project name and number, the signature of the manufacturer, and must include information that clearly demonstrates the material or assembly fully complies with the Contract requirements.

2. If by Contractor’s summary sheet, the summary sheet must include the project name and number, the signature of the contractor, and must include attached documentation that clearly demonstrates the material or assembly fully complies with the Contract requirements.

Electronic submittals that are submitted by email from the Contractor’s email account are considered signed by the Contractor.

The Contractor shall submit additional certificates of compliance or test data if required by the Contract or by the Engineer. The Engineer may refuse permission to incorporate materials or products into the project based on a certificate of compliance that does not meet the Contract requirements.

106-1.06 STORAGE OF MATERIALS. Materials shall be stored to preserve their quality and fitness for the work, and so they can be readily inspected. Materials inspected before storage may be inspected again, before or after being incorporated into the project. The Contractor shall:

1. Use only approved portions of the project site for storage of materials and equipment or plant operations;

2. Provide any additional space needed for such purposes without extra compensation;

3. Restore Department-owned or controlled storage and plant sites to their original condition without extra compensation;

4. Obtain the landowner's or lessee's written permission before storing material on private property, and furnish copies of the permission to the Engineer, if requested; and

5. Restore privately owned or leased storage sites, without extra compensation from the Department, to their original condition or as agreed to between the Contractor and the private owner.

106-1.07 DEPARTMENT-FURNISHED MATERIAL. Material furnished by the Department will be made available to the Contractor at a state yard or delivered at the locations specified in the Special Provisions.

The Contractor shall include the cost of handling and placing all materials after they are delivered in the Contract price for the item in connection with which they are used. The Contractor is responsible for all material delivered to the Contractor. Deductions will be made from any monies due the Contractor to make good shortages and deficiencies from any cause whatsoever, for any damage that may occur after delivery, and for demurrage charges.

106-1.08 SUBMITTAL PROCEDURE. The Contractor shall complete a Submittal Register, and shall submit it to the Engineer on forms provided by the Department or similar forms of the Contractor's choice as approved by the Engineer. The intent of the Submittal Register is to provide a blueprint for the smooth flow of specified project documents. The Contractor shall fill it out sequentially by bid item and allow at least three spaces between bid items. The Submittal Register shall list all working drawings, schedules of work, and other items required to be submitted to the Department by the Contractor including but not limited to: Progress Schedule, anticipated dates of material procurement, Construction Phasing Plan, Traffic Control Plan, Storm Water Pollution Prevention Plan, Quality Control Program, Utility Progress Schedule, Blasting Plan, Mining Plan, annual EEO reports, DBE payment documentation and subcontracts.

The Contractor shall submit materials (product) information to the Engineer for review, as required by the Contract.

Unless otherwise specified, provide all submittals in an electronic format acceptable to the Engineer.

If the Contract has a duration of 180 days or less, the Contractor shall, within fifteen days after the date of the Notice to Proceed, submit to the Department for review all submittals and the submittal register. If the Contract has a duration greater than 180 days, the Contractor shall, within fifteen days after the date of the Notice to Proceed, submit to the Department for review, an anticipated schedule for transmitting submittals.

Each submittal shall include a Submittal Summary sheet. The Contractor shall sign submittals and submit them to the Engineer. Electronic submittals that are submitted by email from the Contractor's email account are considered signed. The Department will return submittals to the Contractor as either: approved, conditionally approved with the conditions listed, or rejected with the reasons listed. The Contractor may resubmit a rejected submittal to the Engineer with more information or corrections. The Department's approval of a submittal in no way relieves the Contractor of its responsibility for the means, methods, techniques, sequence, and procedures of construction, safety, and quality control.

The Contractor shall be responsible for timely submittals. Failure by the Department to review submittals within 30 days or as otherwise provided in the applicable subsection may be the basis for a request for extension of Contract time but not for additional compensation.

Payment for a specific contract item will not be made until the Department has received the Submittal Register for all items and approved all required submittals for that specific contract item.

When material invoices, freight bills, and mill certificates are submitted, they shall provide sufficient information for the Engineer to identify: the date, supplier and origin of invoice (bill, certificate); project name and number where material will be incorporated; manufacturer, product number, quantity, cost and bid item.

SECTION 107
LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

107-1.01 LAWS TO BE OBSERVED. The Contractor shall keep fully informed of, observe, and comply with all federal, state, and local laws, ordinances, and regulations, and all orders and decrees of bodies or tribunals having any jurisdiction or authority, that in any manner affect those engaged or employed on the work or which in any way affect the conduct of the work.

The Contractor and the Surety shall defend, indemnify, and hold harmless the State and its representatives against any claim or liability related to violations of any laws, regulations or decrees by the Contractor, the Contractor's agents, the Contractor's employees, a subcontractor at any tier, or a supplier or service provider.

The Contractor has the affirmative duty to keep informed of and comply with all laws. The Contractor is not entitled to and shall not rely on any Department employee's interpretation, whether oral or written, of any law, ordinance, or regulation.

The Contractor is responsible for conspicuously displaying required posters in an area readily accessible to workers.

1. For wholly state-funded projects, display all posters listed on the Department of Labor and Workforce Development website at http://www.labor.alaska.gov/lss/posters.htm.

2. On projects using federal funds, display posters required by law or funding agency including posters listed on the FHWA website http://www.fhwa.dot.gov/programadmin/contracts/poster.cfm.

107-1.02 PERMITS, LICENSES, AND TAXES. The terms, conditions, and stipulations in permits obtained either by the Department or by the Contractor are made a part of this Contract. Permits obtained by the Department for this project are attached to these Specifications as appendices. Contact names and phone numbers for permits obtained by the Department are shown on the individual permits.

The Department will:

1. Secure permits and licenses that the Department determines are required for the construction of the proposed project, and the use of mandatory sources, designated sources and designated material disposal areas for the proposed project; and

2. Modify Department-acquired permits during the performance of the Contract, if deemed necessary by the Engineer.

The Contractor shall:

1. Acquire any permits and licenses required to complete the project that are not acquired by the Department;

2. Provide qualified professionals to collect data or perform studies necessary to acquire permits for the use of sites not previously permitted;

3. Give all notices required for the prosecution of the work;

4. Abide by all permits and licenses whether acquired by the Department or by the Contractor;

5. Notify the Engineer promptly if any activity cannot be performed as specified in the permits, and cease conducting the activity until permit modifications or any required additional permits are obtained;

6. Obtain modifications to permits acquired by the Contractor;

7. Pay all charges, fees and taxes;

8. Provide proof of payment of all taxes before the Department makes final payment; and,

9. Provide the information necessary to comply with the Alaska Department of Environmental Conservation, Alaska Pollutant Discharge Elimination System (APDES) to discharge stormwater from the construction site. Requirements for this permit are given under Section 641, Erosion, Sediment, and Pollution Control.

The provisions of permits acquired by the Contractor, and of notices and information under this section does not shift or create responsibility for compliance with Federal or State law to the Department, or otherwise impose a duty for oversight or review.

In addition, before using an area on or off project site not previously permitted for use by the Contract, the Contractor shall:

1. Contact all government agencies having possible or apparent permit authority over that area;

2. Obtain all required permits, clearances, and licenses from those agencies;

3. Obtain permission from any property owners or lessees with an interest in the property; and

4. Provide all of the following to the Engineer:

    a. All permits or clearances necessary to use the site for its intended purpose(s);

    b. A written statement that all permits or clearances necessary have been obtained;

    c. Written evidence that the Contractor has contacted all of the relevant agencies and that no additional permits are required on the part of the Contractor, including at a minimum the name of the agency and staff person contacted, the date contacted, and result of coordination; and

    d. A plan that identifies how the site will be finally stabilized and protected.

The Engineer may reject a proposed site if the Contractor fails to provide any of the above information or to demonstrate that a proposed site can be finally stabilized to eliminate future adverse impacts on natural resources and the environment.

107-1.03 PATENTED DEVICES, MATERIALS AND PROCESSES. If the Contractor employs any design, device, material, or process covered by patent, trademark, or copyright, the Contractor shall obtain and provide the Engineer with a copy of a suitable legal agreement with the patentee or owner.

The Contractor and the Surety shall defend, indemnify, and hold harmless the State and its representatives and any affected third party or political subdivision from any claim, cause of action, and damages for infringement arising from or relating to the Contractor's use of a patented design, device, material, process, trademark, or copyright.

107-1.04 WAGE RATES. The Contractor and all subcontractors shall pay the current prevailing rate of wages as per AS 36.05.010 and this Contract. On federally funded projects the Contractor and all subcontractors shall pay the higher of the appropriate wage rates published by the Alaska Department of Labor and the U.S. Department of Labor, for each individual job classification. The Contractor and all subcontractors shall file certified payroll with the Alaska Department of Labor

and Workforce Development (DOLWD) and with the Engineer for all work performed on the project. Submit signed and certified payrolls electronically to the DOLWD and the Engineer.

Before beginning work the Contractor shall file a Notice of Work with DOLWD and pay all required fees. After finishing work the Contractor shall file a Notice of Completion with DOLWD and pay all additional fees required by increases in the Contract amount.

107-1.05 FEDERAL AID PROVISIONS. When the United States government pays all or any portion of the cost of a project, the Contractor shall observe all federal laws, rules, and regulations applicable to the project.

The Contractor shall allow appropriate federal officials access to inspect the work. The federal government is not a party to the Contract. Federal inspections will not form the basis for any claim for interference with the rights of the Contract parties.

107-1.06 SANITARY, HEALTH, AND SAFETY PROVISIONS. The Contractor shall provide and maintain neat and sanitary accommodations for employees that meet all federal, state and local requirements.

The Contractor shall comply with federal, state, and local laws, rules, and regulations concerning construction safety and health standards, including U.S. Mine Safety and Health Administration rules when the project includes pit or quarry operations.

The Contractor shall not expose the public to, or require any workers to work under, conditions that are unsanitary, hazardous, or dangerous to health or safety.

The Contractor is responsible for ensuring all workers are adequately protected. The Contractor shall have a safety and health management program that complies with AKOSH requirements, and includes:

1. A worksite hazard analysis;

2. A hazard prevention and control plan including personal protective equipment and safe work procedures required for specific tasks;

3. New employee training and periodic worker training regarding safety and health;

4. Regular safety meetings with written documentation of attendance, safety topics discussed, worker safety complaints, and corrective actions taken; and

5. A designated safety officer, employed by the Contractor, who monitors the construction site and is responsible for implementing the safety and health management program.

The Contractor and Surety shall defend, indemnify and hold harmless the State of Alaska from all claims, causes of action and judgments arising from or relating to the Contractor’s failure to comply with any applicable federal, state or local safety requirement, regulation or practice, whether or not listed above.

107-1.07 ARCHAEOLOGICAL OR HISTORICAL DISCOVERIES. When the Contractor's operation encounters prehistoric artifacts, burials, remains of dwelling sites, paleontological remains, shell heaps, land or sea mammal bones, tusks, or other items of historical significance, the Contractor shall:

1. Immediately cease operations at the site of the find;

2. Immediately notify the Engineer of the find; and

3. Not disturb or remove the finds or perform further operations at the site of the finds until directed by the Engineer.

The Engineer will issue an appropriate Change Order if the Engineer orders suspension of the Contractor's operations or orders the Contractor to perform extra work in order to protect an archaeological or historical find.

107-1.08 RAILWAY-HIGHWAY PROVISIONS. The Contractor shall conduct all operations on or near a railroad according to the Contract, any contract between the Department and the railroad, and any permits issued by the railroad. The Department shall obtain permits for hauling materials across railroad tracks at locations specified in the Contract. If the Contractor desires additional crossings, the Contractor shall obtain any required permits at the Contractor's expense.

107-1.09 CONSTRUCTION OVER OR ADJACENT TO WATERS. The Contractor shall fully comply with all laws, regulations and permits issued by agencies of the United States and the State of Alaska when working in, over or adjacent to wetlands, tidelands, anadromous fish streams, eagle nests, navigable waters, or coastal waters.

The Contractor shall ensure that all work in, over or adjacent to navigable waters is conducted so that free navigation of the waterways is not obstructed and that existing navigable depths are not impaired, except as allowed by the U.S. Coast Guard and the U.S. Army Corps of Engineers.

107-1.10 USE OF EXPLOSIVES. The Contractor shall obey all laws, regulations and permits applicable to using, handling, loading, transporting, or storing explosives. When using explosives, the Contractor shall take utmost care not to endanger life, property, new construction, or existing portions of the project and facilities that are to remain in place after the project is complete.

The Contractor shall provide notice to property owners, the traveling public, and utility companies in the vicinity before using explosives. The Contractor shall provide notice to the Federal Aviation Administration when required by law. The Contractor shall notify police and fire authorities in the vicinity before transporting or using explosives. The Contractor shall provide notice sufficiently in advance to enable all potentially affected parties to take whatever steps they may deem necessary to protect themselves and their property from injury or damage.

The Contractor is liable for all property damage, injury, or death resulting from the use of explosives on the project. The Contractor shall indemnify, hold harmless, and defend the State of Alaska from all claims related to the use of explosives on the project, including claims from government agencies alleging that explosives were handled, loaded, transported, used, or stored improperly.

107-1.11 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE.

1. Restoring Areas. Areas used by the Contractor, including haul routes, shall be restored to their original condition after the Contractor’s operations are completed. The original condition of an area shall be determined as follows: Prior to commencement of operations, the Engineer and the Contractor shall inspect each area and haul route that will be used by the Contractor and take photographs to document their condition. After construction operations are completed, the condition of each area and haul route will be compared to the earlier photographs. Prior to demobilization the Contractor shall repair damages attributed to its operations. The Contractor agrees that all costs associated with repairs shall be subsidiary to other items of work and will not be paid for directly.

2. Material Disposal Sites. Offsite disposal areas may be at locations of the Contractor’s choice, provided the Contractor obtains written permission from the land owner for such disposal and a waiver of all claims against the State for any damage to such land which may result therefrom, together with all permits required by law for such disposal. A copy of such permission, waiver of claims, and permits shall be filed with the Engineer before commencing

work on private property. The Contractor's selected disposal sites shall also be inspected and approved by the Engineer prior to use of the sites.

3. Property marks. The Contractor shall:

   a. Be responsible for and protect from disturbance all land monuments and property marks until the Engineer has approved the witnessing or otherwise referenced their locations; and

   b. Not move such monuments or marks without the Engineer's approval.

4. Damage to property. The Contractor shall:

   a. Be responsible for all damage to public or private property resulting from any act, omission, neglect, or misconduct in the manner or method of executing the work;

   b. Be responsible for all damage to public or private property resulting from defective work or materials at any time, before, during, or after project completion; and

   c. Restore all such damaged property to a condition similar or equal to that existing before the damage occurred, at no additional cost to the Department.

5. Protection of natural resources. The Contractor shall:

   a. Conduct work in a manner that minimizes disturbance to and protects natural resources in compliance with all federal, state, and local laws and regulations;

   b. When working near designated wetlands, as defined by the Corps of Engineers, place no fill, nor operate equipment outside the permitted area; and,

   c. When working in or near designated anadromous fish streams, as defined by AS 41.14.840 and AS 41.14.870, place no fill or dredge material, nor operate equipment, within or on the banks of the stream (including fording) except as permitted by the State Fish Habitat Permit issued for the project.

6. Hazardous materials. Hazardous materials include but are not limited to petroleum products, oils, solvents, paints, lead based paints, asbestos, and chemicals that are toxic, corrosive, explosive, or flammable. Except as otherwise specified in this Contract, the Contractor shall:

   a. Not excavate, nor use for fill, any material at any site suspected of or found to contain hazardous materials or petroleum fuels;

   b. Not raze and remove, or dispose of structures that contain asbestos or lead-based paints;

   c. Not stockpile, nor dispose of, any material at any site suspected of or found to contain hazardous materials or petroleum;

   d. Report immediately to the Engineer any known or suspected hazardous material discovered, exposed, or released into the air, ground, or water during construction of the project;

   e. Report any containment, cleanup, or restoration activities anticipated or performed as a result of such release or discovery; and,

   f. Handle and dispose of hazardous material with properly trained and licensed personnel who follow an approved Hazardous Material Control Plan as per Section 641.

7. Protected areas. The Contractor shall not use land from any park, recreation area, wildlife or waterfowl refuge, or any historical site located inside or outside of the project limits for excess fill disposal, staging activities, equipment or material storage, or for any other purposes unless permitted by the Contract or unless all permits and clearances necessary for such work have been obtained by the Contractor as detailed in Subsection 107-1.02.

8. Solid waste. The Contractor shall remove all debris, trash, and other solid waste from the project site as soon as possible and in accordance with the Alaska Department of Environmental Conservation Solid Waste Program.

107-1.12 FOREST PROTECTION. The Contractor shall:

1. Comply with all laws and regulations of the United States and the State of Alaska, local governments, or other authorities governing the protection of forests and the carrying out of work within forests;

2. Keep forest areas in an orderly condition;

3. Dispose of all refuse and obtain permits for the construction and maintenance of all construction camps, stores, warehouses, residences, latrines, cesspools, septic tanks, and other structures in accordance with the requirements of the supervising authorities;

4. Take all reasonable precautions to prevent and suppress forest fires;

5. Require workers and subcontractors, both independently and at the request of officials, to do all reasonably within their power to prevent and suppress and to assist in preventing and suppressing forest fires; and

6. Make every possible effort to notify the appropriate forestry agency at the earliest moment of the location and extent of any forest fire.

107-1.13 RESPONSIBILITY FOR DAMAGE CLAIMS. The Contractor shall indemnify, hold harmless, and defend the State of Alaska and its agents and employees from any and all claims or actions for injuries or damages whatsoever sustained by any person or property that arise from or relate to, directly or indirectly, the Contractor's performance of the Contract; however, this provision has no effect if, but only if, the sole proximate cause of the injury or damage is the Department’s negligence.

This Contract does not create a third party benefit to the public or any member of the public, nor does it authorize any person or entity not a party to this Contract to maintain a suit based on this Contract or any term or provision of the Contract, whether for personal injuries, property damage, or any other claim or cause of action.

107-1.14 OPENING SECTIONS OF THE PROJECT TO TRAFFIC. The Engineer may, at their discretion, order the Contractor to open sections of the work to traffic prior to completion of the entire project. Openings under this section shall not constitute (a) acceptance of the opened sections or any other part of the work or (b) a waiver of any other provision of the Contract.

The Engineer may establish a time period for completing any features of the opened section of work that are behind schedule.

The Contractor shall:

1. Maintain the opened portions of the work without additional compensation;

2. Perform all necessary repairs or renewals on the opened sections of the work without additional compensation; and

3. Conduct the remainder of the work with minimum interference to traffic.

107-1.15 CONTRACTOR'S RESPONSIBILITY FOR WORK. The Contractor shall be responsible for implementing all preventative measures necessary to protect, prevent damage, and repair damage to the work from all causes at no additional cost to the Department. This duty continues from the date construction begins until the date specified in a letter of Substantial Completion or Partial Acceptance of a specific section of the project. Where there is a Partial Acceptance, the duty ends only as to the accepted portion of the work. This duty continues during periods of suspended work, except in specific sections the Department has agreed to maintain under Subsection 643-3.07.

The Contractor shall rebuild, repair, restore, and make good all losses or damages to any portion of the work including that caused by vandalism, theft, accommodation of public traffic, and weather. The Department will only be responsible for loss or damage due to unforeseeable causes beyond the control of and without the Contractor’s fault or negligence, such as Acts of God, the public enemy, and governmental authorities.

In case of suspension of work from any cause, the Contractor shall take such precautions as may be necessary to prevent damage to the work or facilities affected by the work. This will include providing for drainage and erecting any necessary temporary structures, signs, or other facilities and maintaining all living material such as plantings, seedings, and soddings.

107-1.16 RESERVED.

107-1.17 FURNISHING RIGHT-OF-WAY. The Department will secure all necessary right-of-way or property in advance of construction. Any exceptions will be indicated in the Contract.

107-1.18 PERSONAL LIABILITY OF PUBLIC OFFICIALS. There shall be no liability upon the Engineer and their authorized representatives, either personally or as officials of the state, in carrying out any of the provisions of this Contract, or in exercising any power or authority granted to them by or within the scope of the Contract, it being understood that in all such matters the Engineer and their authorized representatives act solely as agents and representatives of the State. The Contractor shall bring no suit related to or arising under this Contract naming as defendants any State officer, employee or representative in either their personal or official capacities, and shall include a prohibition to that effect in all subcontracts entered into for this Project.

107-1.19 NO WAIVER OF LEGAL RIGHTS. The Department shall not be precluded nor estopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work and payment, from showing the true amount and character of the work performed and materials furnished by the Contractor, nor from showing that any measurement, estimate, or certificate is untrue or is incorrectly made, nor that the work or materials do not in fact conform to the Contract.

The Department shall not be precluded nor estopped, notwithstanding any measurement, estimate, or certificate and payment, from recovering from the Contractor or the Contractor’s Sureties, or both, such damages as it may sustain by reason of the Contractor's failure to comply with the terms of the Contract.

Neither the acceptance by the Department, or by any representative of the Department, nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Department, shall operate as a waiver by the Department of any portion of the Contract or of any right of the Department to damages. A waiver by the Department of any breach of the Contract shall not be held to be a waiver of any other subsequent breach.

107-1.20 GRATUITY AND CONFLICT OF INTEREST. The Contractor shall not extend any loan, gratuity, or gift of money of any form whatsoever to any employee of the Department, nor will the

Contractor rent or purchase any equipment or materials from any employee of the Department or to the best of the Contractor's knowledge from any agent of any employee of the Department. The Contractor shall execute and furnish the Department an affidavit certifying that the Contractor has complied with this section before final acceptance.

107-1.21 FEDERAL AFFIRMATIVE ACTION (RESERVED).

SECTION 108
PROSECUTION AND PROGRESS

108-1.01 SUBCONTRACTING OF CONTRACT. The Contractor shall submit a Contractor Self Certification for each Subcontractor and each Lower Tier Subcontractor, Form 25D-042, before the Contractor or any subcontractor subcontracts, sells, transfers, assigns, or otherwise disposes of the Contract or any portion of the Contract. The Department has authority to review subcontracts and to deny permission to subcontract work. The Department may penalize the Contractor for false statements or omissions made in connection with Form 25D-042.

The Contractor shall perform, with the Contractor's own organization, work amounting to at least 30 percent of the difference between the original Contract price and the price of designated Specialty Items. For the purpose of this Subsection, work is defined as the dollar value of the services, equipment, materials, and manufactured products furnished under the Contract. The Engineer will determine the value of the subcontracts based on Contract unit prices or upon reasonable value, if entire items are not subcontracted.

The Department’s consent to the subcontracting, sale, transfer, assignment, or disposal of all or a part of the Contract shall not relieve the Contractor and the Surety of responsibility for fulfillment of the Contract or for liability under the bonds regardless of the terms of the transfer or sublet approvals.

1. The Contractor shall ensure that for all subcontracts (agreements):

    a. The Department is furnished with one completed Contractor Self Certification, Form 25D-042, for each subcontract.

    b. The subcontractors have submitted a Bidder Registration, Form 25D-6.

    c. The required prompt payment provisions of AS 36.90.210 are included in all subcontracts:

    d. A clause is included requiring the Contractor to pay the subcontractor for satisfactory performance according to AS 36.90.210 and within eight working days after receiving payment from which the subcontractor is to be paid;

    e. A clause is included requiring the Contractor to pay the subcontractor interest, according to AS 45.45.010(a), for the period beginning the day after the required payment date and ending on the day payment of the amount due is made:

    f. A clause is included requiring the Contractor to pay the subcontractor all retainage due under the subcontract, within eight working days after final payment is received from the Department, or after the notice period under AS 36.25.020(b) expires, whichever is later;

    g. A clause is included requiring the Contractor to pay interest on retainage, according to AS 36.90.250 and AS 45.45.101(a):

    h. Other required items listed in the Contractor Self Certification Form 25D-042, including but not limited to Form 25D-55H, are included in the subcontracts;

    i. The subcontractors pay current prevailing rate of wages as per Subsection 107-1.04 and file signed and certified payrolls with the Engineer and DOLWD for all work performed on the project; and

    j. Upon receipt of a request for more information regarding subcontracts, the requested information is provided to the Department within 5 calendar days.

2. The Contractor shall ensure that for all lower tier subcontracts (agreements between subcontractors and lower tier subcontractors):

   a. The Department is furnished with one completed Contractor Self Certification, Form 25D-042, for each lower tier subcontract;

   b. The required prompt payment provisions of AS 36.90.210 are included in all lower tier subcontracts;

   c. A clause is included requiring the subcontractor to pay the lower tier subcontractor for satisfactory performance according to AS 36.90.210, and within eight (8) working days after receiving payment from which the subcontractor is to be paid;

   d. A clause is included requiring the subcontractor to pay the lower tier subcontractor interest, according to AS 45.45.010(a), for the period beginning the day after the required payment date and ending on the day payment of the amount due is made;

   e. A clause is included requiring the subcontractor to pay the lower tier subcontractor all retainage due under the subcontract, within eight working days after final payment is received, or after the notice period under AS 36.25.020(b) expires, whichever is later;

   f. A clause is included requiring the subcontractor to pay the lower tier subcontractor interest on retainage, according to AS 36.90.250 and AS 45.45.101(a);

   g. Other required items listed in Form 25D-042, including but not limited to Form 25D-55H, are included in the lower tier subcontracts;

   h. The lower tier subcontractors pay current prevailing rate of wages as per Subsection 107-1.04 and file signed and certified payrolls with the Engineer and DOLWD for all work performed on the project; and

   i. Upon receipt of a request for more information regarding lower tier subcontracts, the requested information is provided to the Department within 5 calendar days.

3. The following will be considered as subcontracting, unless performed by the Contractor:

   a. Roadside Production. Roadside production of crushed stone, gravel, and other materials with portable or semi-portable crushing, screening, or washing plants set up or reopened in the vicinity of the project to supply materials for the project, including borrow pits used exclusively or nearly exclusively for the project.

   b. Temporary Plants. Production of aggregate mix, concrete mix, asphalt mix, other materials, or fabricated items from temporary batching plants, temporary mixing plants, or temporary factories that are set up or reopened in the vicinity of the project to supply materials exclusively or nearly exclusively for the project.

   c. Hauling. Hauling from the project to roadside production, temporary plants, or commercial plants, from roadside production or temporary plants to the project, from roadside production or temporary plants to commercial plants, and all other hauling not specifically excluded in this subsection.

   d. Other Contractors. All other contractors working on the project site under contract with the Contractor are considered subcontractors unless specifically excluded in this subsection.

4. The following will not be considered as subcontracting, but the Contractor shall comply with the prompt payment provisions of AS 36.90:

a. Commercial Plants. The purchase of sand, gravel, crushed stone, crushed slag, batched concrete aggregates, ready-mixed concrete, asphalt paving mix, and any other material or fabrication produced at and furnished from established and recognized commercial plants that sell to both public and private purchasers.

b. Hauling. Delivery of materials from a commercial plant to a different commercial plant, and delivery from a commercial plant to the project site by vehicles owned and operated by the commercial plants or by commercial freight companies that have a contract with the commercial plant. Commercial freight companies are trucking or hauling companies that deliver multiple types of materials to multiple clients, both public and private, on an established route and on a recurrent basis.

c. Contractors' General Business. Work within permanent home offices, branch plants, fabrication plants, tool yards, and other establishments that are part of a contractor's or subcontractor's general business operations.

5. Owner-Operators. Hauling of materials for the project by bona fide truck owner-operators who are listed as such on the signed and certified payroll of the Contractor or approved subcontractor is not considered subcontracting for purposes of AS 36.30.115.

The Contractor shall ensure that the required prompt payment provisions of AS 36.90.210 are included in contracts with owner-operators.

The Contractor shall collect and maintain at the project site current and valid copies of the following to prove that each trucker listed is a bona fide owner-operator:

a. Alaska Driver's License with appropriate CDL class and endorsements;

b. Business license for trucking with supporting documents that list the driver as the business owner or corporate officer; and,

c. Documents showing the driver's ownership interest in the truck, including copies of:

(1) Truck registration; and

(2) Lease (if truck is not registered in driver's name or in the name of the driver's company).

The Contractor shall maintain legible copies of these records for a period of at least three years after final acceptance of the project.

Owner-operators must qualify as independent contractors under the current Alaska Department of Labor’s criteria. Owner-operators may be required to show:

d. The owner-operator’s right to control the manner in which the work is to be performed;

e. The owner-operator’s opportunity for profit or loss depending upon their managerial skill;

f. The owner-operator’s investment in equipment or materials required for their task, or the employment of helpers;

g. Whether the service rendered requires a special skill;

h. The degree of permanence of the working relationship; and

i. Whether the service rendered is an integral part of the owner-operator’s business.

The status of owner-operators is subject to evaluation throughout the project period. If the criteria for an independent contractor are not met, the Contractor shall submit amended payrolls listing the driver as an employee subject to all labor provisions of the Contract.

The Contractor shall issue each owner-operator a placard in a form approved by the Engineer that identifies both the truck driver and the vehicle. The placard shall be prominently displayed on the vehicle so that it is visible to scale operators and inspectors.

Notwithstanding the Department's definitions of contracting and subcontracting, the Contractor shall be responsible for determining and complying with all federal and state laws and regulations regarding contracting, subcontracting, and payment of wages. The Contractor shall promptly pay any fines or penalties assessed for violations of those laws and regulations, and shall promptly comply with the directives of any government agency having jurisdiction over those matters.

108-1.02 NOTICE TO PROCEED. The Department will issue a Notice to Proceed authorizing construction to begin and indicating the date when Contract Time will begin. The Contractor shall not begin construction before the effective date of the Notice to Proceed. The Notice to Proceed may include limits or restrictions on allowable activities. The Department will, in its sole discretion, refuse to pay for construction begun before the effective date of the Notice to Proceed. The Contractor shall notify the Engineer at least 48 hours before construction begins at the project site.

108-1.03 PROSECUTION AND PROGRESS. The Contractor shall meet with the Engineer at the regional construction office for a preconstruction conference before beginning construction. The Engineer will schedule the Preconstruction Conference no less than five days after the following have been received:

1. A progress schedule, in a format acceptable to the Engineer, showing the order in which the Contractor proposes to carry out the work and the contemplated dates on which the Contractor and the subcontractors will start and finish each of the salient features of the work, including any scheduled periods of shutdown. The schedule shall indicate the anticipated hours of operation and any anticipated periods of multiple-shift work.

2. A list showing anticipated dates for procurement of materials and equipment, ordering of articles of special manufacture, furnishing of plans, drawings and other data required under Subsection 105-1.02 and for other events such as inspection of structural steel fabrication.

3. A list showing all proposed subcontractors and material suppliers.

4. A Construction Phasing plan, as required under Subsection 643-1.05.

5. A Storm Water Pollution Prevention Plan, a Hazardous Material Control Plan, and a Spill Prevention Control and Countermeasure Plan, with the line of authority and designated field representatives, as required under Section 641 (see submittal deadlines under 641-1.03).

6. A letter designating the Contractor's Project Superintendent, defining that person's responsibility and authority, and providing a specimen signature.

7. A letter designating an Equal Employment Opportunity Officer and a Disadvantaged Business Enterprise Officer, and designating those person's responsibilities and authority.

8. A Quality Control Plan, as required under Subsection 106-1.03.

9. A letter designating a Safety Officer, and designating that person's responsibilities and authority.

The Contractor shall provide adequate materials, labor and equipment to ensure the completion of the project according to the Plans and Specifications. The work shall be performed as vigorously and as continuously as weather conditions or other interferences may permit. The Contractor shall take into consideration and make due allowances at the Contractor's expense for foreseeable delays and

interruptions to the work such as unfavorable weather, frozen ground, equipment breakdowns, shipping delays, quantity overruns, utility work, permit restrictions, and other foreseeable delays and interruptions. The Contractor shall identify these allowances on the progress schedule.

The Contractor shall adjust forces, equipment and work schedules as necessary to ensure completion of the work within the Contract time, and shall notify the Engineer at least 24 hours before resuming suspended operations. Upon a substantial change to the work schedule or when directed by the Engineer, the Contractor shall submit a revised progress schedule in the form required, including a written explanation for each revision made in the schedule or methods of operation.

The Engineer's review or approval of the documents, plans, and schedules provided by the Contractor under this section shall not change the Contract requirements, release the Contractor of the responsibility for successful completion of the work or relieve the Contractor of the duty to comply with applicable laws. The Engineer’s review or approval of schedules shall not indicate agreement with any assertions of delay or claims by the Contractor.

It is the Contractor's responsibility to prepare and submit documents that satisfy all applicable contract requirements. By reviewing and approving the Contractor’s documents, the Department does not warrant that following the Contractor’s documents will result in successful performance of the work. The Department's failure to discover defects in the Contractor's documents, the assumptions upon which they are based or conditions that prevent the Contractor from performing the work as indicated in the documents will not entitle the Contractor to additional compensation or time. If the Contractor becomes aware of any act or occurrence that may form the basis of a claim for additional compensation or an extension of time, it must specifically advise the Engineer of these conditions in accordance with Subsection 105-1.17.

108-1.04 LIMITATION OF OPERATIONS. The Contractor shall not open up work to the detriment of work already started. The Contractor shall minimize interference with traffic within the project. The Contractor shall not stop or otherwise impede traffic outside the project limits without the Engineer's prior written permission. The Engineer may require the Contractor to finish a section of work in progress before starting additional sections if the Engineer determines it is necessary for the convenience of the public or the Department.

108-1.05 CHARACTER OF WORKERS, METHODS, AND EQUIPMENT. The Contractor shall employ sufficient labor and equipment to complete the work required under the Contract and to complete it on time.

The Contractor shall ensure that all workers on the project have the skills and experience necessary to properly perform their assigned work. Workers engaged in special work or skilled work shall have sufficient experience in that work and in the operation of the equipment required to properly perform that work.

The Contractor shall comply with any written order by the Engineer to remove workers, who, in the opinion of the Engineer, perform the work in an unskilled manner, who are intemperate or disorderly, create risk of imminent harm for the traveling public, or who fail to perform the work in accordance with the Contract and any and all applicable federal, state, and local laws, rules, regulations, and ordinances. The Contractor shall allow removed workers to return to the project only with the Engineer’s written permission. The Engineer may suspend the work if the Contractor fails to furnish suitable and sufficient personnel necessary to perform the work, or fails to remove any worker at the Engineer's order.

The Contractor shall not use prisoner labor on the project.

The Contractor shall use equipment of the appropriate size and mechanical condition to produce the specified quality and quantity of work by the means specified in the Contract, if any, and shall ensure that the equipment does not damage roadways or property.

The Contractor shall ensure all equipment, materials, and articles incorporated into the work are new and of the specified quality, unless the Contract specifically permits otherwise.

The Contractor shall provide the Engineer with a list of all powered equipment that will be used on the project, showing the make, model, year, capacity, horsepower, and related information. The Contractor shall update this list when equipment is added or removed from the work site, but need not update more frequently than weekly.

When the methods and equipment to be used by the Contractor are not prescribed by the contract, the Contractor is free to use any method, means or equipment that is satisfactory to produce the specified work in conformity with the Contract, except as provided above. At the request of the Engineer, the Contractor shall demonstrate that the method, means and equipment chosen will produce the work specified in the Contract in the time allowed under the Contract. The Contractor shall bear all costs and impacts associated with any means, methods and equipment chosen by the Contractor. No suggestion, statement or observation from the Engineer or other Department representatives shall alter this responsibility.

If the Contract specifies a particular method, means or type of equipment for performance of the work, the Contractor must use that method, means or equipment unless the Contractor first requests, in writing, permission to alter the Contract requirement and receives prior written approval from the Engineer.

108-1.06 CONTRACT TIME, EXTENSION OF CONTRACT TIME AND SUSPENSION OF WORK. Contract time will be specified in calendar days, by completion date, or both.

1. Calendar Days. When the contract time is specified on a calendar days basis, all work under the Contract shall be completed within the number of calendar days specified. If no starting day is specified in the Contract, the count of Contract time begins on the day following receipt of the Notice to Proceed by the Contractor.

   Calendar days shall continue to be counted against Contract time until and including the date of project completion. Calendar days shall not be counted during the period from November 1 through April 30, except for days that the Contractor is working on the project site.

2. Completion Date. When the contract time is specified on a completion date basis, all work under the Contract shall be completed by the specified completion date.

3. Reasons for Suspension of Work and Extension of Contract Time. The Department may order a suspension of work for any reason listed in this subparagraph 3, items a through p.

   The Department shall not pay additional compensation, but may extend Contract time only, if there are delays in the completion of controlling items of work from unforeseeable causes that are beyond the Contractor's control and are not the result of the Contractor's fault or negligence, including:

   a. Acts of God;

   b. Acts of the public enemy;

   c. Fires;

   d. Floods;

   e. Epidemics;

   f. Quarantine restrictions;

   g. Strikes;

   h. Freight embargoes;

i. Unusually severe weather;

j. In accordance with Subsection 105-1.06.4.d, delays by utility owners beyond completion dates specified in the Special Provisions for relocating or adjusting utilities and related facilities; or

k. Delays of subcontractors, suppliers and fabricators from unforeseeable causes beyond the control of the subcontractors, suppliers or fabricators and that are not the fault of the subcontractors, suppliers or fabricators, including those causes listed in this Subparagraph 3, Items a through j.

No additional Contract time or additional compensation will be allowed due to delays caused by or suspensions ordered due to:

l. Failure to correct conditions that create risk of imminent harm for the traveling public, violations of the Contract or any applicable federal, state, and local laws, rules, regulations, and ordinances;

m. Adverse weather that is not unusually severe;

n. Failure to carry out Contract provisions;

o. Failure to carry out orders given by the Engineer; or

p. Failure to timely obtain materials, equipment, or services.

The Contractor shall notify the Engineer as soon as the Contractor becomes aware of any act or occurrence that may form the basis of a request for a time extension under this section. The Contractor shall submit a request for a time extension to the Engineer within 10 days of the act or occurrence, and if an agreement is not reached, the Contractor may submit a Claim under Subsection 105-1.17.

The time allowed in the Contract, as awarded, is based on performing the original estimated quantities of work set out in the bid schedule. An assertion that insufficient time was originally specified shall not constitute a valid reason for extension of contract time.

If satisfactory fulfillment of the Contract requires extra work, the Department may extend Contract time according to Subsection 104-1.02.

4. Suspension of Work. The Engineer will suspend work on the project, in whole or in part, for such periods and for such reasons as the Engineer determines to be reasonable, necessary, in the public interest, or for the convenience of the Department.

a. The Engineer will issue a written order to suspend, delay, or interrupt all or any part of the work. The Contractor shall not be compensated for the suspension, delay, or interruption if it is imposed for a reasonable time under the circumstances.

b. Unless another Contract section specifically provides otherwise, the Contractor will be compensated by equitable adjustment for a suspension, delay, or interruption of the work only if:

(1) The period of suspension, delay, or interruption is for an unreasonable time under the circumstances and another Contract section allows compensation in the event of a suspension, delay, or interruption of the work under the circumstances that actually caused the suspension, delay, or interruption; or

(2) The delay, suspension, or interruption results from the Department's failure to fulfill a contractual obligation to the Contractor within the time period specified in the Contract or, if no time period is specified, within a reasonable time.

c. No equitable adjustment will be made under this subsection for any suspension, delay, or interruption of the work if the Contractor's performance would have been suspended, delayed, or interrupted by any other cause for which:

(1) The Department is not responsible under the Contract, including the Contractor's fault or negligence; or

(2) An equitable adjustment is either provided for or excluded under any other section of this Contract.

d. Claims for equitable adjustments under this section shall be filed under Subsection 105-1.17 except that:

(1) The Contractor must give written notice of intent to claim no later than 20 days after the event giving rise to the delay, suspension, or interruption;

(2) The claim may not include any costs incurred more than 20 days before the Contractor files the Contractor's written notice of intent to claim;

(3) The contractor must submit a written request for adjustment within 7 calendar days of receipt of the notice to resume work;

(4) No profit will be allowed on an increase in cost necessarily caused by the suspension, delay, or interruption.

108-1.07 FAILURE TO COMPLETE ON TIME. For each calendar day that the work is not substantially complete after the expiration of the Contract time or the completion date has passed, the Engineer shall deduct the full daily charge corresponding to the original Contract amount shown in Table 108-1 from progress payments.

For each calendar day that the work is substantially complete but the project is not complete, after the expiration of the Contract time or the completion date has passed, the Engineer shall deduct 20 percent of the daily charge corresponding to the original Contract amount shown in Table 108-1 from progress payments.

If no money is due the Contractor, the Department may recover these sums from the Contractor, from the Surety, or from both. These are liquidated damages and not penalties. These charges shall reimburse the Department for its additional administrative expenses incurred due to the Contractor's failure to complete the work within the time specified.

TABLE 108-1
DAILY CHARGE FOR LIQUIDATED DAMAGES
FOR EACH CALENDAR DAY OF DELAY

Original Contract Amount		Daily Charge
From More Than	To and Including	
$ 0	$ 100,000	$ 300
100,000	500,000	550
500,000	1,000,000	750
1,000,000	2,000,000	1,000
2,000,000	5,000,000	1,500
5,000,000	10,000,000	2,500
10,000,000	----------	3,000

Permitting the Contractor to continue work after the Contract time has elapsed or the completion date has passed does not waive the Department's rights to collect liquidated damages under this section.

108-1.08 DEFAULT OF CONTRACT. The Contracting Officer will give a written Notice of Default to the Contractor and the Surety if the Contractor:

1. Fails to begin work under the Contract within the time specified;

2. Fails to perform the work with sufficient workers, equipment, or materials to ensure the prompt completion of the work;

3. Performs the work unsuitably or neglects or refuses to remove materials or to replace rejected work;

4. Discontinues the prosecution of the work;

5. Fails to resume work that has been discontinued within a reasonable time after notice to do so;

6. Becomes insolvent except that if the Contractor declares bankruptcy, termination shall be in accordance with the Federal Bankruptcy Code. In the event that the Contractor declares bankruptcy, the Contractor agrees that the Contract will be assumed by the Surety in a timely manner so as to complete the Contract by the date specified in the Contract;

7. Allows any final judgment to stand against the Contractor unsatisfied for a period of 60 days;

8. Makes an assignment for the benefit of creditors, without the consent of the Engineer;

9. Fails to comply with applicable minimum wage or civil rights requirements;

10. Is a party to fraud, deceit, misrepresentation, or malfeasance in connection with the Contract; or

11. Fails to perform the work in an acceptable manner for any other cause whatsoever.

The written Notice of Default will include a notice to cure and will establish a date by which the cure must be completed. The Contracting Officer may allow more time to cure than originally stated in the Notice to Default if the Contracting Officer deems it to be in the best interests of the Department. Failure to cure the delay, neglect, or default within the time specified in the Contracting Officer's Notice of Default authorizes the Department to terminate the contract. The Department will provide the Contractor and the Contractor's Surety with a written Notice of Termination.

After the Notice of Termination is issued, the Department may take over the work without further notice; may complete it by itself, by contract or otherwise; and may take possession of and use materials, appliances, equipment, or plant on the work site necessary for completing the work.

The Department may transfer the obligation to perform the work from the Contractor to the Surety. In that event, the Surety shall submit its plan for completion of the work, including any contracts or agreements with third parties for completion, to the Department for approval before beginning work. The Surety must follow the Contract requirements for approval of subcontracts, except that the limitation on percent of work subcontracted will not apply. On receipt of the transfer notice, the Surety shall take possession of all materials, tools, equipment, and appliances at the work site, employ an appropriate work force, and complete the Contract work as specified. The Contract specifications and requirements shall remain in effect, except that the Department will make subsequent Contract payments directly to the Surety. The Contractor forfeits any right to claim for the work and is not entitled to receive any further balance of the amount to be paid under the Contract.

The Contractor and the Contractor's Surety are jointly and severally liable for any damage to the Department resulting from the Contractor's delay, neglect, or default, whether or not the Department terminates the Contractor's right to prosecute the work. The Department's damages include any increased costs incurred by the Department in completing the work or paying for the work to be completed. The Department's rights and remedies are in addition to any other rights and remedies provided by law or under the Contract.

If, after notice of termination of the Contractor's right to proceed under this clause, it is determined that the Contractor was not in default, or that the default was excusable, the rights and obligations of the parties will be determined under Subsection 108-1.09, Termination for Convenience.

108-1.09 TERMINATION FOR CONVENIENCE.

1. Notice. The Contracting Officer may terminate the Contract in whole or in part due to:

   a. Executive Orders of the President of the United States or the Governor of the State of Alaska with respect to the prosecution of war or the interest of national defense, or any disaster declaration.

   b. Restraining orders or injunctions by a court of competent jurisdiction affecting prosecution of the work based on acts or omissions of persons or agencies other than the Contractor.

   c. Any reason determined by the Contracting Officer to be in the best interest of the Department.

   The Contracting Officer will issue a written Notice of Termination to the Contractor. The Notice of Termination shall state the extent to which performance of work under the Contract is terminated, the effective date of the termination, and for which of the above-listed reasons the Contract is terminated.

2. Required Actions. Unless otherwise directed by the Contracting Officer, upon receipt of a Notice of Termination the Contractor shall immediately:

   a. Stop work as directed in the Notice.

   b. Place no further orders or subcontracts for materials, services, or facilities except as approved to complete work not terminated.

   c. Terminate all orders and subcontracts for the terminated work.

   d. Accomplish either (1) or (2) below as directed by the Contracting Officer:

      (1) Assign to the Department all right, title and interest in any terminated orders or subcontracts. The Contracting Officer will settle all claims on the terminated orders or subcontracts.

      (2) Settle any outstanding liabilities and claims arising from termination of orders and subcontracts. Settlements must be limited to costs allowed under this Section.

   e. Submit to the Contracting Officer a list, certified as to quantity and quality, of all materials acquired or produced for incorporation into the project and that are properly allocable to the terminated portion of the project, exclusive of items disposed of under Subsection 108-1.09.2.f., below.

   f. Dispose of materials in the Contractor’s possession or control that were acquired or produced but not incorporated into the project as of the termination date as directed by the Contracting Officer under either (1) or (2) below:

      (1) Transfer title and deliver the materials to the Department. The Department will pay for the materials at the actual cost delivered to the project or storage site, including transportation charges, to which cost 15 percent will be added.

      (2) Sell the materials. Credit will not have to be extended to prospective purchasers.

The Contractor may acquire the materials if the Contracting Officer approves the sale price and the Contractor meets any other conditions prescribed by the Contracting Officer.

At the sole discretion of the Contracting Officer, the proceeds of any sale, transfer, or disposition of materials may be:

(3) applied to reduce any payments to be made by the Department under the Contract,

(4) credited to the cost of the work, or

(5) paid in any other manner as directed.

g. Deliver to the Department completed or partially completed plans, drawings, information, and other property required to be furnished under the Contract.

h. Take all necessary actions and comply with all directives to protect contract-related property in which the Department has or may acquire an interest.

i. Complete work not terminated.

The Contractor shall proceed immediately with performance of the above obligations notwithstanding any delay in determining or adjusting the amount of any item or reimbursable cost under this clause.

3. Claim. The Contractor shall submit any termination claim to the Contracting Officer within 90 days after the effective date of termination, unless the date for submitting a claim is extended in writing by the Contracting Officer.

a. Without duplication of any amount paid for under Subsection 108-1.09.2., the claim may be for the total of:

(1) costs incurred in performing the terminated work from the date of Contract award to the effective date of the termination subject to the provisions of Subsection 108-1.09.3.b. regarding reimbursement of equipment costs and Subsection 108-1.09.3.c. regarding unallowable items.

(2) payments approved by the Contracting Officer under Subsection 108-1.09.2.d.(2) to settle the termination claims of suppliers and subcontractors to the extent not covered under Subsection 108-1.09.3.a.(1).

(3) reasonably incurred costs for:

(a) accounting, legal, clerical, and other costs reasonably necessary for preparation of the termination claim and settlement negotiations, excluding costs incurred after the date an appeal is filed with the Appeals Officer under Subsection 108-1.09.8.

(b) settling subcontractor and supplier claims, excluding the amounts of those settlements paid under Subsection 108-1.09.3.a.(2).

(4) reasonable profit on the costs included in Subsection 108-1.09.3.a(1) based on the Contractor's bid rate for profit or as determined under any other reasonable accounting method. However, if it appears that the Contractor would have sustained a loss on the entire Contract had it been completed, the Contracting Officer will allow no profit and will reduce the settlement to reflect the indicated rate of loss under Subsection 108-1.09.4. The Department will not pay profit on costs included in Subsections 108-1.09.3.a.(2) and 108-1.09.3.a.(3).

b. Equipment claims will be reimbursed as follows:

(1) Contractor-owned equipment usage, based on the Contractor's ownership and operating costs for each piece of equipment as determined from the Contractor's accounting records. Do not base equipment claims on published rental rates.

(2) Idle time for Contractor-owned equipment, based on the Contractor's internal ownership and depreciation costs. Idle equipment time is limited to the actual period of time equipment is idle as a direct result of the termination, not to exceed 30 days. Operating expenses will not be included for payment of idle equipment time.

(3) Rented equipment, based on reasonable, actual rental costs. Equipment leased under "capital leases" as defined in Financial Accounting Standard No. 13 will be considered Contractor-owned equipment. Equipment leased from an affiliate, division, subsidiary or other organization under common control with the Contractor will be considered Contractor-owned equipment.

c. The following costs are not payable under a termination settlement agreement or Contracting Officer's determination of the termination claim, or on appeal:

(1) Anticipated profits on work that is not performed prior to issuance of the Notice of Termination or any consequential or compensatory damages

(2) Unabsorbed home office overhead (also termed "General & Administrative Expense") related to ongoing business operations

(3) Bidding and project investigative costs

(4) Direct costs of repairing equipment to render it operable for use on the terminated work

4. Adjustment for Loss. If the Contractor would have sustained a loss on the entire Contract had it been completed, the Department will not pay the Contractor more than the total of:

a. The amount due for termination claim costs under Subsection 108-1.09.3.a.(3); plus

b. The remainder of the total allowable claim amount due reduced by multiplying the remainder by the ratio of (1) the total contract price to (2) the remainder plus the estimated cost to complete the entire Contract; minus

c. All disposal and other credits, all advance and progress payments and all other amounts previously paid under the Contract.

5. Deductions. In arriving at the amount due under this Subsection, the Department will deduct:

a. All previous payments made before termination;

b. Any claim which the Department may have against the Contractor;

c. The proceeds of the sale or transfer of any materials, supplies, or other items acquired for the terminated work and not otherwise recovered by or credited to the Department;

d. All partial payments made under this Section; and

e. Any adjustment for loss determined under Subsection 108-1.09.4.

6. Agreed Settlement. The Contractor shall make every effort to arrive at a claim settlement with the Contracting Officer that is fair to both parties, that reflects the reasonable and allocable incurred costs allowable under Subsection 108-1.09.3, that includes a profit under Subsection 108-1.09.3.a.(4) or, where appropriate, a loss adjustment under Subsection 108-1.09.4, and that takes into account the Contractor's reasonable business judgment in performing the work.

The total settlement, whether determined under this Subsection 108-1.09.6 or under Subsection 108-1.09.7, exclusive of the costs listed in Subsection 108-1.09.3.a.(3), may not exceed the total contract price as reduced by previous payments made and the contract price of work not terminated.

If an agreement is reached in whole or in part, the Department will amend the contract and will pay the agreed amount.

7. Determined Settlement. If the Contractor fails to submit a termination claim within the time allowed, or if an agreement is not reached on the amount due, the Contracting Officer may determine in a Contracting Officer's Decision, the amount due under Subsection 108-1.09 on the basis of information available to the Department.

8. Right of Appeal. The Contractor may appeal a Contracting Officer's Decision within the time and in the manner specified in Subsection 105-1.17.

9. Partial Payments. In the sole discretion of the Contracting Officer, the Department may make partial payments against costs incurred by the Contractor in connection with the terminated portion of the Contract. The sum of these partial payments will not exceed the Contracting Officer's estimate of the total amount that will be due as a result of the termination. The estimate will be based on available information. The Contracting Officer may adjust the estimate as additional information becomes available. If the Contracting Officer orders an audit of the Contractor's financial or project records, the Contracting Officer may decline to make partial payments until the audit is completed.

10. No Waiver of Rights. The termination of work by the Department does not affect or extinguish any of the rights of the Department against the Contractor or the Contractor's Surety then existing or which may thereafter accrue. Any retention or payment of monies by the Department due under the terms of the Contract will not release the Contractor or the Contractor's Surety from the contractual obligations or warranties made under Subsection 107-1.19 or elsewhere in the Contract.

11. Retaining Records. The Contractor shall unless otherwise provided for in the Contract or by applicable statute, keep all books, records, documents, and other evidence bearing on the Contractor's cost and expenses under the Contract and relating to the work terminated for a period of 3 years after final settlement under this Contract. Records must be made available to the Department at the Contractor's office and at all reasonable times.

12. Definitions. In this Subsection 108-1.09, the term "cost" and the term "expense" mean a monetary amount in U.S. Dollars actually incurred by the Contractor, actually reflected in the Contractor's contemporaneously maintained accounting or other financial records and supported by original source documentation.

13. Cost Principles. The Department may use the federal cost principles at 48 CFR §§ 31.201-1 to 31.205-52 (or succeeding cost principles for fixed price contracts) as guidelines in determining allowable costs under this Subsection to the extent they are applicable to highway construction contracts and consistent with the specifications of this Contract. The provisions of this contract control where they are more restrictive than, or inconsistent with, these federal cost principles.

SECTION 109
MEASUREMENT AND PAYMENT

109-1.01 GENERAL. Wherever the Contract provides that certain work is subsidiary or it is without extra compensation, the payment for that work is included in the payment for other items of work, and no further or additional payment shall be made for that work.

When more than one type of material or work is specified for a pay item, the proposal line number, the item number, and the item description are used to differentiate the material or work.

Lump sum items will not be measured for payment. The Contractor shall accept the bid amount for a lump sum item as complete payment for all work necessary to complete that item. Quantities shown for lump sum items are approximate. No adjustment in the lump sum price will be made if the quantity furnished is more or less than the estimated quantity unless the Contract specifically states otherwise.

109-1.02 MEASUREMENT OF QUANTITIES. All work completed under the Contract will be measured using the U.S. Customary system of measure. The Engineer may agree for purposes of making progress payments to use a method of measurement other than the methods described below. However, all final payments for quantities will be calculated using one or more of the methods of measurement described below and in the applicable pay item section. Unless otherwise specified, work will be measured as follows:

1. Acre (43,560 ft^2). Horizontally, unless specified on the ground surface. No deductions will be made for individual fixtures with an area of 500 ft^2 or less.

2. Contingent Sum. Measured as specified in the Contract or Directive authorizing the work. The method of payment may include: (1) a lump sum basis, (2) a price multiplied by the units of work performed, (3) a pay adjustment based on the quality of work, or (4) a deduction from the contract amount.

3. Cubic Yard (yd^3). At the location specified using method a, below. Methods b through e may be used with written approval of the Engineer.

    a. Average End Area. End area is the calculated area between original ground cross section and either the design cross section or at the Engineer's discretion the final cross section. Volume of material is calculated using the average of end areas multiplied by the distance along centerline between end areas. In extreme cases where most of the earthwork lies along a single horizontal curve the Engineer may compute volume using the average of end areas multiplied by the distance along centroid of cross section between end areas.

    b. Three-Dimensional. Where it is impractical to measure material by cross sectioning due to erratic location of isolated deposits, acceptable methods involving three-dimensional measurements may be used.

    c. Neat Line. Structures will be measured according to neat lines shown on the Plans or as altered to fit field conditions.

    d. Nominal. Volume calculated as nominal width times nominal thickness times the average length of each piece.

    e. Weight. With the Engineer's written approval, material that is specified to be measured by volume may be weighed and converted to volume for payment purposes. The Engineer will determine the appropriate conversion factors. When liquid asphalt is a pay item, ASTM D4311 will be used to convert from weight to volume at 60 °F.

4. Cubic Yard Vehicle Measure (CYVM). Material measured by volume in the hauling vehicle will be measured at the point of delivery. Vehicles may be of any acceptable size or type provided that the volume of the actual contents may be readily and accurately determined. Vehicles shall be loaded to the measured vehicle volume. If vehicles are not loaded to the measured vehicle volume, the

Engineer at their discretion, may apply a percentage of full factor to the measured volume. Loads shall be leveled when directed. No payment will be made for loads that exceed the legal capacity of the vehicle.

5. Linear Foot (LF). From end to end, in place, parallel to the centerline of the item or ground surface on which the items are placed.

6. Thousand Feet Board Measure (MBM). Nominal volume based on nominal widths and thickness times actual extreme length of each piece. One thousand feet board measure = 1,000 ft^2 X 1 inch thick.

7. Thousand Gallon (MGal). By using method a, below. Methods b or c may be used with written approval of the Engineer.

   a. Measured or calibrated volume tank;

   b. Metered volume, using a certified calibrated meter; or

   c. Weighed under this subsection and converted to volume, using a specified or approved conversion factor.

8. Mile. From end to end, measured horizontally along centerline.

9. Pound. Using a certified scale or the net weight of packaged material as labeled by the manufacturer. The Engineer will accept nominal weights for standard manufactured items, unless otherwise specified. The Engineer will accept industry-established manufacturing tolerances, unless otherwise specified.

10. Square Foot ($ft^{2)}$. Parallel to the surface being measured. No deductions will be made for individual fixtures with an area of 1 ft^2 or less. Transverse measurement for area computations will be the neat dimensions shown on the Plans or as directed by the Engineer.

11. Square Yard ($yd^{2)}$. Parallel to the surface being measured. No deductions will be made for individual fixtures with an area of 1 yd^2 or less. Transverse measurement for area computations will be the neat dimensions shown on the Plans or as directed by the Engineer.

12. Station (100 feet). Horizontally, parallel to centerline.

13. Ton (2,000 pounds). By using method a or c, below. Method b may be used with written approval of the Engineer.

    a. Commercial Weighing System. Permanently installed and certified commercial scale that meets the requirements for the project weighing system.

    b. Invoices. Supplier's invoice with net weight or volume converted to weight for bulk material that is shipped by truck or rail and is not passed through a mixing plant. Periodic check weighing may be required. Net certified weights or volumes of asphalt materials are subject to correction for temperature and foaming. All materials are subject to correction for material that is lost, wasted, or otherwise not incorporated into the work, for computing quantities.

    c. Project Weighing System. Approved automatic digital scale and scale house. All scales are subject to approval according to the Weights and Measures Act, AS 45.75.

       Spring balances and belt conveyor scales shall not be used to determine pay weight.

       The Contractor may use proportioning (batch) scales for weighing material for payment when the batching equipment includes an approved and certified automatic weighing, cycling, and monitoring system.

Weigh scales used with a storage silo may be used to weigh the final product for payment, provided the scales are approved and certified.

Vehicle scales shall be maintained with the platform level and rigid bulkheads at each end. The platform must be long enough to permit simultaneous weighing of the hauling vehicle including coupled vehicles, in a single draft. Double draft weighing is not allowed.

(1) Scale Requirements. The Contractor shall:

(a) Ensure that vehicle scale(s) are installed and maintained to the standards listed in the National Institute of Standards and Technology (NIST), Handbook 44, Specifications, Tolerances and other Technical Requirements for Commercial Weighing and Measuring Devices, as adopted by AS 45.75.050(d);

(b) Contact the Division of Measurement Standards/Commercial Vehicle Enforcement (MSCVE) to coordinate scale inspections before use, at required intervals or as directed by the Engineer and for clarification or possible exceptions to this section;

(c) Ensure that a weatherproof housing is provided to protect the scale indicating/recording equipment and allows the scale operator convenient access to the weigh indicator, scale computer, ticket printer, and sequential printer;

(d) Use competent personnel to operate the scale system;

(e) Furnish and maintain on-site, NIST Class-F cast iron test weights in denominations of 500 lb and/or 1000 lb. The required minimum for vehicle scales is 4000 lb; the required minimum for hopper scales is 2000 lb. Test weights shall have a recognized calibration certificate on file which is dated no more than two years from date of Notice to Proceed. Test weights will be used as directed by the Engineer or MSCVE for initial accuracy calibration testing and may be used for subsequent scale testing or inspection. Projects accessible by direct road access from the communities identified on the dot.alaska.gov/mscve website, 5 days before bid opening, are exempt from the requirement to furnish and maintain on-site test weights;

(f) Provide the following information on any scale used to weigh materials for payment:

(i) Owner of the scales and scale locations;
(ii) Manufacturer's name, model serial number, maximum capacity, and type of scales (single beam, double beam, self-reading, etc.)
(iii) Date(s) the scales were installed and/or adjusted;
(iv) Scale service company inspections and accuracy checks (attach copy);
(v) Division of Measurement Standards inspections and accuracy checks (attach copy); and
(vi) Time and dates of notification of any malfunctions.

(2) Electronic Computerized Weighing System. The Contractor shall use an electronic computerized weighing system (ECWS) with the following minimum capabilities:

(a) Computer. A computer with a self-reading scale system that includes the scale load cell, a sealed direct reading weight indicator, scale computer, ticket printer, and sequential printer, and that can record a complete shift's transaction in an electronic format approved by the Engineer.

The computer must store project numbers, all pay item descriptions for multiple projects and products that are weighed, and the following information for each hauling vehicle used on the project:

i. Vehicle identification number marked on the vehicle;

ii. Tare weight; and
iii. Maximum allowable gross vehicle weight (MAVW).

During weighing operations, the ECWS must compare each vehicle's gross weight to its MAVW. If the vehicle exceeds its MAVW, the system must alert the scale operator that an "overload" exists. The system must not issue a ticket for an overload.

The computer must have a battery backup and protection for power surges or brown outs. The computer system must retain all stored data during a power outage and must operate during a power outage to allow the scale operator to shut down the hard drive without losing information.

(b) Tickets. The ECWS must have a ticket printer that prints a legible, serially numbered weigh ticket for the Engineer with the following information on each ticket in the order listed:

i. Project number;
ii. Item number and description;
iii. Date weighed;
iv. Time weighed;
v. Ticket number;
vi. Vehicle Identification Number;
vii. Maximum allowable gross vehicle weight;
viii. Gross weight;
ix. Tare weight;
x. Net weight;
xi. Subtotal item net weight for each haul unit since start of shift; and
xii. Accumulated item net weight for all haul units since start of shift.

Tickets must show all weights in pounds in accordance to NIST Handbook 44, and in tons reported to two decimal places.

After printing, the weigh ticket must automatically advance to a perforation so it can be torn off and handed to the driver. Each ticket shall be initialed by the scale operator before handoff to the driver.

(c) Sequential Printer. A sequential printer that prints out all transactions (keystrokes) made by the computer concurrently with the ticket printer. For permanent commercial scales, the printer may print at the end of the company's daily shift with the Engineer's approval. The printer must print all scales transactions including tares, voided tickets, and data changes made by the scale operator. The printer must allow for advancing the paper manually so that the scale operator can write notes on the paper when special situations occur, such as voided tickets, incorrect vehicle identification number used, etc. The scale operator shall also note these special situations in the Scales Diary.

The sequential printout shall be submitted to the Engineer at the end of each shift.

(d) Data Files. Submit electronic data files to the Engineer at the end of each shift, with all ticket information produced during the shift recorded. These Data files must be complete and correct without conversion or manipulation.

(e) Scale Diary. The scale operator shall keep a Scale Diary in an electronic format acceptable to the Engineer. The scale operator shall complete the Scale Diary with the following information: dates of action, type of material, source, time the scale opened and time the scale closed, times of scale balance, ticket sequence, time the haul for each material started and stopped, voided ticket numbers, vehicle identification numbers, times

of tare and tare weights, and the scale operator's signature. The Scale Diary shall include the following information on any scale used to weigh materials for payment:

i. Owner of the scales and scale locations;
ii. Manufacturer's name, model serial number, maximum capacity, and type of scales (single beam, double beam, self-reading, etc.);
iii. Date(s) the scales were installed and/or adjusted;
iv. Scale service company inspections and accuracy checks (attach copy);
v. Division of Measurement Standards inspections and accuracy checks (attach copy); and
vi. Time and dates of notification of any malfunctions.

The Scale Diary shall be given to the Engineer at the end of each shift. The Scale Diary is the property of the Department.

(3) Weighing Procedures The scale operator shall tare hauling vehicles and record tare weights at least once daily; perform additional tares and record additional tare weights as directed by the Engineer; perform tares in the presence of the Engineer when requested; and ensure that each hauling truck displays a unique, legible identification mark.

The Engineer will calculate the MAVW for each vehicle and list all vehicles and their MAVW(s) in the scale house. The MAVW is either the maximum allowable legal weight determined by the Engineer when the Contractor cannot haul overloads, or the manufacturer's recommended maximum allowable gross vehicle weight as certified by the Contractor when vehicles are allowed to haul overloads. Only MAVWs that the Engineer has provided in writing shall be used. Tickets may not be issued to a vehicle until the Engineer provides the MAVW.

No payment will be made for any material weighed without using the ECWS, unless the Contractor obtains the Engineer's prior written authorization. If the ECWS malfunctions or breaks down, weights shall be manually weighed and recorded for up to 48 hours as directed by the Engineer. The manual weighing operation shall meet all other Contract requirements.

The system must generate a report either during or at the end of the day or shift that summarizes the number of loads and total net weight for each date, project, and product. The scale operator shall submit the original report to the Engineer at the end of each shift.

No payment for any hauled material on a given date will be made until the following are delivered to the Engineer:

(a) Sequential printout;

(b) Daily data; and

(c) Scale Diary.

The Contractor will not receive payment for any material hauled in a vehicle that does not conform to the requirements of Subsection 105-1.12, Load Restrictions, and this Subsection. The Contractor shall dump material from non-conforming vehicles until they conform, then reweigh the vehicles.

When a weighing device indicates less than true weight, the Contractor will not receive additional payment for material previously weighed and recorded. When a weighing device indicates more than true weight, all material received after the last previously correct weighing accuracy test will be reduced by the percentage of error that exceeds 0.5 percent.

If the Engineer incurs extra construction engineering expenses from checking non-machine data entries or other data irregularities, the total value of those expenses will be deducted from the value of the Contract item before payment.

The Contractor shall accept natural variations in the specific gravity of aggregates, without adjustment in Contract unit price.

109-1.03 SCOPE OF PAYMENT. The Department will make payment at the Contract price or prices for each item shown on the bid schedule or as modified by change order with specified price adjustments. The Contractor shall accept the Contract prices as full and complete payment for (a) furnishing all equipment, materials, tools, and labor necessary to complete the work in a complete and acceptable manner, and for (b) all of the Contractor's risk, loss, damage, or expense of whatever character arising from or relating to the work and performance of the work.

109-1.04 COMPENSATION FOR ALTERED QUANTITIES. Payment to the Contractor for unit price items shall be made only for the actual quantities of work performed and accepted or materials furnished, in conformance with the Contract. When the accepted quantities of work or materials vary from the quantities stated in the bid schedule, the Contractor shall accept payment at the original Contract unit prices for the quantities of work and materials furnished, completed and accepted as payment in full. Payment at the Contract unit price shall compensate the Contractor for all costs, expenses, and profit that the Contractor is entitled to receive for the altered quantities, except as provided below:

1. When the final quantity of a Major Contract Item varies more than 25 percent above or below the bid quantity, either party to the Contract may receive an equitable adjustment, excluding anticipated profits, in the Contract unit price of that item. If the final quantity of work is:

    a. Greater than 125 percent of the bid quantity, the equitable adjustment will be made only for those units that are in excess of 125 percent of the bid quantity.

    b. Less than 75 percent of the bid quantity, the equitable adjustment will be made for those units of work done and accepted, except that the total payment for the item shall not exceed 75 percent of the total amount bid for the item.

Except as provided above and in Subsection 104-1.02, no allowance shall be made for any increased expenses, expected reimbursement, or anticipated profits suffered or claimed, either directly from alterations in quantities or indirectly from unbalanced allocations among the contract items on the part of the bidder and subsequent loss of expected reimbursements, or any other causes.

109-1.05 COMPENSATION FOR EXTRA WORK ON TIME AND MATERIALS BASIS. When the Engineer orders extra work to be performed on a time and materials basis, compensation will be computed as follows:

1. Labor. Based on the sum of a. through f.

    a. Total hours worked times the straight time rate of pay. The rates of pay are those indicated on the certified payroll for all labor and foremen in direct charge of the specific operations. Rates shall not exceed those for comparable labor currently employed on the project, and shall not include general superintendence.

    b. Overtime hours worked times the difference between the overtime rate and the straight time rate. No markup is allowed.

    c. Fringe benefit rate times the total hours worked. Fringe benefits include Health and Welfare, Pension Fund, etc., when such amounts are required by collective bargaining agreement or other employment contracts generally applicable to the classes of labor employed on the project.

d. Workers' Compensation Insurance at 8 percent of a. The actual net rate may be used if it exceeds 10 percent and if proof of rates is furnished within 30 days of the completion of the extra work.

e. Either subsistence and travel allowances or prorated camp costs. If an employee is due and receives subsistence or camp privileges on their days off, divide that cost by the number of days worked that week and add to their daily subsistence entitlement. If the employee did not work an entire day on time and materials work, prorate the entitlement for the hours worked on time and materials.

f. Markup at 35 percent of the sum of a., c., d., and e. This includes and shall fully compensate the Contractor for all overhead and profit, including general superintendence, additional bond, property damage liability insurance, unemployment insurance contributions, social security and other taxes, administrative overhead costs, and profit.

2. Materials. Actual invoiced material and delivery costs plus 15 percent markup. The material must be approved and incorporated into the work. The Contractor shall furnish to the Engineer proof of payment for materials used in the work plus applicable transportation charges. For Contractor-produced materials, certify in writing the Contractor's actual direct costs, the quantities used, and attach cost spreadsheets and production documentation to verify the costs.

3. Equipment. Includes machinery and special equipment (other than small tools) necessary for the work and authorized by the Engineer. No additional compensation will be made for overhead, profit, maintenance, service, repairs, fuels, lubricants, or replacement parts.

a. Hourly Rental Rate. Based on rental rates in the current edition and appropriate volume of the *Rental Rate Blue Book*, by EquipmentWatch, Penton Media, Inc..

The regular hourly rental rate is equal to the equipment rate plus the estimated hourly operating cost. These rates apply for equipment used during the Contractor's regular shift of 10 hours per day. No markup is allowed.

The equipment rate is equal to the age adjusted monthly rate for the basic equipment plus the age adjusted monthly rate for applicable attachments, both divided by 176, and multiplied by the regional adjustment factor. The equipment rate is per hour.

The age adjusted monthly rate is that resulting from application of the age adjustment formula, to eliminate replacement cost allowances in machine depreciation and contingency cost allowances.

Only the attachments required for the time and materials work will be included.

b. Hourly Overtime Rate. Half of the equipment rate plus the full estimated hourly operating cost. The overtime rate will apply to hours the equipment is used in excess of 10 hours per day, either on the Contractor's normal work or on time and materials, and either on single or multiple shifts. No markup is allowed.

c. Hourly Stand-by Rate. Half of the equipment rate, for equipment ordered on stand-by during the Contractor's normal work shift, not to exceed eight hours per day. No operating costs or markup is allowed.

d. Unlisted Equipment. For equipment not listed in The Blue Book, the Contractor and the Engineer may agree to a rate before extra work is begun. If agreement is not reached, the Engineer has authority to establish a rate based on similar equipment in *Rental Rate Blue Book* or prevailing commercial rates. No markup is allowed.

e. Leased or Rented Equipment. Equipment that must be rented or leased specifically for work required under this section and authorized in writing by the Engineer shall be paid at invoice price plus 15 percent markup.

Equipment rented or leased for other work under the Contract and used for work under this section shall be paid based on 3.a., b., and c. (above) with no markup, except that the adjusted monthly rate is the monthly rate determined directly from the submitted rental or lease agreement.

f. Transportation of Equipment. The actual cost of moving equipment to and from the work site. To receive reimbursement for transportation of equipment, the Contractor shall obtain the equipment from the nearest approved source and use the equipment exclusively for time and materials work. Payment for move-out will not exceed the amount of the move-in. No markup is allowed, except on operator's wages.

Basis of payment:

(1) If by common carrier: paid freight bill or invoice.

(2) If hauled with the Contractor's own resources: hourly rental rate for hauling unit plus operator wages.

(3) If equipment must be moved under its own power: half of the normal hourly rental rate plus operator's wages.

4. Work by a Subcontractor or Owner-Operator. For time and materials work performed by an approved subcontractor or owner-operator under items 1 through 3 above, the Contractor will receive a 5 percent markup for administrative costs. No percentage will be paid on work covered under bid items in the original Contract. No percentage over the amount covered above will be paid for work done by a lower tier subcontractor.

5. Work by a Specialty Subcontractor. The Contractor shall obtain the Engineer's advance agreement that the specialty item needed is beyond the Contractor's ability or expertise or that of the Contractor's other subcontractors. For work on a specialty item performed by an approved specialty subcontractor, the Contractor will receive the approved invoice cost of work or service plus a 15 percent markup for administrative costs.

6. Records. The Engineer will maintain a daily record of labor, equipment and materials utilized in the extra work. The Engineer will present this record to the Contractor at the end of each day's work for verification and signature.

7. Compensation. Payment for time and materials work will be made in the progress estimate following receipt of the verified daily records and all required supporting information from the Contractor. If, at any time, a unit price or lump sum basis of compensation is agreed to for work being performed under this subsection, that compensation will be set forth in writing as a Change Order.

109-1.06 PROGRESS PAYMENTS. The Department will make monthly progress payments to the Contractor based on estimates of the value of work performed and materials on hand under Subsection 109-1.07. At the Departments discretion, a progress payment may be made twice monthly if the value of the estimate exceeds $10,000.

Contractor's failure to pay subcontractors, or subcontractor's failure to pay lower tier subcontractors, according to prompt payment provisions required under Subsection 108-1.01 is considered unsatisfactory performance.

The Department will not withhold payment as retainage but may withhold payment for unsatisfactory performance. If satisfactory progress is being made and subcontractors are paid according to Subsection 108-1.01 and AS 36.90.210, the Engineer will authorize 100 percent payment for the estimated value of work accomplished, less any authorized deductions.

If the Engineer finds that satisfactory progress is not being made or payment for satisfactory work by a subcontractor or lower tier subcontractor is not paid according to Subsection 108-1.01, the Engineer may withhold up to 100 percent of the total amount earned from subsequent progress payments. The Engineer

may withhold up to 200 percent of the estimated cost to complete final punch list items for unsatisfactory performance until those items are complete. The Engineer will notify the Contractor in writing within eight working days of a request for a progress payment of the reasons why part or all of the payment is being withheld for unsatisfactory performance and what actions may be taken by the Contractor to receive full payment.

Payments of withheld amounts will be made in accordance with AS 36.90.200. No interest will be paid to the Contractor for amounts withheld for unsatisfactory performance except if the Department fails to pay the amount withheld within 21 calendar days after the Contractor satisfactorily completes the remedial actions identified by the Engineer, as provided in AS 36.90.200(e).

The Contractor shall pay interest on retainage withheld from subcontractors, and at an interest rate according to AS 36.90.250 and AS 45.45.010(a).

109-1.07 PAYMENT FOR MATERIAL ON HAND.

1. Partial Payment. The Engineer will make partial payment for materials designated for incorporation into the work. The material shall:

    a. Meet Contract requirements;

    b. Be delivered and stockpiled at the project or other approved location;

    c. Be supported by invoices, freight bills, and other required information; and

    d. Not be living or perishable.

2. Payment Requests. The Contractor shall make each payment request in writing and:

    a. List stockpiled items, quantities of each, and stockpile location(s);

    b. Certify that materials meet the applicable Contract specifications;

    c. For purchased materials, attach copies of invoices, freight bills, and manufacturer’s published storage recommendations;

    d. For Contractor-produced materials, attach production statements showing quantities and dates produced and copies of process quality control test results; and

    e. Include other information requested by the Engineer.

3. Storage Conditions. The Contractor shall protect material from damage or loss while in storage. The Contractor shall:

    a. Physically separate stockpiled materials from other materials at the storage location;

    b. Clearly label materials with the project name and number; and

    c. Store materials per the manufacturer's recommendations.

If storage conditions become unsatisfactory, liens are filed on any materials, or the storage location is changed without approval, the Engineer will deduct any previous payments made for such materials.

4. Method of Payment. The Engineer will include payments for acceptably stockpiled materials in the progress estimate following receipt of the Contractor’s written request and all required documentation. The Engineer will:

    a. Pay for materials purchased by the Contractor at the delivered cost but not to exceed 85 percent of the Contract amount for those items;

b. Pay for materials produced by the Contractor at up to 50 percent of the Contract amount for those items;

c. Deduct the Department's cost to inspect materials stored off the limits of the project; and,

d. Deduct partial payment quantities as they are incorporated into the project.

The Contractor shall release and discharge the Department from any liability for damages or delays related to the storage or transport of, and to the payment for, material on hand.

The Department's payment for material on hand will not constitute final acceptance by the Department.

109-1.08 FINAL PAYMENT. When the project has been completed as provided in Subsection 105-1.15, the Engineer will prepare the final estimate of the quantities of the various classes of work performed. All prior progress estimates and payments shall be subject to correction in the final estimate and payment. The final estimate will not be processed until the Alaska Department of Labor and Workforce Development has verified that final payment can be released. The Department will not process the final estimate until the Contractor completes Items 1 through 4 in the first paragraph of Subsection 105-1.16.

If the Contractor approves the final estimate, or does not file a claim within 90 days of receiving the final estimate, the estimate shall be processed for final payment. Final payment shall consist of the entire sum found to be due after deducting all previous payments and all amounts to be retained or deducted under the provisions of the Contract. Failure to file a claim within 90 days of receiving the final estimate is a waiver of any and all claims relating to or arising from the final estimate.

When the Contractor approves the final estimate and executes the Contractor's Release form, final payment will be processed.

The Contractor may reserve any unresolved claims that were timely filed in accordance with Subsection 105-1.17 by listing those claims as exceptions on the Contractor's Release. Any claims listed as exceptions that were not filed before the Contractor executes the final estimate will be considered null and void. Any claims filed in a timely manner but not listed on the Contractor's Release are waived and deemed released.

If the Contractor fails or declines to approve the final estimate within 90 days but does not file any claims, the Department will consider the estimate approved and process the estimate for final payment. Any subsequently raised claims will be considered null and void.

109-1.09 ELIMINATED ITEMS. When the Contractor is notified of the elimination of a minor Contract item, the Contractor will be reimbursed for actual work performed and all direct costs incurred before notification. In no case will any payment be made for anticipated profits or overhead.

Should it become necessary to eliminate a major Contract item, an equitable adjustment will be made and the Contract modified in writing accordingly.

SECTION 120
DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM

120-1.01 DESCRIPTION. Provide Disadvantaged Business Enterprises (DBEs), as defined in Title 49 CFR Part 26, the opportunity to participate fairly with other contractors in the performance of contracts financed with federal funds. The Contractor and subcontractors shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor will carry out applicable requirements of 49 CFR Part 26 in the award and administration of U.S. DOT assisted contracts.

The Department, in coordination with the Federal Highway Administration (FHWA), adopted a Race-Neutral DBE Program with an overall DBE Utilization Goal of 8.83 percent for Alaska's FHWA Federal-Aid program. Although the Race-Neutral program does not establish or require individual project DBE Utilization Goals, 49 CFR establishes the Bidder is responsible to make a portion of the work available to DBEs and to select those portions of the work or material needs consistent with the available DBEs to facilitate DBE participation.

If the Department, in collaboration with our contractors, does not meet the overall program DBE Utilization Goal and cannot demonstrate good faith effort to meet the program goal, the program may be modified to Race-Conscious, with individual DBE Utilization Goals established for each Federal-Aid project. The Department and FHWA will use the data collected under Section 120 to evaluate the program for compliance with Section 120 and with 49 CFR Part 26.

120-1.02 INTERPRETATION. This section implements the requirements of 49 CFR Part 26, and the Department's federally approved DBE Program.

120-1.03 ESSENTIAL CONTRACT PROVISION. Failure to comply with the provisions of this section is a material breach of contract, which may result in cancelation of intent to award, contract termination, or other remedy as DOT&PF deems appropriate. Failure to comply with this section is justification for debarment action as provided in AS 36.30.640(4).

120-1.04 DEFINITIONS AND TERMS.

CIVIL RIGHTS OFFICE. The Department's Civil Rights Office. (CRO)

COMMERCIALLY USEFUL FUNCTION. Action within the scope of the Contract where a Disadvantaged Business Enterprise (DBE) is responsible for execution of the work and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. The DBE must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself.

CONTRACT COMPLIANCE OFFICER. Individual within the Department's CRO with the authority to administer the Department's compliance programs.

DISADVANTAGE BUSINESS ENTERPRISE (DBE). A commercial entity which is a for-profit small business certified in accordance with 49 CFR Part 26 and listed in the Alaska DBE Directory.

DBE BROKER. A DBE certified for the delivery of creditable materials, supplies, equipment, transportation/hauling, insurance, bonding, etc., within its certified category, that is necessary to complete the project. A DBE Broker of materials certified in a supply category must be responsible for scheduling the delivery of materials and ensuring that the materials meet specifications before credit will be given.

DBE KEY EMPLOYEE. Employee of the DBE who is identified by the DBE owner in the DBE's certification file at the CRO.

DBE MANUFACTURER. A DBE certified in a supply category that changes the shape, form, or composition of original material in some way. The DBE Manufacturer must provide that altered material to the general public or the construction industry at large on a regular basis.

DBE ON-SITE REPRESENTATIVE. On-site representatives approved by the DBE owner and the CRO to represent a DBE owner. These representatives must have technical knowledge and the ability to answer questions regarding the work being performed on a project.

DBE REGULAR DEALER. A DBE certified in a supply category who operates in a manner consistent with industry practice and who:

1. maintains an in-house inventory on a regular basis of the particular product provided to this project; and

2. keeps an inventory in an amount appropriate for the type of work using that product; and

3. offers that inventory for sale to the general public or construction industry at large (private and public sectors), not just supplied as needed on a project by project basis during the construction season, except where the product requires special or heavy equipment for delivery and the DBE possesses and operates this equipment on a regular basis throughout the construction season in order to deliver the product to the general public or construction industry at large. If the distribution equipment is rented or leased, it must be on a repetitive, seasonal basis; and may additionally fabricate (assemble large components) for use on a construction project, consistent with standard industry practice, for delivery to the project.

   A person may be a DBE Regular Dealer in bulk items such as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business, if the person both owns and operates distribution equipment for the products. Any supplementing of DBE Regular Dealers' own distribution equipment shall be by a long-term lease agreement and not on an ad hoc or contract-by-contract basis.

DBE UTILIZATION GOAL. The percent of work to be performed by certified DBEs.

DBE OFFICER. Individual designated in writing as a representative of the Contractor concerning DBE issues.

GOOD FAITH EFFORT (GFE). Bidder's actions, performed prior to bid opening and demonstrated through detailed and comprehensive documentation, to take all necessary and reasonable steps to achieve DBE participation. Lower case "good faith effort", refers to the Department's and all or contractors' collaborative efforts to meet the overall program DBE Utilization Goal.

PLAN HOLDER SELF-REGISTRATION LIST (PHSRL). The Department's online portal that allows contractors, DBEs and non-DBEs to self-register as an interested contractor to bid.

RACE-CONSCIOUS PARTICIPATION. DBE participation used to meet an individual project specific DBE Utilization Goal.

RACE-NEUTRAL DBE PARTICIPATION. DBE participation when no DBE Utilization Goal is specified in the Contract and DBE participation that exceeds the goal amount when an individual project specific DBE Utilization Goal is specified in the Contract.

120-2.01 RESERVED.

120-3.01 DETERMINATION OF COMPLIANCE.

1. Phase I - Bid. All Bidders' GFEs must be completed prior to bid opening.

2. Phase II - Award. The apparent low bidder shall submit evidence of DBE commitment(s) within 5 working days after receipt of written notification by the Department of the successful low bid. The apparent low bidder may not supplement its DBE efforts after opening, nor offer new or additional DBE participation after submitting the DBE Utilization Report (Form 25A-325C).

a. Written DBE Commitment. Complete Form 25A-326 for each DBE subcontractor.

b. DBE Utilization Report. Submit a completed DBE Utilization Report Form 25A-325C. All listed DBEs must be certified in the appropriate work categories prior to bid opening to be used to meet the DBE contract goal.

c. GFE Documentation. Submit a completed Summary of GFE Documentation Form 25A-332A (with attachments) and Contact Report Form 25A-321A.

120-3.02 GOOD FAITH EFFORT (GFE). Although evaluation of GFE for sufficiency is not a condition of award, documenting GFE is required and is necessary for the Department's and FHWA's determination of compliance with 49 CFR Part 26.

1. GFE Criteria. If the Department does not meet the overall program DBE Utilization Goal, the Department and FHWA will use the following criteria to judge whether the Department, in collaboration with our contractors, demonstrated good faith effort to meet the overall program DBE Utilization Goal.

a. Consider All Subcontractable Items. Before bid opening, seek DBE participation by considering those portions of the work or material needs consistent with the available DBEs to facilitate DBE participation.

b. Initial DBE Notification. Contact DBEs listed in the Department's Plan Holders Self-Registration List for the particular project being bid at least 7 calendar days prior to bid opening to solicit their interest. Log each contact with a DBE firm on a Contact Report, Form 25A-321A.

Give DBEs at least 7 calendar days to quote. The bidder may reject DBE quotes received after the deadline. Responsive DBE quotes should be accepted unless they are determined non-competitive. Consistently apply deadlines for quote submission and responsiveness determinations for DBEs and non-DBEs.

Methods of initial and follow up notification are:

(1) By fax with a confirmation receipt of successful transmission to the DBE's fax number listed in the DBE Directory. A fax transmission without receipt of successful transmission is unsatisfactory.

(2) By email to the DBE's email address listed in the DBE Directory, with confirmation of successful receipt. Email without confirmation of successful receipt is unsatisfactory.

(3) By telephone solicitation made to the DBE's telephone number listed in the DBE Directory, with a record of the date and time of the telephone contact. Telephone solicitation without a record of date and time is unsatisfactory.

(4) By publication, with the names and dates of each advertisement in which a request for DBE participation was placed. Attach copies of advertisements or proof of publication.

c. Non-Acceptance of DBE Quotes.

When a DBE quote is not accepted, the work must be performed by the non-DBE subcontractor whose quote was used to provide the basis of the determination or by your own forces if your forces were the basis of the determination. Include evidence in support of the determination not to use the DBE subcontractor.

Payments received by a non-DBE subcontractor during the execution of the Contract shall be consistent with the accepted quote. This does not preclude increases due to change documents issued by the Department.

d. Assistance to DBEs. Provide DBEs with:

(1) Information about bonding or insurance required by the bidder.

(2) Information about securing equipment, supplies, materials, or business development related assistance or services.

(3) Adequate information about the requirements of the contract regarding the specific item of work or service sought from the DBE.

(4) Document all efforts to provide assistance to DBEs on Federal-Aid projects.

e. Follow-up DBE Notifications. If there is no response from the initial DBE notification, contact the DBEs again to determine if they will be quoting.

Failure to submit a quote by the deadline is evidence of the DBE's lack of interest in bidding. Log follow-up contacts on the Contact Report Form 25A-321A.

f. GFE Evaluation. The Department will review the GFE documentation for content but will not evaluate sufficiency. Failure to provide GFE documentation may result in cancellation of the notice of intent to award and forfeiture of the bid security according to subsection 103-1.03.

2. Reserved.

120-3.03 DBE CREDITABLE AND NON CREDITABLE WORK.

1. DBE Creditable Work. The Commercially Useful Function work items and creditable dollar amounts shown on the DBE Utilization Report, Form 25A-325C, shall be included in any subcontract, purchase order or service agreement with that DBE.

2. DBE Decertification.

a. If a DBE performing a Commercially Useful Function loses its DBE certification at any time prior to execution of a subcontract, purchase order or service agreement, as the result of a determination of ineligibility pursuant to 49 CFR Part 26.87, the work of that firm will not be credited toward the DBE Utilization Goal and the Contractor must either:

(1) meet the contract goal by subcontracting with an eligible DBE firm or demonstrate a GFE to do so; or

(2) continue with the decertified DBE and find other work not already committed to DBEs in an amount that meets or exceeds the DBE Utilization Goal.

b. If a DBE performing a Commercially Useful Function loses its DBE certification after execution of a subcontract, purchase order or service agreement, as the result of a determination of ineligibility pursuant to 49 CFR Part 26.87, the de-certified DBE may continue to perform, and the work may be credited toward the DBE Utilization Goal.

c. If a DBE goes out of business and cannot perform the work, the Contractor must meet the contract goal by subcontracting with an eligible DBE Firm or demonstrate a GFE to do so.

The provisions of 120-3.03(3) Termination of a DBE and 120-3.03(4) DBE Replacement or Substitution do not apply to this section.

A Contractor must notify the CRO within one business day if they become aware of any change in a DBE's circumstances that might lead to a DBE's decertification.

3. Termination of a DBE.

a. In accordance with 49 CFR 26.53(f)(1) the Contractor shall not terminate a DBE without good cause and the prior written consent of the Engineer. For purposes of this paragraph, good cause includes the following circumstances:

(1) DBE defaults on their obligation for any reason;

(2) The DBE fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE to perform its work on the subcontract results from the bad faith or discriminatory action of the Contractor.

(3) The DBE fails or refuses to meet the Contractor's reasonable, nondiscriminatory bond requirements;

(4) The DBE becomes bankrupt, insolvent, or exhibits credit unworthiness;

(5) The DBE is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215, and 1,200 or applicable state law;

(6) The Engineer determines the DBE is not a responsible contractor.

(7) The DBE voluntarily withdraws from the project and provides a written notice of its withdrawal;

(8) The DBE is ineligible to receive DBE credit for the type of work required;

(9) A DBE owner dies or becomes disabled with the result that the DBE is unable to complete its work; or

(10) Other documented good cause that the Engineer determines, compels the termination of the DBE, provided that good cause does not exist if the Contractor seeks to terminate a DBE it relied upon to obtain the contract so that the Contractor can self-perform the work for which the DBE was engaged or so that the Contractor can substitute another DBE or non-DBE after contract award.

b. The Contractor must give written notice to the DBE of its intent to request to terminate and/or substitute, and the reason for the request. The request to terminate and/or substitute must be submitted to the Engineer.

c. The Contractor must give the DBE 5 working days to respond to the written notice. Any response from the DBE must be submitted to the Engineer.

4. <u>DBE Replacement or Substitution.</u>

a. The Contractor shall submit to the Engineer a written request to replace or substitute a DBE who fails or refuses to execute a written subcontract or who is terminated under 120-3.03(3).

b. If the Contractor cannot obtain replacement DBE participation, the DBE Utilization Goal will not be adjusted. However, the Engineer may consider the following criteria as satisfying that portion of DBE participation that cannot be replaced:

(1) The Contractor was not at fault or negligent and that the circumstances surrounding the replacement or substitution were beyond the control of the Contractor; and

(2) The Contractor is unable to find replacement DBE participation at the same level of DBE commitment and has adequately performed and documented the GFE expended in accordance with Subsection 120-3.02; or

(3) It is too late in the project to provide any real subcontracting opportunities for DBEs.

If the Engineer agrees that additional DBE participation is not available, the DBE may be replaced or substituted with a non-DBE or the Contractor may self-perform the work.

120-3.04 COMMERCIALLY USEFUL FUNCTION (CUF).

1. Creditable Work. Measuring the DBE Utilization Goal will be based upon the actual dollars paid to the DBEs for creditable CUF work on this project. This is determined by the Engineer in accordance with this section. CUFs are limited to:

   a. Prime Contractors;
   b. Subcontractors;
   c. Manufacturers;
   d. Regular Dealers;
   e. Brokers; or
   f. Joint Ventures

2. Determination of CUF. In order for the CUF work of the DBE to be credited toward the goal, the Contractor will ensure that the DBE is certified in the appropriate category at the time of the submittal of the subcontract, or the issuance of a purchase order or service agreement. Subcontracts, purchase orders and service agreements shall be consistent with the written DBE commitment.

   a. The CUF performed by a DBE certified in a supply category will be evaluated by the Engineer to determine whether the DBE performed as either a broker, regular dealer, or manufacturer of the product provided to this project.

   b. The following factors will be used in determining whether a DBE trucking company is performing a CUF:

      (1) The DBE must be responsible for the management and supervision of the entire trucking operation for which it is performing on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting DBE goals.

      (2) The DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the contract.

      (3) The DBE receives credit for the total value of the transportation services it provides on the contract using trucks it owns, insures, and operates using drivers it employs.

   c. The Contractor will receive credit for the CUF performed by DBEs as provided in this Section. Contractors are encouraged to contact the Engineer in advance of the execution of the DBE's work or provision of goods or services regarding CUF and potential DBE credit.

   d. The DBE may perform work in categories for which it is not certified, but only work performed in the DBE's certified category meeting the CUF criteria may be credited toward the DBE Utilization Goal.

   e. DBE work shall conform to the following requirements to be a CUF:

      (1) It will be necessary and useful work required for the execution of the Contract.

      (2) The scope of work will be distinct and identifiable with specific contract items of work, bonding, or insurance requirement.

      (3) It will be performed, controlled, managed, and supervised by employees normally employed by and under the control of the certified DBE. The work will be performed with the DBE's own equipment. Either the DBE owner or DBE On-Site Representative will be at the work site and

responsible for the work. Leased equipment may also be used provided the DBE has exclusive use of the equipment and it is operated by a driver the DBE employs. In remote locations or rare situations, a DBE may use equipment and/or personnel from the Contractor or its affiliates. Should this situation arise, a prior arrangement must be in place. The duration of the arrangement must be short term and prior written approval from the Engineer must be obtained.

(4) The manner in which the work is sublet or performed will conform to standard industry practice within Alaska, as determined by the Department. The work or provision of goods or services will have a market outside of the DBE program (and must also be performed by non-DBE firms within the Alaskan construction industry). Otherwise, the work or service will be deemed an unnecessary step in the contracting or purchasing process and no DBE credit will be allowed.

There will be no DBE credit for lower-tier non-DBE subcontract work.

(5) The cost of the goods and services will be reasonable and competitive with the cost of goods and services outside the DBE program within Alaska. Materials or supplies needed as a regular course of the Contractor's operations such as fuel, maintenance, office facilities, portable bathrooms, etc. are not creditable.

The cost of materials actually incorporated into the project by a DBE subcontractor is creditable toward the DBE goal only if the DBE is responsible for ordering and scheduling their delivery and fully responsible for ensuring that they meet specifications. The cost of materials purchased from the contractor or its affiliates is not creditable.

(6) Subcontract work, with the exception of truck hauling, shall be sublet by the same unit of measure as is contained in the Bid Schedule unless approved in advance by the Engineer.

(7) The DBE will control all business administration, accounting, billing and payment transactions. The Contractor cannot perform these functions for the DBE.

In accordance with AS 36.30.420(b), the Engineer may inspect the offices of the DBE and audit their records to assure compliance.

3. Rebuttal of a Finding of No CUF. Consistent with the provisions of 49 CFR Part 26.55(c)(4)&(5), before the Engineer makes a final finding that no CUF has been performed by a DBE, the Engineer will coordinate transmittal of the presumptive finding to the Contractor, who will in-turn, notify the DBE. The Contractor will provide the DBE the opportunity to provide rebuttal information. The Contractor shall present the information to the Engineer.

The Engineer will make a final determination on whether the DBE is performing a CUF. Under no circumstances will the Contractor take any action with respect to the DBE until the final determination is made. The Engineer's decisions on CUF matters are subject to review by the Department, but are not administratively appealable to the U.S. DOT.

4. Monthly Required Reporting. On a monthly basis, the Contractor shall submit the Monthly Summary of DBE Participation, Form 25A-336, to the Engineer. Reports are due by the 15th of the following month. Also attach copies of canceled checks or bank statements that identify payer, payee, and amount of transfer to verify payment information shown on the form.

120-4.01 DETERMINING DBE CREDIT. The Contractor is entitled to count toward the DBE Utilization Goal, monies actually paid to certified DBEs for CUF work performed by the DBE as determined by the Engineer. The Contractor will receive credit toward the DBE Utilization Goal, as follows:

1. Credit for the Commercially Useful Function of a DBE prime contractor is 100 percent of the monies actually paid to the DBE under the contract for creditable work and materials in accordance with 49 CFR Part 26.55.

2. Credit for the CUF of a subcontractor is 100 percent of the monies actually paid to the DBE under the subcontract for creditable work and materials.

3. Credit for the CUF of a subcontractor performing hauling/transportation is 100 percent of the monies actually paid to the DBE under the subcontract for creditable work for those firms certified in the 100 percent category. Credit for the CUF of a subcontractor performing hauling/transportation is 5 percent of the monies actually paid to the DBE under the subcontract for creditable work for those firms certified in the 5 percent credit category.

4. Credit for the CUF of a manufacturer is 100 percent of the monies paid to the DBE for the creditable materials manufactured.

5. Credit for the CUF of a regular dealer of a creditable material, product, or supply is 60 percent of its value. The value is the actual cost paid to the DBE not to exceed the bid price for such item.

6. Credit for the CUF of a broker performed by a DBE certified in a supply category for providing a creditable material, product or supply is limited to a reasonable brokerage fee. The brokerage fee will not exceed 5 percent of the cost of the procurement contract for the creditable item.

7. Credit for the CUF of a broker performed by a DBE certified in a bonding or insurance category is limited to a reasonable brokerage fee, not to exceed 5 percent of the premium cost.

8. Credit for the CUF of a joint venture (JV) either as the prime contractor or as a subcontractor may not exceed the percent of the DBE's participation in the JV agreement, as certified by the CRO. The DBE joint venture partner will be responsible for performing all of the work as delineated in the certified JV agreement.

120-5.01 ACHIEVEMENT OF DBE GOALS. Work under this item is subsidiary to other contract items and no payment will be made for meeting or exceeding the DBE Utilization Goal.

If the Contractor fails to utilize the DBEs listed on Form 25A-325C as scheduled or fails to submit proof of payment, requested documentation, or otherwise cooperate with a DBE review or investigation, the Department will consider this to be unsatisfactory work. If the Contractor fails to utilize GFE to replace or substitute a DBE, regardless of fault [except for Subsection 120-3.03(4)(b)(3)], the Department will also consider this unsatisfactory work. Unsatisfactory work may result in disqualification of the Contractor from future bidding under Subsection 102-1.13 and withholding or progress payments consistent with Subsection 109-1.06.

DIVISION 200 – EARTHWORK

SECTION 201
CLEARING AND GRUBBING

201-1.01 DESCRIPTION. Clear, grub, remove, and dispose of all vegetation and debris within designated areas of the project, except such objects as are designated to remain or are to be removed under other sections of these Specifications. Preserve from injury or defacement all vegetation and objects designated to remain.

201-2.01 MATERIALS. None.

CONSTRUCTION REQUIREMENTS

201-3.01 GENERAL. The Engineer will designate the limits of work and all trees, shrubs, plants and other things to remain. Preserve all things designated to remain.

Keep erosion potential to a minimum.

Preserve survey stakes, boundary markers, bench marks, and tie points until such time as their usefulness has ceased and the Engineer gives permission for their destruction.

201-3.02 CLEARING. Cut and dispose of all trees, down timber, stubs, brush, bushes and debris from all areas designated.

Fell trees toward the center of the area to be cleared, in order to minimize damage to the trees that are to be left standing. Remove and dispose of trees unavoidably falling outside the specified limits. Cut trees and brush to a height of not more than 6 inches above the surrounding ground.

201-3.03 GRUBBING. Remove and dispose of all stumps, roots, moss, grass, turf, debris or other objectionable material within excavation limits, and within fill limits where the embankments are to be made to a depth less than 4 feet below subgrade. Grub any other areas designated on the Plans or in the Special Provisions.

Except in areas to be excavated, backfill stump holes and other holes with suitable materials and compact according to the Specifications.

201-3.04 HAND CLEARING. Cut and dispose of all trees, down timber, stubs, brush, bushes and debris from all areas designated, with minimal disturbance to grass and/or moss cover. Do not use equipment on wheels or tracks in areas designated as hand clearing, except as stated below.

Where shown on the Plans, you may use a mechanical brush cutter, provided such work is performed within the time frame specified in the Special Provisions.

Cut stumps flush with the ground. In areas to be covered by least 4 feet of subgrade material, stumps may extend up to 12 inches above natural ground, except where geotextile is specified.

201-3.05 SELECTIVE TREE REMOVAL. Remove and dispose of selected trees, as designated by the Engineer, and which are located outside the normal clearing and grubbing limits. The Engineer may designate the trees to be removed under this item at any time during the Contract life, subject to conditions in Subsection 201-3.04, Hand Clearing. Cut off designated trees no more than 12 inches above the ground surface.

201-3.06 DISPOSAL. Dispose of all vegetation and debris removed by clearing or grubbing by burning, burying, or other approved methods and at approved locations.

Obtain the property owner's written permission to dispose of vegetation and debris at locations outside the right-of-way limits and a waiver of all claims against the State for any damage to such land which may result. Obtain all permits required by law for such disposal. Furnish a copy of such permission, waiver of claims, and permits to the Engineer before commencing work.

Do not burn when prevailing winds would produce a smoke hazard to traffic or disturb local communities. Place piles for burning in open spaces within the project, or in other spaces designated by the Engineer where no damage to trees, other vegetation or embankment stability will occur.

Conduct all burning operations under the constant care of competent watchmen so that the surrounding forest cover or other adjacent property will not be jeopardized. Comply with applicable laws and ordinances regarding burning.

Where shown on the Plans, you may dispose of clearing debris under 4 inches in diameter within the construction limits. Do this by spreading in an even layer, so the material does not intrude into the upper 3 feet of subgrade.

All merchantable timber in the clearing area at the beginning of construction becomes your property.

201-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Acre. The area acceptably cleared and/or grubbed, measured on the ground surface. Only areas shown on the Plans or staked for clearing and/or grubbing will be measured.

   Existing roadways, lakes, ponds, stream beds, and other areas not covered by trees or brush will not be included for measurement. Other areas which do not require clearing and/or grubbing will be so staked.

2. Each. The number of designated trees acceptably removed, regardless of size.

201-5.01 BASIS OF PAYMENT. Backfill and compaction of holes left from removal of stumps or other objects are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
201.0001.____	Clearing	ACRE
201.0002.____	Grubbing	ACRE
201.0003.____	Clearing and Grubbing	ACRE
201.0004.____	Hand Clearing	ACRE
201.0005.____	Clearing and Grubbing State-Furnished Material Sources	ACRE
201.0006.____	Selective Tree Removal	EACH
201.0007.____	Clearing	LS
201.0008.____	Grubbing	LS
201.0009.____	Clearing and Grubbing	LS
201.0010.____	Hand Clearing	LS
201.0011.____	Clearing and Grubbing State-Furnished Material Sources	LS

SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS

202-1.01 DESCRIPTION. Remove and dispose or salvage all buildings, fences, guardrail, structures, old pavements, abandoned utilities and any other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of under other items in the Contract. Backfill the resulting trenches, holes and pits. When the bid does not include pay items for removal of structures and obstructions as set out in this Section, perform such work under Section 203 or as specified. Remove and reset mailboxes and newspaper delivery tubes and the preserve from injury and defacement all vegetation and objects not scheduled to be removed. Remove existing bridges as indicated on the Plans.

202-2.01 MATERIALS. Use materials that conform to the following:

Timber	AASHTO M 168 (Hemlock, Douglas fir, Western Pine, or Sitka Spruce). Pressure treated per AASHTO M 133.
Steel Pipe	Standard Weight Steel Pipe, 2-inch (max.) diameter. Galvanized per AASHTO M 111.
Steel Fasteners	ASTM A307, Grade A. Galvanized per AASHTO M 232.
Reflectors	Yellow acrylic prismatic type meeting AASHTO M 290 or retroreflective sheeting meeting ASTM D4956, Type III, IV, or V.

CONSTRUCTION REQUIREMENTS

202-3.01 GENERAL. Raze, remove, and dispose of, or salvage all buildings and foundations, structures, fences, and other obstructions, any portions of which are within the right-of-way, except utilities and those for which other provisions have been made for removal.

Fill basements, or cavities left by structure removal, to the level of the surrounding ground and, if within the prism of construction, compact backfill as specified under Section 203.

Stockpile all materials which are designated for use on the project at approved locations.

Burn or otherwise dispose of combustible debris as approved.

Non-combustible debris or materials may be:

1. placed in embankments under the provisions of Subsection 203-3.03 for placing rock in embankments (No metal pipes, wires, or cables may be placed in any embankment),

2. buried on the project, outside the embankment at approved locations, under a minimum covering of 2 feet of earth, or

3. disposed of outside the right-of-way limits, provided that before disposing of such materials or debris on private or public lands, obtain from the owner of such land written permission for such disposal and a waiver of all claims against the State for any damage to such land which may result, together with all permits required by law for such disposal. Furnish a copy of such permission, waiver of claims, and permits to the Engineer before commencing work. Grade disposal areas to drain.

202-3.02 MAIL BOXES. Remove existing mail boxes and newspaper delivery tubes within the project limits and temporarily reset them at approved locations. Install the boxes and tubes in such a position that their usefulness will not be impaired.

After construction has been completed, install mail boxes and tubes to meet Alaska Standard Plans M-20 and M-23. Repair or replace any posts, boxes, tubes or other material broken or damaged by the Contractor.

202-3.03 REMOVAL OF BRIDGES, CULVERTS, AND OTHER DRAINAGE STRUCTURES. Do not remove bridges, culverts and other drainage structures in use by traffic until satisfactory arrangements have been made to accommodate traffic.

1. Culverts and Minor Structures. Do not remove manholes, inlets, valves or any other portion or portions of the sewer or water systems until the new systems are in operation or suitable arrangements have been made for the diversion, interruption, or a temporary system has been installed.

2. Bridges.

   a. Submittals. Submit a Bridge Demolition Plan at least 60 days before beginning bridge removal. Include the following items in the Bridge Demolition Plan:

      (1) Proposed bridge removal date

      (2) Contact names and phone numbers for individuals responsible for the demolition

      (3) Schematic and detailed drawings identifying the method and sequence of removal

      (4) Schematic and detailed drawings identifying and detailing means of access to the bridge during demolition

      (5) Methods to prevent debris from entering the waterway

      (6) A list of the type, number and size of all proposed equipment to be used

      (7) Details of temporary support shoring and bracing, if required

      (8) Schematic drawings specifying crane locations and lifting locations

      (9) A listing of the size and weight of bridge subassemblies to be transported from the site

      (10) A schematic drawing identifying the proposed waste site location

      (11) Details of lead paint containment and disposal

   b. Demolition. Remove and dispose of all bridge steel, concrete and timber bridge elements. Do not damage new construction during demolition operations. Maintain the integrity of undemolished portions of the bridge structure during demolition operations.

      Do not allow debris from bridge removal operations to enter a waterway.

      Unless noted otherwise in the Contract Documents, all existing bridge steel is coated with lead-based paint. Follow all applicable laws, permits, and Section 513 requirements for containing, handling and disposing of lead-based paint waste and debris when dismantling, removing and handling steel from the existing bridge.

   c. Disposal. Deliver all steel bridge components generated during demolition to a steel mill or ferrous foundry where the steel will be melted down to a raw material and recycled. Follow all applicable OSHA, EPA, DEC, Federal, State, Local and Section 513 requirements for containing, handling and disposing of lead-based paint waste and debris when handling, transporting, delivering and recycling structural steel from the existing bridge. Submit certification from the mill or foundry attesting that all of the existing structural steel has been recycled and that the lead byproduct has been recycled or disposed of in accordance with applicable regulatory requirements. In the certification,

provide the weight of steel recycled and the mill or foundry's EPA regulated waste activity identification number.

Dispose of all non-salvageable and non-recyclable materials in a Contractor-furnished waste disposal site or in a manner approved by the Engineer.

d. Cleanup. In addition to the requirements of Subsection 104-1.05, dress all bridge slopes or embankments according to the Plans. Dress slopes not designated in the Plans to conform to the natural ground surface or blend as directed. Fill all excavations and depressions.

202-3.04 REMOVAL OF PIPE. When the bid schedule contains an item for the "Removal of Culvert Pipe", the removed pipe becomes your property.

202-3.05 REMOVAL OF PAVEMENT, SIDEWALKS, AND CURBS. Dispose of all pavement, base course, sidewalks, curbs, gutters, etc., designated for removal, in an acceptable manner.

In removing pavements, curbs, walks, driveways and similar structures, make all cuts clean, vertical, and true to designated lines where an abutting structure or a part of a structure is to be left in place.

202-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Square Yard. Length times average width before removal.

2. Linear Foot. Length before removal.

3. Each. Each complete unit removed or installed. Newspaper tubes will not be measured.

202-5.01 BASIS OF PAYMENT. Items 202.0001.____ and 22.0013.____. Payment includes removing and disposing or relocating of all structures and obstructions encountered within the right-of-way under the provisions of this Section.

Items 202.0002.____ through 202.0009.____. Payment includes salvage of materials removed, their custody, preservation, storage on the right-of-way and disposal as provided.

Items 202.0010.____ through 202.0012.____. Payment includes final installation of mail boxes and newspaper tubes.

Items 020.0014.____ through 202.0019.____. Payment includes removing and disposing of all pavement, sidewalk, curb and gutter and culvert pipe designated for removal.

Items 202.0020.___ through 202.0022.____ Payment includes removal and temporary relocation, of mail boxes and newspaper tubes.

Item 202.0023.____. Payment includes removal, handling, transportation, and disposal of the existing bridge in its entirety. Removal of bridge rail, pavement, utilities, and other objects mounted to the bridge is subsidiary.

Excavation, backfill, and compaction is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
202.0001.____	Removal of Structures and Obstructions	LS
202.0002.____	Removal of Pavement	SY
202.0003.____	Removal of Sidewalk	SY

202.0004.____	Removal of Culvert Pipe	LF
202.0005.____	Removal of Sanitary Sewer Pipe	LF
202.0006.____	Removal of Manhole	EACH
202.0007.____	Removal of Junction Box	EACH
202.0008.____	Removal of Inlet	EACH
202.0009.____	Removal of Curb and Gutter	LF
202.0010.____	Single Mail Box Installation	EACH
202.0011.____	Multiple Mail Box Installation	EACH
202.0012.____	Double Mail Box Installation	EACH
202.0013.____	Removal of Structures and Obstructions	CS
202.0014.____	Removal of Pavement	LS
202.0015.____	Removal of Sidewalk	LS
202.0016.____	Removal of Pavement	STA
202.0017.____	Removal of Culvert Pipe	EACH
202.0018.____	Removal of Culvert Pipe	LS
202.0019.____	Removal of Curb and Gutter	LS
202.0020.____	Removal of Single Mail Box	EACH
202.0021.____	Removal of Multiple Mail Box	EACH
202.0022.____	Removal of Double Mail Box	EACH
202.0023.____	Removal of Bridge	LS

SECTION 203
EXCAVATION AND EMBANKMENT

203-1.01 DESCRIPTION. Excavate, haul, place, and compact or dispose of specified materials necessary to construct the project. Conform to the lines, grades, depths and typical cross sections shown on the Plans or as established. The Contract will designate material to be removed within the excavation limits as classified or unclassified excavation.

203-2.01 MATERIALS.

1. Unclassified Excavation. All materials of whatever character encountered in the work. May include rock, common, or muck.

2. Classified Excavation.

   a. Common Excavation. Silt, sand, gravel, and granular material other than rock or muck.

   b. Rock Excavation. Rock that cannot be excavated without blasting or ripping.

   c. Muck Excavation. Soils, organic matter, and other material not suitable for foundation material regardless of moisture content.

3. Borrow. Approved material required for embankments or for other portions of the work, and obtained from sources outside the right-of-way limits for the project.

4. Rock Stabilization Materials. As specified on the Plans or Special Provisions.

5. Rockfall Mitigation Materials. As specified on the Plans or Special Provisions.

6. Crushed Glass: May be combined with soil-aggregate material to be used in embankment construction. Meet 703-2.15 requirements.

CONSTRUCTION REQUIREMENTS

203-3.01 GENERAL. Perform all necessary clearing and grubbing prior to beginning excavation, grading, and embankment operations in any area.

Keep excavation and embankment areas free draining at all times as the work progresses. Finish the excavation and embankments to reasonably smooth and uniform surfaces.

Excavate and embank material only within the limits on the Plans or as directed. Prevent disturbing material and vegetation outside of the slope limits.

The Engineer may designate excavated soils, that cannot be properly compacted in embankments, as unsuitable.

When unsuitable material is encountered at the required depth of excavation, remove the unsuitable material to the depth specified or directed. Allow for measurements to be taken before backfill is placed.

Dispose of unsuitable material or excess usable material at approved locations.

Obtain the property owner's written permission to dispose of unsuitable material or excess usable material at locations outside the right-of-way limits and a waiver of all claims against the State for any damage to such land which may result. Obtain all permits required by law for such disposal. Furnish a copy of such permission, waiver of claims, and permits to the Engineer before commencing work.

Ensure that all disposal areas are properly graded and drained. Blend the outer limits of unsuitable material into surrounding grounds with no noticeable break or variation readily discernible. When existing roadway embankment slopes are used as disposal sites for unsuitable or excess useable material, finish the slopes with a motor grader or other approved method.

When the volume of suitable excavation is not sufficient for constructing the fill to the grades indicated, furnish the necessary borrow from approved sources. Borrow may be necessary even though not shown on the Plans. The source and acceptability of the borrow is subject to approval.

Do not place borrow material until after the usable roadway excavation has been placed in the fill. If you place more borrow than is required, resulting in or as a result of the unnecessary disposal of usable excavation, the amount of such disposed material will be deducted from the borrow quantity.

Obliteration of Roadways includes all grading operations necessary to incorporate the existing roadway into the new roadway and surroundings in order to provide a pleasing appearance from the new roadway. Fill ditches not required for drainage and grade to the approximate original ground contour.

Do not place soil-aggregate containing glass cullet:

1. Within four feet from the face of any embankment slope,

2. Within 150 feet from any surface water body,

3. In embankment areas where culvert placement is required,

4. In contact with any geosynthetic material.

203-3.02 ROCK EXCAVATION. Excavate rock by blasting, ripping, or both.

Unless Subgrade Blasting is specified, excavate material which would classify as rock within the limits of the roadbed to a minimum depth of 6 inches below subgrade.

1. Blasting.

   a. Blasting Plan. Prior to commencement of drilling, submit a Blasting Plan prepared by a qualified Blaster. Include the details of test blasting, controlled blasting and production blasting. Include station limits, date and time of each blast, layout details of each blast, trade names, types and sizes of explosives and accessories, delay sequences of the blast holes, and powder factors. Submit a revised Blasting Plan any time there is a change in the drilling or blasting methods.

   b. Blaster. Use a qualified blaster licensed or otherwise authorized under all applicable federal, state and local laws or regulations to possess, transport, store and use explosives of the type used on the Project. Provide the Blaster's resume and copies of all applicable licenses to the Engineer with the Blasting Plan. Have the Blaster on site during all loading and blasting operations. Require the Blaster to take responsible charge for safety procedures as set forth below and to maintain a detailed record for each day of blasting work.

   c. Pre-Blast Conference. Hold a pre-blasting meeting at the jobsite prior to commencement of any drilling and blasting operations with the Contractor, the Blaster and representatives of the Engineer. Discuss the Blasting Plan and visit such specific sites as are necessary to familiarize the participants with the details of the blasting operations.

   d. Safety. Submit a Safety Plan that includes descriptions of road closures, warning signals, and plans for notification of affected local, state, and federal agencies. Discuss in the

Safety Plan methods for protection of life and health, public and private property, new work or existing work on the project, nearby structures, wetlands, waters and wildlife. Hold a safety meeting prior to commencement of blasting operations to address safety issues.

e. Controlled Blasting. Controlled blasting holes are closely spaced, lightly loaded holes drilled along the plane of the final design slope. Controlled blasting is either preshear blasting with holes detonated before the production blasting or cushion (trim) blasting with holes detonated after the production blasting. Drill holes parallel to each other and within 12 inches of the staked slope plane. Use controlled blasting techniques for all rock slopes higher than 10 feet to produce a stable cut face sheared along the designed neat excavation line. If at any time during the progress of the work, the approved methods of blasting and drilling fail to produce the desired result of a smooth, stable backslope, modify the blasting method to achieve the desired result. Do not construct benches in finished rock back slopes unless approved by the Engineer. The Engineer may permit an offset for drilling equipment clearances. Do not use ANFO in controlled blasting holes.

f. Production Blasting. Use materials and methods as necessary to fragment and loosen the rock inside the design excavation limits, while leaving a smooth, stable back slope using the controlled blasting methods set forth above. Use appropriately designed delay sequences and charge weights per delay to minimize ground vibrations and prevent damage to buildings, structures, utilities, sensitive fish or wildlife habitat and other facilities. Prior to blasting, remove all loose objects, and render safe all dangerous conditions, in or near the cut slope area. Detonate production hole charges in a delay sequence toward the free face. Remove and dispose of loose material from rock slope failures or slides at the contract price for unclassified excavation if the Engineer determines the failure did not occur as a result of the Contractor's methods. The Engineer will determine the amount of loose material at the time of removal.

g. Scaling. Remove all loose, hanging, or potentially dangerous rock from newly excavated slopes and from surrounding existing slopes as the excavation progresses to ensure the rock slopes are stable. Do not commence work on subsequent lifts or shots until scaling is complete. Accomplish scaling with hand tools, hydraulic splitters, machine scaling with excavators or other equipment, high pressure water spray, light explosive charges, or other approved methods.

h. Ditch Line/Subgrade Blasting. Construct a free-draining fractured rock zone below the ditch line and the bottom of the structural section as shown on the Plans and Specifications or as directed. Blast or rip rock below the bottom profile of the ditch line and below the bottom of the structural section to depths as indicated or directed.

2. Stabilization. Stabilize excavated or existing rock surfaces with rock bolts, rock dowels, shotcrete, or other techniques, as indicated in the Plans and Specifications or as directed. The Engineer may increase or decrease the extent and type of stabilization methods depending on the geologic conditions encountered during the work. Obtain approval from the Engineer for rock bolts, dowels, shotcrete, resin grout, cement grout, mortar, and other stabilization accessories prior to ordering the items. Conduct performance testing as required by the Engineer to confirm the stabilization methods and equipment produce the required capacities and functions.

3. Rockfall Mitigation. Use rockfall mitigation methods such as rock catchment fences, wire mesh draping, flexible or rigid barriers, ditch width modification, and other techniques to intercept rockfall and control it before it reaches the roadway or other facilities. Construct according to the Plans and Specifications or as required by the Engineer. The Engineer may increase or decrease the extent and type of mitigation methods depending on the geologic conditions encountered during the work. Obtain approval from the Engineer for fence material, wire mesh, barrier design and accessories prior to ordering the items. Conduct

performance testing as required by the Engineer to confirm the methods and equipment produce the required capacities and functions.

4. Drain Holes. Drill drain holes in rock slopes to relieve excess water pressure as specified or directed. The Engineer will determine the location and construction details of the drain holes, depending on the conditions encountered in each slope.

203-3.03 EMBANKMENT CONSTRUCTION. Prepare the areas upon which embankments are to be placed, construct dikes within or outside the right-of-way when required, place and compact approved material within the roadway areas where unsuitable material has been removed, and place and compact embankment material in holes, pits, and other depressions within the roadway area. Use only approved materials in the construction of embankments and backfills. Embankment material will be approved for gradation following placement but prior to compaction.

Construct the embankment with selected material meeting the requirements of Subsection 703-2.07. Selected material may be obtained from unclassified excavation, rock excavation, common excavation or borrow.

Do not place rocks, broken concrete or other solid materials in embankment areas where piling is to be placed or driven, or where culvert placement is required.

Bench slopes that are steeper than 4:1, when measured at right angles to the roadway, when embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built half-width at a time. Continuously bench over those areas as the work is brought up in layers. Make benches wide enough to permit placing and compacting operations. Begin each horizontal cut at the intersection of the original ground and the vertical side of the previous bench. Incorporate material cut out, and deemed suitable, into the new embankment and recompact along with the new material.

Scarify existing roadways, lying within 3 feet of subgrade, to a depth of 6 inches and recompact to meet Subsection 203-3.04 or 203-3.05.

When permanently frozen soils are encountered, place backfill or embankment materials in a timely manner, as directed, to minimize degradation of the foundation material. Do not place embankment over seasonally frozen ground unless authorized in writing.

Thaw and drain frozen material deemed acceptable for fill before placing in the embankment. Frozen cuts may require stage excavation: remove thawed material and allow the cut to thaw while work continues on some other portions of the project. After the material in the cut has thawed to a sufficient depth, remove the thawed material. Repeat this operation until all frozen material is removed or the cut is excavated to grade.

When excavation is performed when freezing weather is imminent, place the specified backfill promptly, following the excavation work, at least up to a level which will allow the surface to adequately drain. Make arrangements for the timely availability of such embankment or backfill materials prior to commencement of the stripping or excavation operations, when required.

If embankment can be deposited on one side only of abutments, wing walls, piers or culvert headwalls, prevent the overturning of or excessive pressure against the structure. Do not place the fill adjacent to the abutment of a bridge higher than the bottom of the backwall of the abutment until the superstructure is in place. When embankment is to be placed on both sides of a concrete wall or box type structure, keep the embankment at approximately the same elevation on both sides of the structure.

Place roadway embankment of earth materials in horizontal layers not to exceed 8 inches (uncompacted) for the full width of the embankment, except as required for traffic, and compact as specified before the next layer is placed. Use spreading equipment on each lift to obtain

uniform thickness prior to compacting. Maintain uniform density, during compaction. Add or remove water, as necessary, to obtain the required density. Route compaction equipment uniformly over the entire surface of each layer.

Place rock embankment in lifts not thinner than the thickness of the largest rocks. Restrict maximum rock dimension to 3 feet. Distribute spalls and finer rock fragments to level and smooth each lift. Place succeeding lifts without damaging previously completed lifts. Dump rock on the lift being constructed and distribute by blading or dozing to fill voids and to form a dense, well-compacted embankment. Do not place rocks over 8 inches within 2 feet of finished subgrade.

Rock is considered usable material, regardless of size. Rocks too large to be embanked, as specified above, may either be reduced to a suitable size for incorporation into the embankment or disposed of in approved areas, at your option. Replace all wasted rock from excavation with borrow at no additional cost to the Department, unless such rock is excess to project embankment requirements.

Finish the subgrade surface so it will not vary more than 0.10 foot when tested using a 10-foot straightedge nor vary more than 0.10 ft from the established grade.

When embankment is to be placed over swampy or saturated ground, end dump an initial lift of material of sufficient depth to support hauling equipment, as directed.

Repair damage to embankment caused by hauling equipment.

Construct all embankments with moisture and density control unless the Engineer determines that such controls are not feasible.

Temporary surcharging consists of two methods:

1. Static Surcharge. Leave surcharge in place until the foundation material has reached stability or the required settlement has taken place.

2. Rolling Surcharge. Construct a surcharge on top of the embankment to the specified elevation and continually advance the surcharge as the embankment is constructed ahead.

Use material removed from the temporary surcharge in areas indicated on the Plans. Do not dispose of temporary surcharge material without written approval. Compaction is not required for material placed in a temporary surcharge.

203-3.04 COMPACTION WITH MOISTURE AND DENSITY CONTROL. The maximum density and optimum moisture will be determined by ATM 207 or ATM 212.

Adjust the moisture content of the embankment material to within 2 percent of the optimum moisture content and compact each layer to not less than 95 percent of the maximum density. Acceptance densities will be determined by ATM 213 and ATM 214.

203-3.05 COMPACTION WITHOUT MOISTURE AND DENSITY CONTROL. Except for rock fills and the first layer of fills over swampy ground, deposit embankment materials in layers not exceeding 8 inches in thickness before compaction.

Compact by routing construction equipment and/or rollers uniformly over the entire surface of each layer before the next layer is placed. Compact until embankment does not rut under the loaded hauling equipment.

Keep dumping and rolling areas separate. Do not cover any lift by another until the required compaction has been completed.

203-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Items 203.0001.___ through 203.0004.____ and 23.0008.____. The volume measured in original position.

2. Item 203.0005.____. The volume measured in final position.

3. Item 203.0006.____. By weighing.

4. Item 203.0007.____. By vehicle measure.

5. Item 203.0009.____ and 203.0011.____. By the area measured before obliteration or blasting.

6. Item 203.0010.____. By adding the sum of the depths of line holes drilled and loaded.

7. Item 203.0012.____. By adding the sum of the depths of drain holes drilled.

8. Item 203.0016.____ By the length measured along the base of the fence.

9. Items 203.0015.____, 203.0017.____, and 203.0018.____. By the area covered, measured along the slope.

203-5.01 BASIS OF PAYMENT. When no pay item is shown in the bid schedule for “Stripping Material Sources”, removal of overburden and other unsuitable material from such Material Sources is subsidiary.

The following work is subsidiary:

1. scarifying material in place

2. hauling of material

3. excavating overbreak material

4. slope rounding excavation and benching of slopes

5. water for compaction

6. placing and removing of temporary surcharge material

7. work required to continually advance the heading on a rolling surcharge

8. test pits and explorations required to evaluate the acceptability of borrow

9. stage construction of cuts and stage excavation of material sources

Removal of slides and associated work will be paid for at the contract unit price for excavation at the location of the slide or as extra work under Subsection 109-1.05.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
203.0001.____	Common Excavation	CY
203.0002.____	Rock Excavation	CY
203.0003.____	Unclassified Excavation	CY
203.0004.____	Muck Excavation	CY
203.0005.____	Borrow	CY
203.0006.____	Borrow	TON
203.0007.____	Borrow	CYVM
203.0008.____	Stripping State-Furnished Material Sources	CY
203.0009.____	Obliteration of Roadway	SY
203.0010.____	Controlled Blasting	LF
203.0011.____	Ditchline/Subgrade Blasting	SY
203.0012.____	Drain Holes	LF
203.0013.____	Stabilization - Rock Bolt	EACH
203.0014.____	Stabilization - Rock Dowel	EACH
203.0015.____	Stabilization - Shotcrete	SY
203.0016.____	Rockfall Mitigation - Rock Fence	LF
203.0017.____	Rockfall Mitigation - Wire Mesh	SY
203.0018.____	Rockfall Mitigation - Cable Mesh	SY
203.0019.____	Unclassified Excavation	LS
203.0020.____	Borrow	LS
203.0021.____	Obliteration of Roadway	LS

SECTION 204
STRUCTURE EXCAVATION FOR CONDUITS AND MINOR STRUCTURES

204-1.01 DESCRIPTION. Excavate and backfill for pipe culverts, storm drains, manholes, inlets and other minor structures.

Perform all pumping, bailing, draining, sheeting, bracing, and incidentals required for proper execution of the work.

204-2.01 MATERIALS. Use selected material, Type A (Subsection 703-2.07) passing the 3-inch sieve for bedding material, and for backfill material to 12 inches above the pipe.

Use excavated native material for the remainder of the backfill if it meets the requirements of Selected Material, Type C.

Use bedding material, and backfill material within the pavement structure, meeting the requirements for the applicable lift of material.

Use all suitable material from structure excavation for bedding and backfill prior to using material from another source.

204-3.01 CONSTRUCTION REQUIREMENTS. Remove and dispose of unsuitable foundation material below the designed elevation as directed. Replace with approved material.

Remove rock or other unyielding material, when encountered, to the depth shown on the Plans or as directed and replace with approved material.

Place bedding and backfill in uniform layers not more than 6 inches deep and compact to meet Subsection 203-3.04. Ponding or jetting is not permitted.

Native material may be utilized for electrical conduit backfill outside the pavement structure if it meets the minimum requirements of Selected Material, Type C, as specified in Subsection 703-2.07. Compaction may be as approved by the Engineer.

Place backfill as uniformly as possible on all sides of structural units. Avoid unbalanced loading of backfill which could damage the structure. When placed against concrete, place backfill according to the requirements of Section 550.

Support and protect existing conduits or utilities, which are not scheduled for removal or abandonment, when encountered in the excavation.

Remove all sheeting and bracing used in structure excavation upon completion of the work.

204-4.01 METHOD OF MEASUREMENT. See Section 109 using neat line method as follows:

Structure excavation for:

1. Masonry culverts, headwalls, and drainage structures other than conduit. Between vertical planes 18 inches outside the base of the masonry sections shown on the Plans for the depth required.

2. Conduit, including culverts, storm drains, underdrains, structural plate pipe and pipe arches. Between parallel vertical planes located 18 inches outside the horizontal projection of the outside diameter of the pipe and to the depth shown on the Plans.

Structure excavation will only be measured below the limits of other classes of excavation. When structures are to be placed in embankment sections, the natural ground line as cross-sectioned will be the uppermost level of computation.

204-5.01 BASIS OF PAYMENT. The contract price includes the placing and compacting of all backfill and bedding when the materials used are obtained from excavation, any clearing and grubbing required and not paid for under some other item, formation of any embankments made with surplus material from structure excavation and disposal of all surplus or unsuitable excavation.

Additional excavation to provide for shoring, sheet piles, excavation shields or flattening the excavation slopes, is subsidiary.

When items 204.0001.____ through 204.0003____, Structure Excavation, do not appear in the bid schedule, structure excavation required to complete other items of work is subsidiary except that excavation and disposal of unsuitable material required from below a plane 12 inches below the invert elevation of conduits and 12 inches below the bottom of structures will be paid for as extra work.

Any backfill or bedding material required whose source is other than project excavation will be paid for at the contract unit price for the material being used, or as extra work if no unit price has been established.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
204.0001.____	Structure Excavation	CY
204.0002.____	Structure Excavation	TON
204.0003.____	Structure Excavation	LS

SECTION 205
EXCAVATION AND FILL FOR MAJOR STRUCTURES

205-1.01 DESCRIPTION. Excavate and backfill for bridges, retaining walls, concrete box culverts, and other major structures.

Furnish all resources to place and remove cribbing. Perform all required sheeting, bracing, bailing, pumping, draining, and grouting.

Replace unsuitable material encountered below the elevation of the bottom of footings.

205-2.01 MATERIALS. Use materials that conform to the following:

Selected Material, Type C	Subsection 703-2.07
Porous Backfill Material	Subsection 703-2.10
Structural Fill	Subsection 703-2.13
Controlled Low-Strength Material	Subsection 712-2.22

CONSTRUCTION REQUIREMENTS

205-3.01 EXCAVATION.

1. General. Clear and grub prior to starting excavation according to the requirements of Section 201.

   Cut all rock or other hard foundation material to a firm surface, either level, stepped, or serrated, as directed, and remove all loose material. Within areas that will be filled, bench excavated slopes not made of rock or other hard foundation material.

   Excavate to the bottom of spread footings and approach slabs or to the depth shown on the plans, whichever is lower. Do not disturb material below the bottom of spread footings or approach slabs, unless otherwise noted in the Contract.

   Excavate to the bottom of footing prior to driving piles. Do not excavate below the footing elevation unless otherwise noted in the Contract. When swell results from driving piles, excavate the footing area, to the elevation of the bottom of the footing, as shown on the Plans. When subsidence results from driving piles, backfill with structural fill material, to the elevation of the bottom of the footing, as shown on the Plans.

   Dispose of all necessary excavated material as provided in Subsection 203-3.01.

   Do not alter streambed channel and do not place excavated materials in natural stream channels, unless shown on the Plans or approved in writing.

   Give the Engineer in writing no less than 15 days advance notice prior to beginning excavation for spread footings to allow for inspection of the excavated surface. With this notification, identify the location and specify a time period of no less than two days for the Department to inspect the excavated surface. Dewater and remove all debris from the surface prior to the Department's inspection. Obtain the Engineer's approval of the excavated surface prior to the placement of any formwork or foundation materials. Account for the time required by the Department to perform the inspection in the progress schedule submitted under Subsection 108-1.03. Pausing work to allow for inspection is not a suspension of work per Subsection 108-1.06 and additional contract time will not be allowed.

2. Foundations on Bedrock. Excavate for footings founded on bedrock, to the neat lines of the footings. Fill overbreak areas outside the neat lines of footings, with Class A concrete, at no additional cost to the Department.

205-3.02 STRUCTURAL FILL. Remove material that is unsuitable for supporting foundations, from the bottom of the footing to the depth as shown on the Plans. Remove material that is unsuitable for approach slabs shown on the Plans. Place structural fill in 6-inch layers, compacted to meet Subsection 205-3.05. Place structural fill as uniformly as possible on all sides of structural units as shown on the Plans. Avoid unbalanced loading of structural fill material which could damage the structure. When placed against concrete, place structural fill in accordance with Section 501.

Controlled low-strength material may be used as an alternative source for structural fill if approved by the Engineer.

205-3.03 BACKFILL. Unless otherwise noted, reuse excavated material for backfill where shown on the Plans. If additional backfill is required, use material meeting Selected Material, Type C, or as approved by the Engineer. Place backfill material in layers and compact to meet Subsection 205-3.05.

Place underwater backfill in natural stream channels without compaction or layer requirements.

Place backfill as uniformly as possible on all sides of structural units. Avoid unbalanced loading of backfill which could damage the structure. When placed against concrete, place backfill according to the requirements of Section 501.

No ponding or jetting of backfill is allowed.

205-3.04 POROUS BACKFILL MATERIAL. Place porous backfill material continuously within a vertical plane 1 foot behind retaining walls and abutments, unless otherwise shown on the Plans. Compact to the satisfaction of the Engineer.

Where weep holes are shown on the Plans or required by the Specifications, place not less than 1 cubic foot of porous backfill material in the fill at each hole, securely tied in a burlap bag, or wrapped with an acceptable geotextile fabric. Extend the wrapped porous backfill material at least 6 inches above the hole.

205-3.05 COMPACTION. Compact material in conformance with the following, using moisture and density control unless the Engineer determines that such controls are not feasible.

1. Compaction With Moisture and Density Control. The maximum density will be determined by ATM 207 or ATM 212.

   Water or aerate as necessary to provide the approximate optimum moisture content for compaction. Compact each layer to not less than 98 percent of the maximum density. Acceptance densities will be determined by ATM 213 and ATM 214.

2. Compaction Without Moisture and Density Control. Compact by routing construction equipment and/or rollers uniformly over the entire surface of each layer before the next layer is placed. Compact to the satisfaction of the Engineer.

   Keep dumping and rolling areas separate. Do not cover any lift by another until the Engineer has determined the required compaction is obtained.

205-3.06 CONTROLLED LOW-STRENGTH MATERIAL. Acceptance will be based on a certificate of compliance. Provide a certificate of compliance for each batch of controlled low-strength material (CLSM) in accordance with Subsection 106-1.05.

Do not place CLSM on frozen ground, in standing water, or during wet weather conditions. Do not place CLSM if ambient air temperature is expected to be less than 40°F within 48 hours. Ensure the material temperature is at least 50 °F while being placed.

Do not apply loads to the CLSM until the compressive strength reaches 50 psi.

205-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Excavation. By the actual volume of material removed, excluding the following:

   a. Material removed prior to measurement of the original ground surface.

   b. Material outside of the vertical planes 18 inches outside of and parallel to the neat lines of the footings, except that the limit will be vertical planes coinciding with the neat lines of the seals when seals are shown on the Plans.

   c. Material outside of vertical planes coinciding with the neat lines of footings excavated in solid rock.

   d. Embankment material placed above the elevation of the bottom of footings.

   e. Material within the staked limits of other types of excavation for which payment is otherwise provided.

2. Structural Fill. By the actual volume of material accepted in final position.

3. Porous Backfill Material. By the actual volume of material accepted in final position.

4. Controlled Low-Strength Material. By the actual volume of material accepted in final position.

205-5.01 BASIS OF PAYMENT. Backfill material, obtained from within the limits of structure excavation, is subsidiary to item 205.0001.____. Any backfill material from sources other than excavation for structures will be paid for at the contract unit price for the material being used, or as extra work if no unit price has been established.

Porous backfill material includes all materials and construction operations for making weep holes. When Items205.0004.____, 205.0007.___, and 205.0008.____, Porous Backfill Material, do not appear in the bid schedule, porous backfill material is subsidiary.

Excavation for Structures includes removal, and disposal of unsuitable material.

Excavation for footings ordered by the Engineer, at a depth greater than 3 feet below the bottom of such footings shown on the Plans will be paid for as extra work.

When controlled low-strength material is used as an alternative to structural fill, controlled low-strength material is paid for at the Contract price for structural fill.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
205.0001.____	Excavation for Structures	CY
205.0004.____	Porous Backfill Material	CY
205.0005.____	Controlled Low-Strength Material	CY
205.0006.____	Structural Fill	CY
205.0007.____	Porous Backfill Material	TON
205.0008.____	Porous Backfill Material	LS
205.0009.____	Structural Fill	TON
205.0010.____	Structural Fill	LS

SECTION 206
FILTER BLANKET

206-1.01 DESCRIPTION. Construct a layer of specified material in conformance to the plan dimensions and elevations.

206-2.01 MATERIALS. Use materials that conform to the following:

Filter Blanket Subsection 703-2.08

206-3.01 CONSTRUCTION REQUIREMENTS. Construct Filter Blanket in an even, homogeneous layer, avoiding contamination by the underlying material. Place the layer to full thickness in one application or end-dump and spread by tracked equipment.

206-4.01 METHOD OF MEASUREMENT. See Section 109, by volume in final position or by weight.

206-5.01 BASIS OF PAYMENT. The contract price includes excavating, processing, hauling, spreading and leveling of the filter blanket layer.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
206.0001.____	Filter Blanket	CY
206.0002.____	Filter Blanket	TON

DIVISION 300–BASES

SECTION 301
AGGREGATE BASE AND SURFACE COURSE

301-1.01 DESCRIPTION. Construct an aggregate base course or aggregate surface course on an approved foundation, as shown on the Plans.

301-2.01 MATERIALS. Use aggregate conforming to Subsection 703-2.03.

Crushed glass may be combined with soil-aggregate material to be used in base course construction. Meet 703-2.15 requirements.

CONSTRUCTION REQUIREMENTS

301-3.01 PLACING. Place material in layers not exceeding 8 inches in depth.

Maintain the roadway surface to drain freely at all times.

When paving is specified in the Contract, schedule the work so that any base course placed will be covered prior to winter shutdown.

Place surfacing material over all soil-aggregate bases containing glass cullet.

Do not place base course soil-aggregate containing glass cullet:

1. Within four feet from the face of any embankment slope,
2. Within 150 feet from any surface water body,
3. In embankment areas where culvert placement is required,
4. In contact with any geosynthetic material.

301-3.02 MIXING. Mix the aggregate, incorporating any specified additives. Add water, as needed, to provide the approximate optimum moisture content for compaction.

Mix the aggregate by one of the following methods:

1. Stationary Plant Method
2. Travel Plant Method
3. Road Mix Method

The aggregate will be accepted for gradation based on random samples taken for each lift from the roadway after spreading but prior to compaction.

301-3.03 SHAPING AND COMPACTION. The maximum density and optimum moisture will be determined by ATM 207 or ATM 212.

Spread and shape the material to the required grade and section. Water or aerate as necessary to provide the approximate optimum moisture content for compaction. Compact each layer to a density of not less than 98 percent of the maximum density. Acceptance densities will be determined by ATM 213 and ATM 214.

Maintain the surface of each layer during the compaction operations in such manner that a uniform texture is produced and the aggregates firmly keyed.

The finished surface will be tested using a 10-foot straightedge at selected locations. Limit surface deviations to 3/8 inch, as measured from the testing edge of the straightedge between two contacts with the surface.

301-4.01 METHOD OF MEASUREMENT. See Section 109, by volume in final position or by weight.

301-5.01 BASIS OF PAYMENT. Water for compaction, added to the aggregate on the grade, is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
301.0001.____	Aggregate Base Course, Grading ____	TON
301.0002.____	Aggregate Base Course, Grading ____	CY
301.0003.____	Aggregate Surface Course, Grading ___	TON
301.0004.____	Aggregate Surface Course, Grading ___	CY

SECTION 302
SUBGRADE MODIFICATION

302-1.01 DESCRIPTION. Scarify the existing road surface, incorporate aggregate and additives, if required, and grade and compact the material to the typical section shown on the Plans. Realign the shoulders and clean and reshape the ditches, if required on the Plans.

302-2.01 MATERIALS. As shown on the Plans or specified in the Special Provisions.

CONSTRUCTION REQUIREMENTS

302-3.01 PROCESSING. Blade the shoulder slopes and ditches to form a uniform shoulder line. First remove and dispose of weeds, sod, grass, roots, or other objectionable material from the surface. Spread the useable material obtained from the shoulder slopes and ditches and the surfacing material existing on the road surface uniformly over the roadbed.

Scarify the road surface to the depth specified. Pulverize lumps as needed so that not more than 5 percent of the material exclusive of gravel or stone is retained on a 2-inch sieve. Mix material thoroughly. Form the mixed material into a uniform windrow.

Place the quantity of aggregate for subgrade modification, as designated on the Plans, in a uniform windrow. Blend the windrowed materials together until all materials are uniformly distributed throughout the combined windrow.

Aggregate will be accepted at the point of production based on periodic samples.

Spread the material uniformly to the required cross section and compact to meet Subsection 203-3.04.

When the material being compacted contains a significant quantity of pulverized asphalt, adequacy of compaction will be determined by alternative methods acceptable to the Engineer.

302-3.02 FINISHING. The finished surface will be tested using a 10-foot straightedge at selected locations. Limit surface deviations to 1-1/4 inches, as measured from the testing edge of the straightedge between two contacts with the surface.

If a base or surface course is included in the Contract, maintain the surface of the completed subgrade until the base or surface course has been placed.

302-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

Aggregate for subgrade modification is weighed or measured in the hauling vehicle.

Processing for subgrade modification is measured along centerline.

302-5.01 BASIS OF PAYMENT. The contract price for processing includes all blading of ditches and shoulders, if called for on the Plans; scarifying and pulverizing of the existing surface; all placing and mixing of materials on the road; disposal of unsuitable material; the compacting of the materials; the finishing of the surface; and the maintenance of the completed surface when applicable

Water for compaction added to the aggregate on the grade is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
302.0001.____	Aggregate for Subgrade Modification	TON

302.0002.____	Aggregate for Subgrade Modification	CYVM
302.0003.____	Processing for Subgrade Modification	STA
302.0004.____	Processing for Subgrade Modification	MILE

SECTION 303
RECONDITIONING

303-1.01 DESCRIPTION. Recondition the surface of an existing roadbed, clean and recondition the ditches, and shape the shoulders.

303-2.01 MATERIALS. None.

303-3.01 CONSTRUCTION REQUIREMENTS. Scarify the existing surface to the depth shown on the Plans. Pulverize material to 2 inches or smaller.

Clean and recondition the ditches and shape the shoulders as shown on the Plans.

Spread surface material to line and grade and compact uniformly as specified in Subsection 203-3.04. Compact pulverized asphalt using alternate method acceptable to the Engineer.

The reconditioned surface will be tested using a 10-foot straightedge at selected locations. Limit surface deviations to 1 inch prior to placement of a base course or 3/8 inch prior to placement of a surface course, as measured from the testing edge of the straightedge between two contacts with the surface.

Maintain the surface satisfactorily until the base or surface course has been placed. Apply additional water, as required.

303-4.01 METHOD OF MEASUREMENT. See Section 109.

303-5.01 BASIS OF PAYMENT. Water required for compaction and maintenance is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
303.0001.____	Reconditioning	STA
303.0002.____	Reconditioning	MILE
303.0003.____	Reconditioning	LS

SECTION 304
SUBBASE

304-1.01 DESCRIPTION. Construct a subbase course on an approved foundation, as shown on the Plans.

304-2.01 MATERIALS. Use materials that conform to the following, for the grading specified:

Aggregate Subsection 703-2.09

Crushed glass may be combined with soil-aggregate material to be used in subbase construction. Meet 703-2.15 requirements.

304-3.01 CONSTRUCTION REQUIREMENTS. Place and compact subbase material to meet the requirements of Subsections 203-3.01, 203-3.03, and 203-3.04.

The material will be accepted for gradation based on random samples taken from the roadway after spreading but prior to compaction.

When subbase material is utilized as the finished wearing course, place and compact to meet Subsections 301-3.01 through 301-3.03.

Do not place subbase soil-aggregate containing glass cullet:

1. Within four feet from the face of any embankment slope,
2. Within 150 feet from any surface water body,
3. In embankment areas where culvert placement is required,
4. In contact with any geosynthetic material.

304-4.01 METHOD OF MEASUREMENT. See Section 109. Item 304.0002.____ is measured in place.

304-5.01 BASIS OF PAYMENT. Water for compaction added to the subbase on the grade, is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
304.0001.____	Subbase, Grading ___	TON
304.0002.____	Subbase, Grading ___	CY
304.0003.____	Subbase, Grading ___	CYVM

SECTION 305
STOCKPILED MATERIAL

305-1.01 DESCRIPTION. Produce and place specified material at designated stockpile locations.

305-2.01 MATERIALS. Meet the materials requirements of the Section indicated in the pay item on the bid schedule.

305-3.01 CONSTRUCTION REQUIREMENTS. Clear and grub the stockpile sites and dispose of all trees, stumps, brush and debris, as provided in Section 201. Make the floor of each stockpile site uniform in cross section, compacted, and well drained. Construct the stockpiles to occupy the smallest feasible areas.

Deposit the material in uniform layers or lifts not exceeding 4 feet in thickness. Avoid segregation of the various sizes of crushed stone or gravel in each stockpile. Place the material in each lift by trucks or other types of hauling units. Only rubber tired vehicles are allowed on the stockpile. Do not stockpile from a conveyor belt.

Make the completed stockpiles neat and regular in form. Make the height of the piles, or their average depth, not less than 20 feet. Make the side slopes 1-1/2:1 or steeper.

305-4.01 METHOD OF MEASUREMENT. See Section 109, by volume in the stockpile or by weight. No allowance will be made for settlement, swell, or shrinkage.

305-5.01 BASIS OF PAYMENT. All work involved in preparing the stockpile site is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
305.0001.____	Stockpiled Material Section ___, Grading ___	CY
305.0002.____	Stockpiled Material Section ___, Grading ___	TON
305.0003.____	Stockpiled Material Section ___, Grading ___	CYVM
305.0004.____	Stockpiled Material Section ___, Grading ___	LS

SECTION 306
ASPHALT TREATED BASE COURSE

306-1.01 DESCRIPTION. Construct a plant-mixed asphalt treated base (ATB) course on an approved foundation to the lines, grades, and depths shown on the Plans.

306-2.01 MATERIALS. Use materials that conform to the following:

Aggregate	Subsection 703-2.03, grading D-1, except change the minimum Degradation Value to 30.
Asphalt	Section 702, for the type and grade shown on the bid schedule. Use PG 52-28 if no Grade is specified.
Anti-Strip	As required by the approved Job Mix Design.

CONSTRUCTION REQUIREMENTS

306-3.01 COMPOSITION OF MIXES. At least 15 days in advance of the production of ATB, submit a representative 300-pound sample of the aggregate proposed for the project. Also submit a representative 3-gallon sample of the asphalt binder and a one-pint sample of the anti-strip additive proposed for use in the mix. From this information the Engineer will establish the Job Mix Design, including the maximum specific gravity (MSG). The MSG will be determined by ATM 209.

When changes in the aggregate gradation or aggregate source occur, submit representative samples, in the same manner as above, for a new mix design.

Use anti-strip agents in the proportions determined by ATM 414 and included in the approved Job Mix Design. At least 70 percent of the aggregate must remain coated when tested under ATM 414.

306-3.02 WEATHER LIMITATIONS. Do not place the asphalt mixture on a wet or frozen surface, or when weather conditions will prevent proper handling, compacting or finishing of the mixture. Do not place the asphalt mixture unless the air temperature is above 40 °F, as measured in the shade and away from any heat sources.

306-3.03 STOCKPILING. Aggregates may be stored in a single stockpile. Minimize segregation and contamination.

306-3.04 EQUIPMENT.

1. Mixing Plant. Conform to Subsection 401-3.05.

2. Hauling Equipment. Conform to Subsection 401-3.06.

3. Spreading Equipment. Use either a self-propelled paving machine conforming to Subsection 401-3.07 or motor grader.

4. Rollers. Conform to Subsection 401-3.08.

306-3.05 PREPARATION OF ASPHALT. Provide a continuous supply of asphalt binder to the mixer at a uniform temperature, within the allowable mixing temperature range.

306-3.06 PREPARATION OF AGGREGATE. Heat and dry the aggregate for the mix to within ±25 °F of the Mix Design temperature. Adjust dryer flames to avoid damage to aggregate and to avoid soot on the aggregate.

306-3.07 MIXING. Mix ATB materials per Subsection 401-3.10. Aggregates will be accepted based on samples taken from the combined aggregate cold feed conveyor during ATB production.

306-3.08 SPREADING AND FINISHING. Deposit and spread ATB mixture on an approved surface in layers not exceeding 3 inches in compacted depth.

On areas where irregularities or unavoidable obstacles preclude spreading by mechanical equipment, deposit the mixture in layers, spread, rake, and lute using hand tools. The depth of such layers is governed by the ability of the compaction equipment to achieve the required degree of compaction. Place a tack coat between successive layers of base material. When successive layers are placed on the same day, or have not been contaminated by sand or dust or not subject to traffic, the tack coat may be deleted.

306-3.09 COMPACTION. Use vibratory rollers, steel-wheeled tandem rollers and/or pneumatic tired rollers for initial rolling. Use steel-wheeled tandem rollers for final rolling.

Compact each layer to a minimum density of 94 percent of the MSG. Acceptance densities will be determined by ATM 410.

Cut full depth core samples from the finished mat within 24 hours after final rolling. Neatly cut the samples with a minimum diameter of 6 inches with a core drill at the randomly selected location designated by the Engineer. Backfill and compact all voids left by coring with new asphalt concrete mixture within 24 hours.

306-3.10 SURFACE TEST. After rolling has been completed, the surface will be tested for smoothness and accuracy of grade, crown, superelevation, and width.

Limit surface deviations to 3/8 inch, as measured from the testing edge of a 10-foot straightedge between two contacts with the surface parallel with, and at right angles to, the centerline.

306-3.11 THICKNESS REQUIREMENTS. Meet Plan thickness ± 1/2 inch, compacted.

306-4.01 METHOD OF MEASUREMENT.

1. ATB. See Section 109. No deduction will be made for the weight of asphalt binder or anti-strip additive in the mixture.

2. Asphalt Binder. Subsection 401-4.01, except that no payment will be made for asphalt binder in excess of the upper specification limit.

3. Anti-Strip Additive. Based on the number of tons of asphalt binder containing required additive.

306-5.01 BASIS OF PAYMENT.

Anti-Strip Additive. At the unit price specified in the Special Provisions or Directive.

If no pay item is included for anti-strip additive, it is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
306.0001.____	ATB	TON
306.0002.____	Asphalt Binder, Grade ___	TON
306.0003.____	Anti-Strip Additive	CS

SECTION 307
EMULSIFIED ASPHALT TREATED BASE COURSE

307-1.01 DESCRIPTION. Construct an emulsified asphalt treated base (EATB) course on a prepared foundation to the lines, grades, and depths shown on the Plans.

307-2.01 MATERIALS. Use materials that conform to the following:

Aggregate	Subsection 703-2.03
Asphalt	Section 702, for the type and grade shown on the bid schedule Use PG 52-28 if no Grade is specified
Anti-Strip	As required by the approved Job Mix Design
Portland Cement	Section 701 (Type I)

307-2.02 COMPOSITION OF MIXES. At least 15 days in advance of the production of EATB material, furnish a representative 300-pound sample of the base aggregate proposed for the project, and a representative 3-gallon sample of the asphalt binder, and a one-pint sample of antistrip additive if used in the mix.

The Engineer will determine the job mix design. Changes in aggregate gradation or aggregate sources will require a new job mix design. Submit samples in the same manner as the original submittal.

Use anti-strip agents in the proportions determined by ATM 414 and included in the approved Job Mix Design. At least 70 percent of the aggregate must remain coated when tested by ATM 414.

CONSTRUCTION REQUIREMENTS

307-3.01 MIXING.

1. Mix EATB material either

   a. at an approved central mixing plant,

   b. in place, on an approved subgrade, or

   c. on an approved mixing area.

   If method b. or c. above is used, prevent contamination of the base course material by the underlying material.

   Adjust aggregate moisture content prior to asphalt application. Apply portland cement, if required, to the aggregate immediately prior to mixing.

   Acceptance of aggregates will be based upon representative samples taken just prior to the addition of the emulsified asphalt.

2. Central plants may be either batch or continuous twin-shaft pugmill units equipped with adequate proportioning devices to control aggregate, asphalt, water and portland cement.

   Combine the aggregate, emulsified asphalt, portland cement, and water, in the mixing plant in the specified proportions. Adjust the mixing time to the minimum time which will provide a complete coating of the aggregate particles.

3. Perform in-place mixing with single or double pugmill travel plants, rotary cross-shaft mixers, or motor grader (blade). Equip travel plants and cross-shaft mixers with adequate proportioning devices to control asphalt. Use distributors for applying asphalt for in-place blade mixing which conform to Subsection 402-3.02.

Mix aggregates, asphalt material and additives until a uniform coating of aggregate particles is attained.

307-3.02 WEATHER LIMITATIONS. Do not mix or place EATB material until the aggregate temperature is above 40 °F and the air temperature as measured in the shade and away from any heat source is 45 °F and rising. Do not place the EATB material on a wet or frozen surface, or when weather conditions will prevent proper handling, compacting, finishing, or curing of the mixture.

307-3.03 OPERATIONAL LIMITATIONS. Coordinate the various portions of the work to conform to the traffic maintenance requirements of Section 643.

Place EATB materials only on an accepted subgrade. Ensure that the subgrade surface is substantially true to line and grade, firm and reasonably smooth, and free of loose or objectionable material, before placement of EATB materials.

307-3.04 EQUIPMENT.

1. Mixing Plant. Conform to Subsection 401-3.05.

2. Hauling Equipment. Conform to Subsection 401-3.06.

3. Spreading Equipment. Self-propelled paving machine conforming to Subsection 401-3.07 or motor grader.

4. Rollers. Conform to Subsection 401-3.08.

307-3.05 SPREADING AND FINISHING. Spread EATB material in single lifts not to exceed 6 inches. If the single lift cannot be compacted sufficiently to conform to Subsection 307-3.06, spread and compact in multiple lifts of equal thickness.

307-3.06 COMPACTION. The Engineer will use ATM 412 to determine the density standard. Make each control strip at least 12 feet by 300 feet. Compact the remainder of the project to not less than 98 percent of the density standard, in accordance with ATM 411. The Engineer will designate the location of test strips.

Compact the EATB using at least one pneumatic roller and one vibratory roller. Use vibratory compactors, applying a minimum dynamic force of 50,000 pounds per vibration at a minimum frequency of 1,000 vibrations per minute. Adjust working speed in order to apply 8 to 12 impacts per foot. In areas inaccessible to rollers, use mechanical tampers until thoroughly compacted.

307-3.07 SURFACE TEST. After rolling has been completed, the surface will be tested for smoothness and accuracy of grade, crown, superelevation, and width.

Limit surface deviations to 3/8 inch, as measured from the testing edge of a 10-foot straightedge between two contacts with the surface parallel with, and at right angles to, the centerline.

307-3.08 THICKNESS REQUIREMENTS. Limit deviations in thickness to 1/2 inch.

307-4.01 METHOD OF MEASUREMENT.

1. EATB. See Section 109. No deduction will be made for the weight of asphalt material or for water added to provide optimum moisture content in the mix.

2. Emulsified Asphalt. By supplier's invoice quantity minus waste, diversion and remnant.

307-5.01 BASIS OF PAYMENT. When Pay Item 307.0002.____ does not appear in the bid schedule, emulsified asphalt material is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
307.0001.____	EATB	TON
307.0002.____	Emulsified Asphalt, Type ____	TON
307.0003.____	EATB, ___ in. thick	SY

SECTION 308
CRUSHED ASPHALT BASE COURSE

308-1.01 DESCRIPTION. Construct a base course, using pulverized asphalt pavement, to the grades shown on the Plans.

Add emulsified asphalt to the base course mixture, when shown on the plans.

308-2.01 MATERIALS. Use materials that conform to the following:

Asphalt Concrete	Existing asphalt pavement material
Aggregate Base Course	Subsection 703-2.03
Emulsified Asphalt	Section 702 (CSS-1)

CONSTRUCTION REQUIREMENTS

308-3.01 PULVERIZING AND MIXING. Crush or process the existing asphalt pavement so that 100 percent by weight passes the 2-inch sieve and 95-100 percent by weight passes the 1-1/2-inch sieve.

Use self-propelled pulverizing and mixing equipment capable of processing to full depth in a single pass. If emulsified asphalt is called for on the Plans, the mixing equipment must also be capable of adding the emulsion, through a metered system during mixing.

Add crushed aggregate base course to the base course mixture as needed to conform to the design grade.

308-3.02 WEATHER LIMITATIONS. Do not use any frozen material or compact on a frozen base.

308-3.03 SHAPING AND GRADING. Use a finish grader that is equipped with an automatic grade and cross slope control system. Maintain longitudinal grade control, based on either string line or the existing roadway surface, as determined by the Engineer.

308-3.04 COMPACTION AND COMPACTION EQUIPMENT. The Engineer will use ATM 412 to determine the density standard. Make each control strip at least 12 feet by 300 feet. Compact the remainder of the project to not less than 98 percent of the density standard, in accordance with ATM 411. The Engineer will designate the location of test strips.

Compact the base course using vibratory compactors, applying a minimum dynamic force of 50,000 pounds per vibration at a minimum frequency of 1,000 vibrations per minute. Adjust working speed in order to apply 8 to 12 impacts per foot. In areas inaccessible to rollers, use mechanical tampers until thoroughly compacted.

308-3.05 SURFACE TEST. The finished surface will be tested for smoothness and accuracy of grade, crown, superelevation, and width.

Limit surface deviations to 3/8 inch, as measured from the testing edge of a 10-foot straightedge between two contacts with the surface parallel with, and at right angles to, the centerline.

308-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Crushed Asphalt Base Course, by square yard. By the area of finished top surface.

2. CSS-1 Asphalt for Base Course, by ton. By weighing or invoice.

3. Crushed Asphalt Base Course, by ton. By weighing or invoice.

4. Crushed Asphalt Base Course, by lump sum. Emulsified Asphalt is subsidiary.

308-5.01 BASIS OF PAYMENT. Additional crushed aggregate base course, if required, will be paid for under Section 301.

Water required for compaction of the crushed asphalt base course is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
308.0001.____	Crushed Asphalt Base Course	SY
308.0002.____	CSS-1 for Asphalt Base Course	TON
308.0003.____	Crushed Asphalt Base Course	TON
308.0004.____	Crushed Asphalt Base Course	LS

DIVISION 400–ASPHALT PAVEMENTS AND SURFACE TREATMENTS

SECTION 401
HOT MIX ASPHALT PAVEMENT

401-1.01 DESCRIPTION. Construct one or more courses of plant-produced Hot Mix Asphalt (HMA) pavement on an approved surface, to the lines, grades, and depths shown on the Plans.

MATERIALS

401-2.01 ASPHALT BINDER. Conform to Subsection 702-2.01. Asphalt binder may be conditionally accepted at the source providing a manufacturers certification of compliance according to Subsection 106-1.05, and test results of the applicable requirements of Section 702. Use PG 52-28 if no Grade is specified.

401-2.02 LIQUID ANTI-STRIP ADDITIVE. Use anti-strip agents in the proportions determined by ATM 414 and included in the approved Job Mix Design (JMD). At least 90 percent of the aggregate must remain coated when tested according to ATM 414. The following minimum dose (percent) of liquid anti-strip by weight of asphalt binder is required:

Liquid Anti-strip Type	Minimum Dose by Weight of Asphalt Binder, %
Amines based	0.30
Phosphate Ester based	0.30
Organo-Silane based	0.05

401-2.03 JOINT ADHESIVE. Conform to Subsection 702-2.05.

401-2.04 JOINT SEALANT. Conform to Subsection 702-2.06.

401-2.05 WARM MIX ASPHALT. Conform to Subsection 702-2.07.

401-2.06 ASPHALT RELEASE AGENT. Conform to Subsection 702-2.08.

401-2.07 AGGREGATES. Conform to Subsection 703-2.04. Use a minimum of three stockpiles of crushed aggregate (coarse, intermediate, and fine). Place blend material, if any, in a fourth pile.

401-2.08 RECYCLED ASPHALT PAVEMENT. Recycled asphalt pavement (RAP) may be used in the production of HMA. The RAP may be from pavements removed under the Contract, or from an existing stockpile. Conform to Subsection 703-2.16.

401-2.09 JOB MIX DESIGN. Provide target values for gradation that satisfy both the broad band gradation limits shown in Table 703-4 and the requirements of Table 401-1, for the Type and Class of HMA specified.

TABLE 401-1
HMA MARSHALL DESIGN REQUIREMENTS

DESIGN PARAMETER	CLASS "A"	CLASS "B"
HMA (Including Asphalt Binder)		
Stability, Pounds	1800 Min.	1200 Min.
Flow, 0.01 Inch	8 – 14	8 - 16
Voids in Total Mix (VTM), %	3.0 – 5.0	3.0 – 5.0
Compaction, Number of Blows Each Side of Test Specimen	75	50

DESIGN PARAMETER	CLASS "A"	CLASS "B"
Asphalt Binder		
Voids Filled with Asphalt (VFA), %	65 - 75	65 - 78
Asphalt Content, Min. %	5.0	5.0
Dust-Asphalt Ratio*	0.6 - 1.4	0.6 - 1.4
Voids in the Mineral Aggregate (VMA), %, Min.		
Type I	12.0	11.0
Type II	13.0	12.0
Type III, IV	14.0	13.0
Liquid Anti-Strip Additive**,%, Min.	0.30	0.30
RAP, %, Max.	15.0	25.0

*Dust-Asphalt ratio is the percent of material passing the No. 200 sieve divided by the percent of effective asphalt binder (calculated by weight).

** By Weight of Asphalt Binder

The approved JMD will specify the Target Values (TV) for gradation, the TV for asphalt binder content, the Maximum Specific Gravity (MSG) of the HMA, the additives, and the recommended mixing temperature range.

Submit the following to the Engineer at least 15 days before the production of HMA:

1. A letter stating the location, size, and type of mixing plant. The letter shall state whether or not WMA and/or RAP will be used. The letter shall include the proposed gradation for the JMD, gradations for individual stockpiles, and the blend ratio of each aggregate stockpile.

2. Representative samples of each aggregate (coarse, intermediate, fine, blend material and mineral filler, if any) in the proposed mix design. Furnish a total of 500 pounds of material in the proportional amounts in the proposed JMD.

3. Five separate 1-gallon samples of the asphalt binder proposed for use in the HMA. Include name of product, manufacturer, test results of the applicable quality requirements of Subsection 702-2.01, manufacturer's certificate of compliance according to Subsection 106-1.05, a temperature- viscosity curve for the asphalt binder or manufacturer's recommended mixing and compaction temperatures, and current Material Safety Data Sheet.

4. One sample, minimum one pint, of the anti-strip additive proposed, including name of product, manufacturer, and manufacturer's data sheet, and current Material Safety Data Sheet.

5. Testing results per Subsection 106-1.03.1 for each aggregate type proposed for use.

6. If applicable, a letter stating the WMA technology (Subsection 702-2.07) to be used, location where additive will be introduced and manufacturer's recommended usage rate for each type of HMA. Supply a minimum of 2-pint samples for each proposed additive.

7. If applicable, representative samples of any RAP proposed for use. Furnish a minimum of 200-pound sample of proposed RAP.

The Engineer will evaluate the material and the proposed gradation using ATM 417 and the requirements of Table 401-1 for the appropriate Type and Class of HMA specified, and establish the approved JMD which will become a part of the Contract.

Anti-strip evaluation (ATM 414) of HMA mix designs that include RAP will be completed without the inclusion of the RAP.

Obtain an approved JMD prior to shipment of aggregates to an asphalt plant site or producing HMA for payment.

1. Contractor Mix Design. If a bid item for JMD appears in the contract, or if the Engineer approves a request from the Contractor to perform the JMD at no cost to the Department, provide a JMD following the requirements specified in this section. Submit the JMD to the Engineer at least 15 working days before HMA production. Submit samples to the Engineer upon request for JMD verification testing.

   All Contractor-furnished JMDs must be sealed by a professional Engineer registered in the State of Alaska. The Professional Engineer shall certify that the JMD was performed according to the specified procedures, and meets all project specifications.

2. Changes. Submit a new JMD with changes noted and new samples in the same manner as the original JMD submittal when:

   a. The results of the JMD evaluation do not achieve the requirements specified in Table 401-1

   b. The asphalt binder source is changed

   c. The source of aggregate, aggregate quality, or gradation is changed

Changes to the JMD apply only to HMA produced after the approval of changes.

CONSTRUCTION REQUIREMENTS

401-3.01 PRE-PAVING MEETING. Meet with the Engineer for a pre-paving meeting in the presence of project superintendent and paving foreman at least five (5) working days before beginning paving operations. Submit a paving plan and pavement inspection plan (per 401-3.20) at the meeting.

Include the following elements in the paving plan and address these elements at the meeting:

1. Sequence of operations

2. List of equipment that will be used for production, transport, pick-up (if applicable), laydown, and compaction

3. Summary of plant modifications (if applicable) for production of WMA

4. Procedures to produce consistent HMA

5. Procedures to minimize material and thermal segregation

6. Procedures to minimize premature cooling

7. Procedures to achieve HMA density

8. Procedures for joint construction including corrective action for joints that do not meet surface tolerance requirements

9. Quality control testing methods, frequencies and sample locations for gradation, asphalt binder content, and density, and

10. Any other information or procedures necessary to provide completed HMA construction that meets the contract requirements

Include the following elements in the pavement inspection plan and address these elements at the meeting:

11. Process for daily inspections

12. Means and methods to remove and dispose of project materials

401-3.02 CONTRACTOR QUALITY CONTROL. Perform quality control (QC) of HMA materials in accordance with Subsection 106-1.03.

401-3.03 WEATHER LIMITATIONS. Place HMA on a stable/non-yielding roadbed. Do not place HMA when the base material is wet or frozen, or when weather conditions prevent proper handling or finishing of the mix. Do not place HMA leveling course when the roadway surface temperature is colder than 40° F.

401-3.04 EQUIPMENT, GENERAL. Use equipment in good working order and free of HMA buildup. Make all equipment available for inspection and demonstration of operation a minimum of 24 hours before placement of HMA.

401-3.05 ASPHALT MIXING PLANT. Meet AASHTO M 156. Use an HMA plant capable of producing at least 150 tons of HMA per hour noted on posted DEC air quality permit, designed to dry aggregates, maintain consistent and accurate temperature control, and accurately proportion asphalt binder and aggregates. Calibrate the HMA plant and furnish copies of the calibration data to the Engineer at least 24 hours before HMA production.

Provide a scalping screen at the asphalt plant to prevent oversize material or debris from being incorporated into the HMA.

Provide a tap on the asphalt binder supply line just before it enters the plant (after the 3-way valve) for sampling asphalt binder. Provide aggregate and asphalt binder sampling locations meeting OSHA safety requirements.

You may use belt conveyor scales to proportion plant blends and mixtures if the scales meet the general requirements for weighing equipment and are calibrated according to the manufacturer's instructions.

If WMA is approved by the Engineer, modify the mixing plant as required by the manufacturer and WMA additive manufacturer.

401-3.06 HAULING EQUIPMENT. Haul HMA in trucks with tight, clean, smooth metal beds. Keep beds free of petroleum oils, solvents, or other materials that would adversely affect the mixture. Apply a thin coat of approved asphalt release agent to beds as necessary to prevent mixture adherence. Provide trucks with covers attached and available for use.

Do not haul HMA on barges.

401-3.07 ASPHALT PAVERS. Use self-propelled asphalt pavers with heated vibratory screed assemblies to spread and finish HMA to the specified section widths and thicknesses without introducing thermal or material segregation.

Equip the paver with a receiving hopper having sufficient capacity for a uniform spreading operation and a distribution system to place the HMA uniformly in front of screed. Use a screed assembly that produces a finished surface of the required smoothness, thickness and texture without tearing, shoving or displacing the HMA. Heat and vibrate screed extensions. Place auger extensions within 20 inches of the screed extensions or per written manufacturer's recommendations.

Equip the paver with a means of preventing segregation of the coarse aggregate particles from the remainder of the HMA when carried from the paver hopper back to the augers.

Equip the paver with automatic screed controls capable of operating from a reference line or a ski from either or both sides of the paver.

The use of a “Layton Box” or equivalent towed paver is allowed on bike paths, sidewalks, and driveways.

401-3.08 ROLLERS. Use rollers designed to compact HMA and capable of reversing without shoving or tearing the mixture. Select rollers that will not crush the aggregate or displace the HMA. Equip vibratory rollers with separate vibration and propulsion controls.

Equip the rollers with an infrared thermometer that measures and displays the surface temperature to the operator. Infrared thermometer may be hand-held or fixed to the roller.

Utilize a pneumatic roller in the complement of rollers to compact the leveling course. Use fully skirted pneumatic-tire roller having a minimum operating weight of 3000 pounds per tire.

401-3.09 RESERVED.

401-3.10 PREPARATION OF EXISTING SURFACE. Prepare existing surfaces according to the Contract. Prior to placing HMA, clean existing surfaces of loose material and uniformly coat contact surfaces of curbing, gutters, manholes and other structures with tack coat material meeting Section 402. Treat cold joint surfaces according to 401-3.17.

Before applying tack coat to an existing paved surface, clean and patch the surface. Remove irregularities to provide a reasonably smooth and uniform surface. Remove and replace unstable areas with HMA. Clean the edges of existing pavements, which are to be adjacent to new pavement, to permit the adhesion of asphalt materials. Clean loose material from cracks. Fill the cleaned cracks, wider than 1 inch, with HMA tamped in place. Wash and/or sweep the paved surface clean and free of loose materials.

Preparation of a milled surface:

1. Prelevel remaining ruts, pavement delaminations, and depressions having a depth greater than 1/2 inch with an approved HMA.

2. Notify the Engineer of pavement areas that appear thin or unstable. Where milling operation creates thin or unstable pavement areas, or where it breaks through existing pavement, remove thin and unstable pavement, and 2 inches of existing base material, compact and replace with an approved HMA.

401-3.11 PREPARATION OF ASPHALT. Provide a continuous supply of asphalt binder to the asphalt mixing plant at a uniform temperature, within the recommended mixing temperature range.

401-3.12 PREPARATION OF AGGREGATES. Dry the aggregate so the moisture content of the HMA, sampled at the point of acceptance for asphalt binder content, does not exceed 0.5 percent (by total weight of mix), as determined by ATM 407.

Heat the aggregate for the HMA to a temperature compatible with the mix requirements specified.

Adjust the burner on the dryer to avoid damage to the aggregate and to prevent the presence of unburned fuel on the aggregate. HMA containing soot or fuel is unacceptable per Subsection 105-1.11.

401-3.13 MIXING. Combine the aggregate, asphalt binder, and additives in the mixer in the amounts required by the JMD. Mix to obtain at least 98 percent coated particles when tested according to AASHTO T195.

For batch plants, put the dry aggregate in motion before addition of asphalt binder.

Mix the HMA within the temperature range determined by the JMD.

Upon the Engineer's request, provide daily burner charts showing start/stop times and temperatures.

401-3.14 TEMPORARY STORAGE OF HMA. Silo type storage bins may be used, provided the characteristics of the HMA remain unaltered.

Signs of visible segregation, heat loss, changes from the JMD, change in the characteristics of asphalt binder, lumpiness, and stiffness of the mixture, are causes for rejection.

Do not store HMA on barges.

401-3.15 PLACING AND SPREADING. Use asphalt pavers to distribute HMA, including leveling course and temporary HMA. Place the HMA upon the approved surface, spread, strike off, and adjust surface irregularities. The maximum compacted lift thickness allowed is 3 inches.

When multiple lifts are specified in the Contract, do not place the final lift until all lower lifts throughout that section, are placed and accepted.

Do not place HMA abutting curb and gutter until curb and gutter are installed, except as approved by the Engineer.

Do not pave against new Portland cement concrete curbing until it has cured for at least 72 hours.

When practicable, adjust elevation of metal fixtures before paving the final lift, so they will be between 1/4 and 1/2 inch below the top surface of the final lift. Metal fixtures include, but are not limited to manholes, valve boxes, monument cases, hand holes, and drains.

Use hand tools to spread, rake, and lute the HMA in areas where irregularities or unavoidable obstacles make mechanical spreading and finishing equipment impracticable.

Place HMA over bridge deck membranes according to Section 508 and the membrane manufacturer's recommendations.

Do not mix HMA produced from different plants for testing or paving.

401-3.16 COMPACTION. Thoroughly and uniformly, compact the HMA by rolling. In areas not accessible to large rollers, compact with mechanical tampers or trench rollers.

The Lower Specification Limit for density is 92.0 percent of the Maximum Specific Gravity (MSG) as determined by ATM 409. The MSG from the approved JMD is used for the first lot of each type of HMA. The MSG for additional lots is determined from the first sublot of each lot.

401-3.17 JOINTS. Place and compact the HMA to provide a continuous bond, texture, and smoothness between adjacent sections of the HMA.

Minimize the number of joints. Do not construct longitudinal joints in the driving lanes unless approved by the Engineer in writing at the pre-paving meeting. Offset the longitudinal joints in one layer from the joint in the layer immediately below by at least 6 inches. Align the joints of the top layer at the centerline or lane lines. Where preformed marking tape striping is required, offset the longitudinal joint in the top layer not more than 6 inches from the edge of the stripe.

Form transverse joints by saw-cutting back on the previous run to expose the full depth of the course or by using a removable bulkhead. Skew transverse joints 15 to 25 degrees.

For all joints below the top lift, uniformly coat joint surfaces with tack coat material meeting Section 402.

When Item 401.0014.____ appears in the bid schedule, uniformly coat the joint face of all top lift joints with a joint adhesive. Otherwise use tack coat material meeting Section 402. Follow joint adhesive manufacturer's recommendations for temperatures and application method. Remove joint adhesive applied to the top of pavement surface.

If infrared joint heaters are used and passing joint densities are achieved in each of the first three joint densities taken, then joint adhesive is not required.

The Lower Specification Limit for top lift longitudinal joint density is 91.0 percent of the MSG of the panel completing the joint. MSG will be determined according to ATM 409.

When the longitudinal joint density test result for a top lift panel sublot is less than 91.0 percent, seal the surface of all longitudinal joints within that sublot using a joint sealant meeting Subsection 702-2.06.Apply joint sealant according to the manufacturer's recommendations while the HMA is clean, free of moisture and prior to final traffic marking. Place the sealant at a maximum application rate of 0.15 gallons per square yard, and at least 12 inches wide centered on the longitudinal joint. After surface sealing, inlay by grinding pavement striping into the sealed HMA. Use grooving equipment that grinds a dry cut to groove the width, length, and thickness of the striping within the specified striping tolerances.

Correct improperly formed joints that result in surface irregularities according to a corrective action plan.

Joints formed by paving in echelon while the mat temperature is over 200°F, as measured by the Engineer, within three inches of the joint are considered hot lapped and do not require tack coat or joint adhesive.

When Item 401.0009.____ appears in the Bid Schedule:

1. Top lift longitudinal joint density will be evaluated for price adjustment according to Subsection 401-4.03.2.

2. Hot lapped top lift joints will receive the full Longitudinal Joint Density Price Adjustment incentive without testing for joint density.

401-3.18 SURFACE REQUIREMENTS AND TOLERANCES. The finished surface of all HMA paving must match dimensions shown in the contract for horizontal alignment and width, profile grade and elevation, crown slope, and pavement thickness. Water must drain across the pavement surface without ponding. The surface must have a uniform texture, without ridges, puddles, humps, depressions, and roller marks. The surface must not exhibit raveling, cracking, tearing, asphalt bleeding, or aggregate segregation. Leave no foreign material, uncoated aggregate or oversize aggregate on the HMA surface.

The Engineer will test the finished surface after final rolling at selected locations using a 10-foot straightedge. Measurements will include spanning joints. The Engineer will identify pavement areas that deviate more than 3/16 inch from the straightedge, including joints, as defective work. Perform corrective work by removing and replacing, grinding, cold milling or infrared heating such areas as required. Do not surface patch. After the Contractor performs corrective work, the Engineer will retest the area.

When Item 401.0010.____ appears in the Bid Schedule:

1. Pavement smoothness will be evaluated for price adjustment according to Subsection 401-4.03.3.

2. The Engineer will use an inertial profiler to measure the top lift HMA surface in the driving lanes for surface smoothness within 21 days after paving is complete and driving lanes are delineated.

Profiler measurements will be taken on through lanes identified in the contract. Profiler measurements will not be taken in turn lanes, intersections, ramps, lane transitions, or within 25 feet of bridge abutments and transverse joints with pre-existing pavement.

The Engineer will measure the pavement smoothness in both wheel paths of each lane. The smoothness is measured as International Roughness Index (IRI), reported as inches/mile, at 0.1 mile increments. Pavement smoothness is the average of all IRI measurements for the project.

The Engineer will identify areas requiring corrective action in accordance with Table 401-4. Perform full-width corrective action in those areas. The Engineer may waive corrective work for localized roughness for deficiencies resulting from manholes or other similar appurtenances near the wheel path.

Perform Corrective Actions according to one of the following or by a method approved by the Engineer:

1. Diamond Grinding. If the required pavement thickness is not decreased by more than 0.25", grind to the required surface tolerance and cross section. Remove and dispose of all materials resulting from the grinding process. Apply joint sealant and sand to exposed aggregates per the manufacturer's recommendations.

2. Overlaying. Mill or sawcut the existing pavement to provide a vertical transverse joint face to match the overlay to the existing pavement. Apply tack coat on the milled surface and joint adhesive to all vertical joints and overlay the full width of the underlying pavement surface. Use the same approved HMA for overlays. Place a minimum overlay thickness of 2.0 inches.

3. Mill and Fill. Mill the existing pavement to provide a vertical transverse joint face. Apply tack coat to the milled surface and joint adhesive to all vertical joints prior to inlay new HMA to match the existing pavement. Use the same approved HMA. Place a minimum thickness of 2.0 inches.

After completion of corrective work, the Engineer will measure the pavement surface with an inertial profiler for a smoothness price adjustment.

401-3.19 REPAIRING DEFECTIVE AREAS. Remove HMA that is contaminated with foreign material, is segregated (determined visually or by testing), flushing, or bleeding asphalt. Remove and dispose defective HMA for the full thickness of the course. Cut the pavement so that edges are vertical and the sides are parallel to the direction of traffic. Coat edges with a tack coat according to Section 402. Place and compact fresh HMA so that compaction, grade and smoothness requirements are met.

401-3.20 ROADWAY MAINTENANCE. Inspect daily according to pavement inspection plan. Remove, and dispose of project materials incorrectly deposited on existing and new pavement surfaces(s) inside and outside the project area including haul routes.

The Contractor is responsible for damage caused by not removing these materials and any damage to the roadway from the removal method(s).

Repair damage to the existing roadway that results from fugitive materials or their removal.

401-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Hot Mix Asphalt.

   a. By weight. No deduction is made for the weight of asphalt binder or anti stripping additive or cutting back joints. If the use of WMA is approved by the Engineer, WMA additives will not be measured and are considered subsidiary to the HMA pay item.

   b. By the final HMA surface area.

2 Asphalt Binder. By weight, as follows:

   Method 1 will be used for determining asphalt binder quantity unless otherwise directed in writing. The procedure initially used will be the one used for the duration of the project. No payment is made for any asphalt binder more than 0.4 percent above the optimum asphalt binder content specified in the JMD.

   a. Method 1: Percent of asphalt binder for each sublot multiplied by the total HMA weight represented by that sublot. The Engineer will use either ATM 405 or ATM 406 to determine the percent of asphalt binder. The same test method used for the acceptance testing of the sublot will be used for computation of the asphalt binder quantity. In the absence of testing, the percent of asphalt binder is the target value for asphalt binder in the JMD.

   b. Method 2: Supplier's invoices minus waste, diversion and remnant. This procedure is an Engineer's option for projects where deliveries are made in tankers and the asphalt plant is producing HMA for one project only.

   The Engineer may direct, at any time that tankers are weighed in the Engineer's presence before and after unloading. If the weight determined at the project varies more than 1 percent from the invoice amount, payment is based on the weight determined at the project.

   Any remnant or diversion will be calculated based on tank stickings or weighing the remaining asphalt binder. The Engineer will determine the method. The weight of asphalt binder in disposed HMA is calculated using the target value for asphalt binder as specified in the JMD.

3. Job Mix Design. When specified, a Contractor furnished JMD is measured as one according to the HMA class and type.

4. Temporary Pavement. By weight, without deduction for the weight of asphalt binder or anti-strip additive.

5. Leveling Course. By Lane-Station (12 foot width) or by weighing without deduction for the weight of asphalt binder or anti-strip additive.

6. HMA Price Adjustment. Calculated by quality level analysis under Subsection 401-4.03.1.

7. Longitudinal Joint Density Price Adjustment. By the linear foot of top lift longitudinal joint under Subsection 401-4.03.2.

8. Joint Adhesive. By the linear foot of longitudinal and transverse joint.

9. Pavement Smoothness Price Adjustment. Calculated from inertial profiler data using FHWA's ProVAL software under Subsection 401-4.03.3.

10. Asphalt Material Price Adjustment. Determined under Subsection 401-4.04.

11. Liquid Anti-Strip Additive. Based on the number of tons of asphalt binder containing required additive.

12. Crack Repair. From end to end of the crack repaired according to 401-3.10, measured horizontally along the centerline of the crack. Cleaning loose material from cracks, asphalt binder, and HMA to fill cracks will not be measured separately but are subsidiary.

13. Prelevel for Ruts, Delaminations, and Depressions. By the surface area where prelevel is placed according to 401-3.10(1), measured according to Section 109. Asphalt binder, HMA, and cleaning loose material, will not be measured separately but are subsidiary.

14. Repair Unstable Pavement. By the surface area of pavement repaired according to 401-3.10(2), measured according to Section 109. Asphalt binder, HMA, and removal of pavement and base course will not be measured separately but are subsidiary.

401-4.02 ACCEPTANCE SAMPLING AND TESTING. The bid quantity of each type of HMA produced and placed will be divided into lots and the lots evaluated individually for acceptance.

A lot is normally 5,000 tons. The lot is divided into sublots of 500 tons, each randomly sampled and tested for asphalt binder content, density, and gradation according to this Subsection. The lot is evaluated for price adjustment according to Subsection 401-4.03.1. Seasonal startup or a new JMD requires starting a new lot.

If less than 8 sublots have been placed at the time a lot is terminated, the material in the shortened lot will be included as part of the prior lot. The price adjustment computed for the prior lot will include the samples from the shortened lot. Density test results from material in the shortened lot will be based on the MSG of the shortened lot. If there is no prior lot, and there are at least 3 sublots, the material in the shortened lot will be considered as a lot and the price adjustment will be based on the actual number of test results in the shortened lot. If there are less than 3 sublots, the HMA will be accepted for payment based on the Engineer's approval of the JMD, and placement and compaction of the HMA to the specified depth, finished surface requirements and tolerances. The Engineer reserves the right to perform any testing required in order to determine acceptance.

If 8 or 9 sublots have been placed at the time a lot is terminated, they will be considered as a lot and the price adjustment will be based on the actual number of test results in the shortened lot.

If the bid quantity is between 1,500 to 4,999 tons, the quantity is considered one lot. The lot is divided into sublots of 500 tons, each randomly sampled and tested for asphalt binder content, density, and gradation according to this Subsection. The lot is evaluated for price adjustment according to Subsection 401-4.03.1.

For bid quantity less than 1,500 tons, HMA will be accepted for payment based on the Engineer's approval of the JMD, and placement and compaction of the HMA to the specified depth, finished surface requirements and tolerances. The Engineer reserves the right to perform any testing required in order to determine acceptance.

Sampling and testing include the following:

1. Asphalt Binder Content. HMA samples shall be taken randomly by the Contractor in the presence of the Engineer from behind the paver screed before initial compaction, or will be taken randomly by the Engineer from the windrow, according to ATM 402 or ATM 403, at the discretion of the Engineer. The location (behind the paver screed or windrow) will be determined at the pre-paving meeting. Random sampling locations will be determined by the Engineer.

   Two separate samples will be taken, one for acceptance testing and one held in reserve for retesting if requested. Asphalt binder content will be determined according to ATM 405 or ATM 406, at the discretion of the Engineer.

2. Aggregate Gradation. Aggregates tested for gradation acceptance will have the full tolerances from Table 401-2 applied.

   a. Drum Mix Plants. Samples will be taken from the combined aggregate cold feed conveyor via a diverter device, from the stopped conveyor belt or from the same location as samples for determination of asphalt binder content, at the discretion of the Engineer. Two separate samples will be taken, one for acceptance testing and one held in reserve for retesting if requested. The aggregate gradation for samples from the conveyer system will be determined according to ATM 304. For HMA samples, the gradation will be determined according to ATM 408 from the aggregate remaining after the ignition oven (ATM 406) has burned off the asphalt binder. Locate diverter devices for obtaining aggregate samples from drum mix plants on the conveyor system delivering combined aggregates into the drum. Divert aggregate from the full width of the conveyor system and maintain the diverter device to provide a representative sample of aggregate incorporated into the HMA.

   b. Batch Plants. Samples will be taken from dry batched aggregates according to ATM 301 or from the same location as samples for determination of asphalt binder content, at the discretion of the Engineer. Two separate samples will be taken, one for acceptance testing and one held in reserve for retesting if requested. The aggregate gradation for dry batch samples will be determined according to ATM 304. For HMA samples, the gradation will be determined according to ATM 408 from the aggregate remaining after the ignition oven (ATM 406) has burned off the asphalt binder.

3. Density. The Engineer will determine and mark the location(s) where the Contractor takes each core sample.

   a. Mat Cores: The location(s) for taking core samples is determined using a set of random numbers (independent of asphalt binder and aggregate sampling set of random numbers) and the Engineer's judgment. Take no mat cores within 1 foot of a joint or edge. Core samples are not taken on bridge decks.

   b. Longitudinal Joint Cores: The Engineer will mark the location(s) to take the core sample, centered on the visible surface joint, and adjacent to the mat core sample taken in the panel completing the joint.

      Take core samples according to ATM 413 in the presence of the Engineer. Cut full depth core samples, centered on the marks and as noted above, from the finished HMA within 24 hours after final rolling. Neatly core drill one six inch diameter sample at each marked location. Use a core extractor to remove the core - do not damage the core. The Engineer will immediately take possession of the samples. Backfill and compact voids left by coring according to ATM 413. The Engineer will determine density of samples according to ATM 410.

4. Retest. When test results have failed to meet specifications, retest of acceptance test results for asphalt binder content, gradation, and density may be requested provided the quality control requirements of Subsection 401-3.02 are met. Deliver this request in writing to the Engineer within 7 days of receipt of the final test of the lot. The Engineer will mark the sample location for the density retest within a 2 foot radius of the original core. The original test results are discarded and the retest result is used in the price adjustment calculation regardless of whether the retest result gives a higher or lower pay factor. Only one retest per sample is allowed. When gradation and asphalt binder content are determined from the same sample, a request for a retest of either gradation or asphalt binder content results in a retest of both. Both gradation and asphalt binder content retest results are used in the price adjustment calculation. Retesting will be performed by a department laboratory.

5. Asphalt Binder Grade. The lot size for asphalt binder is 200 tons. If a project has more than one lot and the remaining asphalt binder quantity is less than 150 tons, it is added to the previous lot and that total quantity will be evaluated as one lot. If the remaining asphalt binder quantity is 150 tons or greater, it is sampled, tested and evaluated as a separate lot.

   If the bid quantity of asphalt binder is between 85 – 200 tons, the contract quantity is considered as one lot and sampled, tested, and evaluated according to this subsection. Quantities of asphalt binder less than 85 tons will be accepted based on manufacturer's certified test reports and certification of compliance.

   Sample asphalt binder at the plant from the supply line in the presence of the Engineer according to ATM 401. The Engineer will take immediate possession of the samples. Take three samples from each lot, one for acceptance testing, one for Contractor requested retesting, and one held in reserve for referee testing if requested. Meet Subsection 702 requirements for asphalt binder quality.

6. Asphalt Binder Grade Retest. Retest of acceptance test results may be requested provided the quality control requirements of Subsection 401-3.02 are met. Deliver the request in writing to the Engineer within 7 days of receipt of notice of failing test. The original test results are discarded and the retest result is used for acceptance. Only one retest per sample is allowed.

   If the contractor challenges the result of the retest, the referee sample held by the Engineer will be sent to a mutually agreed upon independent AASHTO accredited laboratory for testing. The original acceptance test result, the retest acceptance test result, and the referee sample test result will be evaluated according to ASTM D3244 to obtain an Assigned Test Value (ATV). The ATV value will be used to determine if the asphalt binder conforms to the contract. The Contractor shall pay for the referee sample test if the ATV confirms the asphalt binder does not meet contract requirements.

401-4.03 EVALUATION OF MATERIALS FOR ACCEPTANCE.

The Engineer may reject material which appears to be defective based on visual inspection. If a test of rejected material is requested, a minimum of two samples are collected from the rejected material and tested. If all test results are within specification limits, payment for the material is made.

The following methods are applied to each type of HMA when Price Adjustment Pay Items are included in the Bid Schedule. These methods describe how price adjustments are determined based on the quality of the HMA, longitudinal joint density and pavement smoothness.

1. HMA Price Adjustment. Acceptance test results for HMA asphalt binder content, gradation and mat density are used in HMA price adjustment. These test results for a lot are analyzed collectively and statistically by the Quality Level Analysis (QLA) method as specified in Subsection 106-1.03.3 to determine the total estimated percentage of the lot that is within specification limits. The values for percent passing the #200 sieve, asphalt binder content and density test results are reported to the nearest 0.1 percent. All other sieves used in QLA are reported to the nearest whole number.

   The HMA price adjustment is based on the lower of two pay factors. The first factor is a composite pay factor (CPF) for HMA that includes gradation and asphalt binder content. The second is the density pay factor (DPF).

   A lot containing material with less than a 1.000 pay factor is accepted at an adjusted price, provided that pay factor is at least 0.800 and there are no isolated defects identified by the Engineer. A lot containing material that fails to obtain the minimum pay factor is considered unacceptable and rejected under Subsection 105-1.11.

HMA pay factors are computed as follows:

a. All statistical Quality Level Analysis (QLA) is computed using the Engineer's Price Adjustment programs.

b. The USL and LSL are equal to the Target Value (TV) plus and minus the allowable tolerances in Table 401-2, or as shown below. The TV is the specification value shown in the approved Job Mix Design.

TABLE 401-2
HMA LOWER SPECIFICATION LIMIT (LSL) &
UPPER SPECIFICATION LIMIT (USL)

Measured Characteristics	LSL	USL
¾" or largest sieve size	99	100
½ inch sieve or first sieve retaining aggregate	TV-6	TV+6
3/8 inch sieve	TV-6	TV+6
No. 4 sieve	TV-6	TV+6
No. 8 sieve	TV-6	TV+6
No. 16 sieve	TV-5	TV+5
No. 30 sieve	TV-4	TV+4
No. 50 sieve	TV-4	TV+4
No. 100 sieve	TV-3	TV+3
No. 200 sieve	TV-2.0	TV+2.0
Asphalt Binder Content, %	TV-0.4	TV+0.4
Mat Density, %	92.0	100.0

c. The percent within limits (PWL), Quality Levels and characteristic pay factors (PFs) are determined by the Engineer for each Lot in accordance with Subsection 106-1.03.3. The Composite Pay Factor (CPF) for the lot is determined from gradation and asphalt binder content (ac) acceptance test results using the following example formula:

$$CPF = \frac{[f_{3/4\ inch}\ (PF_{3/4\ inch}) + f_{1/2\ inch}\ (PF_{1/2\ inch}) + \ldots f_{ac}\ (PF_{ac})]}{\Sigma f}$$

Table 401-3 gives the weight factor (f) for each test property considered.

TABLE 401-3
WEIGHT FACTORS

Property	Type I Factor "f"	Type II Factor "f"	Type III Factor "f"
1 inch sieve	4	-	-
¾ inch sieve	4	4	-
½ inch sieve	4	5	4
3/8 inch sieve	4	5	5
No. 4 sieve	4	4	5
No. 8 sieve	4	4	5
No. 16 sieve	4	4	5
No. 30 sieve	4	5	6
No. 50 sieve	4	5	6
No. 100 sieve	4	4	4

No. 200 sieve	20	20	20
Asphalt Content, %	40	40	40

The Density Pay Factor (DPF) is computed using HMA mat core compaction acceptance test results.

The CPF and DPF are rounded to the nearest 0.001. The price adjustment for each individual lot is calculated as follows:

HMA Price Adjustment = [(CPF or DPF)* -1.00] x (tons in lot) x (PAB)
* CPF or DPF, whichever is lower
PAB = Price Adjustment Base = [Bid Unit Price for 401(1_) + (n/100) x Bid Unit Price for 401(4_)],

Where
n = Optimum asphalt binder content percent, established by the JMD.
The HMA Price Adjustment is the sum of the price adjustments for each lot and paid for under Item 401(8_).

2. Longitudinal Joint Density Price Adjustment. A longitudinal joint density price adjustment will be based on the project average of all top lift joint densities and determined as follows:

   a. If project average top lift joint density is less than 91.0 percent MSG, apply the following disincentive:

      Longitudinal joint density price adjustment equal to $3.00 per lineal foot is deducted.

   b. If project average top lift joint density is greater than 92.0 percent MSG, apply the following incentive:

      Longitudinal joint density price adjustment equal to $1.50 per linear foot is added.

The Longitudinal Joint Density Price Adjustment is the total price adjustment paid for under Item 401(9).

3. Pavement Smoothness Price Adjustment. Pavement smoothness will be measured by the Engineer and reported as IRI (inches/mile), according to Subsection 401-3.18. Incentive for pavement smoothness shall apply only if both the project average CPF and DPF are greater than or equal to 1.000. Disincentive for pavement smoothness shall apply regardless of the project average CPF or DPF.

The Engineer will calculate the pavement smoothness price adjustment according to Method 1 or Method 2 below, as identified in the bid schedule.

Method 1: SPA = PAB x PQ x SF,

Where:
SPA = Pavement Smoothness Price Adjustment
PAB = Price Adjustment Base
PAB = [Bid Unit Price for 401(1_) + (n/100) x Bid Unit Price for 401(4_)],
n = optimum asphalt binder content, percent, established by the JMD
PQ = Top layer HMA quantity, tons
SF = Smoothness Factor (Table 401-4)

TABLE 401-4
SMOOTHNESS FACTOR (SF)

IRI (in./mile)	SF

IRI (in./mile)	SF
Less than 40	0.05
40 to 70	0.05 – (IRI - 40)/600
70 to 90	0.00
90 to 120	(90 – IRI)/120
Greater than 120*	-

* Corrective Work required, see Subsection 401-3.18

Method 2: SPA = PAB x PQ x SF,

Where:
SPA = Pavement Smoothness Price Adjustment
PAB = Price Adjustment Base
PAB = [Bid Unit Price for 401(1_) + (n/100) x Bid Unit Price for 401(4_)],
n = optimum asphalt binder content, percent, established by the JMD
PQ = Top layer HMA quantity, tons
SF = Smoothness Factor = 0.12 x RR – 0.02; SF not to exceed 0.05
RR = Roughness Reduction = (Initial IRI – Final IRI) / Initial IRI
Initial IRI = Pre-project average IRI as measured and reported by the Engineer. The Initial IRI will either be included in the bid documents or the timeline for when the Initial IRI will be measured will be identified in the bid documents.
Final IRI = Top layer HMA average IRI as measured and reported by the Engineer according to Subsection 401-3.18.

The Pavement Smoothness Price Adjustment is the total price adjustment paid for under Item 401(10).

401-4.04 ASPHALT MATERIAL PRICE ADJUSTMENT.

Asphalt Material Price Adjustment. This subsection provides a price adjustment for asphalt material by: (1) additional compensation to the contractor or (2) a deduction from the contract amount.

1. This provision shall apply:

   a. To asphalt material meeting the criteria of Section 702, and is included in items listed in the bid schedule of Sections 306, 307, 308, 401 thru 408, 520, 608 and 609.

   b. To cost changes in asphalt material that occur between the date of bid opening and the date on the certified bill of lading from the asphalt material refiner/producer.

   c. When there is more than a 7.5 percent increase or decrease in the Alaska Asphalt Material Price Index, AAMPI, from the date of bid opening to the date on the certified bill of lading from the asphalt refiner/producer.

2. Provide the certified bill of lading from the asphalt material refiner/producer.

3. The AAMPI is calculated bimonthly on the first and third Friday of each month, and will remain in effect from the day of calculation until the next bimonthly calculation. The AAMPI is posted on the Department's Statewide Materials website at and calculated according to the formula posted there. http://www.dot.state.ak.us/stwddes/desmaterials/aprice_index.shtml

4. Price adjustment will be cumulative and calculated with each progress payment. Use the AAMPI in effect on the date of the certified bill of lading from the asphalt material refiner/producer, to calculate the price adjustment for asphalt material The Department will

increase or decrease payment under this contract by the amount determined with the following asphalt material price adjustment formula:

For an increase exceeding 7.5 percent, additional compensation = [(IPP – IB) – (0.075 x IB)] x Q

For a decrease exceeding 7.5 percent, deduction from contract = [(IB – IPP) – (0.075 x IB)] x Q

Where:
Q = Quantity of Asphalt Material incorporated into project during the pay period, in tons as measured by the Engineer
IB = Index at Bid: the Bi-monthly AAMPI in effect on date of bid, in dollars per ton
IPP = Index at Pay Period: The bi-monthly AAMPI in effect on the date shown on the certified bill of lading from the asphalt refiner/producer, in dollars per ton

5. Method of measurement for determining Q (quantity) is the weight of asphalt material that meets the criteria of this subsection and is incorporated into the project. The quantity does not include aggregate, mineral filler, blotter material, thinning agents added after material qualification, or water for emulsified asphalt. The quantity for emulsified asphalts will be based on the asphalt residue material only and will be calculated using the percent residue from testing, or if not tested, from the manufacturer's certificate of compliance.

401-5.01 BASIS OF PAYMENT.

Asphalt binder, liquid anti-strip additives and tack coat are subsidiary to HMA Item 401.0001.____ and 401.0006.____ unless specified as Pay Items. Asphalt binder and liquid anti-strip are subsidiary to HMA for Items 401.0002.____, 401.0003.____, 401.0005.____, 401.0011.____, and 401.0012.____.

Item 401(8_) HMA price adjustment is the sum of the price adjustments for each material lot and for deductions and fees assessed. Deductions and fees assessed include:

1. The Department will bear the cost of the initial JMD evaluation for each type of HMA. All subsequent evaluations required to obtain an approved JMD will be assessed a fee of $6,000 per evaluation. Failed retest will result in a fee of $2,500.

2. Failure to cut core samples within the specified period will result in a deduction of $100 per sample per day.

3. Failure to backfill voids left by sampling within the specified period will result in a deduction of $100 per hole per day.

4. If an asphalt binder referee test is requested and the ATV confirms the asphalt binder does not meet contract requirements, a fee of $500 will be assessed.

Item 401.0008.____ HMA price adjustment does not apply to:

1. HMA, when contract quantity is less than 1500 tons

2. HMA for leveling course 401.0002.____ and 401.0003.____

3. Temporary HMA 401.0005.____

4. Driveway HMA 401.0011.____ and 401.0012.____

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
401.0001.____	HMA, Type ___; Class ___	TON
401.0002.____	HMA, Leveling Course, Type ___; Class ___	LnSt
401.0003.____	HMA, Leveling Course, Type ___; Class ___	TON
401.0004.____	Asphalt Binder, Grade ____	TON
401.0005.____	HMA, Temporary, Type ___; Class ___	TON
401.0006.____	HMA, Type ___; Class ___	SY
401.0007.____	Liquid Anti-Strip Additive	CS
401.0008.____	HMA Price Adjustment, Type ___; Class ___	CS
401.0009.____	Longitudinal Joint Density Price Adjustment	CS
401.0010.____	Pavement Smoothness Price Adjustment, Method ___	CS
401.0011.____	HMA, Driveway, Type ___; Class ___	LS
401.0012.____	HMA, Driveway, Type ___; Class ___	TON
401.0013.____	Job Mix Design	EACH
401.0014.____	Joint Adhesive	LF
401.0015.____	Asphalt Material Price Adjustment	CS
401.0016.____	Crack Repair	LF
401.0017.____	Prelevel for Ruts, Delaminations, and Depressions	SY
401.0018.____	Repair Unstable Pavement	SY

SECTION 402
TACK COAT

402-1.01 DESCRIPTION. Apply an asphalt tack coat on an approved surface.

402-2.01 MATERIALS. Use materials that conform to the following:

Asphalt Section 702 (STE-1)

CONSTRUCTION REQUIREMENTS

402-3.01 WEATHER LIMITATIONS. Do not apply tack coat to a wet surface or when the roadway surface temperature is below 40 °F.

402-3.02 EQUIPMENT. Furnish, maintain, and operate asphalt distributor to apply asphalt material uniformly at even heat on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.01 to 0.11 gallon per square yard, with uniform pressure, and with an allowable variation from any specified application rate not to exceed 0.02 gallon per square yard. Equip with a heater, tachometer, pressure gauges, calibrated tank, thermometer for measuring temperatures of tank contents, power unit for the pump and full circulation spray bars adjustable laterally and vertically.

402-3.03 PREPARATION OF SURFACE TO BE TREATED. Clean and patch the existing surface to receive the treatment. Remove irregularities to provide a reasonably smooth and uniform surface. Remove and replace unstable corrugated areas with suitable patching materials. Clean the edges of existing pavements, which are to be adjacent to new pavement, to permit the adhesion of asphalt materials.

402-3.04 APPLICATION OF ASPHALT MATERIAL. Apply tack coat uniformly with a pressure distributor at a rate of 0.04 to 0.10 gallon per square yard, as directed.

Apply the tack coat in such a manner as to offer the least inconvenience to traffic and to permit one-way traffic without pickup or tracking of the asphalt material.

Limit application of tack coat so it will be covered by paving within one day.

402-4.01 METHOD OF MEASUREMENT. See Section 109.

402-5.01 BASIS OF PAYMENT. Payment for patching existing surfaces will be made at the contract unit price for the various items used unless a reconditioning item is included in the Contract.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
402.0001.STE1	STE-1 Asphalt for Tack Coat	TON
402.0002.STE1	STE-1 Asphalt for Tack Coat	LS

SECTION 403
PRIME COAT

403-1.01 DESCRIPTION. Construct an asphalt prime coat on an approved surface. Apply blotter material, if required.

403-2.01 MATERIALS. Use materials that conform to the following:

Asphalt	Section 702 (MC-30, CSS-1)
Blotter Material	Suitable clean sand

CONSTRUCTION REQUIREMENTS

403-3.01 WEATHER LIMITATIONS. Do not apply asphalt material to a wet surface, or when the surface temperature is below 45 °F, or when weather conditions would prevent the proper penetration of the prime coat.

403-3.02 EQUIPMENT. A distributor meeting Subsection 402-3.02. An approved self-propelled aggregate spreader and rotary paver broom.

403-3.03 PREPARATION OF SURFACE. Ensure that surface to be primed is shaped to the required grade and section, free of ruts, corrugations, segregated material or other irregularities, and uniformly compacted.

403-3.04 APPLICATION OF ASPHALT MATERIAL. Before prime coat application, obtain approval of rate of application, temperature, and areas to be treated, from the Engineer.

When CSS-1 Emulsified Asphalt is specified, dilute with an equal amount of potable water at a temperature between 50 and 120 °F and mix for a minimum of 15 minutes before using.

Apply asphalt material to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread. Do not exceed maximum application rate at overlaps. Squeegee excess asphalt material from the surface. Correct any skipped areas or deficiencies. Place building paper over the end of the previous applications and start the joining application on the building paper. Remove and dispose of used building paper.

When road is open to traffic, treat not more than 1/2 of the width of the section in one application. Maintain traffic on the untreated portion of the roadbed. As soon as the asphalt material has been absorbed by the surface and will not pick up, traffic may be transferred to the treated portion and the remaining width of the section primed.

Maintain the surface until the next course has been placed. Protect the surface against damage.

403-3.05 APPLICATION OF BLOTTER MATERIAL. If, after the application of the prime coat, the asphalt material fails to penetrate and dry, and traffic must be routed over the primed surface, or rain is imminent, apply blotter material as directed.

Do not apply blotter material sooner than 4 hours after application of the asphalt material.

403-4.01 METHOD OF MEASUREMENT. See Section 109. By calculated residual weight for emulsified asphalt.

403-5.01 BASIS OF PAYMENT.

Water for emulsified asphalt and blotter material are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
403.0001.MC30	MC-30 Liquid Asphalt for Prime Coat	TON
403.0002.CSS1	CSS-1 Emulsified Asphalt for Prime Coat	TON

SECTION 404
SEAL COAT

404-1.01 DESCRIPTION. Construct a seal coat on an approved surface, with or without cover coat material, as specified.

404-2.01 MATERIALS. Use materials that conform to the following, for the type and grade specified:

Asphalt	Section 702
Cover Coat Aggregate	Subsection 703-2.05

CONSTRUCTION REQUIREMENTS

404-3.01 WEATHER LIMITATIONS. Do not apply asphalt material to a wet surface, or when the surface temperature is below 60 °F, or when weather conditions would prevent the proper penetration and adhesion of the cover aggregate.

404-3.02 EQUIPMENT. Use the following equipment, or its approved equivalent:

1. Distributor. Conform to Subsection 402-3.02.

2. Broom. A rotary power broom or power vacuum sweeper.

3. Rollers. A minimum of two self-propelled pneumatic tired rollers having gross loads adjustable to apply 200 to 350 pounds per inch of rolling width as directed. Tire pressure or contact pressure may be specified for pneumatic tire rollers. Operate pneumatic tire rollers at a maximum speed of 5 mph.

4. Spreader. One self-propelled aggregate spreader of approved design supported by at least 4 wheels equipped with pneumatic tires on two axles.

404-3.03 PREPARATION OF SURFACE. Clean the roadway surface of all loose material immediately before applying asphalt.

404-3.04 APPLYING ASPHALT MATERIAL. Apply asphalt material to an approved surface by means of a pressure distributor in a uniform, continuous spread and within the temperature range specified.

Apply asphalt material at the rate specified. If the surface texture is such that asphalt material penetrates the surface, a preliminary application of 0.05 to 0.10 gallon per square yard of surface may be required.

Use building paper at the beginning of each spread. Remove and dispose of used building paper. Open the spray bar only when the distributor is moving forward at proper application speed. Correct any skipped areas or deficiencies. Do not exceed maximum application rate at overlaps.

Suspend spreading asphalt material early enough in the day to permit the termination of traffic control prior to darkness. Apply asphalt material to only one designated traffic lane at a time. Cover the entire width of the lane in one operation.

Spread the asphalt material not more than 6 inches wider than the width covered by the cover coat material. Do not allow asphalt material to chill, set up, or dry.

Do not allow the distributor to drip on the surface of the traveled way.

404-3.05 APPLICATION OF COVER COAT MATERIAL. Moisten the cover coat material with water the day before the aggregate is to be used. Spread the aggregate at a surface dry or slightly damp condition.

Aggregate may be accepted in the stockpile at the source. Gradation will be determined by ATM 304.

Immediately following asphalt material application, spread the specified quantity of cover coat material. Do not allow truck or aggregate spreader tires to contact the wet asphalt material.

Cover any deficient areas with additional material immediately after the cover coat material is spread. Begin rolling immediately for the full width of the aggregates, and continue until 3 complete coverages are obtained. Complete pneumatic tire rolling the same day the asphalt and cover coat materials are applied.

After the application of the cover coat material, lightly broom the surface and maintain for a period of 4 days or as directed. Maintenance of the surface includes the distribution of cover coat material over the surface to absorb any free asphalt material. Do not displace imbedded material. Sweep excess material from the entire surface by means of rotary brooms at the time directed.

When applying asphalt material without a cover coat, begin rolling the asphalt material immediately upon application and continue until there is no evidence of kneading action. Make at least one complete roller coverage of the road surface.

Do not permit traffic on the seal coat until rolling is completed. Control traffic on seal coats by pilot cars at a speed not to exceed 15 mph for a period of 2 to 24 hours, as directed.

404-4.01 METHOD OF MEASUREMENT. See Section 109. By calculated residual weight for emulsified asphalt.

404-5.01 BASIS OF PAYMENT. Water for emulsified asphalt is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
404.0001.____	Asphalt for Seal Coat, ____	TON
404.0002.____	Seal Coat Aggregate, Type ___, Grading ___	TON

SECTION 405
SURFACE TREATMENT

405-1.01 DESCRIPTION. Construct a single or multiple course asphalt surface treatment.

405-2.01 MATERIALS. Use materials that conform to the following:

Asphalt	Section 702, for the type and grade specified
Surface Treatment Aggregate	Subsection 703-2.05, for the grading specified
Blotter Material	Suitable clean sand

CONSTRUCTION REQUIREMENTS

405-3.01 PRIME COAT. Apply prime coat, when specified, per Section 403, Prime Coat.

Allow a curing period of up to 4 days between the application of the prime coat and the next application of asphalt material, as directed.

Maintain the primed surface during the curing period. Repair all holes, ravels and areas deficient in prime with asphalt treated materials, by penetration methods, or other approved procedures.

405-3.02 SURFACE TREATMENT. Apply each course (asphalt and surface treatment aggregate per Section 404, Seal Coat. Allow each course to cure for a period of 4 days before applying additional courses.

Surface treatment aggregate may be accepted in stockpile at the source. Gradation will be determined by ATM 304.

405-3.03 OPENING TO TRAFFIC. Keep the highway open to traffic as practicable. As soon as the final layer is rolled, controlled traffic may be permitted as specified under Subsection 404-3.05.

405-4.01 METHOD OF MEASUREMENT. See Section 109. By calculated residual weight for emulsified asphalt.

405-5.01 BASIS OF PAYMENT. Water for emulsified asphalt is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
405.0001.____	Asphalt for Surface Treatment, ____	TON
405.0002.____	Aggregate for Surface Treatment, Grading ___	TON
405.0003.____	Asphalt for Surface Treatment	SY
405.0004.____	Aggregate for Surface Treatment, Grading ___	CY

SECTION 406
RUMBLE STRIPS

406-1.01 DESCRIPTION. Form a series of indentations into the pavement.

406-2.01 MATERIALS. None.

406-2.02 MILLING EQUIPMENT. Use equipment designed to mill rumble strips into asphalt pavement capable of providing, in a single pass, smooth (approximately 1/16-inch between peaks and valleys) indentations with crisp clean edges.

Equipment will use water with the cutting head, minimize dust creation, and align the indentations with a guidance system that is clearly visible to the operator.

CONSTRUCTION REQUIREMENTS

406-3.01 PREPARATION. Inspect roadway to receive rumble strips for acceptable pavement condition. Repair unacceptable pavement as directed.

Stake all locations where milling will start and stop with the specified setback distances and place the edigeline.

Prepare the roadway for the milling operation by providing a smooth clean surface. Sweep all loose material from the roadway surface in line with the planned rumble strips and to each side of the strips for the width of the milling machine plus an additional 12” minimum per side or edge of pavement whichever is smaller, and as directed. Sweep and broom according to Subsection 643-3.04, item. 6.

406-3.02 TOLERANCES FOR RUMBLE STRIPS. Make the edges of the indentation straight, smooth and free of spalling. Meet the following tolerances:

1. Length and width of indentation: ± 1/2-inch.

2. Depth of indentation: ± 1/16-inch.

3. Spacing between indentations: ± 1/2-inch.

4. Alignment of rumble strip to edge line: ± 1-inch.

Rumble strips will be unacceptable if they do not meet the specified tolerances, are not smooth, the edges are not crisp, spalling has occurred, or the pavement surface is damaged from rumble strip installation. Repair unacceptable rumble strips by grinding out the full width of the strip to a depth of 2-inches, repaving with HMA according to Section 401, and milling new rumble strips. Do not perform repairs in a "patch work" manner. If more than one repair is required in a group of rumble strips, repair the entire group. In a continuous run of rumble strips, repair the unacceptable rumble strip and the rumble strips to either side to maintain continuity of the rumble strip run. Repair the unacceptable rumble strips to the satisfaction of the Engineer.

406-3.03 RUMBLE STRIP TEST SECTION. Construct a rumble strip test section, and receive acceptance prior to production. The equipment, preparation, personnel, and method of operation used for the test section shall be the same as used on the remainder of the work. Install a test section, for each type of rumble strip specified, for a distance of 1/4 mile, or as required by the Engineer.

Demonstrate for each type of rumble strip that the equipment and method will provide the desired milled-in rumble strip, including the surface inside each depression, without damaging the surrounding asphalt pavement. If a test section does not meet tolerances, provide new equipment, new method, or make necessary adjustments and retest. Additional test sections will

be required before production runs will be allowed to begin. Testing in addition to the initial test sections will be at the Contractor's expense.

Demonstrate the equipment for containing dust and waste material.

406-3.04 RUMBLE STRIP INSTALLATION. Do not begin milling until the Engineer approves the pavement repairs, all of the start and stop locations, and the edge line, Subsection 406-3.01, and the rumble strip test section, Subsection 406-3.03. Do not construct rumble strips on HMA longitudinal joints or on Portland Cement Concrete.

Rumble strip types are "Shoulder" and "Centerline". Each type has its own pattern identified in the Plans. Install the rumble strip types where specified.

1. Shoulder. Place along the shoulder. Do not disturb existing shoulder striping.

2. Centerline. Place along the roadway. Replace existing centerline stripe(s) after installing the rumble strip.

Locate the inside edge of the rumble strip as shown in the Plans. In compacted pavement with a temperature below 80˚ F, mill each type of rumble strip into the pavement. The Engineer will randomly check the edge alignment of the milled pattern.

Make immediate adjustments to correct errors in rumble strips placement.

Milled roadway segments shall be returned to debris-free state prior to re-opening for traffic.

406-3.05 CLEAN UP. . Handle, transport, and store, or dispose of material according to the Alaska Department of Environmental Conservation (ADEC) regulations.

Keep the travel lanes free of milling debris. Clean milling debris off the pavement. Do not berm the millings at the shoulder edge. Do not allow an accumulation of millings to impede road drainage or enter any waterways. Remove millings immediately following rumble strip installation. Maintain the removal operation within 50 feet of the milling machine. Dry power brooming and power brooming without direct immediate means of collection/pickup is not permitted.

Dispose waste material outside the project limits, unless directed otherwise.

406-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Lump Sum. A single lump sum price for all rumble strips installed as shown on the plans.

Linear Foot. A single lineal measurement for every measured foot of rumble strip installed.

Station. A single lineal measurement for every measured station of rumble strip installed.

Mile. A single lineal measurement for every measured mile of rumble strip installed.

Shoulder rumble strip measurement, when measured by Station or Mile, includes gaps (provided for bicycles or other as shown in the Plans) between groups of rumble strips.

406-5.01 BASIS OF PAYMENT. Payment will be made under:

Payment for replacement striping is under Section 670, Traffic Markings.

PAY ITEM		
Item Number	**Item Description**	**Unit**
406.0001.____	Rumble Strips	LS
406.0002.____	Rumble Strips	STA

406.0003.____	Rumble Strips	LF
406.0004.____	Rumble Strips	MILE
406.0005.____	Rumble Strips, Shoulders	LS
406.0006.____	Rumble Strips, Shoulders	STA
406.0007.____	Rumble Strips, Shoulders	LF
406.0008.____	Rumble Strips, Shoulders	MILE
406.0009.____	Rumble Strips, Centerline	LS
406.0010.____	Rumble Strips, Centerline	STA
406.0011.____	Rumble Strips, Centerline	LF
406.0012.____	Rumble Strips, Centerline	MILE

DIVISION 500– STRUCTURES

SECTION 501
CONCRETE FOR STRUCTURES

501-1.01 DESCRIPTION. Furnish, place, finish, and cure Portland cement concrete for structure construction. Use the class of concrete noted on the Plans unless otherwise specified.

CLASSES OF CONCRETE

Class A:	General use concrete
Class A-A:	Concrete where improved strength and durability is required
Class P:	Concrete where strength in excess of 5000 psi is required
Class DS:	Concrete for drilled shaft foundations

501-1.02 DEFINITIONS.

ADMIXTURE. A material other than water, aggregate, hydraulic cement, pozzolan, and fiber reinforcement, added to the batch before or during mixing, used as an ingredient of a cementitious mixture to modify its freshly mixed, setting, or hardened properties.

Air-Entraining Admixture. An admixture causing the development of a system of microscopic air bubbles in concrete, mortar, or cementitious material paste during mixing, usually to improve its workability and resistance to damage by freezing and thawing.

Set-Accelerating Admixture. An admixture causing an increase in the rate of hydration of the hydraulic cement and shortens the time of setting, increases the rate of strength development, or both.

Set-Retarding Admixture. An admixture causing a decrease in the rate of hydration of the hydraulic cement and lengthens the time of setting, decreases the rate of strength development, or both.

Water-Reducing Admixture. An admixture either increasing slump of freshly mixed mortar or concrete without increasing water content or maintaining slump with a reduced amount of water, due to factors other than air entrainment.

AGITATION. The process of providing motion in mixed concrete just sufficient to prevent segregation or loss of plasticity.

BLEED WATER. The autogenous flow of water emerging from newly placed concrete, and caused by the settlement of the solid materials within the mass. The relative quantity of mix water that will bleed can be estimated by AASHTO T 158.

CAMBER. For prestressed concrete members, camber is the net upward deflection of an eccentrically prestressed concrete member due to the combined loads, shrinkage, creep, and eccentricity of the prestress force. For non-prestressed members, camber is a deflection intentionally built into a structural element or form to improve appearance or to nullify the deflection of the element under the effects of loads, shrinkage, and creep.

CEMENT. A binding material that sets and hardens by hydration and is capable of doing so underwater, sometimes called hydraulic cements.

CEMENTITIOUS MATERIAL. Hydraulic cements and pozzolans with cementing properties.

CHAMFER. A beveled edge or corner formed into finished concrete.

COMPRESSIVE STRENGTH TEST. The average strength test of concrete, from at least two 6.0 x 12.0 inch or at least three 4.0 x 8.0 inch compressive strength test cylinders sampled according to AASHTO T 141 or ATM 501, cured according to AASHTO R 39 or ATM 506, and tested according to AASHTO T 22 or sampled, cured, and tested to equivalent ASTM test methods. Or the average strength test of grout, from at least three specimens sampled and tested according to ATM 507, AASHTO T 106, or ASTM C 109. Unless otherwise noted, tested at an age of 28 days.

COMPRESSIVE STRENGTH, (f'_c). The measured maximum resistance of a concrete, grout, or mortar specimen to axial compressive loading; expressed as force per unit cross-sectional area; or the specified resistance used in design calculations.

CONCRETE ANCHOR. Cast-in-place or post-installed fastening device installed in the concrete for the purpose of transferring loads to the concrete. See ASTM E2265 for standard terminology.

CONSOLIDATION. The process of inducing a closer arrangement of the solid particles in freshly mixed concrete during placement by the reduction of voids, usually by vibration, rodding, tamping, or some combination of these actions.

CONSTRUCTION JOINT. The surface where two successive placements of concrete meet.

CURING COMPOUND. A liquid applied as a coating to the surface of newly placed concrete to retard the loss of water and, in the case of pigmented compounds, reflects heat to provide an opportunity for the concrete to develop its properties in a favorable temperature and moisture environment.

CURING PERIOD. The length of time in which continuous curing operations are maintained thereby allowing the concrete to properly hydrate and develop its required strength and durability.

CURING. Action taken to maintain moisture and temperature conditions in a freshly placed cementitious mixture to allow hydraulic cement hydration and (if applicable) pozzolanic reactions to occur so the desired properties of the mixture develop.

DURABILITY. The ability of concrete to resist weathering action, chemical attack, abrasion, and other conditions of service.

EVAPORATION RATE REDUCER. A material generating a continuous thin film when spread over water on the surface of fresh concrete to retard the evaporation of bleed water.

FIELD TEST RECORD. A record of compressive strength test results from concrete used on prior projects and produced by the concrete production facility.

FINAL CURING PERIOD. The time period after the concrete achieves final set in which deliberate action is taken, without damaging or marring the concrete surface, to maintain satisfactory moisture content and temperature in concrete.

FINAL SET. Attainment of significant rigidity in which rainfall, foot traffic, and curing materials contacting the concrete surface do not damage or mar the concrete surface and do not alter the properties of the finished surface.

INFORMATIONAL FIELD TEST. A compressive strength test, determined by the Engineer, from field test cylinders cured on the site under temperature and moisture conditions similar to the concrete in the structure; except, the compressive strength test may consist of one 6.0 x 12.0 inch or one 4.0 x 8.0 inch compressive strength test cylinder.

INITIAL CURING PERIOD. The time period between placement and implementation of final curing methods in which deliberate action is taken to reduce the loss of moisture from the surface of the concrete.

INITIAL SET. The first stiffening of concrete.

KEYWAY. A recess or groove in one lift or placement of concrete and filled with concrete of the next lift or grout, giving shear strength to the joint.

LAITANCE. A layer of weak material derived from cementitious material and aggregate fines either: 1) carried by bleeding to the surface or to internal cavities of freshly placed concrete; or 2) separated from the concrete and deposited on the concrete surface or internal cavities during placement of concrete underwater.

MORTAR. A mixture of cementitious material paste and fine aggregate occupying the space between particles of coarse aggregate.

REQUIRED AVERAGE COMPRESSIVE STRENGTH, (F'_{cr}). The 28-day compressive strength, used as the basis for selection of concrete proportions in the mix design process, sufficiently greater than the Specified Compressive Strength to ensure the acceptance criteria are met.

RETEMPER. To add water and remix concrete or mortar to restore workability to a condition in which the mixture is placeable or usable.

ROCK POCKET. A porous, mortar-deficient portion of hardened concrete consisting primarily of coarse aggregate and open voids.

SCREED. To strike off concrete lying beyond the desired plane or shape. A tool for striking off the concrete surface, sometimes referred to as a strikeoff.

SET. The condition reached by a cementitious material paste, mortar, or concrete that has lost plasticity to a degree of stiffening generally stated as the time in hours and minutes required for cementitious material paste to stiffen sufficiently to resist the penetration of a weighted test needle as prescribed by AASHTO T 197,

SPECIFIED COMPRESSIVE STRENGTH, (F'_C). The 28-day compressive strength used in structural design and specified in the Contract documents.

TREMIE. A pipe or tube with a hopper for filling at its upper end through which concrete is deposited.

501-2.01 MATERIALS. Use materials conforming to the following:

1. Cementitious Materials

Portland Cement	Subsection 701-2.01
Blended Hydraulic Cement	Subsection 701-2.02
Fly Ash	Subsection 701-2.04
Ground Granulated Blast-Furnace Slag	Subsection 701-2.05
Silica Fume	Subsection 701-2.06

2. Aggregate Materials

Fine Aggregate	Subsection 703-2.01
Coarse Aggregate	Subsection 703-2.02
Aggregate for Abrasive Finish	Subsection 703-2.14

3. Water, Admixtures and Curing Materials

Curing Materials	Subsection 711-2.01
Chemical Admixtures	Subsection 711-2.02
Water and Ice	Subsection 712-2.01

4. Anchors and Inserts

Concrete Anchor Inserts and Bolts	Subsection 712-2.20
Utiliduct, HDPE	Subsection 706-2.08
Utiliduct, Steel	Section 716
Structural Steel	Section 716
Asphalt Felt	ASTM D226, Type I (No. 15 Asphalt Felt)
Expanded Polyethylene	Subsection 705-2.06

5. Grout and Epoxy

Grout	Subsection 701-2.03
Epoxy Adhesive for Crack Sealing	AASHTO M 235, Type IV, Grade 3
Epoxy Adhesive for Crack Injection	AASHTO M 235, Type IV, Grade 1
Low-Viscosity Resin	Subsection 712-2.19
Epoxy Bonding Agents	AASHTO M235, Type V

501-2.02 COMPOSITION OF MIXTURE - JOB MIX DESIGN. Provide a Job Mix Design, for each required class of concrete and Specified Compressive Strength (f'_c), which meets the requirements of this Subsection and provides workability and consistency so the concrete can be worked readily into the forms and around reinforcement without segregation or bleeding. Determine proportions using the absolute volume method according to ACI 211.1.

1. Water-Cement Ratio and Cementitious Materials. Provide a Job Mix Design meeting the water-cement ratio requirements in Table 501-1.

   Calculate the water-cement ratio based on the total weights of water and cementitious material. The weight of water includes all water as defined in Subsection 501-3.01.2c. The following are considered cementitious materials: Portland cement, blended hydraulic cement, fly ash, ground granulated blast-furnace slag, and silica fume.

   Fly ash, ground granulated blast-furnace slag, silica fume, and combinations of these materials may be used as a substitute for Portland cement provided the quantity meets the limits of Table 501-2 and the total quantity of combined fly ash, ground granulated blast-furnace slag, and silica fume does not exceed 40 percent of the total cementitious material by weight. Do not use Type III Portland cement for cast in place concrete decks and approach slabs.

TABLE 501-1
WATER-CEMENT RATIO REQUIREMENTS

Class of Concrete	Water-Cement Ratio, maximum lbs/lbs
A	0.45
A-A	0.40
P	0.35
DS	0.45

TABLE 501-2
SUPPLEMENTARY CEMENTITIOUS MATERIAL LIMITS

Cementitious Material	Percent of Total Cementitious Material by Weight[1]
	Maximum
Fly Ash	35%
Ground Granulated Blast-Furnace Slag	40%
Silica Fume	10%

[1] The maximum percent includes initial quantities in blended hydraulic cement plus additional supplementary cementations materials.

2. Aggregate Gradations. Provide a Job Mix Design meeting the fine aggregate gradation requirements in Subsection 703-2.01 and the coarse aggregate gradation requirements in Table 501-3. Alternative sizes of course aggregate, as shown in Table 1 of AASHTO M 43, may be used only when approved in writing. Combined aggregate gradations, shown in Table 1 of ATM 530, may be used for packing density mix designs (e.g. Shilstone) on the condition that the nominal maximum aggregate size specified remains unchanged and the concrete is proportioned according to ATM 530.

TABLE 501-3
COARSE AGGREGATE GRADATION REQUIREMENTS

Class of Concrete	Coarse Aggregate Size Number
	AASHTO M 43
A	No. 57 or 67
A-A	No. 57 or 67
P	No. 67
DS	No. 7 or 8

3. Air Content. Provide a job mix design meeting the requirements of Table 501-4

TABLE 501-4
AIR CONTENT REQUIREMENTS

Class of Concrete	Air Content
A	6.0% ±0.5%
A-A	6.0% ±0.5%
P	4.0% ±0.5%[1] and Super Air Meter (SAM) number ≤0.20[1]
DS	Not required

[1]*Not required for web and bottom flange of precast, prestressed decked bulb-tee girders.*

4. Slump. Provide a Job Mix Design meeting the slump requirements in Table 501-5.

5. Chloride Ion Content. Provide Job Mix Designs with water-soluble chloride ion contents determined by percent weight of cementitious material according to ASTM C1218 for the concrete mixture aged between 28 and 42 days. For Class P and Class A-A Concrete the limit is 0.06 percent. For Class A and DS concrete the limit is 0.08 percent.

6. Required Averaged Compressive Strength. Provide a Job Mix Design meeting a Required Average Compressive Strength (f'_{cr}) established from either the Empirical Method or the Statistical Method.

If the Specified Compressive Strength (f'_c) is not designated on the Plans, use a Specified Compressive Strength listed in Table 501-6.

TABLE 501-5
SLUMP REQUIREMENTS

Condition	Slump
Concrete without a water-reducing admixture	4" max.
Concrete with a Type A, D, or E water-reducing admixture	6" max.
Concrete with a Type F or G high-range water-reducing admixture	9" max.
Class DS concrete, wet-shaft process	7" min. 9" max.
Class DS concrete, dry-shaft process	6" min. 9" max.

TABLE 501-6
COMPRESSIVE STRENGTH REQUIREMENTS

Class of Concrete	Specified Compressive Strength (f'_c) *(psi)*
A	4000
A-A	5000
P	8000
DS	4000

a. Empirical Method. Establish the Required Average Compressive Strength from the following equations:

$f'_{cr} = f'_c + 1200$ for $f'_c \leq 5000$ psi
$f'_{cr} = 1.1f'c + 700$ for $f'_c > 5000$ psi

Where: f'_{cr} = Required Average Compressive Strength, psi
f'_c = Specified Compressive Strength, psi

b. Statistical Method. If the production facility has field test records of compressive strength tests, establish the Required Average Compressive Strength based on the calculated standard deviation of the field test records and using the largest result of the following equations:

$f'_{cr} = f'_c + 1.34ks$ for all f'_c
or,
$f'_{cr} = f'_c + 2.33ks – 500$ for $f'_c \leq 5000$ psi,
$f'_{cr} = 0.90f'_c + 2.33ks$ for $f'_c > 5000$ psi,

Where: f'_{cr} = Required Average Compressive Strength, psi

f'_c = Specified Compressive Strength, psi
k = 1.16 if 15 total tests are considered
1.08 if 20 total tests are considered

1.03 if 25 total tests are considered
1.00 if 30 or more total tests are considered
s = standard deviation, psi

Use linear interpolation to determine *k* for intermediate number of tests.

Use field test records performed within the past 12 months and spanning a period of more than 60 days for a class of concrete within 1000 psi of the Specified Compressive Strength. Use field test records from concrete produced at the production facility, which represent materials, quality-control procedures, and climatic conditions similar to those expected in the work. Do not use field test records from concrete in which acceptance requirements for materials or concrete proportions were more closely restricted than those in the proposed work. Use field test records meeting one of the following:

(1) One Group of Field Test Records. Use field test records representing a group of at least 15 consecutive compressive strength tests in which all concrete was produced using the same mixture proportions. Calculate the standard deviation using the following equation:

$$s = \sqrt{\frac{\sum_{i=1}^{n}(X_i-\bar{X})^2}{(n-1)}}$$

Where: s = standard deviation, psi

n = number of compressive strength test results considered
X_i = individual compressive strength test result, psi
$\bar{X}$ = average of *n* compressive strength test results, psi

(2) Two Groups of Field Test Records. Use field test records representing two groups of consecutive compressive strength tests totaling at least 30 tests. Ensure each group is comprised of at least 10 consecutive compressive strength tests, and all concrete in each group was produced using the same mixture proportions. Calculate the standard deviation using the following equation:

$$s = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{(n_1+n_2-2)}}$$

Where: s = standard deviation for the two groups combined, psi

s_1, s_2 = standard deviation for groups 1 and 2, respectively, calculated according to Subsection 501-2.02.6.b.(1), psi
n_1, n_2 = number of test results in groups 1 and 2, respectively

7. Job Mix Design Verification.

a. Required Average Compressive Strength. Verify the Job Mix Design satisfies the Required Average Compressive Strength by meeting at least one of the following requirements:

(1) Field Test Records. Use field test records that:

(a) use materials of the same brand and type and from the same manufacturer as the materials used in the work;

(b) were from concrete produced at the production facility;

(c) use quality-control procedures, and had climatic conditions similar to those expected in the work; and

(d) encompass a period of not less than 60 days.

Do not use field test records from concrete in which acceptance requirements for materials or concrete proportions were more closely restricted than those in the proposed work.

For a single group of at least 10 consecutive compressive strength tests for one mixture, verify the average of the compressive strength tests equals or exceeds the Required Average Compressive Strength.

For two groups, each having at least 10 consecutive compressive strength tests, for two mixtures representing classes of concrete within 1000 psi of the Specified Compressive Strength, plot the average strength of each group versus the water-cementitious material ratio of the corresponding mixture proportions and interpolate between them to determine the compressive strength corresponding to the water-cementitious material ratio of the Job Mix Design. Verify the interpolated compressive strength equals or exceeds the Required Average Compressive Strength.

(2) Laboratory Trial Mixtures. Use materials and material combinations for trial mixtures of the same brand and type and from the same manufacturer as the materials used in the work.

Record the temperature of the freshly mixed concrete according to ASTM C1064 and ensure the temperature is within 10°F of the intended maximum temperature of the concrete as mixed and delivered.

For each trial mixture, make and cure at least two 6.0 x 12.0 inch or at least three 4.0 x 8.0 inch compressive strength test cylinders for each test age according to AASHTO R 39. Test for compressive strength according to AASHTO T 22 at test ages of 3, 7 and 28 days.

For a single trial mixture, verify the compressive strength test equals or exceeds the Required Average Compressive Strength.

For a group of trial mixtures, make at least three trial mixtures with each mixture having a different cementitious material content. Select water-cement ratios producing a range of compressive strengths encompassing the Required Average Compressive Strength. From the results of the 28-day compressive strength tests, plot a curve showing the relationship between water-cement ratio and compressive strength. From the curve of water-cement ratio versus compressive strength, determine the compressive strength corresponding to the water-cementitious material ratio of the Job Mix Design. Verify the compressive strength equals or exceeds the Required Average Compressive Strength.

b. Flowability Requirements for Class DS Concrete (Wet-Shaft Process). Verify the Job Mix Design satisfies the concrete flowability requirements of Subsection 501-3.05.6.a.(1.) Develop a slump loss table showing the slump at 1 hour intervals since batching until the concrete takes initial set.

c. Plasticity Requirements for Class DS Concrete (Dry-Shaft Process). Verify the Job Mix Design satisfies the concrete plasticity requirements of Subsection 501-3.05.6.b.(1.) Ensure initial set occurs after placement operations are complete.

8. Job Mix Design Submittal. Submit a written mix design, signed and sealed by a Professional Engineer registered in the State of Alaska, for each specified class of concrete and for each Specified Compressive Strength, to the Engineer at least 45 days prior to scheduled production. Submit the mix design on Form 25D-203. Include the following:

   a. Job Mix Design Proportions and Test Results. Submit concrete mixture proportions per cubic yard and test results for the proposed Job Mix Design. Include the following information:

      (1) Weights of cementitious materials

      (2) Weights of aggregates in saturated surface dry condition

      (3) Volume or weight dosage range of each admixture.

      (4) Weight of water

      (5) Water-cement ratio

      (6) Percentage of air by volume

      (7) Total water soluble chloride ion content

      (8) Wet unit weight

      (9) Expected slump

      (10) Expected 3, 7 and 28-day compressive strength (Include 1-day compressive strength for Class P concrete.)

      (11) Slump loss table for Class DS concrete (if applicable)

      (12) Time of initial set for Class DS concrete (if applicable) and for other classes where extending Time for Placement (Subsection 501-3.02.2) will be requested

      (13) Compressive strength test results showing the Required Average Compressive Strength is met or exceeded.

   b. Materials Documentation. Submit the following:

      (1) For each cementitious material, include:

         (a) Type/Class

         (b) Brand

         (c) Producer

         (d) Plant location

         (e) Certified test reports confirming the cementitious material meets these Specifications.

      (2) For aggregates, include:

         (a) Pit or quarry location(s)

         (b) Bulk dry specific gravity, bulk saturated surface dry specific gravity, and apparent specific gravity

(c) Absorption values

(d) AASHTO size number for coarse aggregates

(e) Gradations for aggregates

(3) For each admixture, include:

(a) Type

(b) Manufacturer

(c) Manufacturer's product data sheet giving the procedure for admixture use and confirming the admixture meets these Specifications.

(d) The batching process step and mixing instructions when each admixture is added.

(e) Manufacture's certificates demonstrating admixture compatibility and manufacture's recommended dosage range.

(4) Include the source of supply for water and ice.

c. Materials Samples. The Engineer may require samples of aggregate, cementitious materials, and admixtures to verify the mix design. If requested, furnish representative samples (330 pounds each) of both coarse and fine aggregates, 94 pounds of each cementitious material, and one-quart of each admixture to allow for Job Mix Design verification testing. Ensure the Department receives these samples at least 45 days before the mixture's scheduled production for the project.

d. Basis of Required Average Compressive Strength. If the Statistical Method is used, submit the following for each field test record:

(1) Compressive strength test results of the tested concrete.

(2) Standard test method used for determining compressive strength.

(3) Date the compressive strength tests were performed

(4) Aggregate source used for the tested concrete.

(5) Specified strength of the tested concrete.

(6) Batched weights of constituent materials or the producer's mix design identification number for the concrete used for each compressive strength test.

e. Documentation of Required Average Compressive Strength. Submit documentation indicating the proposed concrete proportions will produce an average compressive strength equal to or greater than the Required Average Compressive Strength meeting one of the following requirements:

(1) Field Test Records. If field test records were used to verify the Required Average Compressive Strength, submit the following for each field test record:

(a) Compressive strength test results of the tested concrete.

(b) Standard test method used for determining compressive strength.

(c) Date the compressive strength tests were performed

(d) Aggregate source used for the tested concrete.

(e) Specified strength of the tested concrete.

(f) Batched weights of constituent materials or the producer's mix design identification number for the concrete used for each compressive strength test.

(2) Trial Mixtures. If a single or group of trial mixtures were used to verify the Required Average Compressive Strength, submit concrete mixture proportions per cubic yard and test results for each trial mixture. Include the following information:

(a) Weights of cementitious materials

(b) Weight of aggregates in saturated surface dry condition

(c) Volume or weight of each admixture

(d) Weight of water

(e) Water-cement ratio

(f) 3-day, 7-day, and 28-day compressive strength test results (Include 1-day compressive strength test results for Class P concrete)

(g) Percentage of air by volume

(h) Wet unit weight

(i) Slump

9. Approval. Obtain the Engineer's approval of each mix design prior to use. Approval of the Job Mix Design does not constitute acceptance of produced concrete and will not obligate the Department to accept or pay for concrete that does not meet the mix acceptance requirements of Subsection 501-3.03.

10. Changes. Provide a new Job Mix Design and obtain the Engineer's approval according to Subsection 501-2.02 for a change in approved Job Mix Design proportions, materials, aggregate gradation, aggregate quality, or admixtures.

CONSTRUCTION REQUIREMENTS

501-3.01 BATCHING. Batch concrete, in proportioned amounts, according to the approved Job Mix Design.

1. Certification and Calibration. Batch concrete using a certified batch plant.

Use concrete batch plants certified according to the requirements of a. or b. of this subsection for cast-in-place concrete, and for precast or prestressed concrete where the concrete is supplied from a batch plant that is not located at the casting facility.

Use concrete batch plants certified according to the requirements of a., b., or c. of this subsection for precast and prestressed concrete where the concrete is supplied from a batch plant located at the casting facility.

Use concrete batch plants certified according to the requirements of a., b., or d. of this subsection for non-prestressed precast concrete where the concrete is supplied from a batch plant located at the casting facility.

Use and maintain calibrated weighing and measuring devices for concrete batching and for adding material on-site, meeting the requirements of this Subsection..

a. Plant Certification by the National Ready Mix Concrete Association. Certification may be obtained from the National Ready Mix Concrete Association (NRMCA). Information concerning NRMCA certification may be obtained from the NRMCA, 900 Spring Street, Silver Springs, MD 20910, or online at www.nrmca.org. The NRMCA certification is valid for 2 years from the date of inspection.

b. Plant Certification by a Professional Engineer. Certification may be obtained by independent inspection and evaluation by a Professional Engineer:

   (1) registered in the State of Alaska,

   (2) qualified by NRMCA for concrete plant certification, and

   (3) who uses and completes the NRMCA Plant Certification Check List.

   Correct deficiencies to the satisfaction of the Professional Engineer. The Professional Engineer must sign and seal the completed NRMCA Plant Certification Check List certifying all applicable items have been met. The certification by a Professional Engineer is valid for 2 years from the date of inspection.

c. Plant Certification by Precast/Prestressed Concrete Institute. Certification may be obtained from the Precast/Prestressed Concrete Institute (PCI) for fabrication of precast and prestressed concrete if the batching plant is located at the concrete casting facility. Information concerning PCI certification may be obtained from the Precast/Prestressed Concrete Institute, 200 W. Adams St. #2100, Chicago, IL 60606, or online at www.pci.org.

d. Plant Certification by National Precast Association. Certification may be obtained from the National Precast Association (NPCA) for fabrication of non-prestresed precast concrete if the batching plant is located at the concrete casting facility. Information concerning NPCA certification may be obtained from the National Precast Concrete Association, 1320 City Center Drive, Suite 200, Carmel, IN 46032, or on-line at http://precast.org.

e. Calibration of Weighing and Measuring Devices. Use weighing and measuring devices meeting the requirements of the NRMCA *Plant Inspector's Guide*, calibrated by a commercial scale service, using equipment traceable to the Alaska State Standards of Weight and Measure as adopted by AS 45.75.020.

   Verify calibration of all weighing and measuring devices used in concrete production:

   (1) no more than 6 months before commencing concrete work,

   (2) after each relocation,

   (3) at least once every 6 months until the work is completed, and

   (4) when, in the opinion of the Engineer, the accuracy or adequacy of the device is in question.

f. Certification and Calibration Submittals. Submit documentation required for plant certification and weighing and measuring device calibration meeting the requirements of this Subsection before commencing concrete work.

If the Plant Certification is by NRMCA, PCI or NPCA submit a copy of the Certificate of Conformance. Include the most recent date of inspection and the calibrated accuracy for each weighing and measuring device.

If the Plant Certification is by a Professional Engineer, submit a copy of the signed and sealed completed NRMCA Plant Certification Check List and calibration and/or verification worksheets for each weighing and measuring device. Include the most recent date of inspection and the calibrated accuracy for each weighing and measuring device.

2. Measuring Materials.

c. Cementitious Materials. Use cementitious materials of the same brand, type, and from the same plant of manufacture as the cementitious materials used to verify the approved Job Mix Design according to Subsection 501-2.02.7. Ensure the quantity of the Portland cement and the cumulative quantity of Portland cement plus other cementitious materials is proportioned in amounts required by the Job Mix Design and meets the mix acceptance requirements.

Measure cementitious materials by weight. When other cementitious materials, including fly ash, ground granulated blast-furnace slag, or silica fume, are specified in the concrete proportions, the material may be cumulatively weighed with the Portland cement. Weigh cementitious materials on a weighing device that is separate and distinct from those used for other materials. Weigh the Portland cement before other cementitious materials.

Portland cement is permitted to be measured in bags of standard weight (94 pounds). Do not use a fraction of a bag of cementitious materials unless its weight has been determined by calibrated weighting devices.

d. Aggregates. Use aggregates from the same sources and gradations as the aggregates used in the trial mixtures or field test records used to verify the required average compressive strength. Ensure the quantity of the aggregates is proportioned in amounts required by the Job Mix Design.

Measure aggregates by weight. Establish batch weight measurements on dry materials and adjust the actual scaled weight for the required dry materials weight plus the total weight of moisture, both absorbed and surface, contained in the aggregate.

e. Water. The total quantity of mixing water includes water added to the batch, ice added to the batch, and water occurring as surface moisture on the aggregates. Measure the added water by weight or volume. Measure added ice by weight. Discharge the flush water (wash water) prior to loading the next batch of concrete. Do not use flush water (wash water) as a portion of the mixing water.

f. Admixtures. Use concrete admixtures according to the manufacturer's instructions and as approved in the Job Mix Design. Measure powdered admixtures by weight. Measure paste or liquid admixtures by weight or volume.

3. Materials Storage and Handling.

a. Cementitious Materials. Keep cementitious materials dry and free from contaminants. Do not use cementitious materials which have become partially hydrated or which contain lumps of caked cementitious material.

b. Aggregates. Do not allow segregation of the aggregates or contamination with foreign materials. Separate aggregate to prevent intermixing of specified gradations.

Drain aggregate so the moisture content is uniform and is accounted for during the batching process.

Do not use aggregates that contain ice, are frozen, or have been heated directly by combustible materials. Use direct steam, steam-coil, or water-coil heating when heating aggregates. When direct steam is used to thaw aggregate piles, drain aggregates to uniform moisture content before batching.

c. Admixtures. Protect admixtures from contamination, evaporation, or damage. Store admixtures according to the manufacturer's instructions. Protect liquid admixtures from freezing and from temperature changes affecting the admixture's performance.

501-3.02 MIXING AND DELIVERY. Mix concrete, in proportioned amounts, according to the approved Job Mix Design. Mix ingredients into a thoroughly combined and uniform mixture. Do not retemper concrete mixtures. Do not use concrete that has developed initial set prior to placement

1. Addition of Water. Additional water may be added on-site provided the following are met:

   a. The volume of concrete in the mixer after the additional water is added does not exceed the maximum mixing capacity.

   b. The water measuring device is calibrated according to Subsection 501-3.01.1.e.

   c. The total quantity of mixing water, including water added according to Subsection 501-3.02.1 is within the proportion requirements in Subsection 501-3.03.4. Account for the actual volume of concrete remaining in the mixer.

   d. Water additions are completed within 30 minutes after the introduction of the mixing water to the cementitious materials.

   The addition of water is not prohibited from being several distinct additions of water. Inject additional water into the mixer under pressure and direction of flow to allow for proper distribution within the mixer. Provide additional mixing to ensure a thoroughly combined and uniform mixture is attained.

2. Time for Placement. Discharge the concrete within 1.5 hours of the following:

   a. after adding the mixing water to the cementitious materials, and

   b. after adding the cementitious materials to the aggregates.

   The time to complete discharging the concrete may be extended 2 minutes for every degree the concrete temperature is below 70°F, measured at the point of discharge, to a maximum total time of 2 hours. The Engineer may extend the Time for Placement if Time of Initial Set information is provided in the approved Job Mix Design submittal.

501-3.03 EVALUATION OF MATERIAL FOR ACCEPTANCE. All concrete in the work will be evaluated for acceptance.

The Engineer may reject a batch or load of concrete failing to meet the requirements for proportions, slump, total air content, or temperature. Prior to sampling, the Engineer may reject a batch or load of concrete that appears defective in composition.

1. Sampling. The Department will take all samples from the delivery truck discharge.

   Provide adequate and representative fresh concrete for sampling and testing as directed by the Engineer. The Engineer will sample the concrete after a minimum of 1/2 cubic yard of concrete has discharged from the delivery truck. Do not add water or admixtures to the mix after the concrete has been sampled for acceptance testing.

The Engineer will determine aggregate gradation for acceptance based on random samples taken at the plant.

2. Sampling and Test Methods. The Department will sample and test according to the following:

ATM 301	Sampling of Aggregates
ATM 304	Sieve Analysis of Fine and Coarse Aggregates, and Materials Finer Than No. 200 Sieve in Mineral Aggregate by Washing
ATM 501	Sampling Freshly Mixed Concrete
ATM 502	Temperature of Freshly Mixed Portland Cement Concrete
ATM 503	Slump of Hydraulic Cement Concrete
ATM 504	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ATM 505	Air Content of Freshly Mixed Concrete by the Pressure Method
ATM 506	Method of Making and Curing Concrete Test Specimens in the Field
AASHTO T 231	Capping Cylindrical Concrete Specimens
AASHTO T 22	Compressive Strength of Cylindrical Concrete Specimens
ATM 507	Field Sampling and Fabrication of 50-mm (2-in) Cube Specimens using Grout (Non-Shrink) and or Mortar

3. Batch Tickets. Provide a printed ticket with each batch of concrete delivered to the project. Include the following information:

   a. Manufacturer plant (batching facility)

   b. Department contract number

   c. Date

   d. Batch number

   e. Time batched

   f. Time batch plant discharge is completed

   g. Truck number

   h. Quantity (quantity batched this load)

   i. Type of concrete by class and producer's mix design identification number

   j. Weights of every type of cementitious material

k. Weights of each aggregate type

l. Weight or volume of each admixture

m. Weight or volume of water added at the plant

n. Total moisture and absorption percentage for each aggregate

o. Volume or weight of any water added after batching

p. Signature of Contractor's representative, affirming the accuracy of the information provided

4. Proportion Requirements. Meet the proportion requirements of the approved Job Mix Design within the proportion tolerances:

a.	Total Cementitious Material, weight	±1%
b.	Aggregates, weight	±2%
c.	Total Water, weight or volume	±3%

d. Admixtures, weight or volume, according to the dosage range in the approved Job Mix Design.

If the total cementitious material weight is made up of different components, keep the component weights within the following tolerances:

(1)	Portland Cement	±1%
(2)	Fly Ash	±5%
(3)	Ground Granulated Blast-Furnace Slag	±5%
(4)	Silica Fume	±10%

Proportion tolerance will be calculated using consistent units for M_{JMD} and M_A as follows:

$$P = \frac{(M_A - M_{JMD})}{M_{JMD}} \cdot 100$$

Where: P = Proportion tolerance, percentage

M_{JMD} = Weight or Volume of component according the approved Job Mix Design

M_A = Weight or Volume of actual batched component

5. Slump Requirements. Provide concrete with slump within 1 inch of target mix design slump.

6. Total Air Content Requirements. Provide concrete with total air content within +/-1.5 percent of the approved Job Mix Design at delivery time.

7. Temperature Requirements. Unless otherwise noted, ensure the concrete temperature is between 50°F and 90°F when placed in the forms.

8. Compressive Strength Requirements. Meet the strength requirements for the Specified Compressive Strength. Concrete of the approved Job Mix Design will be considered to meet

the Specified Compressive Strength requirements when both of the following conditions are met:

a. The lowest individual compressive strength test result is not less than the Specified Compressive Strength minus 500 psi, or 90.0 percent of the Specified Compressive Strength, whichever is lower.

b. The lowest averaged result of three consecutive compressive strength tests meets or exceeds the Specified Compressive Strength.

501-3.04 PREPARATION FOR CONCRETE PLACEMENT. Allow time for inspection prior to concrete placement.

Remove debris, concrete splatter, oil, paint, and other foreign substances from the surfaces of forms and reinforcing steel, against which the concrete is to be placed.

Remove soil and other debris from pipe piles to the bottom of concrete elevation shown on the Plan.

Prepare foundations according to Section 205.

Moisten foundations and forms with water before the concrete is placed. Remove standing water on the foundation, in the pile, and in the forms before placing concrete.

501-3.05 PLACING CONCRETE. Do not begin concrete placement without the Engineer's authorization. Place concrete conforming to the approved Job Mix Design. Place and consolidate each layer within 30 minutes and before the preceding layer takes initial set.

If concrete placement operations are delayed so initial set occurs before placement of the succeeding section or layer, place a joint according to Subsection 501-3.11. The resulting joint will be considered a construction joint. If, in the opinion of the Engineer, the location of the construction joint will affect the strength or durability of the concrete, the Engineer may reject the concrete, the structure, or a portion of the structure.

Place concrete in a sequence to obtain a well-consolidated concrete and to prevent cracks. Place concrete as near as possible to final position. Prevent segregation of the mix, displacement of reinforcing steel, and spattering of mortar on the reinforcing steel and forms above the elevation of the layer being placed. Do not deposit a large quantity of concrete at any point and run or work the concrete along the forms. Do not allow concrete to slide down the sides of the forms.

Regulate concrete placement so the pressures do not exceed the load capacity of the forms. Limit layer thickness to no more than 2.5 feet, or the capacity of the vibrators to consolidate and merge the concrete with the previous layer, whichever is less.

Unless otherwise specified, use a tremie, tube, or other such device to limit the free-fall height to less than 5.0 feet when placing operations would otherwise allow concrete to drop more than 5.0 feet. When using a tremie to place concrete, use a watertight tremie with an inside diameter of at least 10 inches. When using a concrete pump to place concrete, use concrete pump lines that are watertight with an inside diameter of at least 5 inches.

Concrete placed in piles or in dry-shaft process may free-fall more than 5 feet without use of tremie, tube or other such device, provided the falling concrete does not contact rebar or other objects before reaching the top surface of the placed concrete. When free-falling concrete more than 5 feet, use a drop chute at least 3 feet long.

After initial set, prevent movement of forms, projecting ends of reinforcing steel, and other embedded items.

Do not use aluminum components in contact with fresh concrete.

Place concrete in the superstructure only after substructure forms are removed and the substructure has been inspected.

1. Concrete Placement Plan. Submit a concrete placement plan to the Engineer, for concrete decks and drilled shafts. Submit each concrete placement plan to the Engineer, at least 30 days before placing concrete. Do not place concrete until after the Engineer has approved the plan. Include the following in each concrete placement plan:

   a. concrete placement sequence,

   b. schedule of concrete placement and curing,

   c. estimated concrete volume of each section,

   d. placement rate and duration,

   e. description of finishing equipment,

   f. placement procedure,

   g. name of the concrete foreman,

   h. curing materials, equipment, and procedure.

2. Pre-concreting Conference. Hold a pre-concreting conference for concrete decks and Drilled Shafts, at least 5 working days before placing concrete. Include the Engineer, the Superintendent and foremen in charge of placing reinforcing steel, placing concrete, finishing concrete, and curing operations. Discuss construction procedures, personnel, and equipment to be used.

   If the project includes more than one concrete placement operation, and if key personnel change between concreting operations, hold additional conferences to include replacement personnel before placing successive concrete sections.

3. Pumping Concrete. Use a pump producing a continuous stream of concrete without air pockets. When pumping is completed, the concrete remaining in the pipeline, if used, must eject without contaminating the concrete or separating the ingredients. Discard concrete contaminated by priming or cleaning the pump.

4. Conveying Concrete. Concrete may be conveyed if the equipment will handle the class of concrete, with the slump and air content specified and without segregation of the aggregate, and no equipment vibrations will damage freshly placed concrete or reinforcing steel. Limit the length of conveyor belts to prevent aggregate segregation or 300 feet, whichever is less. Cover the belt to protect the concrete from heat, evaporation, precipitation, or when the Engineer determines precipitation is likely.

5. Piles. Do not place concrete underwater in piles.

6. Drilled Shaft Foundations. Place concrete following either the wet-shaft process or dry-shaft process, as applicable.

   The dry-shaft process may be used where the ground water level and soil and rock conditions are suitable to permit construction of the shaft in a relatively dry excavation, and where the sides and bottom of the shaft can be visually inspected by the Engineer prior to placing the concrete. Relatively dry excavation conditions exist when excavation fluids have been removed from the shaft and the rate of water intrusion is less than 6 inches of water

accumulating above the base in a 1-hour period without pumping or other methods to drain or remove water. Suitable soil and rock conditions exist when the sides and bottom of the hole remain stable without caving, sloughing, or swelling between completion of excavation and concrete placement; and loose material and water can be satisfactorily removed prior to inspection and concrete placement. Do not begin concrete placement if there is more than 1 inch of water in the bottom of the shaft excavation. Use wet-shaft process if the requirements for dry-shaft process cannot be satisfied.

Provide process control testing during concrete placement. Test slump and air content before placing each batch of concrete in the drilled shaft. Perform sampling and testing according to Subsection 501-3.03.2 using a WAQTC qualified concrete testing technician or ACI certified concrete field testing technician. Test every batch of concrete before placement. Record the time when each sample is collected. Submit test results in writing to the Engineer immediately after completing each test.

a. Wet-Shaft Process. Place concrete using a tremie or concrete pump. Place concrete continuously until good quality concrete, as determined by the Engineer, is evident at top of the shaft or nearest construction joint. Good quality concrete is considered concrete of the same consistency, appearance, and quality as the concrete being delivered and meeting the applicable mix acceptance requirements. Remove a sufficient volume of concrete to ensure elimination of contaminated concrete at the top of shaft before continuing with subsequent construction operations.

   Remove concrete laitance during or immediately after concrete placement operations have ended.

   Do not allow water, fluids, drilling aids, or concrete from the top of the shaft to enter streams or other waterways.

   Construct the discharge end of the tremie or pump line to prevent water intrusion and permit the free flow of concrete during concrete placement. Use caps, bottom plates, pigs, or other such devices inserted into or attached to discharge pipe to separate the concrete from the excavation fluid during initial charging of the discharge pipe. Ensure the discharge pipe has sufficient length and weight to rest on the shaft base before starting concrete placement.

   When using a tremie, provide adequate support so the tremie can be raised to increase the discharge of concrete and lowered to reduce the discharge of concrete. Do not shake, vibrate, or rapidly raise or lower the tremie to increase the discharge of the concrete.

   Maintain a positive head of concrete inside the tremie or pump line relative to the excavation fluid level. Position the discharge orifice within one pipe diameter of the shaft base. Do not re-position the discharge pipe until the orifice is at least 8 feet below the concrete surface. Maintain at least 8 feet of concrete above the discharge orifice during concrete placement. Monitor the concrete level during placement to ensure the tremie or pump line discharge orifice remains at least 8 feet below the concrete surface throughout placement.

   If the discharge orifice rises above the concrete surface before concrete placement is complete, the shaft will be considered defective. Immediately terminate concrete placement operations and notify the Engineer.

   (1) Concrete Flowability Requirements. Ensure concrete placed in the shaft remains flowable throughout placement operations by maintaining a slump of at least 6 inches until placement is completed. Collect samples from the first batch of concrete. Test slump from the first batch of concrete at the beginning of the concrete placement

operations and immediately after concrete placement operations are complete. Record the time when samples are collected and when tests are performed. Submit test results in writing to the Engineer immediately after completing each test.

b. Dry-Shaft Process. Place concrete continuously until concrete is evident at top of the shaft or nearest construction joint. Concrete may be permitted to free-fall into place if the concrete does not contact the sides of the shaft, reinforcing steel, or other objects while free falling.

Remove concrete laitance during or immediately after concrete placement operations have ended.

(1) Concrete Plasticity Requirements. Ensure concrete placed in the shaft remains plastic throughout placement operations by completing placement operations before initial set occurs.

7. Concrete Decks and Approach Slabs. Before placing concrete, operate the finishing machine over the entire length of the deck to check screed deflection, reinforcing steel clearance, and concrete thickness.

Limit the rate of placing concrete to what can be finished before initial set.

a. Placement Sequence. Place the concrete deck in the sequence shown on the Plans. The Engineer may approve a revised placement sequence for casting the concrete deck continuously from one end to the other provided the following:

(1) Stockpile the materials necessary to complete the placement and have the equipment, incidentals, and workers on the site before beginning concrete placement operations.

(2) Ensure the continuous concrete placement and finishing operation proceeds at a minimum rate of 30 feet per hour, measured longitudinally along the axis of the span.

(3) The Engineer determines the revised placement sequence will not reduce the stability during construction and will not reduce the quality, capacity, or durability of the completed structure.

If the Engineer approves the proposal for a continuous concrete placement operation, the Department will observe and evaluate performance to the first planned construction joint in the sequence. At this point, the Engineer may authorize you to proceed with the continuous concrete placement operation or suspend the placement and install a construction joint. The Engineer's decision will be based on whether the concrete can be produced, delivered, and finished at a continuous rate permitting the structure to accommodate final dead load deflections while the concrete is plastic.

If the Engineer suspends the continuous concrete placement operations after the first sequential placement, submit modifications for improving the continuous concrete placement operations, beginning at the other end of the deck. If a second attempt at continuous concrete placement is authorized, the placement will be evaluated and allowed or terminated based on the same criteria as the first sequential placement.

If the Engineer suspends the continuous concrete placement operation after the second attempt, additional attempts will not be permitted. Follow the deck placing sequence shown on the Plans.

501-3.06 CONSOLIDATION OF CONCRETE. Consolidate concrete to make a dense homogeneous mass free of voids and rock pockets. Consolidate each layer to leave a compact,

dense, and impervious concrete with smooth faces on exposed surfaces with no visible line of separation between adjoining layers.

Consolidate concrete, except underwater or other exempted placements, by mechanical vibration at the point of deposit. Use vibrators capable of visibly affecting concrete with a 1-inch slump for a distance of at least 18 inches from the vibrator.

Use vibrators and regulate placement in order to consolidate the fresh concrete within 15 minutes of placement and before initial set. Effectively vibrate the full depth of each layer.

For immersion-type vibrators, insert vibrators vertically to a depth penetrating into the previous layer. Withdraw vibrators slowly to avoid segregation or grout pockets. Vibrate in a uniform pattern spaced less than 1.5 times the radius of visible effectiveness.

Avoid vibration of initially set layers and reinforcing steel below the succeeding placement. Do not hold vibrators against reinforcing steel or use them to flow or spread the concrete into place. Manipulate vibrators to produce concrete free of voids, with proper texture on exposed faces, and maximum consolidation. Do not allow the concrete to segregate, form pools of mortar, or form laitance on the surface.

When immersion-type vibrators are used to consolidate concrete around epoxy-coated reinforcing steel, use rubber or nonmetallic vibrator heads that will not damage epoxy coatings.

Concrete may be placed directly into drilled shaft foundations and piles without mechanical vibration; except, vibrate the top 5 feet of concrete. For drilled shaft foundations, consolidate the top 5 feet of concrete after good quality concrete is evident at the top of the shaft and after water, slurry, drilling aids, and other materials other than concrete have been removed.

501-3.07 FINISHING CONCRETE SURFACES. After the concrete is consolidated and prior to the application of curing materials, strike off unformed concrete surfaces to the required elevation and slope. Finish the surface by floating the surface to remove local irregularities and leave sufficient mortar to seal the concrete surface. Do not use mortar topping for concrete surfaces. Do not use aluminum finishing equipment.

Complete initial floating operations before bleed water or excess moisture is present on the surface and before the concrete takes initial set. Complete final finishing before final set occurs. Do not use finishing aids or additional water to assist in finishing concrete surfaces. Do not finish concrete surfaces if bleed water, excess moisture, or curing materials are present.

Provide formed concrete surfaces with an ordinary finish unless otherwise noted.

1. Ordinary Finish. An ordinary finish is the finish left on a surface after removing the forms, filling the holes left by the form ties, and repairing defects. Ensure the surface is true and even and free from rock pockets and depressions or projections.

   Immediately after removing the forms, remove the metal devices holding the forms in place and passing through the body of the concrete, or cut them back at least 1 inch beneath the surface of the concrete. Remove fins of mortar and irregularities caused by form joints.

   Patch cavities produced by form ties, depressions, holes, and voids greater than 1/4 inch. Fill the cavity with stiff mortar composed of one part of Portland cement to two parts of fine aggregate. Proportion the mortar by loose volume with only enough water to form a small ball when squeezed gently by hand. Clean the cavity and saturate the concrete with water before filling the cavity. Thoroughly tamp the mixture into place. Float the surface of the mortar before initial set to make the surface neat in appearance. Cure the patch according to Subsection 501-3.08.

Do not repair concrete with rock pockets, cracks, or other defects until the concrete is inspected by the Engineer. Concrete repaired prior to inspection by the Engineer may be rejected. If, in the opinion of the Engineer, the defect will affect the strength or durability of the concrete, the Engineer may reject the concrete, the structure, or portion of the structure. If the defect is greater than 3/4 inch in depth, submit a repair plan including complete details of the method, materials, and equipment proposed for use in repairing the concrete. Obtain the Engineer's approval of the repair plan before repairing the defect. A repair plan is not required if the defect is less than 3/4 inch in depth.

Repair broken corners and edges, rock pockets, and other defects. If the defect is greater than 3/4 inch in depth, repair the defect according to the approved repair plan. If the defect is less than 3/4 inch in depth, chip away coarse or broken material according to Subsection 501-3.16 to obtain a dense, uniform surface of concrete exposing solid coarse aggregate. Cut feathered edges to form faces perpendicular to the surface. Apply an epoxy bonding agent to the concrete mating surfaces according the manufacturer's instructions. Patch the repaired area with stiff mortar composed of one part of Portland cement to two parts of fine aggregate. Proportion the mortar by loose volume with only enough water to form a small ball when squeezed gently by hand.

Perform repairs prior to releasing falsework, prestressing, or applying additional loads to the concrete.

2. Rubbed Finish. Provide a rubbed finish at locations shown on the Plans. When forms can be removed, wet the surface and then rub with a wooden float until irregularities and form marks are removed and the surface is covered with a lather composed of cement and water. A thin grout composed of one part Portland cement and one part fine aggregate may be used. Allow this lather to set for at least 5 days. Then, smooth the surface by lightly rubbing with a fine carborundum stone.

   If the concrete has hardened before being rubbed, use a medium coarse carborundum stone to finish the surface at least 4 days after placing the concrete. Spread a thin grout composed of one part Portland cement and one part fine aggregate over a small area of the surface. Immediately rub the surface with the stone until form marks and irregularities are removed and the surface is covered with a lather. Allow this lather to set for at least 5 days. Then, smooth the surface by rubbing lightly with a fine carborundum stone.

   Complete ordinary finish work before applying the rubbed finish.

3. Concrete Decks and Approach Slabs. Obtain a smooth riding surface of uniform texture, true to the required grade and cross section.

   Use a self-propelled mechanical finishing machine

   a. capable of forward and reverse movement,

   b. with a rotating cylindrical single or double drum screed,

   c. with necessary adjustments to produce the required cross-section, line, and grade,

   d. allowing screeds to be raised and lowered, and

   e. with an upper vertical limit of screed travel permitting the screed to clear the finished concrete surface.

   When placing concrete abutting previously placed concrete, equip the finishing machine to travel on the existing concrete.

The Engineer may approve hand-operated motorized roller screeds (friction screeds) where jobsite conditions prohibit the use of conventional configuration finishing machines described above, for small areas less than 12 feet wide, and on approach slabs in which conventional configuration finishing machines are not used to finish the concrete deck. Do not use vibratory screeds.

Use equipment capable of striking off the full placement width without intermediate supports or rails. Use rails resting on adjustable supports that can be removed with the least disturbance to the concrete. Place the supports on structural members or on forms rigid enough to resist deflection. Use supports that are removable to at least 2 inches below the finished surface. If possible, place rails outside the finishing area. If not possible, place them above the finished surface.

Use rails (with their supports) that are strong and stiff enough for operation of the equipment without excessive deflection. Place and secure rails for the full length of the deck before placing concrete. Set the rails to the proper grade and elevations to ensure the required profile is provided.

After placing and consolidating the concrete, carefully strike off the concrete surface. Correct imperfections left on the deck. Provide a float finish to surfaces receiving a waterproof membrane. Texture other surfaces with a heavy-broom finish perpendicular to the direction of traffic.

Do not place finishing machines or other loads on the screed rail supports or on features supporting fresh concrete after the concrete has initially set and before the concrete attains at least 80 percent of the Specified Compressive Strength.

Do not release falsework or wedges supporting concrete on either side of a joint until each side has cured as specified.

4. Curb, Sidewalk, and Concrete Barrier Surfaces. Finish exposed faces of curbs, sidewalks, and concrete barriers to true surfaces and provide a broom finish. Broom finish sidewalks perpendicular to the direction of traffic.

5. Sandblasted Finish. Sandblast the cured concrete surface with hard, sharp abrasive media to produce an even fine-grained surface in which the mortar has been cut away, leaving the aggregate exposed.

6. Trowel Finish. Trowel the surface smooth and free of trowel marks.

501-3.08 CURING CONCRETE. Maintain a satisfactory moisture content and temperature in the concrete immediately after finishing operations are completed.

1. Initial Curing Period. Before final curing, ensure the surface of the concrete is kept moist. Concrete surface is beginning to dry when no bleed water is present and the surface color changes. If the concrete surface begins to dry before the final curing method can be applied, prevent further loss of moisture by one or more of the following methods:

   a. Fog Spray. Use equipment producing a fog spray from an atomizing nozzle with sufficient velocity to cover the entire concrete surface. Direct the atomized water spray above the concrete surface to allow the fog to drift down to the concrete surface. Do not apply the discharge of the atomized water spray directly at the concrete surface. Continue fogging to maintain the reflective appearance of the damp concrete. Do not allow the surface to dry, or to undergo cycles of drying and wetting. Keep the concrete surface damp, but do not accumulate water until after final set has occurred. Use water meeting the requirements of Subsection 712-2.01.

b. Evaporation Rate Reducer. Apply a monomolecular film intended specifically as an evaporation rate reducer to entrap bleed water or excess moisture on the concrete surface. Apply the evaporation rate reducer according to the manufacturer's written instructions. Do not use the evaporation rate reducer during finishing operations or as a finishing aid. Do not use evaporation rate reducers on concrete surfaces receiving a waterproofing membrane such as concrete decks, approach slabs, end diaphragms and decked precast concrete members.

2. Final Curing Period. Unless otherwise noted, employ the final curing method immediately following finishing operations.

Use wet curing on construction joints, concrete with a mix design water-cement ratio less than 0.40, concrete decks, approach slabs, and other concrete surfaces subject to tire contact in the completed structure. For other concrete, use wet curing, liquid membrane-forming curing, forms-in-place curing, or a combination of these curing methods.

Do not use liquid membrane-forming curing compounds on concrete surfaces to which other materials will be cast against or bonded such as concrete and waterproofing membranes.

In addition to the requirements in this section, precast concrete members may use accelerated curing.

a. Wet Curing. Until the end of the curing period, provide continuous moisture by:

(1) watering a covering of heavy burlap blankets or quilted cotton mats,

(2) keeping concrete surfaces wet with water continuously,

(3) wetting the outside surfaces of wood forms.

Wait to install curing materials until the concrete has sufficiently hardened to permit such operations without damaging the concrete or marring the finish. While waiting to employ curing materials, maintain the concrete surface moisture as specified for the initial curing period.

Uniformly distribute absorbent materials across the entire concrete surface. Apply water in a manner that will not displace the curing materials or erode the concrete surface. Keep the concrete surfaces continuously wet. Do not allow concrete surfaces to dry or alternate with wetting and drying cycles. Cover the concrete, wooden forms and absorbent material with impermeable sheeting. Use white reflective impermeable sheeting if direct sunlight is present, or if the Engineer determines direct sunlight may be present during the curing period.

Do not use absorbent materials containing harmful substances such as sugar or fertilizer, or materials that may discolor the concrete.

b. Liquid Membrane-Forming Curing Compounds. Apply liquid membrane-forming compounds immediately after final finishing and as soon as the free water has disappeared, no water sheen is visible, and bleeding has essentially ceased. Apply two coats of liquid membrane-forming compound with the second coat at right angles to the first. Apply both coats of liquid membrane-forming compounds uniformly until the original color of the concrete is obscured. Apply liquid membrane-forming compound according to the manufacturer's instructions.

Do not apply the liquid membrane-forming compound to dry concrete surfaces. Moisten the concrete surface, without standing water, before applying the liquid membrane-forming compound. Protect the membrane from damage for the duration of the curing period. Re-apply the liquid membrane-forming compound if the membrane is cracked or damaged during the curing period.

c. Forms-In-Place Curing. Formed concrete surfaces may be cured by retaining the forms in place for the entire curing period. Keep the forms moisture tight. Do not loosen forms. For wooden forms, keep the forms wet as required for wet curing. If gaps develop between the forms or between the forms and concrete:

(1) remove the forms and implement another curing method

(2) keep the gaps continuously filled with water for the remainder of the curing period.

d. Accelerated Curing. Accelerated curing may be used only for precast concrete members with Class P Concrete.

During the curing period, keep the concrete in a saturated curing atmosphere until the concrete achieves the required release strength.

The curing period may be accelerated by using saturated low-pressure steam, convection-heat, or radiant-heat in a suitable curing chamber to contain the live steam or heat. Provide at least 3 inches of clearance between the enclosure and forms to allow adequate circulation.

If accelerated curing methods are used, embed at least one temperature-recording device in the concrete to verify concrete temperatures are within the specified limits. Install one temperature-recording device, accurate to ±5°F, near the member's midpoint, 6 to 8 inches from the top or bottom, and along the member's centerline. Monitor the concrete temperature with the temperature-recording device sensor arranged and calibrated to continuously record, date, and identify the concrete temperature throughout the heating cycle. Begin recording temperatures once concrete is placed in the forms. Stop recording temperatures after the heating cycle is complete and when the concrete temperature is within 20°F of the air temperature to which the concrete will be exposed. Upon request, submit the temperature record to the Engineer for each precast concrete member.

While waiting to begin the heating cycle, maintain the concrete temperature between 50°F and 90°F and maintain concrete surface moisture as specified for the initial curing period. Do not apply steam, convection-heat or radiant-heat prior to initial set except to maintain the concrete temperature. Determine the time of initial set according to AASHTO T 197.

Begin the heating cycle immediately after the initial set. Prevent hot air and steam from blowing directly onto the concrete or forms. Increase the concrete temperature at an average rate not exceeding 40°F per hour until the curing temperature is reached. Limit curing temperature within the concrete to 175°F maximum. Decrease the concrete temperature not more than 40°F per hour until reaching a temperature 20°F above the temperature of the air to which the concrete will be exposed.

Apply radiant heat by pipes circulating steam, hot oil, or hot water, or by electric heating elements.

3. Curing Temperature. Maintain concrete temperature at or above 50°F for the first 6 days after placement. After 6 days you may choose to maintain concrete temperature between 32°F and 50°F with the addition of curing time as specified under 501-3.08.4a.

4. Ending Curing Operations. Continue curing operations uninterrupted until the required concrete properties, strength, and durability have developed or until there is reasonable assurance these properties will be achieved after the curing operations have been terminated.

Curing operations may be terminated after both 501-3.08.4.a and 501-3.08.4.b are satisfied:

a. The concrete has cured for:

(1) at least 7 days.

(2) at least 10 days when fly ash or ground granulated blast furnace slag in excess of 10 percent by weight of the Portland cement are used in the mix.

Add one additional day of curing to the requirements of 501-3.08.4.a.(1) and 501-3.08.4.a.(2), for each day or portion of a day the concrete temperature falls below 50°F during the curing period.

b. The compressive strength from informational field tests reaches the following:

(1) 70 percent of the Specified Compressive Strength if post curing concrete temperature is expected to remain at or above 50°F until 100 percent of the Specified Compressive Strength is attained.

(2) 100 percent of the Specified Compressive Strength, if post curing conditions are expected to allow the concrete temperature to fall below 50°F before 100 percent of the Specified Compressive Strength is attained.

501-3.09 PROTECTION OF CONCRETE. Protect concrete from damage. Do not apply loads to the concrete until the end of the curing period and until the Engineer determines the concrete has attained sufficient strength to safely carry the applied loads without damage. Unless otherwise noted, sufficient strength is attained when the concrete has attained a compressive strength, determined from informational field tests, of at least 80 percent of the Specified Compressive Strength.

Release forms and falsework according to Section 512.

During the curing period, protect concrete from damaging mechanical disturbances. Protect concrete surfaces from damage by construction traffic, equipment, materials, rain or running water, and Cold Weather Conditions, and other adverse weather conditions. Meet the vibration limits during pile driving of Section 505.

Do not backfill against concrete structures until the end of the curing period and until the concrete has attained a compressive strength, determined from informational field tests, of at least 80 percent of the Specified Compressive Strength.

Obtain authorization from the Engineer before driving vehicles or equipment, or storing materials on the structure. Keep the structure closed to traffic until the end of the curing period and until the concrete has attained a compressive strength determined from informational field tests, of at least 100 percent of the Specified Compressive Strength. Obtain authorization from the Engineer before opening the structure to traffic.

1. Rain Protection. Provide materials and equipment on site to protect concrete until final set. During precipitation, or when the Engineer determines precipitation is likely before final set, employ materials and equipment to protect the concrete until final set occurs. Do not expose the concrete to rain or flowing water before final set occurs.

2. Cold Temperature Protection. Place and cure concrete according to an approved cold temperature concreting plan whenever the air temperature in the shade, away from artificial heat, is expected to be below 40° F during placement or curing, or in the opinion of the Engineer, the air temperature in the shade, away from artificial heat, is likely to be below 40°F during placement or curing.

Prevent damage to concrete throughout the curing period. Prevent concrete from freezing, rapid cooling of concrete surfaces, or from large temperature differences within the concrete. Have materials and equipment ready to protect concrete from exposure to cold during placement and throughout the curing period. Maintain the concrete temperature with methods such as insulated forms, enclosures, and indirect heat. Vent flue gases to the outside of the enclosure when using combustion heaters. Prevent overheating areas or drying of concrete during the curing period by directing heaters and ducts away from the concrete surface. Do not heat the curing concrete to a temperature more than 90°F except as permitted in Subsection 501-3.08.2.d.

Measure and record air temperature in the work area, away from sunlight and artificial heat, at approximate 12 hour intervals, at least twice each 24-hour period. Air temperature measurement is not required when air temperature is expected to remain above 40°F throughout concrete placement and the curing period.

a. Cold temperature concreting plan submittals. Submit cold temperature concreting plan to the Engineer at least 5 days before beginning concrete placement when Cold Weather Conditions are present or expected.

   For each concrete placement include:

   (1) Procedures for the production, transport and placement
   (2) Considerations for section size and outside air temperature during the pour
   (3) Concrete placement temperatures
   (4) Methods that ensure adequate curing conditions are maintained as required in Subsection 501-3.08
   (5) Procedures for measuring and reporting concrete temperatures
   (6) Procedures for abrupt changes in weather conditions and equipment failures
   (7) Methods for verification of in-place strength

b. Temperature of Concrete During Batching and Placement. Obtain concrete batching and placement temperatures by heating the mixing water and/or aggregates. Avoid overheating aggregates so spot temperatures of aggregates do not exceed 212°F and average temperature of aggregates does not exceed 150°F when added to the batch.

   Ensure temperature of combined ingredients does not exceed 85°F when cementitious materials and admixtures are added. Ensure concrete is between 50°F and 90°F during placement.

c. Preparation. Remove snow, ice, and frost from all surfaces that will touch fresh concrete. Thaw the subgrade to at least 2 feet below the concrete to be placed before beginning concrete placement.

   Preheat surfaces that will be in contact with placed concrete. Maintain these temperatures to no more than 10°F greater or 15°F less than that of the concrete during placement.

d. Ending Cold Temperature Protection. Cold temperature protection may be terminated when the air temperature in the shade, away from artificial heat, is rising, above 40°F, and is expected to remain above 40°F until the end of the curing period. At the end of the protection period, remove the protection so the concrete surface drops in temperature gradually at a rate not more than 1.25°F per hour until the concrete temperature is within 20°F of the air temperature in the shade, away from artificial heat. If water curing is used, terminate the addition of water to the surface and allow the concrete surface to dry prior to exposure of the concrete to freezing temperatures.

3. Hot Temperature Protection. Do not begin concrete placement when air temperatures are expected to exceed 90°F during concrete placement without an approved hot temperature concreting plan. When air temperatures are expected to, have materials and equipment in place to prevent the concrete temperature from exceeding 90°F before final set and exceeding 150°F during the final curing period. Implement the hot temperature concreting plan when the air temperature in direct sunlight is greater than 90°F.

   a. Submittals. Submit a hot temperature concreting plan to the Engineer at least 5 days before placing concrete when the air temperature is expected to exceed 90°F during the concrete placement. Submit detailed procedures for the production, transport, placement, protection, curing, and temperature monitoring of concrete during hot temperatures for each concrete placement. Include procedures for abrupt changes in temperature conditions or equipment failures.

   b. Preparation. Prior to placing concrete, plan to minimize the exposure of the concrete to hot temperatures and direct sunlight. Cool surfaces that will touch the concrete to less than 90°F.

      Do not sprinkle fine aggregate piles with water. If sprinkling coarse aggregates, monitor the moisture content and adjust the mixing water for the free water in the aggregate.

      If replacing all or part of the mixing water with crushed ice, then ensure the ice is completely melted and thoroughly mixed with the other concrete materials before beginning concrete placement.

   c. Temperature of Concrete Before Placement. Ensure concrete being placed in forms is between 50°F and 90°F. Obtain these temperatures by cooling the mixing water and/or aggregate.

   d. Temperature of In-place Concrete. Protect the concrete from damage due to hot weather immediately after concrete placement and ensure adequate curing conditions are maintained as required in Subsection 501-3.08.

      Provide extra protection in areas especially vulnerable to temperatures above 90°F such as exposed top surfaces, corners and edges, thin sections, and concrete placed against steel.

      Protection may be terminated when the air temperature in direct sunlight drops below 90°F and is expected to remain below 90°F for at least 24 hours.

501-3.10 TOLERANCES. Produce concrete elements conforming to the following tolerances:

1. Length: ±3/4 inch for members 100’ and shorter. ±1 inch for members longer than 100’

2. Cross-sectional Dimensions:

   a. For dimensions 6 inches or less: -1/8 inch to +1/4 inch.

   b. For dimensions over 6 inches but not over 18 inches: -1/8 inch to +3/8 inch.

   c. For dimensions over 18 inches: -1/4 inch to +3/8 inch.

3. Distortion of Cross-section: Limit the slope with respect to the specified surface, plane, or line to less than ±1/16 inch per foot, but not to exceed ±1/4 inch measured perpendicular to the long axis of member.

4. Surface Irregularities (deviation from a 10-foot straight edge):

a. For surfaces receiving a topping or are buried: ±1/4 inch.

b. For surfaces not receiving a topping or are visible in the completed work: ±1/8 inch.

5. Camber: Do not vary from the approved camber more than ±1/8 inch per 10 feet of length, but not to exceed 1 inch. In addition, the camber of each girder may not differ from the camber or the other girders by more than 1 inch.

6. Lateral Sweep (deviation from a straight line parallel to centerline of member):

   a. For member length 40 feet or less: ±1/4 inch.

   b. For member length over 40 feet but not over 60 feet: ±3/8 inch.

   c. For member length over 60 feet: ±1/2 inch.

7. Deck Width (measured out-to-out): Zero to +2 inches, except not more than +1/2 inch where more precision is dictated by the substructure details such as anchor bolts, parallel wing walls, etc.

8. Position and Alignment:

   a. Bottom of footing elevation: ±0.1 feet.

   b. Profile grade: ±0.05 feet.

   c. Lateral position: ±0.1 feet.

   d. Skew: ±0.05 degrees.

9. Bearing Seats:

   a. Elevation: ±0.01 feet

   b. Variation between bearing seats: Do not vary from a straight line coincident with the centerline of bearings and parallel to the surface of the bottom flanges more than 0.01 feet.

   c. Grade and cross slope: ±0.005 feet per foot.

10. Openings:

    a. Size of opening: ±1/4 inch.

    b. Location of centerline of opening: ±1/2 inch.

11. Embedded Items:

    a. Bolts: ±1/4 inch.

    b. Utility hangers: ±1/2 inch.

    c. Weld Plates: ±1/2 inch measured along the length of the member, ±1/8 inch measured perpendicular to the length of the member.

    d. Inserts: ±1 inch.

    e. Rail post anchor plates: ±1/4 inch.

f. Expansion joints: ±1/8 inch.

g. Electrical conduits: ±1/2 inch.

h. Deck drains: ±1/2 inch.

i. Other embedded items: ±1/2 inch.

501-3.11 CONSTRUCTION JOINTS. Unless otherwise noted, locate construction joints where specified in the Contract documents. Obtain approval before adding, deleting, or relocating construction joints specified in the Contract documents. Make requests for such changes in writing, accompanied by a drawing depicting the joint. The Engineer will evaluate the proposed construction joint to determine if the joint will affect the strength or durability of the concrete. Joints noted as "permissible" do not need the Engineer's approval before deleting. When permitted, place the joints where they will not be exposed to view in the finished structure.

At horizontal construction joints, place gage strips 1-1/2 inches thick inside the forms along exposed faces to give the joints straight lines.

Do not use wire mesh forming material.

If the Plans require a roughened surface on the joint, create grooves at right angles to the length of the member. Make grooves that are 1/2 to 1 inch wide, 1/4 to 1/2 inch deep, and spaced equally at twice the width of the groove. Terminate the grooves within 1-1/2 to 2 inches from the edges of the joint.

If the Plans require a smooth surface on the joint, provide a trowel finish.

Include shear keys at the joint when the Contract documents do not require a roughened surface or a smooth surface. Make shear keys of formed depressions with slight beveling to ensure ready form removal. Do not use raised shear keys. Make shear keys that meet the following:

1. For tops of beams, at the tops and bottoms of boxed girder webs, in diaphragms, and in crossbeams, use shear keys 1-1/2 inches deep, 8 inches long, and spaced at 16 inches.

2. In other locations, use shear keys at least 1-1/2 inches deep and 1/3 of the joint width.

Terminate the shear keys within 1-1/2 to 2 inches of the joint edge.

Clean construction joints of surface laitance and other foreign materials before fresh concrete is placed against the surface of the joint. Flush construction joints with water and allow the joint to dry to a surface-dry condition immediately prior to placing concrete.

501-3.12 FORMS AND FALSEWORK. Use forms and falsework designed and constructed according to Section 512.

501-3.13 PRECAST CONCRETE MEMBERS. In addition to the requirements listed in this Section, conform to Section 502 when fabricating prestressed concrete members.

1. Shop Drawings. Provide shop drawings for precast concrete members. Include details not provided in the Plans for the construction and erection of the members. Cast members only after shop drawings are approved. Use precast methods for cast-in-place elements when approved. Submit shop drawings, showing construction joint details and other required information.

2. Manufacture. Prestress concrete according to Section 502. Fabricate and install reinforcing steel according to Section 503.

a. Unless otherwise noted, use Class P concrete for precast concrete members meeting the Specified Compressive Strength noted on the Plans.

3. Storage and Handling. Handle and move precast concrete members without damage. Store and transport precast concrete members in an upright position with the directions of the support reactions on the member during storage or transport as if in the final position. Locate support points during transport and storage within 30 inches of their final position, or as shown on approved shop drawings. Ship only after the member has cured at least 7 days and has a compressive strength not less than 100 percent of the Specified Compressive Strength.

4. Erection. Maintain member stability during transport, lifting, and erection operations. Limit concrete tension stresses due to transport, lifting, and erection operations to less than 500 psi.

   Set interchangeable precast concrete members so the initial difference between the top surfaces of the edges of adjacent precast concrete members is no more than 1/2 inch at midspan and no more than 1/4 inch at the bearings.

   Set and securely brace precast concrete members within a span before making shear connections. Secure the member to the structure, and provide temporary braces necessary to resist wind or other loads immediately after erecting each precast concrete member.

   Provide and use forcing devices as shown in the Plans or as recommended by the precast concrete member manufacturer. Use devices maintaining the top edges of adjacent members at the same elevation while casting or welding diaphragms, welding shear connector plates, and while placing and curing grout in the shear keys.

   Make field welds according to Section 503 and Section 504.

   Install cast-in-place diaphragms within 2 weeks after setting precast concrete members on their bearings.

   If cast-in-place diaphragms cannot be placed within the prescribed time limit, ensure the members are adequately braced to resist movement and rotation. Submit a bracing plan including complete details and substantiating calculations, sealed by a Professional Engineer registered in the State of Alaska.

   Erect and place precast deck panels so the mating surfaces do not allow grout leakage. Seal joints where grout leakage may occur.

   When the Plans require filling keyways between adjacent concrete members with grout, place grout according to the manufacturer's written instructions. Clean joints of surface laitance and other foreign material before placing grout. Do not place loads on the grouted members until the grout compressive strength has reached 5000 psi.

   Tightly pack and rod the grout in the keys and spaces. Keep the grout surface smooth and neat. Ensure the grout surface meets the member edges throughout their lengths and matches the surface elevation of the members with a tolerance of ±1/8 inch.

501-3.14 PLACING ANCHOR BOLTS. Secure anchor bolt assemblies where shown on the Plans.

When casting anchor bolts in concrete, secure anchor bolts before placing concrete in the forms. Do not disturb anchor bolts after concrete has been placed.

When installing anchor bolts in pipe sleeves, pre-cast holes, cored holes, or drilled holes, completely fill the cavity with grout. Do not allow water to freeze in the cavity. Do not allow foreign material in the cavity.

501-3.15 UTILIDUCTS, PIPES, CONDUITS, DUCTS, AND UTILITY HOLES. When utiliducts, pipes, conduits, and ducts will be encased in concrete, install them in the forms before placing the concrete. Support the utiliducts, pipes, conduits, and ducts to prevent displacement during concrete placement.

Install utiliducts and utility holes parallel to the roadway centerline unless noted otherwise. Prevent bond between the utiliducts and concrete by tightly wrapping the utiliducts with at least two layers of asphalt felt.

501-3.16 REMOVING CONCRETE. Do not damage other portions of the structure remaining in place when removing concrete.

Determine and delineate the extent of removal area. Outline the area with a 3/4-inch deep saw cut to form faces perpendicular to the surface prior to the removal of concrete. Do not cut or damage existing reinforcing steel or prestressing steel. During the course of removal, the Engineer may suspend removal or may require additional removal and outline saw cut.

Use any combination of mechanical methods, water-blast cleaning, or abrasive-blast cleaning to remove coarse or broken concrete until a dense, uniform surface of concrete exposing solid coarse aggregate is obtained. When using mechanical methods for removal of concrete, meet the following:

1. Use impact tools weighing less than 15 lbs.

2. Operate impact tools at an angle less than 45 degrees relative to the surface of the concrete being removed.

3. Use hand tools such as hammers and chisels or small air chisels, water blast cleaning, or abrasive blast cleaning to remove final particles of unsound concrete.

During the removal operation do not damage existing reinforcing steel, prestressing steel, or concrete to remain in place.

Before applying the repair material, clean the surface according to ASTM D4258 within 24 hours of applying the repair material.

Use water meeting the requirements of Subsection 712-2.01 for removal operations.

501-3.17 CRACK EVALUATION. The Engineer will evaluate concrete that is cracked during execution of the Contract. Measure cracks at their widest point.

For concrete decks and approach slabs, allow the Engineer to inspect any surface cracking immediately after termination of concrete curing operations, before prestressing (if applicable), and before releasing falsework. If any 500 square foot portion of the concrete deck or approach slab has cracks, whose width exceeds 0.020 inches and combined lengths total more than 16 feet, treat the surface by performing low-viscosity resin crack repair.

For other concrete, cracks will be evaluated based on the crack width.

1. For crack widths equal to and greater than 0.060 inches, the concrete will be considered unacceptable.

2. For cracks widths equal to and greater than 0.013 inches but less than 0.060 inches, the Engineer will evaluate the cracked concrete for structural adequacy and durability. If the Engineer determines the crack may affect structural adequacy or durability, the Engineer may reject the concrete, the structure, or a portion of the structure. If the Engineer determines the cracked concrete is acceptable, repair the crack by performing low-pressure crack repair according to Subsection 501-3.18.

3. For cracks widths less than 0.013 inches wide, the crack will be considered acceptable with no additional evaluation or repairs required.

501-3.18 CRACK REPAIR. Perform crack repairs and replace unacceptable concrete at no cost to the Department. No contract time extension will be given for repairing, removing, and replacing unacceptable material.

1. Low-Pressure Crack Repair. Repair cracked concrete according to the following requirements:

   a. Crack Repair Plan. Submit a crack repair plan to the Engineer. Do not repair the crack until the Engineer has approved the crack repair plan. Include the following in the crack repair plan:

      (1) Experience of the injection equipment technicians

      (2) Evaluation of the crack width and the recommended epoxy viscosity allowing the epoxy to achieve and maintain the penetration requirements

      (3) Material information including manufacturer's product data sheets

      (4) Equipment

      (5) Crack preparation, injection procedures, and injection sequence

      (6) Cleanup procedures

   b. Experience. Provide epoxy injection technicians who have a minimum of 2 years experience in performing repairs using the methods and materials of the selected system.

   c. Materials. Use epoxy adhesive for crack injection with viscosity capable of filling at least 90 percent of the crack volume. Use epoxy adhesive for crack sealing capable of containing the epoxy adhesive for crack injection.

   d. Equipment. Use positive displacement plural component pumps, specifically designed to meter, mix, and to inject epoxy, and capable of filling at least 90 percent of the crack volume.

   e. Surface and Crack Preparation. Remove contaminants and other foreign material reducing the effectiveness of the surface seal and repaired crack. Allow adequate time for drying. If cleaning solutions are used, perform trial tests to verify the contaminants can be removed. Prepare the surface and crack according to the epoxy manufacturer’s instructions.

   f. Entry and Venting Ports. Install entry/venting ports spaced equal to the thickness of the concrete member along one face of the crack. Acceptable types of entry/venting ports are fittings inserted into drilled holes, bonded flush fittings, and gasket devices covering unsealed portions of interrupted seals, allowing injection of epoxy directly into the crack without leaking epoxy.

   g. Mixing Epoxy for Crack Sealing. Mix the epoxy adhesive for crack sealing to the volume ratio prescribed by the manufacturer.

   h. Surface Sealing. Seal the surface of the crack with epoxy adhesive for crack sealing.

   i. Mixing Epoxy for Crack Injection. Mix the epoxy adhesive for crack injection to the volume ratio prescribed by the manufacturer.

j. Epoxy Injection. Assure the crack seal is cured and capable of containing the crack injection epoxy. Inject the epoxy according to the epoxy manufacturer's instructions. Do not inject epoxy until the air, substrate, and epoxy are within the manufacturer's application temperature range. Limit injection pressure to prevent propagation of the crack, prevent additional damage, and injection pressure in excess of 50 psi.

(1) Inject the epoxy in the sequence noted in the approved crack repair plan. Ensure at least 90 percent of the crack volume is filled.

(2) Maintain the epoxy temperature within the manufacturer's application temperature range during injection operations and until the epoxy is cured.

k. Finishing and Cleanup. After the injected epoxy is cured, remove ports and surface seal flush with the concrete surface. Do not damage the injected epoxy and do not heat the surface seal to aid in removal.

2. Low-Viscosity Resin Crack Repair. When concrete deck or approach slab crack repair is required, the Engineer will define the repair area with the following boundary limits:

a. Beginning and ending on straight lines perpendicular to the direction of traffic and extending across the entire width of the concrete deck or approach slab, between the concrete barriers or curbs.

b. Beginning and ending at least 5 feet beyond the furthest opposing cracks, measured from where the crack widths exceeds 0.020 inches

If grinding is required, treat the concrete before grinding.

Before treatment, ensure the concrete surface is clean, sound and free of foreign materials that may reduce the effectiveness of the repaired cracks. If the concrete surface becomes contaminated before placing the resin, repeat the cleaning process.

Apply low-viscosity resin to the repair area. Protect barriers, railing, joints, and drainage facilities to prevent contamination by the treatment material.

Completely cover the deck surface with resin so the resin penetrates and fills cracks. Ensure the relative humidity is less than 80 percent, the prepared area is dry, and the surface temperature is at least 50°F and not more than 90°F when the resin is applied. Apply the resin and distribute excess material within the manufacturer's listed pot life. For textured surfaces, including grooved surfaces, remove excess material from the texture indentations.

For concrete decks and approach slabs not receiving a waterproofing membrane, apply aggregate for abrasive finish within 20 minutes of resin application and before setting occurs. Broadcast the aggregate for abrasive finish evenly over the entire treated area at a rate of 1.5 to 2.5 pounds per square yard.

501-3.19 CLEANUP. Remove concrete splatter, paint marks, laitance, rust staining, chamfer strips, and other material not providing a uniform texture and color to the concrete surface.

501-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Cubic Yard. The lesser of the actual volume or neat line volume of each class of concrete accepted in place in the finished structure.

2. Class DS Concrete. The sum of the lengths of drilled shafts complete in place, measured along the centerline of the drilled shaft from the bottom to the top.

3. Precast Concrete Members. Measured per unit, complete in place.

Crack repair for unacceptable concrete will not be measured for payment.

501-5.01 BASIS OF PAYMENT.

Material not appearing in the Bid Schedule and contained within, embedded, or attached to concrete elements is subsidiary.

Crack repair for unacceptable concrete is subsidiary.

Precast Concrete Member. Payment for precast concrete member includes materials and work for the following items: Class P concrete, reinforcing steel contained in the member, prestressing steel, plates, nuts, inserts contained within the concrete member, bolts, studs, anchor bars, blockouts, elastomeric bearing pads, grout, drains, and other miscellaneous steel embedded in or attached to the precast concrete member.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
501.0001.____	Class A Concrete	LS
501.0002.____	Class A-A Concrete	LS
501.0004.____	Class A Concrete	CY
501.0007.____	Precast Concrete Member, (Identification)	EACH
501.0009.____	Class DS Concrete, (Identification)	LF

SECTION 502
PRESTRESSING CONCRETE

502-1.01 DESCRIPTION. Prestress precast or cast-in-place concrete by furnishing, placing, tensioning, and bonding prestressing steel by using either pretensioning or post-tensioning methods or a combination of the two methods according to the Contract documents.

For pretensioning, this work also includes furnishing and installing the materials and equipment necessary to prestress concrete as designated in the Contract documents.

For post-tensioning, this work includes furnishing and installing all post-tensioning systems and other pertinent items necessary for the particular prestressing system used, including but not limited to ducts, anchorage assemblies, supplementary reinforcement, and grout used for pressure grouting ducts.

502-1.02 DEFINITIONS.

ANCHORAGE. An assembly of various hardware components that secure a tendon at its ends after it has been stressed imparting the tendon force into the concrete.

ANTICIPATED SET. The set that was assumed to occur in the design calculation of the post-tensioning forces immediately after load transfer.

BEARING PLATE. Hardware that transfers the prestressing force directly into concrete.

BLEED. The autogenous flow of mixing water within or its emergence from newly placed grout caused by the settlement of the solid materials within the mass and filtering action of strands.

DUCT. Material forming a conduit to accommodate prestressing steel installation and provide an annular space for the grout that protects the prestressing steel.

FLUIDITY. A measure of time, expressed in seconds, necessary for a stated quantity of grout to pass through the orifice of a flow cone.

GROUT. A mixture of cementitious materials and water with or without admixtures proportioned to produce a pumpable consistency without segregation of the constituents when injected into the duct to fill the space around the prestressing steel.

GROUT CAP. A device that contains the grout and forms a protective cover sealing the post-tensioning steel at the anchorage.

POST-TENSIONING. A method of prestressing in which the tendons are tensioned after the concrete has reached a specified strength.

POST-TENSIONING SCHEME OR LAYOUT. The pattern, size and locations of post-tensioning tendons.

POST-TENSIONING SYSTEM. An assembly of proprietary post-tensioning hardware, including but not limited to anchorage assembly, local zone reinforcement, wedge plate, wedges, bearing plate, prestressing steel, duct, duct connections, vents and grout cap, used to construct a tendon of a particular size and type.

PRESTRESSING STEEL. The steel element of a post-tensioning tendon, which is elongated and anchored to provide the necessary permanent prestressing force.

SET (Also Anchor Set Or Wedge Set). The total movement of a point on the strand outside the anchoring wedges during load transfer from the jack to the permanent anchorages. Set

movement is the sum of slippage of the wedges with respect to the anchorage head and the elastic deformation of the anchor components.

STRAND. An assembly of several high-strength steel wires wound together. Strands usually have six outer wires helically wound around a single straight wire of a similar diameter.

STRAND COUPLER. An assembly by which the prestressing force may be transmitted from one partial length prestressing tendon to another. (Strand couplers are not permitted.)

TENDON. A single or group of prestressing steel elements and their anchorage assemblies that imparts prestress to a structural member. Also, included are ducts, grouting attachments, grout and corrosion protection filler materials or coatings.

TENDON SIZE. The number of individual strands of a certain strand diameter.

THIXOTROPIC. The material property exhibited by certain grouts that enable material to stiffen, achieve a higher viscosity, in a short time while at rest, but to become liquid, acquire a lower viscosity, when mechanically agitated.

VENT. Tubing or pipe used for injection of grout into the duct and to allow escape of air, water, grout and bleed water from the duct.

WEDGE. A conically shaped device that anchors the strand in the wedge plate.

WEDGE PLATE. The hardware that holds the wedges of a multi-strand tendon and transfers the tendon force to the anchorage assembly.

502-2.01 MATERIALS. Use materials that conform to the following:

Concrete	Section 501
Water	Subsection 712-2.01
Reinforcing Steel	Subsection 709-2.01
Epoxy-Coated Reinforcing Steel	Subsection 709-2.01
Prestressing Steel and Fittings	Section 721
Post-tension Grout	Section 701-2.03
Epoxy Bonding Agents	AASHTO M 235, Type V

CONSTRUCTION REQUIREMENTS

502-3.01 PRETENSIONING METHODS. Select a pretensioning method that provides the magnitude and distribution of prestressing force specified in the Contract documents.

1. Shop Drawings. Before casting members to be prestressed, submit for approval shop drawings including complete details and substantiating calculations of the method, materials, and equipment proposed for use in the prestressing operations, any additions or rearrangement of reinforcing steel, and any revision in concrete dimensions.

   Include an outline of the method and sequence of stressing, complete specifications and details of the prestressing steel and anchoring devices to be used, anchoring stresses, strand release sequence, and other data pertaining to the prestressing operations, including the proposed arrangement of the prestressing units in the members.

   Compute the anticipated camber at the time of prestressing force transfer and at other significant times. Show the values on the shop drawings as a time/deflection curve, subject to approval.

   Include on shop drawings embedded items such as reinforcing steel, lifting devices, coil anchors, anchor bolts, drainage systems, utility conduits and other such items. Ensure there

will be no conflict between the planned positions of any embedded items and that concrete cover will be adequate.

2. Quality Control Plan. Submit a quality control plan that verifies that all materials and workmanship incorporated into the prestressed concrete members conform to the requirements.

   Perform pretensioning operations under the direct supervision and control of a qualified pretensioning technician. Provide a pretensioning technician, skilled in the prestressing method, to aid and instruct in using the prestressing equipment and in installing the materials to obtain required results.

3. Protection of Prestressing Steel. Protect prestressing steel and anchor assemblies against physical damage and corrosion. Keep prestressing steel and anchor assemblies clean and free of deleterious material such as grease, oil, wax, paint, or other foreign materials. The Engineer will reject prestressing steel that has at any time sustained physical damage. The Engineer will reject prestressing steel that has developed visible rust pitting or other results of corrosion, other than rust stain.

   Protect prestressing steel and anchorage assemblies against physical damage and corrosion during shipping and storage by packaging the prestressing steel and anchorage assemblies in containers or shipping forms. Place a corrosion inhibitor in the package or form, incorporate a corrosion inhibitor carrier-type packaging material, or apply a corrosion inhibitor directly to the steel. Do not use corrosion inhibitors that have deleterious effect on the steel or concrete or bond strength of steel to concrete. Immediately replace packaging or forms damaged from any cause or restore packaging to original condition.

   Clearly mark the shipping package or form with a statement that the package contains high-strength prestressing steel, and the type of corrosion inhibitor used, including the date packaged.

4. Prestressing Equipment. Use hydraulic jacks to tension prestressing steel strands so the force in the prestressing steel will not be less than the value specified in the Contract documents or as approved by the Engineer.

   Equip each jack used to stress strands with either:

   a. two calibrated pressure gages, or

   b. one calibrated pressure gage and one calibrated load cell

   In the event that any uncertainty exists regarding jack calibration, pressure gage usage, strand elongation or any other prestressing strand tensioning issue, provide and use a calibrated load cell when prestressing steel strands.

   Permanently mark the jack body with the ram area. Ensure each pressure gage is fully functional, calibrated and has an accurately reading dial at least 6 inches in diameter.

   Calibrate the jack and each gage, used to stress strands, as a unit within 6 months prior to use and after each repair. If used, provide a load cell calibrated within the past 12 months with an indicator that may be used to determine the prestressing force in the strand. The range of the load cell shall be such that the lower 10 percent of the manufacturer's rated capacity will not be used in determining the jacking stress.

   Use the following calibration procedure; Perform three calibration test cycles with the cylinder extension of the jack in various positions (i.e. 2 inch, 4 inch, 8 inch stroke). At each pressure increment, average the forces from each test cycle to obtain an average force. Perform the

calibration with the equipment setup in the same configuration that will be used at the job site. Use load cells calibrated within the past 12 months to calibrate stressing equipment.

For each jack and gauge unit used on the project, provide certified calibration curves prior to the start of the work and every 6 months thereafter, or as requested by the Engineer. If used, supply documentation denoting the load cell calibration date prior to the start of the work and every 6 months thereafter. Furnish certified calibration charts prior to stressing.

Recalibrate jacks requiring repair, such as replacing seals or changing the length of the hydraulic lines. No extra compensation will be allowed for the initial or subsequent calibrations.

5. Placing Reinforcing Steel and Prestressing Steel. Place reinforcing steel according to Section 503, except as modified by this Section.

   Place prestressing steel in the position required in the Contract documents or on the approved shop drawings.

6. Girder Inserts. Provide threaded inserts, coil anchors, or approved equal in the girder as required in the Contract documents.

   With the written approval of the Engineer, additional inserts in the girder may be provided to accommodate diaphragm forms or other construction related requirements.

   Provide holes in the girder web as indicated on the plans to accommodate reinforcing steel. Verify that the hole size is sufficient to accommodate reinforcement placement procedures.

7. Pretensioning. Stress strands to the magnitude specified in the Contract documents by either single strand stressing or multiple strand stressing. Prior to applying full pretensioning, bring all strands to be stressed in a group (multiple strand stressing) to a uniform initial tension that is sufficient to eliminate all slack and equalize the stresses in the strands. Limit the strand stress in pretensioned members before seating (jacking stress) to 70 percent of the minimum breaking strength (0.70 f_{pu}) of the prestressing steel.

   Ensure that the tension load indicated by the gauge(s) is within 5 percent of the calculated tension load based on elongation measurements for each strand.

   Use approved low-friction devices at points of change in slope of strand trajectory when tensioning harped strands.

   Tension harped strands from both ends of the bed if the prestressing force, as determined by elongation measurements, is less than 95 percent of that indicated by the jack gauges. Ensure the computed load from the sum of elongation at both ends is within 5 percent of that indicated by the jack gauges.

   When splicing strands, locate splices outside of the prestressed units. Account for additional elongation due to the splice when verifying the tension load based on elongation measurements.

   Keep the temperature of the strands during tensioning and concrete placement within 25 °F of the concrete temperature during placement. During the interval between tensioning and concrete placement, do not let temperature changes alter the stress level in the strands more than 5 percent of the jacking stress, nor cause the stress in the strand to exceed 75 percent of the minimum breaking strength.

8. Placing Concrete. Produce and place concrete according to the requirements of Section 501, except as modified by this section.

Before depositing concrete in the forms, obtain an inspection of the reinforcing steel, enclosures, anchorages, and prestressing steel by an authorized Department representative.

Consolidate the concrete using any combination of internal and external vibration that does not displace the reinforcing steel or other items embedded in the concrete.

9. Release. Do not release prestressing strands or transfer prestressing forces to the member until concrete cylinder tests, manufactured according to AASHTO T 23 and tested according to AASHTO T 22 using the same concrete and maintained in the same curing conditions as the member, indicate that the concrete has attained the minimum initial compressive strength (release strength, f'_{ci}) as indicated in the Contract documents.

   Cut or release the elements in an order that minimizes the lateral eccentricity of the pre-stress. Cut all prestressing strands to a depth of at least 1 inch from the concrete surface. Fill the recess with cement mortar and finish flush to the concrete surface. Alternatively, cut all prestressing strands flush with the end of the member. Clean the exposed ends of the strand and a 1-inch strip of adjoining concrete to remove all dirt and residue not firmly bonded to the metal or concrete surfaces.

   If the member's curing is accelerated according to Section 501, transfer the stressing force to the concrete immediately after the heating cycle has been discontinued, while the concrete is still moist, and before the temperature of the concrete drops below 100°F.

502-3.02 POST-TENSIONING METHODS. Select a post-tensioning system that provides the magnitude and distribution of prestressing force specified in the Contract documents.

For box girders, distribute the prestressing steel so the force in each girder stem does not vary more than 5 percent from the required force per girder stem and the required total force in the superstructure is obtained and distributed symmetrically about the centerline of the typical section.

Do not exceed 75 percent of the minimum breaking strength of the prestressing steel for maximum temporary tensile stresses (jacking stresses) in prestressing steel. Do not exceed 70 percent of the minimum breaking strength of the prestressing steel at anchorages after anchor set.

Working force and working stress will be considered as the force and stress remaining in the prestressing steel after all losses (e.g., creep and shrinkage of concrete, elastic compression of concrete, creep of steel, losses in post-tensioned prestressing steel due to sequence of stressing, friction and take up of anchorages and all other losses peculiar to the method or system of prestressing) have taken place or have been accommodated. Calculate loss of prestress using industry recognized methods. The calculation and analysis methods are subject to approval by the Engineer.

1. Shop Drawings and Calculations. Before casting members to be prestressed, submit shop drawings and supporting calculations of the prestressing system for approval no less than 45 days prior to the placement of bridge concrete.

   Provide complete details on the shop drawings of the prestressing system and substantiating calculations of the method, materials, and equipment to be used in the prestressing operations, including any additions or rearrangement of reinforcing steel and any revision in concrete dimensions from that shown on the Plans. Outline in sufficient detail the method and sequence of stressing. Include complete specifications and details of the prestressing steel and anchoring assemblies, working stresses, anchoring stresses, type of ducts, initial prestress losses, final prestress losses and all other data pertaining to the prestressing operation. Show tendon geometry and locations complying with the plans and the limitations of the selected post-tensioning system. Show all vent locations, high point outlet inspection

details, anchorage inspection details and grout caps, protection system materials and application limits. Include on the shop drawing the location of the anchorages, vents, and duct enclosures at 2-foot (maximum) intervals along the length of the member.

Submit calculations for the anticipated camber at the time of prestressing force transfer and at other significant times. Show the values on the shop drawings as a time/deflection curve.

Submit calculations for the anticipated tendon elongation. Utilize the modulus of elasticity, based on nominal area, as furnished by the prestressing steel manufacturer for the lot of steel being tensioned. Show a typical tendon force diagram, after friction, wobble and anchor set losses, on the shop drawings based upon the expected friction curvature and wobble coefficients and values for the post-tensioning system used. Show the coefficients and values on the shop drawings.

Provide shop drawings, calculation, and procedures related to post-tensioning, prepared and sealed by a Professional Engineer, registered in the State of Alaska who specializes in post-tensioning concrete. Bear the signature and seal of the Professional Engineer who specializes in post-tensioning construction on all calculations, drawings, and procedures.

Include post-tensioning system certification(s) conforming to Section 721.

2. Post-tensioning and Grouting Technicians. Perform post-tensioning field operations under the direct supervision of a qualified post-tensioning technician. Provide a post-tensioning technician with at least 5 years of experience in construction of post-tensioned prestressed concrete structures. Provide a technician, skilled in the prestressing method, to aid and instruct in using the prestressing equipment and in installing the materials to obtain required results.

   Perform grouting under the direct supervision of a certified grouting technician. Provide a technician skilled in various aspects of grouting whom the American Segmental Bridge Institute certifies as an "ASBI Certified Grouting Technician".

   Ensure the post-tensioning technician is present at all times during duct installation, tendon tensioning, and grouting operations and provides close observation and control of all post-tensioning and grouting operations, as necessary for compliance with the Contract. Submit the name of the post-tensioning technician and proof of certification no less than 30 days before the start of bridge concrete placement operations.

3. Protection of Prestressing Steel and Anchorages. Protect prestressing steel and anchor assemblies against physical damage and corrosion. Keep prestressing steel and anchor assemblies clean and free of deleterious material such as grease, oil, wax, paint, or other foreign materials. The Engineer will reject prestressing steel that has at any time sustained physical damage. The Engineer will reject prestressing steel that has developed visible rust pitting or other results of corrosion, other than rust stain.

   Protect prestressing steel and anchorage assemblies against physical damage and corrosion during shipping and storage by packaging the prestressing steel and anchorage assemblies in containers or shipping forms. Place a corrosion inhibitor in the package or form, incorporate a corrosion inhibitor carrier-type packaging material, or apply a corrosion inhibitor directly to the steel. Do not use corrosion inhibitors that have deleterious effect on the steel or concrete or bond strength of steel to concrete. Immediately replace packaging or forms damaged from any cause or restore packaging to original condition.

   Clearly mark the shipping package or form with a statement that the package contains high-strength prestressing steel, and the type of corrosion inhibitor used, including the date packaged.

If prestressing steel is installed in ducts but not tensioned and grouted within the 7 days, perform Nondestructive Examination (NDE) by either videoscoping the entire length of the prestressing steel inside the ducts or visually inspecting the prestressing steel upon removing the prestressing steel from the duct for corrosion. Perform NDE inspection at least once every 7 days until the prestressing steel is tensioned and grouted. Perform NDE inspection to the satisfaction of the Engineer. Provide a report of the tendon condition following each NDE inspection for each tendon installation.

If corrosion is not found on the prestressing steel upon completion of NDE inspection, the Engineer may require protecting prestressing steel corrosion by means of a corrosion inhibitor placed in the ducts. Do not place a corrosion inhibitor inside the duct if prestressing steel installation, tensioning, and grouting is performed within 7 days. Do not use corrosion inhibitors that have deleterious effect on the steel or concrete or bond strength of steel to concrete. Submit for approval the name, manufacturer, and type of corrosion inhibitor to be used in the ducts at least 7 days before installation of any prestressing steel. Prior to grouting, flush the corrosion inhibitor from the ducts using a solution of quick lime (calcium oxide) or slaked lime (calcium hydroxide) in the amount of 0.1 lbs/gal. Use compressed air that is oil free to blow out ducts and remove flush water.

Cover and protect the anchorages against corrosion at all times from installation of the prestressing steel to placement of the concrete pour-backs.

Do not weld on or near prestressing steel, ducts, anchorages, or other assemblages. Protect prestressing steel and hardware from weld spatter or other damage. Once the prestressing steel has been installed, do not make welds or grounds for welders on the forms, reinforcing steel, or adjacent steel members.

4. Prestressing Equipment. Use hydraulic jacks to tension prestressing steel tendons so that the force in the prestressing steel will not be less than the value specified in the Contract documents or as approved by the Engineer. Do not use monostrand jacks to stress multi-strand tendons.

   Equip each jack used to stress tendons with either:

   a. two pressure gages

   b. one pressure gage and one load cell

   In the event that any uncertainty exists regarding jack calibration, pressure gage usage, strand elongation or any other prestressing strand tensioning issue, provide and use a calibrated load cell when prestressing steel tendons.

   Permanently mark the jack body with the ram area. Ensure each pressure gage is fully functional, calibrated and has an accurately reading dial at least 6 inches in diameter.

   Calibrate the jack and each gage used to stress tendons as a unit within 6 months prior to use and after each repair. If used, provide a load cell calibrated within the past 12 months with an indicator that may be used to determine the prestressing force in the tendon. The range of the load cell shall be such that the lower 10 percent of the manufacturer's rated capacity will not be used in determining the jacking stress.

   Use the following calibration procedure; Perform three calibration test cycles with the cylinder extension of the jack in various positions (i.e. 2 inch, 4 inch, 8 inch stroke). At each pressure increment, average the forces from each test cycle to obtain an average force. Perform the calibration with the equipment setup in the same configuration that will be used at the job site. Use load cells calibrated within the past 12 months to calibrate stressing equipment.

For each jack and gauge unit used on the project, provide the Engineer with certified calibration curves prior to the start of the work and every 6 months thereafter, or as requested by the Engineer. If used, supply documentation denoting the load cell calibration date prior to the start of the work and every 6 months thereafter. Furnish certified calibration charts prior to stressing.

5. Enclosures for Post-Tensioning. Accurately place enclosures (anchorages, ducts, and vents) for prestressing reinforcing according to the Plans or approved shop drawings.

   Set and hold the anchorage assemblies and block-out templates for anchorages so their axis coincides with the axis of the tendon and the wedge plates are normal in all directions to the tendon. Securely fasten anchorages and block-outs to prevent displacement during concrete placement. Unless otherwise specified in the Contract documents or shown on the approved shop drawings, recess the anchoring assemblies in formed block-outs so that the ends of the prestressing steel and all parts of the anchoring assemblies will be at least 3 inches inside of the end surface of the member. Construct block-outs in leak proof forms that create neat lines with the end surface of the member.

   Securely fasten ducts at the proper locations in the forms by ties to reinforcing steel that are adequate to prevent displacement during concrete placement. Use supplementary support bars where needed to maintain proper alignment of the duct. Use hold-down ties to prevent displacement due to duct buoyancy in the fluid concrete. Fasten ducts at 2-foot maximum intervals along the member.

   Do not damage the ducts during installation. Do not crimp, flatten, or dent the ducts. Do not perforate the ducts or provide openings in the ducts except at locations designated in the Contract documents or shop drawings. After duct installation, inspect all ducts for damage. The Engineer will reject ducts with unintentional holes or openings and ducts that are dented, crimped, or flattened. Repair duct sections to the satisfaction of the Engineer at no additional cost to the Department and no adjustment in Contract time.

   After installation in the forms, cover the ends of the ducts and anchorages at all times to prevent the entry of water or debris.

   Prior to placing forms for closing slabs of box girder cells, demonstrate that the ducts are unobstructed.

6. Location of Grout Vents. Place grout vents at locations designated in the Contract documents and shop drawings. Equip grout vents with positive shut-off devices. Extend grout tubes with sufficient distance out of the concrete member to allow for proper closing of the valves.

7. Placing Reinforcing Steel and Prestressing Steel. Place reinforcing steel according to the requirements of Section 503 and as modified by this Section.

   Place prestressing steel in the position as designated in the Contract documents or on the approved shop drawings. Install the prestressing steel in the enclosures by pushing or pulling the total number of strands in a tendon individually or as a unit.

   For strands that are pushed, round off the end of the strand and fit the end of the strand with a smooth protective cap.

   For strands that are pulled, use a special steel wire sock or other device attached to the end strands to pull the assembled tendon through the duct. Do not weld the ends of the strands together for this purpose. Round the end of the pre-assembled tendon for smooth passage through the duct. Cut strands using an abrasive saw or equal. Do not flame cut strands.

Immediately prior to installing the prestressing steel, demonstrate that the ducts are free of water, debris, and obstructions by passing a torpedo through the ducts. Use a torpedo having the same cross-sectional shape as the duct and is 1/4 inch smaller all around than the clear, nominal inside dimensions of the duct. Make no deductions to the torpedo section dimensions for tolerances allowed in the manufacture or fixing of the ducts. For straight ducts, use a torpedo at least 2 feet long. For curved ducts, determine the length so that when both ends touch the outermost wall of the duct, the torpedo is 1/4 inch clear of the innermost wall. If the torpedo will not travel completely through the duct, the Engineer will reject the member, unless a workable repair can be made to clear the duct. Ensure the torpedo passes through the duct easily, by hand, without resorting to excessive effort or mechanical assistance.

If the strands do not easily pass through the duct or an obstruction is encountered, do not force strands through the duct.

Do not install the prestressing steel in the duct prior to placing and curing of the concrete.

Straighten prestressing steel strands that are to be stressed simultaneously or when necessary to ensure proper positioning in the ducts.

8. Placing Concrete. Produce and place concrete according to the requirements of Section 501 and as modified by this section.

   Before depositing concrete in the forms, obtain an inspection and approval of the placement of reinforcing, enclosures, anchorages, and prestressing steel. Vibrate the concrete internally, externally, or both. Vibrate carefully to avoid displacing the reinforcing steel, anchorages, ducts, grout vents, or other items embedded in the concrete.

9. Post-tensioning. Do not begin tensioning operations until concrete cylinder tests, manufactured according to AASHTO T 23 and tested according to AASHTO T 22 using the same concrete and maintained in the same curing conditions as the member, indicate that the concrete has attained the minimum initial compressive strength (release strength, f'_{ci}) indicated in the Contract documents. Do not begin tensioning operations until after the Engineer approved patches or repairs have been satisfactorily completed. Do not tension the prestressing steel until all concrete in the member has been placed.

   Perform stressing of tendons in conformance with the sequence shown on the approved shop drawings. Stress tendons in such a sequence that lateral eccentricity of prestress and loss of prestress will be a minimum. Stress tendons symmetrically about the center of the typical section so no more than one tendon is eccentric about the centerline at any one time. Sequence the stressing of the tendons so the individual tendon force does not exceed the tendon force in other tendons by more than 50 percent of the final jacking force of the tendon.

   Stress strands in each tendon simultaneously. Stress tendons by jacking from only one end of the member unless otherwise approved by the Engineer.

   Conduct the tensioning process so that tension being applied and the elongation of the prestressing steel may be measured at all times. Measure elongation to the nearest 1/16 inch. Tension tendons to a preliminary force between 5 and 25 percent of the final jacking force to eliminate any wedge slip or take-up in the tensioning system before elongation measurements are started. Record the preliminary force so that it can be used in the elongation measurement. Mark at least 25 percent of the strands in each tendon prior to final stressing to permit measurement of elongation and to ensure the anchor wedges are set properly.

   For the required tendon force, ensure the observed elongation agrees within 5 percent of the theoretical tendon elongation. In the event the observed elongation is not within acceptable

tolerances, determine the source of error and revise the post-tensioning operation to the satisfaction of the Engineer before proceeding. Do not overstress the tendon to achieve the theoretical elongation.

Multi-strand post-tensioning tendons having wires that fail, by breaking or slippage during stressing, will be rejected.

Cut post-tensioning steel with an abrasive saw within 1 to 2 inches from the anchoring device. Do not flame cut prestressing steel.

Provide a record of the post-tensioning operation following each tendon installation including, but not limited to, the following:

a. Project name and bridge number;

b. Contractor and / or subcontractor name;

c. Tendon location, size, type;

d. Date and time tendon was first installed in the duct;

e. Reel number for strands;

f. Tendon cross-sectional area;

g. Modulus of elasticity;

h. Date and time tendon was stressed;

i. Jack and gage numbers per end of tendon;

j. Required jacking force;

k. Gauge pressure;

l. Elongation (theoretical and actual);

m. Anchor set; (anticipated and actual);

n. Stressing sequence (i.e. tendons stressed before and after);

o. Stressing mode (one end/ two ends/ simultaneous);

p. Witnesses to stressing operation (signature); and

q. Date grouted.

Cover ends of tendons and anchorages immediately after stressing in accordance with Subsection 502-3.02.3.

502-3.03 CAMBER. Camber is the upward deflection that occurs in prestressed concrete flexural members due to the combination of stressing forces and dead load. It does not include dimensional inaccuracies from manufacturing errors.

Form girders so the roadway surface conforms to the indicated grade line with an allowance for 1/2 inch of positive camber at midspan. Form girders to adjust for the predicted long-term camber from loss of prestress and from dead load deflection. When estimating this adjustment, assume that future paving will be applied 3 years after erection.

Control the concrete properties and the placing, curing, curing times, tensioning procedures, and the storage of precast prestressed beam sections. Control these elements so that the shape and amplitude of the deflection curves for all girders will be within specified tolerances and as nearly alike as possible.

Measure camber with the girder supported at bearing points only. When it is impractical to support the girder on its bearing points, you may use alternative support points. Obtain approval of the alternative supports and submit calculations of the effects of the supports on girder camber. Measure actual camber during prestressing force transfer and compare it with computed values and tolerances.

502-3.04 TOLERANCES. Produce prestressed concrete members conforming to the following dimensional tolerances:

1. Camber: Do not vary from approved camber more than ±1/8 inch per 10 feet of length, but not to exceed 1 inch. In addition, the camber of any girder may not differ from that of any other girder by more than 1 inch.
2. Position of Strands: ±1/4 inch (±1/2 inch where harped strands exit the member).
3. Longitudinal Position of Deflection Point for Harped Strands: ±12 inches.
4. Position of Ducts and Anchorages: ±1/4 inch
5. Position of Local Zone Reinforcement: Center reinforcement on the duct and start within 1/2 inch of the back of the bearing plate.
6. Position of Weld Plates: ±1 inch measured along joint. ±1/8 inch transverse to joint.

502-3.05 BONDING AND GROUTING. Conform to the following:

1. General. Bond post-tensioned prestressing steel to the concrete by completely filling the entire void space between the duct and the tendon with grout. Grout tendons according to the procedures set forth in the approved grouting operation plan. Grout empty ducts.

2. Personnel Qualifications. Carry out grouting operations by workers trained for and experienced in the tasks required. Perform grouting under the immediate control of the post-tensioning technician as described in Subsection 502-3.02.

3. Grouting Operation Plan. No less than 30 days prior to the initiation of production grouting, submit a grouting operation plan for approval. Devise the grouting procedures to ensure the ducts will be completely filled by grout. As a minimum, address and provide procedures for the following items in the grouting operation plan:

    a. Type, quantity, and brand of materials used in the grouting including all material certifications;

    b. Type of equipment furnished, including capacity in relation to demand and working condition, as well as back-up equipment and spare parts;

    c. Types and locations of vents;

    d. Types and sizes of grout hoses and connections;

    e. Theoretical grout volume calculations;

    f. General grouting procedure;

    g. Duct cleaning method prior to grouting;

    h. Mixing and pumping procedures;

    i. Type and frequency of quality control production tests;

j. Direction of grouting;

k. Sequence of use of the vents;

l. Method to be used to control the rate of flow and pressure within the ducts;

m. Procedures for handling blockages, including flushing of ducts;

n. Procedures for possible post grouting repair; and

o. Names of the persons in charge and the other personnel who will perform the grouting operation, including their relevant certification, experience, and skill.

Do not commence production grouting until the Engineer provides written approval of the grouting operation plan.

Before initiation of production grouting, conduct a joint meeting with the grouting technician, subcontractors, grouting crew, and the Engineer to discuss the grouting operation plan, required testing, corrective procedures, and other relevant issues.

4. Grout Storage. Store all grout materials in a dry enclosure or building that is convenient to the work site. Limit on site storage of grout to a maximum period of one month.

5. Grout Production Tests. Carry out the minimum number of production grout tests as follows:

   a. Grout Strength Test. Prepare grout cube specimens according to ASTM C942. Perform a minimum of one strength test per day during grouting operations. Submit strength test results within 24 hours of test completion.

   b. Fluidity test. Perform the modified version of ASTM C939 test specified in Subsection 701-2.08. Repeat testing at least every 2 hours of grouting operations. Submit fluidity test results within 24 hours of test completion.

6. Field Trial Test. Demonstrate to the satisfaction of the Engineer that the grouting equipment, methods, and procedures are appropriate. Conduct field trial tests at least 7 days prior to initiation of production grouting or as specified by the Engineer. Perform batching and testing with the same materials, personnel, and equipment used in production grouting. Furnish all materials and labor at no cost to the Department.

7. Preparation of Enclosures. If a corrosion inhibitor or any other material other than prestressing steel is inside the duct, flush the ducts using a solution of quick lime (calcium oxide) or slaked lime (calcium hydroxide) in the amount of 0.1 lbs/gal.
   Blow duct with oil free compressed air to remove water and debris blockages that may interfere with the injection of grout.

   Inspect valves to be sure that they can be opened and closed properly. Check that the grout hose connections and inlets are free of dirt.

8. Equipment. Provide grouting equipment consisting of measuring devices for water, a high-speed shear colloidal mixer, a storage hopper (holding reservoir) and a pump with all the necessary connecting hoses, valves, and pressure gauge. Provide grouting equipment with sufficient capacity to ensure that the post-tensioning ducts to be grouted can be filled and vented without interruption in less than 20 minutes.

   Provide an air compressor, flushing equipment, and hoses with sufficient output to perform the required functions.

If voids that cannot be completely filled using grout injection equipment are present after the grouting operation is complete, then provide vacuum grouting equipment (volumetric measuring type). No additional compensation will be made in the event that vacuum grouting equipment is required.

Provide the following equipment:

a. Mixing Equipment. Provide a high speed shear colloidal mixer capable of continuous mechanical mixing producing a homogeneous and stable grout free of lumps and un-dispersed cement. Use only colloidal grout machinery that has separate charging and storage tanks. Equip the charging tank with a high shear colloidal mixer and fit the storage tank with an agitator to keep the grout moving continuously before it is pumped into the duct. Use grouting equipment with a gravity feed to the pump inlet from the storage tank.

   Include a screen having clear openings of 1/8 inch maximum size to screen the grout prior to its introduction into the grout pump or storage hopper. Locate the screen between the charging tank and the storage tank so that the screen is easily accessible for inspection and cleaning.

   Keep the holding tank agitated and at least 1/4 full at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

   Periodically inspect the screen during grouting operations. Do not use grout if lumps of cement remain on the screen.

   Add water during the initial mixing by use of a calibrated flow meter or calibrated water reservoir with a measuring accuracy equal to one percent of the total water volume. Where water is not supplied through the public water supply system, provide a water storage tank of sufficient capacity.

b. Grout Injecting Equipment. Provide pumping equipment capable of continuous operation with little variation of pressure that includes a system for circulating the grout when actual grouting is not in progress.

   Use positive displacement type grout pumps that provide a continuous flow of grout and will be able to maintain a discharge pressure of at least 145 psi. Use grout pumps with adequate capacity so that an optimal rate of grouting can be achieved. Ensure pumps are constructed to have seals adequate to prevent oil, air or other foreign substances entering the grout and to prevent loss of grout or water.

   Use equipment capable of maintaining pressure on completely grouted ducts and fitted with a valve that can be closed off without loss of pressure in the duct.

   Install a pressure gauge having a full-scale reading of no more than 290 psi at the duct inlet. If hoses in excess of 100 feet total length are used, place and use two gauges, one at the pump and one at the inlet.

   Use grout hoses with sufficient diameter, rated pressure capacity and that are compatible with the pump output. Install a sampling tee with stopcock that minimizes the number of bends, valves, and changes in diameter. Firmly connect grout hoses to pump outlets, pipes, and duct inlets.

   Do not use compressed air to aid the pumping of grout.

c. Air Compression. Provide equipment to supply oil-free and water-free compressed air to blow out excess water and to check the free passage of the ducts.

d. Flushing Equipment. Provide standby flushing equipment using a potable water supply to facilitate complete removal of grout from the duct if difficult grouting conditions exist. This equipment is in addition to the grouting equipment. Utilize a different power source than the grouting equipment. Furnish equipment that is capable of delivering a pressure of at least 290 psi to flush out partially grouted enclosures.

e. Vacuum Grouting Equipment. Use volumetric measuring type vacuum grouting equipment with the ability to measure a void and supply a measured volume of grout to fill the void.

f. Standby Equipment. During grouting operations, provide a standby grout mixer and pump.

9. Mixing of Grout. Mix grout using the entire contents of each bag in accordance with the manufacturer's recommendations and using a metered amount of water. Mix the materials thoroughly to produce a homogeneous grout without excessive temperature increase or loss of properties. Do not mix grout longer than the manufacturer's recommended duration. Continuously agitate the grout until grouting is complete.

   Check the fluidity of the grout in accordance with Subsection 701-2.08. Do not commence grout pumping until fluidity requirements are satisfied.

   Do not add water to increase fluidity that has decreased by delayed use of the grout.

10. Injection of Grout. Use a method of injecting grout that will ensure complete filling of the ducts and complete encasement of the prestressing steel.

    Open grout vents before commencing grouting operations, unless otherwise approved by the Engineer.

    Perform grouting in one operation, maintaining a continuous, one-way flow of grout. Grout tendons from the lowest vent in an uphill direction. Unless approved otherwise by the Engineer, pump grout at a rate of 15 feet to 50 feet of duct per minute to avoid air entrapment, segregation of the grout, and to ensure complete filling of the duct. Conduct normal grouting operations at a pressure range of 10 psi to 75 psi measured at the grout inlet. Do not exceed the maximum pumping pressure of 145 psi at the grout inlet.

    Pump grout through the duct and continuously discharge grout from the first and subsequent outlets until residual water and entrapped air have been removed and the consistency of the grout is equivalent to that of the grout being pumped into the inlet. Discharge at least 1/2 gallon of grout from each outlet prior to closing the vent. Close all outlet vents in a similar manner one after another in the direction of flow except that at intermediate crests, close outlet vents placed a short distance downstream of the crest before closing their associated high point vent. Discarded grout does not represent additional cost to the Department.

    Pump grout through the duct and continuously discharge grout, to the satisfaction of the Engineer, at the anchorage and grout cap outlets until all free water and air are discharged and the consistency of the grout is equivalent to that of the grout being pumped into the inlet. Close the anchorage outlet vent and discharge a minimum of 1/2 gallon of grout from the grout cap. Close the grout cap outlet.

    After the outlets have been bled and sealed, bleed the grout pressure to 5 psi and wait a minimum of ten minutes for entrapped air to flow to the high points. After ten minutes, increase the pressure as needed and discharge grout at each high point outlet to eliminate all entrapped air or water. Complete the process by locking a pressure of 30 psi into the tendon prior to closing the inlet vent.

If the actual grouting pressure exceeds the maximum allowed, close the inlet vent and pump grout at the next outlet, which has just been or is ready to be closed, as long as one-way flow is maintained. Do not pump grout into a succeeding outlet vent from which grout has not yet flowed. If this procedure is used, equip the new inlet vent with a positive shut-off and pressure gage.

11. Temperature Considerations. Do not grout if the ambient air temperature exceeds 100°F. Do not grout if the ambient air temperature is expected to be less than 40°F within 48 hours. Ensure grout temperature upon mixing is between 50°F and 90°F.

    If the ambient air temperature is below 32°F, keep ducts free of water to avoid damage due to freezing. Do not warm ducts with steam. Blow dry air (60 percent humidity or less) through the ducts to extract trapped water. Ensure ducts are free of frost and ice before commencing grouting operations.

12. Post-Grouting Inspection. Do not remove or open vents until the grout has cured for at least 24 hours. After the grout has cured, remove outlets and grout caps located at anchorages and high points along the tendon to facilitate inspection. If voids are suspected or if duct grouting operations were prematurely terminated prior to completely filling the duct, explore the voided area inside the duct with an endoscope, borescope, videoscope, or other visual means approved by the Engineer. Probing is not allowed. Determine the location and extent of all voided areas.

    Depending on the location of the void, drilling may be required to penetrate the inner surface of the anchorage or duct. Use drilling equipment that will automatically shut-off when steel is encountered.

13. Repairing and Filling Voids. Repair and fill voids that occur in the ducts after the grouting operation is complete. If voids are found, submit a grouting repair plan for review and approval that describes the location and extent of the void and the method of repairing and filling the void. If the extent and location of the void is such that complete filling of the void is not possible using the grout injection equipment, repair and fill the void using a volumetric measuring vacuum grouting process utilizing the vacuum grouting equipment specified in Subsection 502-3.05.8.

14. Finishing. Remove valves, caps and pipes for each vent to a depth at least 1 inch below the surface of the concrete. Fill the void left by the vent pipe according to Subsection 501-3.07.1. Do not remove or open vents until the grout as set for at least 24 hours.

15. Protection of End Anchorages. Within 7 days upon completion of the grouting, permanently protect the anchorage of post-tensioning tendons to prevent access of water or other aggressive agents.

    Immediately before casting the concrete pour-backs (within 24 hours), mechanically clean and roughen the mating concrete surfaces to remove any laitance and to expose small aggregate. Use abrasive blast cleaning or water blasting with a pressure washer capable of at least 10,000 psi nozzle pressure at all elevations to clean the concrete surfaces. Keep the nozzle tip no more than 12 inches from the surface during all phases of water blasting. Flush the surface with water and blow dry. Ensure surfaces are clean, sound and without standing water.

    Unless otherwise specified in the Contract documents or shown on the approved shop drawings, ensure the prestressing steel and all parts of the anchoring assemblies are at least 3 inches inside of the end surface of the member. Apply an epoxy bonding agent to the concrete mating surfaces according the manufacturer's instructions. Fill the recess with concrete and finish the concrete surface to true lines according to the Contract requirements.

16. Record of Grouting Operation. Submit a written report within 72 hours after grouting. Include in this report:

    a. the date of grouting;

    b. the number of days from tensioning to grouting;

    c. the tendons grouted;

    d. the quantities and types of materials used;

    e. the volume of grout pumped into the duct

    f. a summary of problems encountered during grouting and steps taken to resolve them;

    g. the maximum pumping pressure at the inlet;

    h. the temperature measurement of the air, water, prepackaged material, mix grout, and concrete member in the duct.

    i. the results of quality control testing.

502-4.01 METHOD OF MEASUREMENT. See Section 109.

502-5.01 BASIS OF PAYMENT. The lump sum payment is full compensation for furnishing, installing, stressing, grouting, repairing, and inspecting post-tensioned tendons accepted in place.

Items of the post-tensioning system embedded within the concrete including but not limited to prestressing steel, enclosures for prestressing steel, wedges, wedge plates, anchorage assemblies and associated supplemental reinforcing steel required by the supplier, grout vents, and grout gaps are subsidiary to post-tensioned concrete structural members.

Post-tensioning system hardware that is not embedded in concrete, including but not limited to jacks, gauges, wire socks, and torpedoes, is subsidiary to post-tensioned concrete structural members.

Items and equipment to fill the ducts with grout, including but not limited to mixers, gauges, flushing equipment, and production tests, are subsidiary to post-tensioned concrete structural members.

Materials for protecting the post-tensioning steel and anchorages including but not limited to corrosion inhibitors, flushing equipment, concrete bonding agents, and equipment to prepare the concrete block-outs are subsidiary to post-tensioned concrete structural members.

Labor, materials, tools, equipment and incidentals necessary for completing the work are subsidiary to post-tensioned concrete structural members.

Payment for prestressing precast concrete members is included in the Contract price paid for the precast members, as provided for under Section 501.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
502.0001.____	Post-Tensioning, (Type)	LS

SECTION 503
REINFORCING STEEL

503-1.01 DESCRIPTION. Furnish and place reinforcing steel for reinforced concrete structures.

503-1.02 DEFINITIONS.

BAR SIZE / DIAMETER. Nominal dimensions equivalent to those of a circular area having the same weight per foot as the AASHTO/ASTM designated bar.

COVER. The minimum distance between the surface of embedded reinforcing steel and the outer surface of the concrete.

HOOK. A bend in the end of a bar.

HOOP. A one-piece closed tie or continuously wound tie, with hooked or welded ends, enclosing the longitudinal reinforcing steel.

LATERAL REINFORCING STEEL. Reinforcing steel perpendicular to the length of a concrete member.

LONGITUDINAL REINFORCING STEEL. Reinforcing steel parallel to the length of a concrete member.

LOT. A defined quantity.

SPIRAL. Continuously wound reinforcing steel in the form of a cylindrical helix.

STIRRUP. Lateral reinforcing steel formed of individual or paired units, open or closed, used to resist shear and diagonal tension stresses in a structural member.

TIE. Reinforcing steel with hooked ends tied at right angles to and enclosing the other reinforcing steel, and used to provide confinement.

503-2.01 MATERIALS.

Reinforcing Steel Bars	Subsection 709-2.01
Epoxy-Coated Reinforcing Steel Bars	Subsection 709-2.01
Headed Reinforcing Steel Bars	Subsection 709-2.01
Epoxy Coating Patch Material	Subsection 709-2.01
Bar Supports	Subsection 709-2.03
Epoxy for Bonding Dowels	Subsection 712-2.21

CONSTRUCTION REQUIREMENTS

503-3.01 PLACING DRAWINGS. Submit placing drawings, detailed according to ACI 315, Chapter 3.

Do not substitute reinforcing steel bars of different size, material, coating, or grade without prior approval of the Engineer. When substituting epoxy-coated reinforcing steel for uncoated reinforcing steel, protect and repair epoxy-coated bars according to Subsection 503-3.02.

503-3.02 PROTECTION OF MATERIALS. Protect reinforcing steel from damage. Before placing reinforcing steel in the work, ensure that the reinforcing steel is free of salt and foreign substances that may affect the performance of the reinforcing steel.

Do not weld or tack weld reinforcing steel, unless otherwise noted.

Do not field cut reinforcing steel unless approved by the Engineer. Do not flame cut reinforcing steel.

Do not drop or drag the epoxy-coated reinforcing steel bars or bundles.

Store epoxy-coated reinforcing steel off the ground.

Protect epoxy-coated reinforcing steel from sunlight, salt spray, and weather exposure. The Engineer may reject epoxy-coated reinforcing steel when the cumulative environmental exposure time, including uncovered storage time after coating application to full embedment in concrete, exceeds 2 months.

The Engineer may reject epoxy-coated reinforcing steel when the extent of damaged coating exceeds 2 percent of the surface area in any 1-foot length of bar. When the extent of damaged coating does not exceed 2 percent of the surface area in any 1-foot length of bar, repair damaged coating. Coating damage includes cracks, abrasions, chips, bond loss (the coating can be removed with a peeling action by the finger), and exposed steel areas visible to a person with normal or corrected vision. Repair coating damage before visible oxidation appears on the steel surface.

Protect mechanical splice assemblies, headed bar assemblies, and connecting elements (including bar ends) against physical damage, corrosion, and coating damage. Keep assemblies and connecting elements clean and free of foreign materials that adversely affect the performance of the assembly.

1. Repairing Damaged Epoxy-Coating. Clean and remove disbonded areas of coating. Remove loose and deleterious materials. The Engineer may reject epoxy-coated reinforcing steel when the removed coating exceeds 2 percent in any 1-foot length of bar or if the weight, dimensions, cross-sectional area, or tensile properties are less than the minimum requirements of the applicable specification.

   Use an approved epoxy coating patch material according to the material manufacturer's recommendations. Apply patching material according to the patching material manufacturer's instructions. Allow the patching material to cure before placing concrete. The Engineer may reject epoxy-coated reinforcing steel when the surface area covered by patching material exceeds 5 percent in any 1-foot length of bar.

   Rejected epoxy-coated reinforcing steel may not be substituted for uncoated reinforcing steel or used as bar supports.

503-3.03 FABRICATION. Fabricate reinforcing steel to the size and dimension shown on the Plans. Reinforcing steel dimensions shown are out-to-out of bar, unless otherwise noted.

Meet fabrication tolerances in ACI 117, Section 2.1.

Weld reinforcing steel according to AWS D1.4. and meet the Qualifications and Submissions requirements of 503-3.05.3.b.

1. Bends. Bend bars when the bar temperature is above 45°F and less than 150°F. Bend bars to the diameter shown on the Plans. If the bend diameter is not shown, bend the bar with inside diameters as shown in Table 503-1. The Engineer may reject reinforcing steel bent with an inside diameter less than the minimum diameter shown in Table 503-1.

   Do not re-bend or straighten bars without approval by the Engineer.

TABLE 503-1
BEND DIAMETER

BAR SIZE	STIRRUPS AND TIES	STANDARD HOOKS AND OTHER BENDS
No. 3	1½"	2¼"
No. 4	2"	3"
No. 5	2½"	3¾"
No. 6	4½"	4½"
No. 7	5¼"	5¼"
No. 8	6"	6"
No. 9	-	9½"
No. 10	-	10¾"
No. 11	-	12"
No. 14	-	18¼"
No. 18	-	24"

Fabricate bar end hooks meeting the following requirements:

a. Stirrup and Tie Hooks.

(1) 90° Hook: 90° bend plus:

(a) For No. 5 bar and smaller, a 6.0 nominal bar diameter extension at the free end of the bar.

(b) For No 6, No. 7, and No. 8 bars, a 12.0 nominal bar diameter extension at the free end of the bar.

(2) 135° Hook: 135° bend plus a 6.0 nominal bar diameter extension, but not less than 2.5 inches, at the free end of the bar.

b. Standard Hooks.

(1) Std 180° Hook: 180° bend plus a 4.0 nominal bar diameter extension, but not less than 2.5 inches, at the free end of the bar.

(2) Std 90° Hook: 90° bend plus a 12.0 nominal bar diameter extension at the free end of the bar.

2. Bar Repairs. The Engineer will evaluate improperly bent bars and bars bent at locations not required by the Plans for structural adequacy and durability. Do not repair improperly bent bars until the bars are inspected by the Engineer and the Engineer approves repairing the bar. Bars repaired prior to inspection by the Engineer may be rejected. If, in the opinion of the Engineer, the bend is of such extent or character as to affect the strength or durability of the bar, the Engineer may reject the bar. Otherwise, the bar may be re-bent or straightened by means meeting the requirements of this Section and in a manner that will not damage the material, coating, or concrete.

If the Engineer approves repairing the bar, preheat the reinforcing steel before bending. Apply heat by any method that does not damage the reinforcing steel or concrete. Preheat the reinforcing steel at least 5.0 nominal bar diameters in each direction from the center of the bend but do not extend preheating below the surface of the concrete. Insulate concrete within 6 inches of the heated bar area. Do not allow the temperature of the reinforcing steel at the concrete interface to exceed 500°F. Preheat the reinforcing steel to at least 1100°F. Ensure the maximum reinforcing steel temperature never exceeds 1200°F. Maintain a

uniform temperature throughout the thickness of the bar by using at least 2 heat tips simultaneously at opposite sides of bars larger than No. 6. Maintain the preheat temperature of the reinforcing steel until bending or straightening is complete. Make the bend gradually with smooth continuous application of force. When straightening, move a bender progressively around the bend. When bending or straightening is complete, gradually reduce the temperature of the reinforcing steel to the ambient air temperature. Do not artificially cool the bars with water, forced air, or any other means.

503-3.04 PLACING AND FASTENING. Place reinforcing steel in the position as shown on the Plans. Secure the reinforcing steel to prevent movement during concrete placement. Do not place bars in addition to those shown on the Plans without prior approval of the Engineer. Do not place bars of different size, material, or grade without prior approval of the Engineer. Space reinforcing steel evenly unless noted otherwise. Provide 2 inches of concrete clear cover, measured from the surface of the reinforcing steel to the outside surface of the concrete, unless noted otherwise.

Do not place bars on layers of fresh concrete or adjust bars while placing concrete.

1. Fastening Requirements. Tie the bars with No. 14 or No.16 gauge steel wire. When the spacing between bars is 1 foot or more, tie the bars at all intersections. When the bar spacing is less than 1 foot, tie every other intersection. If the Plans require bundled bars, tie bundled bars together at not more than 6-foot centers. Tie all intersections of epoxy-coated reinforcing steel in the top mat of concrete decks and approach slabs. Use wire coated with plastic, epoxy, or similar non-conductive material when tying epoxy-coated reinforcing steel. Obtain the Engineer's written authorization before welding reinforcing steel. Provide at least 1 inch clear cover to the tie wire by turning the tie wire away from concrete surfaces.

   For slip-formed concrete, tie reinforcing steel at all intersections. Provide additional reinforcing steel cross bracing to keep the cage from moving during concrete placement. Place cross bracing both longitudinally and transversely.

2. Bar Supports. Maintain distances from the forms using approved precast mortar blocks, metal supports, or plastic supports strong enough to resist permanent movement under construction loads. If supports extend to exposed concrete surfaces, use metal or plastic supports. To support and fasten epoxy-coated reinforcing steel, use plastic supports or metal supports coated with plastic, epoxy, or similar non-conductive material. Do not use wooden or aluminum supports.

   Place supports at frequent intervals to maintain the cover between the reinforcing and the surface of the concrete. Space supports under concrete deck reinforcing steel and approach slab reinforcing steel not more than 4 feet apart in each direction.

503-3.05 SPLICING. Splice reinforcing steel bars at locations shown on the Plans and specified in this Section. Obtain the written approval of the Engineer before splicing bars at other locations. The Engineer will evaluate splices at locations not designated in the Contract documents for structural adequacy.

Splice reinforcing steel bars using lap splicing, welded butt joints, electric resistance butt welded joints, welded lap splicing, mechanical butt splicing, or mechanical lap splicing, unless noted otherwise. Do not splice reinforcing steel bars at locations where splices in the reinforcing steel are not allowed.

Splices will not be permitted in bars 40 feet or less in plan length, unless otherwise noted in the Contract documents. For bars exceeding 40 feet in plan length, ensure the distance center-to-center of splices is not less than 30 feet, with no individual bar length less than 10 feet. Stagger splices in adjacent bars, unless otherwise noted. Stagger lap splices a distance greater than the lapped splice length. Stagger butt splices at least 2 feet.

Reinforcing steel may be continuous at locations where splices are noted in the Contract documents.

Do not use lap splicing for No. 14 or No. 18 bars.

Do not lap splice spiral reinforcing steel. Anchor each end unit of reinforcing steel spiral by lapping the free end of the spiral to the continuous spiral and using either a welded lap splice or a mechanical lap splice.

Do not field weld epoxy-coated reinforcing steel bars.

1. Lap Splicing.

   a. General. Place reinforcing steel bars in contact and securely tie the bars together. Provide a minimum clear distance of 2 inches between the spliced bars and the nearest adjacent bar. Do not reduce the minimum clearance to the surface of the concrete.

      Use lapped splices meeting the minimum lengths as shown in Table 503-2, unless otherwise noted:

TABLE 503-2
LAPPED SPLICE LENGTH

BAR SIZE	UNCOATED	EPOXY-COATED
No. 3	1' - 4"	1'- 11"
No. 4	1' - 9"	2' - 7"
No. 5	2' - 2"	3' - 3"
No. 6	2' - 7"	3' - 10"
No. 7	3' - 5"	5' - 2"
No. 8	4' - 6"	6' - 9"
No. 9	5' - 9"	8' - 7"
No. 10	7' - 3"	10' - 10"
No. 11	8' - 11"	13' - 4"

   b. Qualifications and Submittals. No qualifications apply when lap splicing.

   c. Testing/Inspection. Field verify lap splice length.

2. Electric Resistance Butt Welded Joints.

   a. General.

      Produce electric resistance butt welds by a fabricator qualified by California Department of Transportation (Caltrans).

      Correct deficiencies in materials and workmanship without additional compensation.

      Do not weld or tack brackets, clips, shipping devices or other material not required by the Contract documents to the reinforcing steel, unless shown on the approved working drawings.

   b. Qualifications and Submittals. At least 30 days prior to welding, submit for approval the fabricator's proof of Caltrans qualification for electric resistance butt welding and the following:

      (1) Welding procedure (WPS) and pertinent welding information and calibration
      (2) Equipment operators' name and qualifications
      (3) Equipment name and serial number

(4) Description of identification and tracking system
(5) Quality control inspector's name and qualifications
(6) Quality control manual and procedures
(7) Type and extent of Nondestructive Examination (NDE) to be conducted, as required in the specifications
(8) Nondestructive testing personnel qualifications
(9) Sample QC and Test Reports

c. Testing/Inspection.

Perform job control tests using a testing laboratory with experience with ASTM A370 and California Test 670. A job control test consists of the fabrication, under the same conditions used to produce the splice, and the physical testing of 4 sample splices for each lot of splices. An authorized Department representative will designate when samples for job control tests are to be fabricated and will determine the limits of the lot represented by each job control test.

A lot of shop produced resistance welded butt joints is defined as no more than 150 splices of the same type of welds used for each combination of bar size and bar deformation pattern that is used in the work.

The Engineer or the Engineer's authorized representative shall witness the job control tests performed by the testing laboratory. Give the Engineer at least 7 working days' notice before beginning control tests.

Identify sample splices with tamper proof and weatherproof markings prior to shipment to the testing laboratory.

The sample shall consist of a resistance welded butt splice bar and a control bar that are identified and marked as a set. The same reinforcing bar (hoop) may be used to provide the test weld and control bar.

Test each sample to failure in accordance with ASTM A370 including Appendix A9, *Methods for Testing Steel Reinforcing Bars*, and Caltrans December 1, 2013 California Test 670. Determine the ultimate tensile strength for all control bars by testing the bars to failure.

The production lot will be rejected if:

(1) a sample fails within one bar diameter of the splice at less than 95 percent of the ultimate tensile strength of the associated control bar
(2) necking of the bar prior to rupture, as defined in California Test 670, is not observed
(3) a sample does not meet the mechanical requirements of ASTM A706 Grade 60

3. Welded Lap Splicing.

a. General. Use direct lap joint welds conforming to the requirements in AWS D1.4 except as noted below.

Use the joint details and dimensions as shown in Figure 3.4 (A), "Direct Lap Joint with Bars in Contact" of AWS D1.4.

Use electrodes classified as "Nickel-Steel" as referenced in AWS A5.5, A5.28, or A5.29.

b. Qualifications and Submittals. Perform welds using qualified welders and qualified Welding Procedure Specifications (WPS) meeting AWS D1.4. The operator and procedure qualification tests may be performed simultaneously.

Perform quality control inspection necessary to ensure the materials and workmanship meets the requirements of the Contract documents using an inspector currently certified as an AWS Certified Welding Inspector (CWI) according to the provisions of AWS QC1.

Submit a welding plan stamped and signed by the CWI responsible for quality control and consisting of the following documents:

(1) Quality control inspector qualifications including CWI number.
(2) Welding Procedure Specifications (WPS).
(3) Procedure Qualification Records (PQR) and test results.
(4) Welder Performance Qualification Records (WPQR) with documentation of current welder certification.
(5) Type and extent of Nondestructive Examination (NDE) to be conducted, as required in the specifications.
(6) Nondestructive testing personnel qualifications.
(7) Methods of protecting the welding area.
(8) Certified test report(s).

Submit quality control inspection documents, test results, and required test assemblies.

c. Testing/Inspection. Perform inspection according to AWS D1.4.

4. Mechanical Butt Splices.

a. Types. Use one of the following types of mechanical butt splices:

(1) Sleeve-Threaded Mechanical Butt Splices. Use a sleeve-threaded mechanical butt splice consisting of a steel splice sleeve with tapered interior threads that joins the bars with matching tapered threads.

(2) Sleeve-Swaged Mechanical Butt Splices. Use a sleeve-swaged mechanical butt splice consisting of a seamless steel sleeve applied over the ends of the reinforcing steel bars and swaged to the bars by means of a hydraulic press.

(3) Sleeve-Lock Shear Bolt Mechanical Butt Splices. Use a sleeve-lock shear bolt mechanical butt splice consisting of a seamless steel sleeve with serrated steel strips welded to the inside of the sleeve, center hole with centering pin, and bolts tightened until the bolt heads shear off and the bolt ends are embedded in the reinforcing steel bars.

(4) Two-Part Sleeve-Forged Ends Mechanical Butt Splices. The two-part sleeve-forged ends bar type of mechanical butt splices consists of a shop machined two-part threaded steel sleeve coupling forged ends of the reinforcing steel bar.

b. General. Conform to the manufacturer's instructions when splicing.

Cut the reinforcing steel bars perpendicular to the long axis of the bar.

Provide a clear cover of not less than 1-1/2 inches measured from the surface of the concrete to the outside of the splice sleeve. Adjust stirrups, ties and other reinforcing steel if necessary to provide clear cover.

For epoxy-coated bars, use epoxy-coated mechanical splices.

Mark each splice with the lot, heat, or batch number that identifies the splice.

c. Qualifications and Submittals. A splice will be considered qualified if the splice can develop a minimum tensile strength of 80000 psi, based on the nominal bar area, and the

bars within the splice do not exceed a total slip shown in Table 503-3, when tested according to ASTM A370, including Appendix A9 and California Test 670.

TABLE 503-3
TOTAL SLIP LENGTH

Reinforcing Bar No.	Total Slip (inch)
4	0.020
5	0.020
6	0.020
7	0.028
8	0.028
9	0.028
10	0.036
11	0.036
14	0.048
18	0.060

Submit the following information:

(1) the manufacturer's name;

(2) the name of the product or assembly;

(3) the lot, heat, or batch number that identifies the splice;

(4) the bar grade and size number to be spliced by the material;

(5) a complete description of the splice and installation procedure; and,

(6) test results indicating the splice, used according to the manufacturer's procedures, complies with the minimum tensile strength requirements and the total slip requirements.

d. Testing/Inspection. Perform job control tests consisting of the fabrication, under conditions used to produce the splice, and tensile testing of 6 sample splices for each lot of splices. The Engineer will designate when samples for job control tests are to be fabricated and will determine the limits of the lot represented by each job control test.

A lot of mechanical butt joints is defined as no more than 150 splices of the same type of mechanical butt splice used for each combination of bar size and bar deformation pattern that is used in the work.

Make splice samples using the same splice materials, position, equipment, and following the same procedures as used to make splices in the work. Make splice samples at least 5 feet long with the splice at mid-length. Shorter sample splice bars may be used if approved by the Engineer.

Perform job control tests in the presence of the Engineer. Splices tested in the absence of the Engineer may be rejected. Notify the Engineer, in writing, at least 7 working days prior to performing testing.

Identify sample splices with weatherproof markings prior to shipment to the testing laboratory.

Test each sample according to ASTM A370, including Appendix A9. Tensile test each sample until partial or total fracture of the parent bar material, mechanical splice material, or bar-to-splice connection.

All splices in the lot represented by a test will be considered to meet the tensile strength requirements when the minimum individual tensile strength of the sampled splices is not less than 80000 psi, based on the nominal bar area.

5. Mechanical Lap Splices.

a. General. Conform to the manufacturer's instructions when splicing.

Provide a clear cover of not less than 1-1/2 inches measured from the surface of the concrete to the outside of the splice sleeve. Adjust stirrups, ties and other reinforcing steel if necessary to provide clear cover.

For epoxy-coated bars, use epoxy-coated mechanical splices.

Mark each splice with the lot, heat, or batch number that identifies the splice.

b. Qualifications. A splice will be considered qualified if the splice can develop a minimum tensile strength of 75000 psi, based on the nominal bar area, when tested according to ASTM A370, including Appendix A9.

Submit the following information:

(1) the manufacturer's name;

(2) the name of the product or assembly;

(3) the lot, heat, or batch number that identifies the splice;

(4) the bar grade and size number to be spliced by the material;

(5) a complete description of the splice and installation procedure; and,

(6) test results indicating the splice, used according to the manufacturer's procedures, complies with the minimum tensile strength requirements.

c. Testing/Inspection. Perform job control tests consisting of the fabrication, under conditions used to produce the splice, and tensile testing of 6 sample splices for each lot of splices. The Engineer will designate when samples for job control tests are to be fabricated and will determine the limits of the lot represented by each job control test.

A lot of mechanical butt joints is defined as no more than 150 splices of the same type of mechanical butt splice used for each combination of bar size and bar deformation pattern that is used in the work.

Make splice samples using the same splice materials, position, equipment, and following the same procedures as used to make splices in the work. Make splice samples at least 5 feet long with the splice at mid-length. Shorter sample splice bars may be used if approved by the Engineer.

Perform job control tests in the presence of the Engineer. Splices tested in the absence of the Engineer may be rejected. Notify the Engineer, in writing, at least 7 working days prior to performing testing.

Identify sample splices with weatherproof markings prior to shipment to the testing laboratory.

Test each sample according to ASTM A370, including Appendix A9. Tensile test each sample until partial or total fracture of the parent bar material, mechanical splice material, or bar-to-splice connection.

All splices in the lot represented by a test will be considered to meet the tensile strength requirements when the minimum individual tensile strength of the sampled splices is not less than 75000 psi, based on the nominal bar area.

503-3.06 HEADED BAR REINFORCING STEEL. Use headed bar reinforcing steel consisting of deformed reinforcing steel bars with a head attached to one or both ends. Attachment can be accomplished through welding or forging of heads onto the bar ends, by internal threads in the head mating to threads on the bar end or by a separate threaded nut to secure the head to the bar. Heads may be forge formed, machined from bar stock, or cut from plate.

Perform production control tests consisting of the installation, using the same procedure as used in the work, and tensile testing of 3 sample headed bar assemblies for each lot of heads.

A production lot of headed bar reinforcing steel is defined as no more than 150 headed bar assemblies of the same bar size, with heads of the same size and type, and manufactured by the same method, produced from bar material of a single heat number and head material of a single heat number. For bars having heads on both ends, the bar will be counted as 2 reinforcing steel bars for the purposes of establishing and testing production lots.

Test each sample according to ASTM A970.

All headed bar assemblies in the lot represented by a test will be considered to meet the tensile strength requirements when the minimum individual tensile strength of the sampled headed bar assemblies meets the tensile strength requirements of ASTM A970. Failure of one or more sample headed bar assemblies will result in the rejection of the entire lot.

Provide the test reports to the Engineer for approval prior to placing concrete.

503-3.07 DRILLING AND BONDING DOWELS. Install dowels at locations shown on the Plans or as authorized by the Engineer. Drill holes by methods that do not shatter or damage the concrete adjacent to the holes. Do not damage reinforcing steel or prestressing steel when drilling through reinforced concrete members, unless approved by the Engineer. The Engineer will evaluate holes in which reinforcing steel or prestressing steel is encountered during drilling for structural adequacy and durability.

Drill each hole to the diameter and depth recommended by the manufacturer to develop the ultimate strength of the dowel or to the depth shown on the Plans, whichever is greater.

Prepare each hole according to the manufacturer’s instructions before placing the epoxy and the dowels. Fill the hole with epoxy and install the dowel according to the manufacturer's instructions. Completely fill drilled holes with epoxy using a method that will not trap air or create voids. Support dowels and prevent movement during curing. Do not disturb the dowels until the epoxy has cured.

Do not use dowels made from epoxy-coated reinforcing steel, except as noted on the Plans.

503-3.08 PLACEMENT TOLERANCES. When placing reinforcing steel, do not reduce the total number of bars specified. Place reinforcing steel within the following tolerances:

1. Clear Cover: +1/4 inch, -3/8 inch, but not reducing the clear cover to less than 1 inch.

2. Placement of Reinforcing Steel: ±1/2 inch.

3. Spacing of Reinforcing Steel: ± One-quarter of the specified spacing, but not to exceed 1 inch.

4. Spacing for Bundled Reinforcing Steel: 1 inch or 2 times the individual nominal bar diameter between bundles, whichever is greater.

5. Embedment Length and Length of Lap Splices: -1 inch for No. 3 through No. 11 bars, -2 inches for No. 14 and No. 18 (embedment only).

6. Location of Bends in Bars and Ends of Bars: ±2 inch.

503-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

Drill and Bond Dowels. Measured per dowel, complete in place.

503-5.01 BASIS OF PAYMENT.

Reinforcing Steel. Reinforcing steel will be paid for at the Contract lump sum price. The lump sum price is full compensation for furnishing, fabricating, placing, splicing, heading, inspecting and testing reinforcing steel as indicated in the Contract documents. Increase in weight of reinforcing due to splices, heads, and additional support bars will not be paid for.

Payment for reinforcing steel used in precast concrete members is included in the Contract price for the precast members, as provided in Section 501.

Drill and Bond Dowels. Payment for Drill and Bond Dowels includes materials and work for installing dowels.

Payment for reinforcing steel used in minor structures is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
503.0001.____	Reinforcing Steel	LS
503.0002.____	Epoxy-Coated Reinforcing Steel	LS
503.0003.____	Drill and Bond Dowels	EACH

SECTION 504
STEEL STRUCTURES

504-1.01 DESCRIPTION. Construct steel structures and the structural metal portions of composite structures according to the Plans.

Furnish, fabricate, erect, and coat structural metals shown on the Plans, including structural steel of all grades, bolts and fasteners, stud shear connectors, welding, special and alloy steels, metallic electrodes, steel forgings and castings, and iron castings. Furnish, fabricate, and install incidental metal construction and elastomeric material not otherwise provided for, according to the Contract.

504-2.01 MATERIALS. Use materials that conform to the following:

Paint	Subsection 708-2.01
Structural Steel	Section 716
Arc Welding Electrodes	Section 716
Fasteners	Section 716
Steel Grid Floors	Section 716
Steel Pipe	Section 716
Galvanizing	Section 716
Steel Forgings	Section 718
Steel Pins & Rollers	Section 718
Castings	Section 719

With written approval, substitute a grade of steel, for that specified, for a particular application where it is desired. Substituted steel must be equal or superior in both physical and chemical properties.

CONSTRUCTION REQUIREMENTS

504-3.01 FABRICATION.

1. Shop Inspection. Furnish 30 days' notice of when work will begin at the fabrication shop to allow for an inspection.

   Furnish 4 signed copies of mill reports covering all steel used on the project.

2. General. Fabricate steel bridge members, except for rolled shapes, at a plant certified under the American Institute of Steel Construction (AISC) Certification Program for Steel Bridge Fabricators at the "Advanced Bridge" level with a Fracture Critical Endorsement.

   Protect structural steel from corrosion, dirt, grease, or other foreign matter. Store structural steel at least 12 inches above the ground.

   Ensure that rolled material is straight before being laid off or worked. If straightening is necessary, use methods that will not injure the metal. Do not use material with sharp kinks or bends.

   Steel or wrought iron may be flame cut provided a mechanical guide is used to secure a smooth surface. Flame cut by hand only where approved, and smooth the surface by planing, chipping, or grinding. Manipulate the cutting flame to avoid cutting beyond the prescribed lines. Fillet re-entrant cuts to a radius of at least 3/4 inch.

   Ensure that finished members are true to line and free from twists, bends, and open joints.

   Plane sheared edges of plates more than 5/8 inch thick and carrying calculated stresses to a depth of 1/4 inch deep. Fillet re-entrant cuts before cutting.

Make sure the surface finish of bearing and base plates and other bearing surfaces that will contact each other or concrete meets the surface roughness requirements as defined in ANSI/ASME B-46.1, surface roughness, waviness and lay, Part I:

Steel slabs	ANSI 2,000
Milled ends of compression members, stiffeners, and fillers	ANSI 500
Slide bearings	ANSI 125

Face and bring to an even bearing abutting joints in compression members and girder flanges, and in tension members where specified on the drawings. Where joints are not faced, keep the opening at 1/4 inch or less.

Build floor beams, stringers, and girders with end construction angles to the exact length shown on the Plans, as measured between the heels of the connection angles. The permissible tolerance is plus 0 inch to minus 1/16 inch. Where continuity is required, face end connections.

Cold bend load-carrying rolled-steel plates as follows:

Take the rolled-steel plates from the stock plates so that the bend line is at right angles to the direction of rolling. Before bending, round the edges of the plate to a radius of 1/16 inch throughout the portion of the plate to be bent.

Bend until the radius of the bends, measured to the concave face of the metal, is not less, and preferably more, than shown in the following table, where T is the thickness of the plate.

Angle Through Which Plate is Bent	**Minimum Radius**
61-90 degrees	1.0 T
91-120 degrees	1.5 T
121-150 degrees	2.0 T

If a shorter radius is essential, bend the plates when hot, but not shorter than a radius of 1.0 T.

Fit up and attach end and intermediate stiffeners as shown on the Plans. Do not weld ends of stiffeners and other attachments to flanges unless shown on the Plans.

Submit shop drawings in one complete submittal package. Partial or incomplete submittals will not be reviewed or considered. Partial or incomplete submittals will be rejected. No additional contract time will be permitted due to partial, incomplete, or inadequate submittals.

3. Shop Splices. In addition to those shown on the Plans, girder webs and flanges may contain a maximum of 2 shop splices per plate per span. Indicate all splices on the shop drawings. These splices are subject to approval and are subject to the following limitations:

Make splices complete penetration butt welds. Grind flange splices flush. Grind web splices flush on the outside face of exterior girders only. Grind parallel to the longitudinal axis of the girder.

Do not place a bottom flange splice within the middle third of any span. Use tension flange splices only as shown on the Plans or as approved.

Completely weld each element of a girder, such as flange or web, before attaching it to another element.

Make all splices at least 6 inches from the nearest stiffener plate. Offset web and flange splices at least 6 inches.

4. Bolt Holes. Either drill or punch bolt holes. Make finished bolt holes 1/16 inch larger than the nominal diameter of the bolt. Ensure holes are clean cut and without burrs or ragged edges. Material with poorly matched holes will be rejected.

   When material forming parts of a member is composed of not more than 5 thicknesses of metal, and whenever the thickness of the metal is not greater than 3/4 inch for structural carbon steel or 5/8 inch for alloy steel, either punch or drill the holes to full size.

   When there are more than 5 thicknesses or when any of the main material is thicker than 3/4 inch in carbon steel, or 5/8 inch in alloy steel, or when required under paragraph 7 below, subpunch or subdrill the holes 3/16 inch smaller. After assembling, ream them to size or drill them from the solid to full size.

   For punched holes, the diameter of the die must not exceed the diameter of the punch by more than 1/16 inch. Ream any holes that must be enlarged to admit bolts.

   Ream holes cylindrical and perpendicular to the member. Direct reamers mechanically, where practicable.

   Ream and drill using twist drills. Assemble connecting parts requiring reamed or drilled holes and securely hold them while reaming or drilling them. Match mark them before disassembling.

   Subpunch (or subdrill if required) holes for field connections and field splices of arch members, continuous beams, towers (each face), bents, plate girders, and rigid frames while assembled in the shop. Obtain approval of the assembly, including camber, alignment, and accuracy of holes and milled joints before beginning reaming.

   Subpunch and ream holes for floor beam and stringer field end connections to a steel template, or ream them while assembled. When partial assembly is permitted ream holes for web member connections with steel templates.

   When using templates to ream field connections of web members of an arch, bent or tower, mill or scribe at least one end of each web member normal to the long axis of the member. Accurately set the templates at both ends from this milled or scribed end.

   Ream or drill the full size of the field connection through templates after carefully locating the templates as to position and angle and firmly bolting them. Use exact duplicate templates used to ream matching members or the opposite faces of one member. Accurately locate templates for connections that duplicate so that like members are duplicates and require no matchmarking.

   Accurately punch holes full-size, subpunch them, or subdrill them so that after assembling (before reaming), a cylindrical pin 1/8 inch smaller in diameter than the nominal size of the punched hole may be entered perpendicular to the face of the member, without drifting, in at least 75 percent of the contiguous holes in the same plane. If the requirement is not fulfilled, the badly punched pieces will be rejected. If any hole will not pass a pin 3/16 inch smaller in diameter than the nominal size of the punched hole, the material will be rejected.

   Ream or drill holes so that 85 percent of the holes in any contiguous group after being reamed or drilled show no offset greater than 1/32 inch between adjacent thicknesses of metal.

Provide in steel templates hardened steel bushings in holes accurately dimensioned from the center lines of the connection as inscribed on the template. Use the center lines to locate accurately the template from the milled or scribed ends of the members.

5. Shop Assembling. Completely shop assemble the entire structure, including the floor system. When the Contract Documents indicate “partial assembly,” assemble continuous beams and plate girders in lengths of 3 or more abutting panels. The assembled length must be at least 150 feet.

   Clean metal surfaces in contact before assembling them. Assemble, pin well, and firmly draw together the parts of a member with bolts before beginning reaming. Make milled ends of compression members in full bearing before starting reaming. Take apart assembled pieces, if necessary, to remove burrs and shavings produced by reaming. Keep the members free of twists, bends, and other deformities.

   To prepare to shop bolt material punched full-size, spear-ream the bolt holes, if necessary, to admit the bolts. Make the reamed holes no more than 1/16 inch larger than the nominal diameter of the bolts.

   Secure end connection angles, stiffeners, and similar parts using shipping bolts to prevent damage in shipment and handling.

   Furnish a camber diagram showing the camber at each panel for each truss. Take the camber from actual measurement while the truss is assembled, or base it on calculated values when full assembly is not required.

   Allow holes to drift during assembly only as needed to position the parts, and not enough to enlarge the holes or distort the metal. To enlarge holes to admit the bolts, ream them.

   Match mark connecting parts assembled in the shop to allow for reaming holes in field connections. Furnish a diagram showing the marks.

6. Bolted Connections, High-Strength Bolts. Determine bolt lengths by adding the values given in Table 504-1 to the total thickness of connected material. These values compensate for thickness of nut, bolt point, and washers. Add 5/32 inch to the grip length per each additional flat washer. Adjust the total length to the next longer 1/4 inch increment up to a 5 inch length and to the next longer 1/2 inch increment for lengths over 5 inches.

   Fit bolted parts solidly together when assembling them and do not separate them by gaskets or other interposed compressible material. Place hardened washers under the turned element.

TABLE 504-1
BOLT LENGTH DETERMINATION

Bolt Diameter (inches)	Added Length (inches)
1/2	11/16
5/8	7/8
3/4	1
7/8	1-1/8
1	1-1/4
1-1/8	1-1/2
1-1/4	1-5/8

Keep assembled joint surfaces, including those adjacent to washers, free of scale except tight mill scale. Clean off dirt, loose rust, burrs, and other defects that would prevent the parts from seating. Keep contact surfaces free of oil, paint, or lacquer.

When the outer face of the bolted parts has a slope of more than 1:20, use a smooth beveled washer in contact with the sloped surface.

Tighten fasteners to give at least the required minimum tension values shown in Table 504-2 when the joint is completed. Use bolts and nuts made by the same manufacturer in a connection.

TABLE 504-2
REQUIRED BOLT TENSION

Bolt Size (inches)	Required Minimum Tension (pounds)
3/4	28,400
7/8	39,250
1	51,500

Use zinc coated load indicating washers. Demonstrate the suitability of the device by testing a representative sample of at least three devices for each diameter and grade of fastener used in the structure. Test with a calibration device capable of indicating bolt tension. Include in the test assembly flat, hardened washers, if required in the actual connection, arranged as those in the actual connection to be tensioned. Demonstrate with the calibration test that the device indicates a tension at least 5 percent greater than that required by Table 504-2. Follow manufacturer's installation procedures when installing bolts in the calibration device and in all connections. Be careful to properly install flat, hardened washers when using load indicating devices with bolts installed in oversized or slotted holes and when using the load indicating devices under the turned element. The load indicating device will count as one washer for the purpose of determining bolt length.

Place the load indicating device under the bolt head and turn only the nut when tightening the bolt. The device must indicate full tensioning of the bolt when the opening reaches zero.

Install bolts in all holes of the connection and bring them to a snug tight condition. Then, tighten fasteners, progressing systematically from the most rigid part (usually near the center) of the connection to the free edges, or as directed. Keep previously tightened fasteners from relaxing. Multiple systematic tightening cycles may be required.

Do not reuse high-strength bolts. Remove previously fully tightened bolts that were loosened by tightening adjacent bolts. Replace them with new bolts, nuts, and load indicating devices.

7. Welding. Perform all welding and Nondestructive Examination (NDE) as specified or shown on the Plans. Conform to ANSI/AASHTO/AWS *Bridge Welding Code* D1.5 when welding new steel bridge girders, beams, and stringers. Conform to the *Structural Welding Code* AWS D1.1 when welding all other steel structures.

   At least 30 days prior to welding, submit for approval a welding plan stamped and signed by an American Welding Society Certified Welding Inspector per QC1 (CWI) responsible for the Quality Control (QC) and consisting of the following documents

   a. Quality control personnel qualifications including CWI number
   b. Welding Procedure Specifications (WPS) using forms in AWS D1.1, Sample Welding Forms

c. Procedure Qualification Records (PQR) when applicable, using forms in AWS D1.1, Sample Welding Forms
d. Welder Performance Qualification Records (WPQR) using forms in AWS D1.1, Sample Welding Forms with documentation of current welder certification
e. Type and extent of NDE to be conducted, as required in the specifications

Using a CWI, perform all quality control inspection necessary to ensure the materials and workmanship meet the requirements of the contract documents.

Correct all deficiencies in materials and workmanship revealed by Quality Control and Quality Assurance inspections without additional compensation.

Furnish all completed quality control inspection documents.

Do not weld or tack brackets, clips, shipping devices or other material not required by the Contract documents to the permanent structure, unless shown on the working drawings and approved by the Engineer.

504-3.02 ERECTION.

1. General. Provide the falsework and all tools, machinery, and appliances, including driftpins and fitting-up bolts, needed to perform the work efficiently. Erect the structural steel, remove the temporary construction, and do the work to complete the structure, as required by the Contract Documents. Make temporary field welds to structural steel according to the procedures required by these Specifications. Steel with sharp kinks or bends will be rejected.

2. Handling and Storing Materials. Store material on skids above the ground. Keep it clean and properly drained. Place girders and beams upright and shore them. Adequately support long members, such as columns and chords, on skids to prevent injury from deflection.

3. Falsework. Use falsework according to Section 512.

4. Erection Plan. Submit an erection plan for approval stamped by a Professional Engineer registered in the State of Alaska. Submit the erection plan not less than 30 days prior to erecting the structural steel. Do not erect structural steel without the written approval of the Engineer.

   The erection plan must include, but is not limited to the following:

   a. Drawings indicating geometry, member sizes, material properties, foundations capacities, design assumptions, and other relevant information required to erect the structural steel.
   b. Support and lifting reactions for each stage of the erection procedure.
   c. Equipment type, size, capacity, position, work radius and other relevant information.
   d. Schedule, duration of each portion of work and other timing considerations.

   If multiple segments will be connected and supported or lifted as a single member, the following additional information is required:

   e. Stress sheets for each state of the erection procedure.
   f. Deflection diagrams including camber effects and adjustments.
   g. Bolted field splice stress calculations
   h. Falsework, if required, details and supporting calculations in accordance with Section 512.

   The erection plan shall conform to the requirements of the most recent edition of the AASHTO *LRFD Bridge Design Specifications,* the DOT&PF Bridges and Structures Manual and the Contract Documents. Do not exceed the permissible stresses defined in the most recent edition of the AASHTO *LRFD Bridge Design* Specifications using a construction load

factor of 1.25 for essentially static loads and 1.50 for dynamically applied loads. The Engineer will make the determination which loads shall be designated as static and dynamic loads.

Do not induce buckling or other instabilities at any time during shipping, handling or erection.

Submit changes needed to accommodate the erection plan for approval. Do not submit shop drawings until the Engineer has approved the erection plan.

Submit plans and calculations for the erection plan in one complete submittal package. Partial or incomplete submittals will not be reviewed or considered. Partial or incomplete submittals will be rejected. No additional contract time will be permitted due to partial, incomplete, or inadequate submittals.

Do not deviate from the approved erection plan without the written permission of the Engineer.

5. Assembling Steel. Accurately assemble the parts as shown on the Plans and follow match-marks. Handle the material carefully to avoid bending, breaking, or otherwise damaging the parts. Do not hammer if doing so will injure or distort the members. Clean bearing surfaces and surfaces to be in permanent contact before assembling the members.

6. Attachment of Formwork. When approved, use 1-inch maximum diameter holes in steel girder webs for attaching formwork. Place holes 6 inches minimum clear distance from all horizontal or vertical welds and space them at least 4 feet center to center. Drill or subpunch and ream holes. Do not provide empty bolt holes. Fill empty holes with tensioned high-strength bolts.

   Include in the request enough detail of the formwork for determining the stresses that will be imposed on the girder.

504-3.03 PAINTING.

1. Preparing Metal Surfaces for Painting. Prepare metal surfaces according to Specification SSPC-SP 10, Near White Blast Cleaning to a profile depth of 1 to 3 mils. Use a profile comparator to ensure minimum profile depth. Do not reuse sand or flint abrasives.

   Clean grit or shot of contamination before reusing it. Blow dust and grit from the surface with clean dry air. Remove weld spatter and round sharp edges to a smooth curve. To remove contamination, jet wash or scrub with a stiff brush and clear water or brush blast. Remove light rust with a steel brush or mechanical tool.

2. Schedule of Paint Coats for Metals. Unless otherwise specified, if structural steel will be exposed to weathering, shop-paint it at least 3 coats: prime coat, intermediate coat, and finish coat.

3. Painting Metal Surfaces.

   a. Time of Application. Apply 1 or more applications of prime coat. Apply the initial application within 4 hours after blast cleaning. Allow the manufacturer's recommended drying time between primer applications. Before painting and after preparing the surface, remove any oil, grease, soil, dust, or foreign matter on the surface. If rusting occurs after the surface is prepared, clean the surface again.

      Avoid contaminating cleaned surfaces with salts, acids, alkali, or other corrosive chemicals before applying the prime coat and between applications of the remaining coats of paint. Remove any contamination from the surface.

b. Storage of Paint and Thinner. Store paint and thinner in a separate building or in a room that is well ventilated and free from excessive heat, sparks, flame, or direct sun rays. Keep paints susceptible to damage from freezing in a heated storage space when necessary.

Leave paint containers unopened until required for use. Use open containers first. Seal left-over, partial containers.

Do not use paint that has begun to polymerize, solidify, gel, or deteriorate.

c. Mixing and Thinning. Mix paint thoroughly before use and agitate often during application.

Do not transfer paint mixed in the original container until all settled pigment is incorporated into the vehicle. Pouring off part of the vehicle temporarily to simplify mixing, is permitted.

Mix by mechanical methods, except use hand mixing for containers up to 5 gallons.

Do not use an air stream bubbling under the paint surface to mix paint or keep it in suspension. Remove and discard any skin that has formed in the container. Do not use the paint if the skin exceeds 2 percent of the paint volume.

When mixing paint, break up all lumps, completely disperse settled pigment, and create a uniform composition. If mixing by hand, pour off most of the vehicle into a clean container.

Lift the pigment in the paint from the bottom of the container using a broad, flat paddle. Break up lumps and thoroughly mix the pigment with the vehicle. Return the poured-off vehicle to the paint by simultaneously stirring or pouring repeatedly from one container to another until the composition is uniform. Inspect the bottom of the container for unmixed pigment.

Wet tinting pastes or colors with a small amount of thinner, vehicle, or paint and thoroughly mix them. Add the thinned mixture to the large container of paint and mix until the color is uniform.

If paint does not have a limited pot life, or does not deteriorate on standing, mix it at any time before use. However, if it has settled, remix it immediately before use. Do not keep paint in spray pots, painters' buckets, etc., overnight. Gather it into a container and remix it before use.

When the engineer deems it necessary to obtain satisfactory application, add paint thinner according to the manufacturer's instructions.

d. Application of Paint. Use the oldest of each kind of paint first. Apply paint by spraying. Use brushes, daubers, or sheepskins when no other method can properly apply paint in difficult access areas. Use dipping, roller coating, or flow coating only when authorized.

Blast clean all areas with mudcracking in the zinc-rich primer and then paint them with primer to the specified thickness.

After applying the prime coat, apply the intermediate and finish coats to exposed surfaces according to the manufacturer's recommendations.

Apply the intermediate coat in 2 applications. Apply the first application as a mist coat. Apply the second application after the mist coat has dried to a set-to-touch condition.

Apply the finish coat in 1 application.

Apply paint within the environmental limitations specified by the coating manufacturer. Do not apply paint when the temperature of the steel surface is less than 40 °F or more than 125 °F.

Do not apply paint in fog or mist, when it is raining or snowing, or when the relative humidity exceeds the manufacturer's recommendations. Do not apply paint to wet or damp surfaces. Do not apply paint on frosted or ice-coated surfaces.

With approval, apply paint in damp or cold weather, and only under the following conditions. Paint the steel under cover and protect and shelter it, or heat the surrounding air and the steel to a satisfactory temperature. Meet the above temperature and humidity conditions. Keep the steel under cover or protected until it is dry or until weather conditions permit its exposure.

Allow to dry any applied paint exposed to freezing, excess humidity, rain, snow, or condensation. Then, remove damaged areas of paint, prepare the surface again, and repaint it with the same kind as the undamaged areas.

Stripe paint before applying each coat of paint. Spot paint edges, corners, crevices, rivets, bolts, welds, and sharp edges before applying the full coat of paint on the steel. Extend striping for at least 1 inch from the edge. Let this stripe coat dry before applying the full coat, if possible. Otherwise, set-to-touch the stripe coat before applying the full coat. However, do not permit the stripe coat to dry long enough to allow the unprimed steel to rust.

Apply each coat of paint as a continuous film of uniform thickness, free of pores. Repaint any thin spots or areas missed in the application. Allow them to dry before applying the next coat.

Wait until each coat of paint is in the proper state of cure or dryness before applying the next coat.

Ensure a minimum dry film thickness of 3 mils and a maximum dry film thickness of 5 mils for each coat of paint. The dry film thickness of the paint will be measured in place with a calibrated magnetic film thickness gauge. If any coat of paint is thinner than specified, obtain the minimum dry film thickness by applying additional coats of paint.

A Tooke gauge may be used to perform destructive testing of each coat's dry film thickness. Repair damaged areas.

e. Brush Application. Brush paint areas inaccessible to a spray gun. Work paint into crevices and corners. Paint surfaces not accessible to brushes using daubers or sheepskins. Brush out runs or sags. Leave a minimum of brush marks in the applied paint.

f. Spray Application of Paint. To apply paint by spraying, use equipment capable of properly atomizing the paint to be applied. Use equipment with pressure regulators and gauges and use air caps, nozzles, and needles recommended by the equipment manufacturer for the material being sprayed. Keep the equipment in satisfactory condition to permit proper paint application. In closed or recirculating paint spray systems, where gas is used under pressure over the liquid, use an inert gas, such as nitrogen.

Provide adequately sized traps or separators to remove oil and water from the compressed air. Drain them periodically during operations. Ensure that the air from the spray gun impinging against the surface shows no water or oil.

Keep paint ingredients properly mixed in the spray pots or containers while applying the paint. Use either continuous mechanical agitation or frequent intermittent agitation.

Adjust the pressure on the material in the pot and adjust the air pressure at the gun for optimum spraying effectiveness. Adjust the pressure on the material in the pot when changing the elevation of the gun above the pot. Keep the atomizing air pressure at the gun high enough to atomize the paint properly but not so high as to cause the paint to fog or the solvent to evaporate, or to cause loss by overspray.

Keep spray equipment clean to avoid depositing dirt, dried paint, and other foreign materials in the paint film. Remove any solvents left in the equipment before applying paint to the surface.

Apply paint in a uniform layer, overlapping at the edge of the spray pattern. During application, hold the gun perpendicular to the surface and at a distance that will deposit a wet layer of paint on the surface. Release the gun's trigger at the end of each stroke.

Apply coats free of runs, sags, and dry spray.

g. Shop Painting. Perform shop painting after fabrication and before the surface is damaged from weather or other exposure.

Do not paint shop contact surfaces. Paint surfaces to be in contact after field erection.

Apply only a mist coat (0.5 to 0.8 mil dry film thickness) of inorganic zinc-rich primer, meeting SSPC Paint Specification No. 30, Weld-Through Inorganic Zinc Primer, Class 5, on the following surfaces:

(1) High strength bolted connection contact surfaces
(2) Top flange steel surfaces
(3) Areas within 2 inches from the edges to be welded
(4) Areas where the full 3 coats of paint will interfere with field assembly

Apply the full paint coats specified to steel surfaces that will contact wood.

Remove anti-weld spatter coatings before painting.

Before abrasive blasting, grind smooth all metal defects, fins, slivers, burrs, weld spatter, and sharp edges from shearing or similar operations, including flame hardened edges from cutting or burning. Grind flame hardened edges to a 1/16 inch minimum radius. Repair defects that become evident after abrasive blasting or prime coat application. Retexture the surface to match the blasted profile.

Copy erection marks and weight marks on areas that have been previously painted with the shop coat.

h. Field Painting. If steel surfaces have not received the full paint coats, paint them as soon as possible after erection.

Touch up metal that has been shop coated with the same type of paint as the shop coat. Touch up by cleaning and painting field connections, welds, bolts and all damaged or defective paint and rusted areas.

If concreting or other operations damage any paint, clean the surface and repaint it. Remove concrete spatter and drippings before applying paint.

Protect wet paint against damage from dust or other detrimental foreign matter.

i. Drying of Painted Metal. Allow the paint to dry before recoating or exposing it. Do not add a dryer to paint on the job unless the paint specification calls for one. Do not immerse painted metal until the paint has dried. Protect paint from rain, condensation, contamination, snow, and freezing until dry.

j. Handling of Painted Steel. Do not handle painted steel until the paint has dried except for turning it for painting or stacking it for drying. Minimize damage to paint films from stacking steel members.

Remove paint that is damaged during handling and touch it up with the same number of coats and kinds of paint previously applied.

Wait until painted steel is dry before loading it for shipment.

Repair damaged galvanized coating per Subsection 716-2.07.

k. System Durability and Certification. Have the coating manufacturer review the project and the proposed service environment and issue you written recommendations and instructions to properly prepare the surface, apply the coating, and achieve maximum durability on this project.

Certify to the Department that the system was applied according to the manufacturer's recommendations and instructions. Enclose a copy of the recommendations and instructions with the certificate.

504-3.04 CLEANUP. Upon completion and before final acceptance of the structure, remove falsework and falsework piling down to 2 feet below the finished ground line.

504-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Structural steel measured by weight, will include castings, forgings, alloy steels, steel plates, high-strength bolts and nuts, anchor bolts and nuts, stud shear connectors, shoes, rockers, rollers, pins and nuts, expansion dams, roadway drains and scuppers, weld metal, and structural shapes for expansion joints and pier protection.

The weight of the metal in the completed structure will be computed, based on the following:

1. Unit Weights, pounds per cubic foot:

Aluminum, cast or rolled	173
Bronze or copper alloy	536
Copper sheet	558
Iron, cast	445
Iron, malleable	470
Lead, sheet	707
Steel, cast or rolled, including alloy, copper bearing, and stainless	490
Zinc	450

2. Shapes, Plates, Railing and Flooring. By their nominal weights and dimensions as shown on the contract drawings, deducting for copes, cuts and open holes, exclusive of bolt holes. The weights of plates more than 36 inches wide will include an estimated overrun computed as one-half the "permissible variation in thickness and weight" as tabulated in ASTM A 6.

The weight of railing will be included as structural steel unless the bid schedule contains a pay item for bridge railing under Section 507.

The weight of steel grid flooring will be computed separately.

3. Castings. From the dimensions shown on the Plans, deducting for open holes. To this weight will be added 5 percent for fillets and overruns. Scale weights may be used for castings of small complex parts, since it would be difficult to compute their weight accurately.

4. Welds. From the following for shop and fillet welds:

Size of weld (inches)	Pounds per linear foot
1/4	0.20
5/16	0.25
3/8	0.35
1/2	0.55
5/8	0.80
3/4	1.10
7/8	1.50
1	2.00

The weight of other welds will be computed on the basis of the theoretical volume from dimensions of the welds, adding 50 percent to the weight to allow for overrun.

5. High-Strength Bolts. From the following for bolt heads and nuts for high-strength bolts:

Bolt Diameter (inches)	Pounds per 100 Heads or Nuts
5/8	15
3/4	25
7/8	37
1	50
1-1/8	75

6. Excluded Items. The weight of the following will not be measured: erection bolts, shop and field paint, galvanizing; boxes, crates, and other containers used for shipping; together with sills, struts, and rods used for supporting members during transportation; and bridge hardware connectors used for joining timber members.

504-5.01 BASIS OF PAYMENT. If no pay item is included in the bid schedule for structural steel, the quantities of metal drains, scuppers, conduits, ducts and structural shapes for expansion joints and pier protection measured as provided above, will be paid for as reinforcing steel under Section 503.

No additional payment will be made for increases in structural steel quantities due to your erection method.

Structural steel for precast or prestressed concrete bridges is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
504.0001.____	Structural Steel	LS
504.0002.____	Structural Steel	LB

SECTION 505
PILING

505-1.01 DESCRIPTION. Furnish and drive piles, and assist in high strain dynamic pile testing.

505-1.02 DEFINITIONS.

CUT-OFF. The cut off end of a pile, or cutting a pile end at the finish elevation.

DIFFICULT DRIVING. Difficult driving occurs when the approved hammer exceeds 120 blows per foot, while operating at the corresponding stroke indicated in the approved wave equation analysis used to assess pile stresses.

DRIVECAP. A pile driver component that is used to transmit impact forces from the hammer ram to the pile top. The drivecap includes the anvil or striker plate, hammer cushion (capblock), helmet, and pile cushion, if used. (Also termed the driving head).

DRIVING RESISTANCE. The required axial resistance, in units of force, to be demonstrated during pile installation.

ESTIMATED PILE TIP ELEVATION. The pile tip elevation that was assumed in order to estimate the pile quantities shown on the bid schedule.

FRESH HEADING. Cutting the end of a pile perpendicular to the long axis to remove damage, and to obtain a proper driving or splicing surface.

FOLLOWER. A pile driving aid placed between the helmet and the pile top when the pile head is below the reach of the hammer.

HAMMER CUSHION. A disk of material placed on top of the helmet but below the anvil or striker plate to relieve impact shock and provide protection for the hammer and pile.

HAMMER ENERGY:

Maximum Rated Hammer Energy**.** The theoretical maximum amount of gross energy that a pile driving hammer can generate.

Transferred Hammer Energy. The amount of energy transferred to the pile for a given blow accounting for friction energy during the ram down stroke, energy retained in the ram and drivecap during rebound, and other impact losses as measured by high strain dynamic testing.

HELMET. A pile driver component that fits closely on top of the pile to ensure the impact force is transmitted uniformly across the top of the pile and concentric with the axis of the pile.

LEADS. Pile driver components used to maintain pile and hammer alignment during driving, and on which the pile hammer may travel. Types of leads include:

Fixed Leads**.** Pile driving leads that are attached at the top of the boom by a pivot and to the crane at the bottom with a brace. The pile is held at the top by the helmet and is guided at the bottom by the pile gate.

Semi-Fixed Leads**.** Pile driving leads that are attached at the top of the boom by a pivot and supported by the lead line. The lead can slide axially along the pivoted boom point and may be fitted with an extendable brace at the bottom of the leads.

Swinging Leads**.** Pile driving leads that are suspended from the boom by the cable and are not attached to the crane at the bottom with a brace. (Also known as offshore leads)

MINIMUM PENETRATION. The minimum length of pile below the footing or finished ground elevation to which the pile must be driven.

OBSTRUCTION. An unanticipated object projecting within the path of the pile that causes pile refusal or impedes the pile's advance within required tolerances.

PILE GATE. A device at the base of the leads that is closed around the pile to maintain alignment.

REFUSAL. Refusal occurs when the approved hammer requires 15 or more blows to move the pile one inch or less while the hammer is operating at the hammer's rated stroke or higher, or, when the pile yield stress is measured or estimated to be equal to or greater than 90 percent of the specified pile yield stress.

SUBSTRUCTURE UNIT. A unit of the substructure such as an abutment or pier that transmits loads directly from the superstructure to the ground.

TEST PILE. A pile that has a high-strain dynamic test performed on it.

TEMPLATE. A structure affixed to the ground used to maintain proper pile alignment during driving.

WAVE EQUATION ANALYSIS. A numerical method of analysis for the behavior of driven piles that predicts the pile capacity versus blow count relationship (bearing graph) and pile driving stress. Wave equation analysis is performed using a commercially available wave equation analysis program (WEAP) with a version dated 2010 or later.

505-2.01 MATERIALS. Use materials that conform to the following:

Structural Steel Piles	Section 715
Sand	Subsection 703-2.12

505-2.02 PILES. Furnish piles sufficient in length to extend to the Estimated Pile Tip Elevation specified in the Contract documents. Furnish full-length piles where practical. Where splices are required, follow the provisions of Subsection 505-3.04. Furnish additional pile length to provide for fresh heading and to suit the method of installation. Use metal shoes or reinforced tips as required. Store and handle piles in a manner that protects them from damage.

1. Steel Piles. Furnish H-pile sections, pipe piles, sheet piles or other structural steel sections described in the Contract.

   The Engineer will reject steel piles that exceed the camber and sweep permitted by allowable mill tolerance.

   Hot-dip galvanize steel piles a minimum thickness of 4 mils from the top to a distance not less than 10 feet below the finished ground line according to Subsection 716-2.07. Steel piles and pile shells that do not protrude above the final ground line do not require galvanizing.

CONSTRUCTION REQUIREMENTS

505-3.01 PILE DRIVING EQUIPMENT.

1. Pile Driving System. Use impact hammers to drive piles and to determine resistance during pile driving. Vibratory hammers may be used only for initial placement up to a penetration of 15 feet unless approved by the Engineer. Use pile driver leads that allow the hammer to move freely. Do not use followers to drive piles.

Fit the pile driving hammer with a cast-steel driving head (or similar device) that is recommended in the hammer manufacturer's guidelines, is compatible with the pile, and aligns concentrically and fits closely with the top of the pile.

If the pile driving hammer is fitted with a hammer cushion, use a cushion that satisfies the recommendation in the hammer manufacturer's guidelines, is appropriate to prevent damage to the hammer or pile, and ensures uniform driving performance. If not new, ensure the hammer cushion is at least 75 percent of the manufactured thickness. Replace driving hammer cushions with a reduction in cushion thickness exceeding 25 percent of the manufactured thickness. Do not use wood, wire rope, or asbestos hammer cushions.

Use only equipment included in the approved pile driving plan. The Engineer may inspect the pile driving equipment for conformance with the approved pile driving plan after it has been mobilized to the site and prior to beginning pile driving operations. Remove and replace pile driving equipment the Engineer determines does not conform with the approved pile driving plan, at no extra cost to the Department and with no adjustment to contract time.

2. Pile Driving Plan. No less than 30 days prior to the anticipated start of pile driving, submit for approval the details of each proposed pile driving system. Include in the pile driving plan:

   a. A completed Pile Driving Equipment Data form (Form 25D-098) for all hammer/pile configurations proposed for use on the project.

   b. Manufacturer's catalog cuts, specifications, manuals, guidelines, and technical bulletins for all pile driving equipment to be used.

   c. A description of the techniques to be used for ensuring proper placement and alignment of the piles, and advancing the piles to the Minimum Penetration and Driving Resistance as provided on the plans. Include proposed pile section lengths, estimated pile cutoff lengths, number of splices expected for each pile, and where galvanized pile will be used, if applicable.

   d. Alternate methods of pile installation in the event obstructions are encountered.

   e. A wave equation analysis for each pile driving system (see 505-3.01-3).

   The Engineer will base approval of the pile driving hammer on the wave equation analysis submitted by the Contractor and the requirements in this Subsection. The Department will verify the wave equation analysis using the computer program "GRLWEAP" and GRLWEAP industry standard hammer input data.

   The Engineer's approval of the pile driving plan will not relieve the Contractor of responsibility for:

   f. removing and replacing piles damaged during pile driving operations,

   g. obtaining the Driving Resistance specified in the Contract, or

   h. meeting Minimum Penetration specified in the Contract documents.

   Do not mobilize pile driving equipment to the site without an approved pile driving plan.

   Submit all revisions to the approved pile driving plan to the Engineer for approval. For all pile driving equipment not previously identified in the pile driving plan, include in the submittal all of the information required above for the pile driving plan. Explain to the Engineer, in writing, which portions of the approved pile driving plan will be superseded by the revision and which portions remain unchanged. Allow at least 5 days for the Engineer's approval of pile driving plan revisions.

3. Wave Equation Analysis. Submit a wave equation analysis sealed by a registered professional civil engineer licensed in the State of Alaska for all pile impact driving systems used to install piling according to the requirements of this subsection and the user's manual for the program. Verify that the pile driving system proposed does not produce pile stresses greater than 90-percent of the yield stress at the Driving Resistance specified in the plans. The rate of pile penetration must be between 30 and 100-blows per foot at the Driving Resistance specified in the plans, unless approved by the Engineer.

   Unless otherwise specified in the Contract or directed by the Engineer, use the presumptive quake and damping values presented in the program user's manual for the pile and soil conditions. Use of residual stress option is not allowed for prediction of blow counts.

TABLE 505-1
HAMMER EFFICIENCIES USED IN HAMMER APPROVAL

Hammer Type	For Analysis of Driving Rate	For Analysis of Driving Stresses
Single acting diesel hammers	0.72	0.84
Closed-ended diesel hammers	0.72	0.84
Single acting air/steam hammers	0.60	0.70
Double acting air/steam hammers	0.45	0.53
Hydraulic hammers or other external combustion hammers having ram velocity monitors that may be used to assign an equivalent stroke.	0.85	1.00

505-3.02 PILE TESTING AND PILE DRIVING CRITERIA. The Engineer will use high-strain dynamic testing to monitor pile driving performance and to evaluate the resistance of the pile during driving. The pile driving acceptance criteria will be developed using the results of the dynamic testing. The Engineer may also perform pile testing to confirm hammer-system efficiency; pile driving stresses, and pile integrity. Attend a meeting with the Engineer at least 14 days prior to the beginning of pile driving operations to evaluate and discuss the test pile program. Give the Engineer 7 days advance notice before driving each test pile.

The Engineer will perform the high-strain dynamic testing in accordance with ASTM D4945. Piles tested using high-strain dynamic testing may be incorporated into the work. Dynamic pile testing will include gathering dynamic data for at least 25 feet of the final pile drive as well as a restrike up to 30 hours after end of initial drive. The restrike may be waived at the direction of the Engineer.

The Engineer will test the first pile driven at each substructure. Do not install any production piles at the substructure unit until the test pile has been driven to the Driving Resistance and Minimum Penetration specified in the Contract documents unless directed in writing by the Engineer. The Engineer will require 4 hours at each test pile to set up and install the test equipment. The Engineer will attach testing instruments near the top of the test pile through drilled and threaded holes. When the pile is driven to the point where the testing instruments need to be removed from the lower pile section, they will be reattached to the top of the newly spliced section. The Department will furnish the testing equipment and labor necessary to mount the testing instruments to the pile. Provide a reasonable and safe means of access to the top of the test pile after the pile is placed in the leads. Furnish electrical power (a 115 volt, 55-60 cycle AC outlet, 10 amp minimum) for the Engineer's use during the installation and operation of the testing instruments.

Drive each test pile to the Driving Resistance and Minimum Penetration specified in the Contract documents as indicated by the driving criteria provided by the Engineer. The Engineer will record

driving data for the test pile. If an obstruction is encountered during driving of the test pile, testing will stop on that pile and the next pile driven at the substructure unit will be designated as a test pile.

If a pile is driven to Estimated Pile Tip Elevation and the high-strain dynamic test results do not support the conclusion that the Driving Resistance has been obtained, the Engineer may direct testing of additional piles and or suspension of pile driving operations and require the Contractor to restrike the pile up to 30 hours later with the Engineer present to record driving data. Perform the restrike with a warmed-up hammer with the energy or fuel setting adjusted to the position indicated in the approved pile driving plan. Strike the test pile with 60 consecutive blows or until the pile penetrates an additional 3 inches, whichever comes first. The Engineer may terminate the re-strike at any point during the testing.

If the results from the high-strain dynamic testing are acceptable to the Engineer, drive the remaining piles at the substructure unit using the driving criteria developed from the high-strain dynamic testing. The Engineer will provide the driving criteria within 1 day of the completion of high-strain dynamic testing. If the results from high-strain dynamic testing are not acceptable to the Engineer, proceed as per the written direction of the Engineer.

Account for the entire allotted equipment installation time required by the Engineer in the progress schedule submitted under Subsection 108-1.03 or Section 646, as applicable. Suspension of pile driving operations at a testing location to allow for testing instrument installation or a re-strike of a test pile is not a suspension of work per Subsection 108-1.06 and additional contract time will not be allowed.

505-3.03 DRIVING PILES. Drive all piles to the Driving Resistance and Minimum Penetration specified in the Contract documents using the pile driving criteria provided by the Engineer. Use the same pile driving system used to set pile driving criteria to drive all piles. Install piles in groups starting from the center of the group and proceed outward in either direction.

If the pile is driven to the Estimated Pile Tip Elevation and does not meet the acceptance criteria, continue driving only at the written direction of the Engineer.

1. Placement and Alignment. Ensure proper placement and alignment of the piles. The Engineer will reject piles that are bent or otherwise damaged by forcing the pile into the leads or template.

   Drive piles within an allowed variation as to direction of pile of not more than 1/4 inch per foot. Limit the rotation of steel piles about their longitudinal axis to 15 degrees from the plan position. In addition, position piles to the following tolerances:

   a. Abutments. Position the piles at the bottom of an abutment within 3 inches of the position specified in the Contract documents. Do not vary the distance between any two piles more than 3 inches from that specified in the Contract documents, and keep the clear distance from the edge of pile to the edge of footing to at least 9 inches.

   b. Pier Footings. Position the piles at the bottom of a footing within 6 inches of the position specified in the Contract documents. Do not vary the distance between any 2 piles more than 6 inches from that specified in the Contract documents, and keep the clear distance from the edge of pile to the edge of footing to at least 9 inches.

   c. Exposed Pile Piers. Position the piles within 2 inches of the position specified in the Contract documents at cut-off elevation and within 3 inches of the position specified in the Contract documents at the original ground line elevation.

2. Protection of New Concrete. When driving a pile near concrete placed within 28 days, ensure the distance between the pile being driven and the nearest edge of concrete is not less than the distance determined by the following formula:

$$D = C\sqrt{E}$$

Where: D = Distance in feet
E = Maximum rated hammer energy in foot-pounds
C = Vibration coefficient shown in Table 505-2 based on the number of calendar days after concrete placement

TABLE 505-2
VIBRATION COEFFICIENT

Concrete Age (days)	**Coefficient**
1	0.34
2	0.23
3	0.18
4	0.15
5	0.13
6	0.12
7-9	0.11
10-13	0.10
14-20	0.09
21-28	0.08

3. Obstructions. Use alternate methods to drive through or remove obstructions. Obtain written approval from the Engineer before employing any alternative methods of pile advancement.

   After exhausting all practicable means to obtain the minimum penetration, but without success, the Engineer will evaluate the structural adequacy of the bridge at a lesser penetration. This review will be based on the resistance of the pile during driving. If the Engineer finds the structure to be adequate, the pile will be accepted at the lesser pile penetration.

4. Concrete Filled Pipe Piles. After driving pile, clean out the pile to the bottom of concrete elevation specified in the Contract documents. If there is a delay between cleanout and placing concrete, verify that the soil level in the pile has not rebounded before placing concrete.

505-3.04 SPLICES, EXTENSIONS AND BUILD-UPS. If the length of a steel pile is not sufficient to obtain the Minimum Penetration and Driving Resistance specified in the Contract documents, the pile may be spliced in order to obtain the length required to reach the Minimum Penetration and Driving Resistance. Use pile additions with cross sections identical to the pile cross sections.

Make splices with complete joint penetration welds over the entire cross section. If approved, piles may be spliced using pile cut-offs and short pieces if no piece used is less than 10 feet long.

Meet the welding requirements of Section 504. Align the piles at a splice to meet the dimensional tolerances for the allowable variation in straightness of welded columns in AWS D1.1.

505-3.05 DEFECTIVE PILES. Use a pile driving method which does not damage the pile. Do not manipulate the piles to force them into proper position. Correct damaged or improperly driven piles using a method approved by the Engineer. Drive down all piles pushed up by driving adjacent piles or by any other cause. Approved methods may include one of the following:

1. Withdraw and replace the pile with a new and, when necessary, longer pile.

2. Drive a second pile adjacent to the defective pile.

3. Splice or build up the pile.

4. Extend a sufficient portion of the footing to properly imbed the pile.

505-3.06 CUTTING OFF PILES. Cut off the piles at the elevations indicated on the Plans. Ensure that all injured material is removed.

When steel piles are shown embedded in concrete footings or pile caps, cut off piles within -1/2 inch to +3 inches of the plan embedment, but do not interfere with reinforcing steel or other items embedded in concrete. When steel pipe piles are shown cutoff below concrete footings or pile caps, cut off piles within -1/2 inch to +1/2 inch of the plan elevation. In pile bents with steel cap beams, make accurate cut-offs to ensure full bearing between the caps and piles.

505-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Furnish Piles. The sum of the lengths of the piles in place in the completed structure, measured from the tip of pile to the cut-off elevation.

Drive Piles. The number of piles driven which are incorporated into the completed structure.

Sheet Piles. The projected area of furnished and driven sheet piles remaining in place in the permanent structure as called for on the Plans, measured in final position.

505-5.01 BASIS OF PAYMENT.

Furnish Piles. The contract price includes pile materials delivered to the site, pile shoes, reinforced tips and casing. Unused pile lengths removed by cut-offs and fresh heading are subsidiary. The payment amount will be calculated using the quantity of pile indicated on the bid schedule, or the measured quantity of installed piles, whichever is greater.

Drive Piles. The contract price includes:

1. All related work required to drive the piles to the Minimum Penetration and Driving Resistance, including: pile crew time (including payroll and administrative additives), equipment costs, and other fixed or variable items incurred during pile driving, the construction of temporary work platforms, fresh heading, splicing, restrike, pile cleanout and cutting off.

2. All related work required to construct preformed pile holes in locations identified in the Contract and sand backfill material.

3. All related work required to assist the Engineer in performing High Strain Dynamic Testing is subsidiary.

Sheet Piles. Sheet piles used as temporary shoring for excavation, whether removed or left in place at your option with permission of the Engineer, are subsidiary.

Obstruction Removal. Alternate methods of pile advancement through obstructions or difficult driving will be performed at the direction of the Engineer and will be paid in accordance with section 109-1.05 under item 505.0014.____ Special Pile Excavation.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
505.0005.____	Furnish Structural Steel Piles, _____	LF
505.0006.____	Drive Structural Steel Piles,_____	EACH
505.0009.____	Structural Steel Sheet Piles	SF
505.0014.____	Special Pile Excavation	CS

SECTION 506
TIMBER STRUCTURES

506-1.01 DESCRIPTION. Construct timber structures and the timber portions of composite structures. Furnish, prepare, fabricate, erect, treat and/or paint timber and hardware, as specified.

506-2.01 MATERIALS. Use materials that conform to the following:

Timber	Section 713
Preservatives for Timber	Section 714
Structural Shapes, Rods, and Plates	Section 716

Glued-Laminated Timber Members. Construct of Douglas Fir produced and inspected in conformance with the requirements of ANSI/AITC A 190.1. Use laminating adhesives for timber to be used in wet conditions. Use Industrial-Grade glued-laminated members that have been treated with pressure preservative.

Bolts, Screws and Drive Spikes. Conform to ASTM A307 (ANSI/ASME B 18.2.1). Galvanize meeting AASHTO M 232. Use standard timber fasteners manufactured with economy heads and spiral threads as drive spikes for fastening glued-laminated deck panels.

Preservatives. Use pressure treatment preservatives for timber bridges as specified.

Mastic Sealer. Use Seal Tight 158 Rubber Asphalt Sealer, or approved equal.

Steel Dowels. Use uncoated steel dowels with a minimum yield strength of 36,000 psi on glued-laminated deck panels.

Timber Connectors. Conform to the requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division II, Section 16.2.6, Timber Connectors.

CONSTRUCTION REQUIREMENTS

506-3.01 GENERAL. Employ competent bridge carpenters. Framing must be true and exact. Set the heads of nails and spikes flush with the wood surface. Workmanship on all metal parts must conform to specified requirements.

Stack all lumber and timber at the worksite to prevent warping. Open-stack untreated material at least 12 inches above the ground surface so that the pile will shed water. When required, cover untreated timber to protect it from the weather. Close-stack treated timber above the ground on blocks or lagging. Clear weeds and rubbish underneath and around all stacks.

Locate all non-removable erection marks on fabricated timber so they are hidden from view in the completed work.

Do not drag or drop timber members. Use web-belting slings and chokers to handle timber members. Protect corners with protection angles or blocking at pickup points.

The estimated quantity of treated timber shown on the Plans is approximate only and no guarantee is made that it is the exact quantity to be furnished. Glued-laminated timber quantities shown on the Plans indicate gross quantities of timber, based on nominal dimensions and actual lengths before final planing of the laminated member.

506-3.02 TREATED TIMBER. Fabricate timber (including all cutting, shaping, and boring) before treatment. Handle timber carefully without dropping, breaking the outer fibers, or bruising or penetrating the surface with tools. In coastal waters, avoid cutting and boring below the high-water mark. Carefully trim all abrasions and treat all cuts in treated piles according to AWPA standard M 4.

Before driving bolts, treat all holes bored after treatment according to the applicable AWPA standards. Plug remaining holes with treated plugs.

506-3.03 RESERVED.

506-3.04 HOLES FOR BOLTS, DOWELS, RODS, AND LAG SCREWS. Bore holes for round drift-bolts and dowels with a bit 1/16 inch smaller in diameter than the bolt or dowel to be used. Bore holes for square drift-bolts or dowels equal to one side of the bolt or dowel. Bore holes for machine bolts 1/16 inch wider than the bolt. Bore holes for lag screws with a bit not larger than the body of the screw at the root of the thread. Bore holes for deck dowels in glued-laminated timber deck panels 1/2 inch deeper than the dowel embedment and no more than 1/16 inch oversize.

506-3.05 BOLTS AND WASHERS. Use washers of the type and size specified to protect wood from bolt heads and nuts. Use cast-iron washers with a thickness equal to the diameter of the bolt and with a diameter 4 times its thickness. Use malleable or plate washers with diameter or side dimensions of the square equal to 4 times the diameter of the bolt, and thickness equal to 1/2 the diameter of the bolt. Use cast-iron washers when the timber is in contact with the earth. Check or burr all nuts with a pointed tool after final tightening to prevent turning.

506-3.06 COUNTERSINKING. Countersink bolts where smooth faces are required. Paint recesses formed for countersinking, except in railing, with pentachlorophenol or creosote oil. After bolts or screws are in place, fill the recesses with hot pitch or mastic sealer. Countersink fasteners for attaching glu-lam deck panels to their supporting members below the top surface of the deck. After installation, fill all fastener recesses in the top surface of the deck with mastic sealer.

506-3.07 FRAMING. Cut all lumber and timber accurately and frame to a close fit so that the joints bear weight evenly over all contact surfaces without shimming.

506-3.08 FRAMING BENTS. Bed mud sills firmly and evenly to solid bearing. Tamp them in place.

Carefully finish concrete pedestals for supporting framed bents so that posts will bear evenly on them. Set dowels for anchoring posts when the concrete is cast.

506-3.09 STRINGERS. Size stringers at bearings and place them in position so that knots near edges are in the top portions of the stringer.

Separate the lapped ends of untreated stringers by at least 1/2 inch for air circulation. Securely fasten the lapped ends by drift-bolting where specified. Stagger the joints when stringers are two panels in length.

Securely toe-nail cross-bridging between stringers with at least two nails in each end. Place cross-bridging at the center of each span.

506-3.10 PLANK FLOORS. Lay the planks heart side down. For seasoned material, use 1/4 inch openings between planks. For unseasoned material, use tight joints. Securely spike each plank to each stringer. Carefully grade the planks for thickness and lay them so that adjacent planks vary in thickness by no more than 1/16 inch.

506-3.11 LAMINATED OR STRIP FLOORS. Lay each piece vertically and tightly against the preceding piece. Each piece must bear evenly on all the stringers.

Use pieces long enough to bear on at least four stringers. Make end joints on any one stringer no closer than every third piece. Place end joints in adjoining pieces no closer than every second stringer.

Coat joints between adjacent glu-lam timber deck panels with mastic sealer before drawing the panels together.

506-3.12 TRUSSES. Check completed trusses to ensure that they show no irregularities of line. Chords must be straight and true from end to end in horizontal projection. Ensure that chords show a smooth curve through panel points conforming to the correct camber in vertical projection. Accurately fit all bearing surfaces and joints. The Engineer will reject pieces with uneven or rough cuts at the points of bearing.

506-3.13 PAINTING. Paint the structure only when specified.

506-4.01 METHOD OF MEASUREMENT. See Section 109.

506-5.01 BASIS OF PAYMENT.

Mastic sealer, elastomeric bearing pads, and hardware are subsidiary.

Structural steel is subsidiary unless shown on the bid schedule.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
506.0001.____	Treated Timber	LS
506.0002.____	Untreated Timber	LS
506.0003.____	Treated Timber	MBM
506.0004.____	Untreated Timber	MBM

SECTION 507
BRIDGE BARRIERS AND RAILING

507-1.01 DESCRIPTION. Construct concrete, timber, or steel bridge railing, pedestrian railing and safety railing as shown on the Plans. Furnish and install bridge number plates as shown on the Plans.

507-2.01 MATERIALS. Use materials that conform to the following:

Steel Railing	Section 722
Timber Railing	Section 506
Concrete	Section 501
Epoxy-Coated Reinforcing Bars	Subsection 709-2.01
Grout	Section 701-2.03
Cable	Use ¼ inch galvanized wire rope with a minimum breaking force of 7,000 pounds.
Bronze	ASTM B98, UNS Alloys C65100 or C65500 or ASTM B584, UNS Alloy C92200

CONSTRUCTION REQUIREMENTS

507-3.01 CONSTRUCTION REQUIREMENTS.

1. General. Construct railing to the line and grade shown on the Plans. Ensure that the rail does not reflect any unevenness of the bridge structure. Set rail posts plumb. Place railing after all falsework is removed and the span is self-supporting. Do not paint bridge railing.

   Furnish and install concrete curbing, associated reinforcing steel, and the approach rail transition bracket for steel bridge railing.

2. Steel. Erect steel railing in conformance with Section 504, except do not use load indicating washers. Weld in conformance with Section 504. Complete welding before galvanizing the railing.

3. Timber. Fabricate and install timber railing according to Section 506.

4. Concrete. Construct concrete barriers to meet applicable requirements of Sections 501 and 503. Use Class A concrete with a specified compressive strength of 4000 psi. Apply a rubbed finish to exposed surfaces of concrete.

507-4.01 METHOD OF MEASUREMENT. See Section 109.

507-5.01 BASIS OF PAYMENT. The contract price includes all rail elements, rail posts, brackets, spacers, fastenings and anchors required to attach the railing to the structure; concrete and associated reinforcing steel included or partially contained within the limits of the concrete rail section or within the limits of the concrete curb for the steel bridge rail section; and bridge number plates.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
507.0001.____	Steel Bridge Railing,_____	LF
507.0002.____	Pedestrian Railing	LF
507.0003.____	Thrie Beam Bridge Railing	LF
507.0004.____	Concrete Bridge Barrier	LF
507.0005.____	Timber Bridge Railing	LF

507.0006.____	Cable Safety Railing	LF

SECTION 508
WATERPROOFING MEMBRANE

508-1.01 DESCRIPTION. Furnish and install waterproofing membrane system on concrete bridge decks. Remove and dispose of waterproofing membrane systems on existing concrete bridge decks.

508-1.02 SUBMITTALS. Submit for approval a copy of the manufacturer's latest data sheets, installation procedure, curb and corner details, and manufacturer's on-site representative's name and experience.

For low voltage electric field vector mapping (EFVM) acceptance methods, submit for approval an acceptance testing plan. Include a list of equipment to be used, a diagram showing installation locations, inspection method, inspector's name and experience, and a letter from the membrane manufacturer stating that the system is compatible with EFVM testing. The EFVM inspector must not be employed by the contractor, subcontractor, or installer.

Provide one complete submittal not less than 30 days prior to installation of the waterproofing membrane system.

508-1.03 MANUFACTURER'S ON-SITE REPRESENTATIVE. Install waterproofing membrane system under the on-site supervision of a third-party representative from the manufacturer. The representative must not be employed by the contractor, subcontractor, or installer. The representative must be on site for the full duration of installation, testing, and during placement of the first lift of pavement overlay material. Do not substitute manufacturer's representative listed in the submittal without prior written approval from the Engineer.

508-2.01 MATERIALS. Use materials that conform to the following:

Spray-Applied Waterproofing Membrane	Subsection 731-2.01
Sheet Waterproofing Membrane	Subsection 731-2.02
Pavement Overlay Material	Division 400

CONSTRUCTION REQUIREMENTS

508-3.01 CONSTRUCTION.

1. General. Install the waterproofing membrane system in accordance with the manufacturer's installation procedure. Do not apply membrane until the end of the curing period and until concrete and grout has reached at least 80 percent of the specified 28-day compressive strength (f'c). Apply the membrane system vertically at curb faces up to the pavement thickness shown on the Plans. Use a tack coat recommended for use by the manufacturer. Protect adjacent surfaces not to be covered with the membrane from splatter or coating. Use pavement overlay material within the membrane manufacturer's temperature limitations.

   Hold a pre-placement meeting at least 3 days prior to application of the membrane. Include the Engineer, manufacturer's on-site representative, membrane installation foreman, and paving foreman.

2. Deck Preparation. Remove existing pavement and membrane systems by methods that do not damage the concrete.Prepare the concrete surfaces that are to receive the waterproofing membrane system as required by the manufacturer.

   Provide a letter prior to membrane placement from the manufacturer's on-site representative stating that the concrete surfaces to receive membrane meet the manufacturer's requirements and contract requirements prior to placement of the membrane system.

508-3.02 QUALITY CONTROL.

1. General. Record material batch numbers, batch manufacture date, processing information, and quantity of each material used. Submit these records to the Engineer within 3 days of completing the membrane installation.

2. Spray-Applied Waterproofing Membrane. Perform tensile adhesion bond testing of the waterproofing membrane system, at locations determined by the Engineer, in accordance with ASTM D4541 at least once every 2000 square feet of coated area.

   Perform wet or dry film thickness testing of the base membrane at least once per 100 square feet of coated area. Perform wet film thickness in accordance with ASTM D4414 and perform dry film thickness in accordance with either SSPC PA2 or SSPC PA9.

3. Sheet Waterproofing Membrane. Perform visual inspections on all surfaces throughout the installation process and repair any tears, unbonded areas or other defects in the waterproofing membrane system.

508-3.03 ACCEPTANCE TESTING. Perform acceptance testing by performing a flood test or by low voltage electric field vector mapping (EFVM).

1. Flood Testing. Perform flood testing of spray-applied waterproofing membrane prior to placement of tack coat or asphalt. Perform flood testing of sheet waterproofing membrane after completion of asphalt overlay.

   a. Saturate the bridge deck with repeated and continuous passes of a water truck in each lane for a 10 minute period.

   b. Continue wetting the deck at successive 15 minute intervals for a 4 hour period by driving at least one pass of the water truck in each traffic lane.

   c. Prevent or mitigate erosion of embankments.

   d. Any leakage during or after the 4 hour period will require repair according to 508-3.04.

2. Low Voltage Electric Field Vector Mapping. Perform EFVM acceptance testing in accordance with ASTM D7877. Perform testing prior to application of pavement. Do not apply asphalt until all repairs are made. Test again application of pavement. Provide a letter from the EFVM inspector stating that no breaches were found or that all breaches were repaired according to 508-3.04.

508-3.04 MEMBRANE REPAIRS.

1. General. Repair breaches in the membrane system in accordance with manufacturer's recommendations. If the total area of repairs exceeds 1 percent of the covered area, remove the membrane system in its entirety and reapply the membrane system. For the purposes of this section the minimum individual repair area will each be counted as one square foot. After all repairs are made and prior to final acceptance retest the membrane system in accordance with 508-3.03.

2. Spray-Applied Waterproofing Membrane Repairs. Use repair materials that meet the requirements of 731-2.01.

3. Sheet Waterproofing Membrane. If flood test acceptance testing is used after paving and breaches in the membrane system are found, remove the pavement and membrane system in its entirety and reapply the membrane system.

508-4.01 METHOD OF MEASUREMENT. See Section 109.

508-5.01 BASIS OF PAYMENT. Contract price is for removal and disposal of existing membrane(s) where present, and installation of new membrane(s).

Pavement overlay material will be paid for under the respective bid items for the material used. Removal and reapplication of pavement overlay material due to unacceptable membrane is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
508.0001.____	Waterproofing Membrane,_____	LS

SECTION 509
MICROSILICA MODIFIED CONCRETE OVERLAY (RESERVED)

SECTION 510
REMOVAL OF CONCRETE BRIDGE DECK

510-1.01 DESCRIPTION. Remove, wholly or in part, and satisfactory dispose of bridge deck concrete to the depth and limits shown on the Plans and/or as directed. Remove all unsound (spalled, cracked and/or delaminated) concrete.

510-2.01 MATERIALS. Use falsework meeting Section 512.

CONSTRUCTION REQUIREMENTS

510-3.01 GENERAL. Perform work to meet the applicable requirements of Section 202.

Prevent damage to reinforcing steel designated to remain in place.

Following the concrete removal, the Engineer will inspect any exposed reinforcing steel. Remove and replace bars or sections of bars that are damaged or deteriorated at any point to less than 80 percent of their original cross section, including cracked or broken bars.

Remove sufficient concrete to allow for splicing of a new piece of reinforcing steel. Extend the spliced reinforcing steel 32 inches beyond each end of the damage or deterioration.

Replace damaged or deteriorated steel reinforcing bars under Subsection 109-1.05, if:

1. not damaged by Contractor operations, or
2. damage from milling is a result of the concrete cover being 1 inch or less.

510-3.02 METHOD OF REMOVAL. Remove concrete to specified depth using hydrodemolition equipment. For areas of the deck not accessible to hydrodemolition, use mechanical impact methods. You may use power operated rotary milling machines to scarify the upper deck to a nominal depth of 3/4 inch.

510-3.03 MILLING. Use rotary type milling machines, capable of scarifying a minimum width of 4 feet per pass.

510-3.04 HYDRODEMOLITION.

1. Equipment. Use high-pressure water pumping system, low-pressure water filtration and feed systems, and remote-control stations for two remote-controlled demolishing units. Ensure a nozzle pressure of 25,000 psi.

   Employ qualified personnel, certified by the equipment manufacturer, to operate the equipment. Submit operator certification(s) to the Engineer for approval before beginning concrete removal operation.

2. Concrete Removal. Perform concrete deck removal as shown on the Plans. Perform hydrodemolition removal resulting in a rough finished surface, free of debris.

   Before concrete removal begins, the Engineer will select a trial area of sound concrete of the deck approximately 30 ft^2 in size. Advance the demolishing unit over this area and establish the operating parameters to achieve the depth of removal called for on the Plans. Submit a list of operating parameters to be used for production work to the Engineer for approval.

   During production work, the Engineer may require recalibration of the equipment if, in the Engineer's opinion, satisfactory concrete removal is not being obtained.

   Remove debris immediately after demolition operation to prevent rebonding to the surface of sound concrete. Remove any material which is allowed to rebond without extra compensation

and with no contract time extension. Avoid damage to remaining sound concrete and reinforcing steel.

Furnish and erect rigid safety shields adjacent to hydrodemolition equipment, or otherwise protect adjacent traffic and property from flying debris.

Protect traffic from hazardous glare of work lights during nighttime operations.

Furnish water to operate the hydrodemolition equipment.

3. Controlling Wastewater and Debris. Submit a work plan no less than 5 working days prior to the preconstruction conference describing environmental protection and procedures including BMPs for hazardous and non-hazardous waste, including but not limited to testing, handling, treatment, temporary storage, transportation, and disposal according to federal, state, and local requirements. The plan must be stamped by an Engineer registered in the State of Alaska and must be acceptable to the Alaska Department of Environmental Conservation.

   Perform the following:

   a. Capture and contain all wastewater and debris within the work area.
   b. Filter wastewater to ensure that it is free of concrete particles and sediment before being discharged.

4. Reinforcing Steel. Clean all reinforcing steel that is to remain in place and has been exposed by removal operations. Remove all rust and corrosive products immediately prior to concrete placement. Remove oil, dirt, concrete fragments, laitance, loose scale, and other coating that would destroy or inhibit the bond with the new concrete.

   Protect cleaned reinforcing steel from the elements and from contamination. Sandblast reinforcing steel contaminated as a result of your failure to provide adequate protection, at your expense.

510-3.05 MECHANICAL METHODS. In areas not accessible to hydrodemolition remove concrete by mechanical impact methods to the same depth as adjacent areas. Avoid damage to sound concrete structures by the improper use of mechanical tools. Repair, cracked or damaged structures, as required.

Also use mechanical methods if either of the following conditions exists:

1. There is unsound concrete remaining after the hydrodemolition is done in an area
2. There is a lack of bond between the existing concrete and the reinforcing steel

If unsound concrete exists or if the bond is broken around existing reinforcing steel, remove concrete to provide a 3/4 inch minimum clearance around the reinforcing steel. Do not damage any of the existing reinforcing steel that is to remain in place.

Operate the mechanical impact tool at angles less than 45 degrees as measured from the deck surface to the tool. Do not use jack hammers heavier than the nominal 30 lb class or chipping hammers heavier than the nominal 15 lb class.

510-3.06 CLEANUP. Following concrete removal, clean the job site and remove debris. Dispose of debris at a Department of Environmental Conservation approved landfill. Remove dust and loose particles by flushing with water and/or vacuum cleaning.

510-4.01 METHOD OF MEASUREMENT. See Section 109, by the area of removed surface, regardless of the depth of removal.

510-5.01 BASIS OF PAYMENT. The contract price includes full compensation for containment structures, debris collection systems, wastewater filtration systems, disposal of debris, and incidentals required to complete the work.

Removal and disposal of incidental items such as deck drains or dowels, repair of electrical conduits, replacement of electrical conduit expansion fittings, removal and reinstallation of pipe hangers, and removal and reinstallation of light fixtures or illuminated signs, are subsidiary.

Payment for falsework is covered under Section 512.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
510.0001.____	Removal of Concrete Bridge Deck	SF

SECTION 511
MECHANICALLY STABILIZED EARTH (MSE) WALL

511-1.01 DESCRIPTION. Furnish and install mechanically stabilized earth wall.

511-2.01 MATERIALS. Meet the following:

Class A Concrete	Section 501
Precast and Cast-in-Place Concrete Panels	Section 501
Reinforcing Steel	Section 503
Structural Steel	AASHTO M 270
Pipe and Perforated Pipe	Section 706
Geotextile for Drainage	Subsection 729-2.02
Geogrid	Subsection 729-2.05
Geocomposite Drainage System	As Specified
Porous Backfill Material	Subsection 703-2.10

1. Structure Backfill and Foundation Fill. Meet Subsection 703-2.07, Selected Material, Type A. Use materials with a sodium sulfate soundness loss less than 30 percent after four cycles as determined by AASHTO T 104 and free of shale or other particles of low durability.

   When using backfill material with 80 percent passing the 3/4 inch sieve, the minimum angle of internal friction on the portion of the material finer than the No. 10 sieve must be 34 degrees, as tested by AASHTO T 236.

   When using steel soil reinforcement, use backfill material meeting the following electrochemical requirements:

   a. pH of 5 to 10 (AASHTO T 289)

   b. Resistivity not less than 30 ohmmeters (AASHTO T 288)

   c. Chlorides not greater than 100 ppm (AASHTO T 291)

   d. Sulfates not greater than 200 ppm (AASHTO T 290)

2. Wall Members. Provide facing consisting of precast concrete panels, modular units, cast-in-place concrete, or welded wire fabric, as specified.

   Manufacture concrete panels with a minimum concrete compressive strength of 4,000 psi. Finish the exposed face with ordinary finish. For the face not exposed to view, provide a uniform surface finish free of open pockets of aggregate or surface distortions in excess of 1/4 inch. Locate soil reinforcement connection hardware during concrete placement to avoid contact with the panel reinforcing steel. Shop-fabricate welded wire fabric reinforcement from cold-drawn wire meeting AASHTO M 32, and the finished fabric meeting AASHTO M 55.

3. Soil Reinforcement. Use approved geogrid reinforcement.

   Galvanize all steel soil reinforcement and any steel connection hardware to meet AASHTO M 111. Manufacture steel strip reinforcement by hot rolling to meet ASTM A572, Grade 450, or approved alternate.

4. Working Drawings. Submit all working drawings and design calculations, including:

   a. Earthwork requirements including specifications for material and compaction of backfill.

   b. Details of revisions or additions to drainage systems or other facilities required to accommodate the system.

c. Existing ground elevations verified by the Contractor for each location involving construction wholly or partially in original ground.

d. Complete design calculations substantiating that all proposed designs satisfy the design parameters in the Contract documents.

e. Complete details of all elements required for the proper construction of the system, including complete material specifications.

Prohibit work on earth retaining systems for which working drawings are required until such drawings have been approved.

511-3.01 CONSTRUCTION.

1. Excavation and Backfill. Excavate and backfill earth retaining systems to meet Section 205. Replace excavated material with structure backfill material meeting Section 205. Compact the material as specified under Subsection 203-3.04.

2. Drainage. Provide outlet works at sags in the profile and at the low ends of the gutter.

   a. Weep Holes. Place a minimum of 2 cubic feet of porous backfill material encapsulated with geotextile at each weep hole. Cover joints between retaining wall panels, which function as weep holes, with geotextile. Dry and thoroughly clean the face panels that are to receive the geotextile.

   b. Drainage Blankets. Construct drainage blankets consisting of porous backfill material encapsulated in geotextile, collector pipes, outlet pipes, and cleanout pipes. Construct and compact the subgrade to receive the geotextile so it is free of loose or extraneous material and sharp objects that may damage the geotextile. Stretch, align, and place the fabric in a wrinkle-free manner. Overlap adjacent borders of the fabric from 12 to 18 inches. Repair torn or punctured fabric by covering the damaged area with a piece of fabric large enough to cover the damaged area and meet the overlap requirement.

      Place the porous backfill material in horizontal layers and thoroughly consolidate by the same methods specified for structure backfill. Prohibit ponding or jetting of porous backfill material or structure backfill material. Maintain a minimum of 6 inches of porous backfill material, structure backfill, or embankment material between the fabric and the equipment during spreading and compaction of the porous backfill material.

      Place perforated collector pipe, when required, within the porous backfill material to the flow line elevations shown. Place outlet pipes at sags in the flow line and at the low end of the collector pipe. Construct rock slope protection, when required, at the end of outlet pipes, as shown on the Plans. Place cleanout pipes at the high ends of collector pipes.

   c. Geocomposite Drainage Systems. Place and secure the geocomposite drainage material tightly against the excavated face, lagging or back of wall. Protect the drainage material against physical damage and grout leakage when concrete is to be placed against geocomposite drainage material.

3. Retaining Wall Construction. Construct mechanically stabilized earth walls consisting of a facing system to which steel or polymeric soil reinforcement is connected. Provide facing of precast concrete panels, cast-in-place concrete or welded wire fabric.

   Install polymeric soil reinforcement under Section 634.

   When constructing cast-in-place concrete facing, embed soil reinforcement which extends beyond the temporary facing into the facing concrete.

Form welded wire facing by bending the horizontal soil reinforcement 90 degrees upward to form the wire face. Connect the vertical portion of the welded fabric forming the face to the next upper level of soil reinforcement. Place a separate backing mat and hardware cloth immediately behind the vertical portion of soil reinforcement.

Provide a precast reinforced or cast-in-place concrete leveling pad at each panel foundation level. Place panels or wire fabric and support to achieve the final position.

Place and compact structure backfill material at the same time as placement of facing and soil reinforcement, without distortion, damage, or displacement of the facing or soil reinforcement. Backfill to an elevation approximately 1-1/4 inch above the facing connection level before placing the next level of soil reinforcement. Roughly level the backfill material before placing the soil reinforcement. Uniformly tension all soil reinforcement to remove any slack in the connection or material.

Install joint filler, bearing pads, and joint-covering material concurrently with face panel placement.

Furnish and install instrumentation for monitoring corrosion, where specified.

511-4.01 MEASUREMENT. See Section 109, by the square foot of wall face. The vertical height of each section is measured on the outer face from the bottom of the lowermost face element to the top of the wall.

511-5.01 PAYMENT.

Excavation and backfill are paid for under Section 205.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
511.0001.____	Mechanically Stabilized Earth Wall	SF

SECTION 512
FORMS AND FALSEWORK

512-1.01 DESCRIPTION. Design, construct, maintain and remove forms and falsework used to form or temporarily support structural concrete until the structure is self supporting.

512-1.02 DEFINITIONS.

COMPRESSIVE STRENGTH. See definitions in Subsection 501-1.02.

FALSEWORK. A temporary structure erected to support the permanent structure, in the process of construction, until the permanent structure attains adequate strength to become self-supporting and capable of supporting other imposed loads.

FORMS. Also known as formwork, are a temporary structure or mold used to retain the plastic concrete in its designated shape while the concrete is curing and gaining sufficient strength to maintain its designated shape.

HAUNCH. A thickened portion of a concrete deck filling the space between the top of the girder and the bottom of the roadway slab.

INFORMATIONAL FIELD TEST. See definitions in Section 501-1.02.

512-2.01 MATERIALS. As specified or approved.

DESIGN AND CONSTRUCTION REQUIREMENTS

512-3.01 SUBMITTALS.

1. Falsework Plan. When complete details for falsework are not shown on the Plans, prepare and submit a falsework plan, prepared and sealed by a Professional Engineer registered in the State of Alaska. When the structure is not open to traffic and is not over or adjacent to railroads or roadways, a falsework plan and independent design check are not required.

   Include detailed working drawings, material specifications, and supporting calculations to allow for complete review of the falsework plan. For manufactured or proprietary falsework components, include the manufacturer's information, technical bulletins, design data, and other necessary information used in the calculations.

   Include an independent design check to verify that the design satisfies the Contract requirements. Perform the independent design check by a Professional Engineer registered in the State of Alaska. Independent means the Professional Engineer performing the independent design check is not associated as a subordinate, subsidiary, employee, or member of the business employing the Professional Engineer sealing the falsework design.

   Submit an independent design check letter, sealed by the Professional Engineer performing the independent design check, certifying the falsework plan meets the Contract requirements of this Section. Include the independent design check letter with the falsework plan submittal.

2. Falsework Inspection Verification. Prior to placing reinforcing steel or other loads, perform a falsework inspection by the Professional Engineer sealing the falsework design. Do not place reinforcing steel until a written verification, signed by the Professional Engineer sealing the falsework design, stating that the falsework meets the design and construction requirements is provided to the Engineer.

3. Concrete Deck Haunch Dimensions. Prior to placing falsework, submit the girder elevations, required haunch dimensions, and supporting calculations for review. Ensure the haunch dimensions meet the requirements of Subsection 512-3.05.

512-3.02 FALSEWORK DESIGN. Design falsework according to the AASHTO Guide Design Specifications for Bridge Temporary Works and these specifications. When the structure is supported by falsework and is open to traffic, also design the falsework for highway loads according to the AASHTO Standard Specifications for Highway Bridges.

1. Falsework Foundations. Where spread footing type foundations are used, determine the bearing capacity of the soil and include the bearing capacity on the plans.

   Design and construct pile type foundation according to this specification and Section 505.

2. Falsework Over Or Adjacent to Roadways. Provide a minimum vertical clearance of 17.5 feet through falsework, unless otherwise shown on the Plans. Install advance warning devices and vertical clearance signs at falsework openings according to the Alaska Traffic Manual. When the vertical clearance is less than 18.5 feet, post a W12-2 low clearance sign with a vertical clearance as 3 inches less than the minimum clearance.

3. Falsework Over Or Adjacent to Railroads. Meet the clearance requirements of the American Railway Engineering and Maintenance-of-Way Association Manual for Railway Engineering.

512-3.03 FALSEWORK CONSTRUCTION. Construct falsework to conform to the approved falsework plan. Do not begin falsework construction without an approved falsework plan. Do not modify or alter the structure to accommodate falsework unless otherwise noted or authorized by the Engineer.

When welding falsework, meet the welding requirements of Section 504.

Build camber into the falsework to compensate for falsework deflection and anticipated structure deflection. Camber shown on the Plans or specified by the Engineer is for anticipated structure deflection only.

Do not use driven devices to attach falsework to concrete. Do not modify or alter the structure to attach falsework unless otherwise noted or authorized by the Engineer.

512-3.04 FORMS. For surfaces that are exposed in the completed work, use plywood forms meeting the requirements of the American Plywood Association (APA) grade High Density Overlaid (HDO) Plyform Class I or other approved material that will produce an equivalent smooth and uniform concrete surface. For other surfaces, use plywood forms meeting the requirements of the American Plywood Association (APA) grade B-B Plyform Class I. Use only form panels in good condition free of defects on surfaces in contact with concrete.

Furnish and place form panels for exposed surfaces in uniform widths of not less than 3 feet and in uniform lengths of not less than 6 feet except where the width of the member formed is less than 3 feet.

Arrange form panels in symmetrical patterns conforming to the general lines of the structure. Place panels for vertical surfaces with the long dimension horizontal and with horizontal joints level and continuous. For walls with sloping footings that do not abut other walls, placement of panels with the long dimension parallel to the footing is permitted.

Follow the manufacturer's written recommendations when using form liners.

Increase the thickness of concrete members that receive an architectural finish to maintain the specified cover to reinforcing steel.

Bevel exposed corners and edges with 3/4 inch chamfers built into the forms.

Do not modify or alter the structure to attach forms unless otherwise noted or authorized by the Engineer. Form ties, anchors, and other devices may be cast into the concrete for supporting

forms or for lifting precast members. Ensure form ties and anchors can be removed without damaging the concrete surface. Do not use driven devices to attach forms to concrete. Do not use anchors coated with materials that will stain the concrete for supporting forms. Construct metal ties or anchorages within the forms to permit their removal to a depth of at least 1 inch from the concrete surface without damage to the concrete.

Construct concrete forms mortar-tight. Clean the inside surfaces of forms free of contaminants that affect the concrete finish. When forms are supported by existing concrete, ensure the forms fit tightly against the existing concrete and mortar will not pass through the joint.

Forms may be omitted when the sides of a footing excavation is in rock. If the excavation is larger than the plan dimensions, any additional concrete placed will be at the Contractor's expense.

Coat forms to be removed with form release agent prior to use. Use a commercial quality product, designed specifically to release forms, and that will not discolor the concrete surfaces.

512-3.05 FORMS AND FALSEWORK FOR CONCRETE DECKS. Use forms and falsework that span between adjacent girders without altering or damaging the supporting girders. Hangers may be cast into the concrete for supporting deck falsework. Do not use driven devices to attach forms or falsework to concrete. Do not use materials that will stain the concrete to support the falsework. Construct hangers to permit their removal to a depth of at least 1 inch from the concrete surface without damage to the concrete.

Adjust the falsework haunch dimensions to accommodate the camber and elevation of the installed girders. Measure the installed girder elevations along the centerline of the girders at locations shown on the Plans after erection but before installing falsework, forms, reinforcing steel, or applying other loads. Determine the required haunch dimensions accounting for the variations in the girder elevations and anticipated deflection due to additional dead loads.

Prestressed concrete girder elevations shown on the Plans are based on estimated girder deflections at 40 and 120 days after release of the prestressing strands. The girder elevations shown in the Plans are intended to advise the Contractor as to the expected range of girder deflection at the time of deck forming.

Construct falsework supporting concrete work on steel structures so that loads applied to girder webs are applied within 6 inch of the flange or stiffener. Construct Falsework to distribute loads so that local distortion of the web is not produced.

1. Forms. Do not use permanent forms including metal, wood, or precast concrete for concrete deck construction, unless otherwise noted. Provide concrete deck forms meeting the following requirements:

   a. Maintain the deck thickness despite irregularities in and between the girders.

   b. Accommodate haunch variation along the length and between the girders.

2. Haunches. Limit haunch dimensions to meet the following requirements:

   a. 1/2 inch maximum embedment of the top flange into the deck measured at the edge of the flange.

   b. 2-1/2 inch minimum clearance between the top of deck and shear stud or shear stirrup.

   c. 2 inch minimum penetration of shear stud or shear stirrup into the deck.

   d. 4 inch maximum haunch measured at the centerline of the girder.

512-3.06 REMOVAL OF FORMS AND FALSEWORK. Remove forms and falsework without damaging the concrete member.

Forms may be removed after the concrete has cured for at least 24 hours, will not be damaged, and has a compressive strength of at least 1400 psi as determined from informational field test cylinders cured on the site under temperature and moisture conditions similar to the concrete in the structure. Protect exposed concrete surfaces from damage. Maintain curing operations according to Section 501 if forms are removed before curing operations may be terminated.

Completely remove forms, including the roadway deck forms, from cells of box girders which have permanent access. Unless otherwise shown in the Plans, the roadway slab interior forms in cells where no permanent access is available may be left in place.

Falsework may be removed after the concrete has a compressive strength, determined from informational field test cylinders cured on the site under temperature and moisture conditions similar to the concrete in the structure, as specified in Table 512-1. If informational field test cylinders are not available, meet the minimum number of curing days specified in Table 512-1.

Do not release falsework for cast-in-place prestressed portions of structures until the prestressing steel has been tensioned.

TABLE 512-1
FALSEWORK RELEASE CRITERIA

Structural Element	Percent of Specified 28-Day Strength (f'_c), min.	Curing Days, min.[1]
(a) Concrete decks	70	10
(b) Simple span girders, slab bridges, cross beams, pier caps, struts, and top slabs of concrete box culverts	80	14
(c) Box girders	90	21
(d) Continuous span girders	90	21
(e) Other elements	80	14

[1] Cured according to Section 501.

512-3.07 CLEANUP. Upon completion of the structure and before final acceptance, leave the structure and entire site in a clean and orderly condition. Remove temporary structures, equipment, unused materials, debris, forms, and falsework. Remove falsework piling at least 2 feet below the finished ground line, unless noted otherwise.

512-4.01 METHOD OF MEASUREMENT. Forms and Falsework will not be measured for payment.

512-5.01 BASIS OF PAYMENT. When either Item 512.0001.____ or 512.0002.____ does not appear in the bid schedule, the work required for that item is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
512.0001.____	Forms	LS
512.0002.____	Falsework	LS

SECTION 513
FIELD PAINTING OF STEEL STRUCTURES

513-1.01 DESCRIPTION. Clean and paint the structural steel on existing bridges. Contain, collect, and dispose of waste materials and protect existing facilities, vehicles, the environment, and the public from damage due to this work.

513-2.01 MATERIALS. Use materials that conform to the following:

1. Paint. Section 708. Use approved contrasting colors for each coat.

2. Abrasives. Use an abrasive that is free of oil, moisture, and salts and will produce a minimum profile of 1.5 mils on the surface of the cleaned steel.

   a. Non-Steel Abrasives. Meet SSPC-AB1 (Abrasive Specification No. 1), Mineral and Slag abrasives. Do not use abrasives containing more than 1 percent “free” silica.

   b. Steel Abrasives. Recycle and reclean after each use. Must produce a profile approved by the coating's manufacturer.

513-2.02 COMPONENT ORIGIN. Use only components that are the standard, regularly produced product of a single manufacturer and meet or exceed the requirements in this Section.

Paint systems must be the same generic type, be field applicable under the environmental constrictions of the site and structure, and have been used successfully in the field for at least 2 years on similar structures in a similar environment as this project.

Submit the following information on paint systems for approval:

1. Description of product

2. Intended uses and exposures of the product

3. Technical data on the formulation and components

4. Description of surface preparation required

5. Application information, including written recommendations and instructions for this project

6. Safety information and precautions, including Material Safety Data Sheets

7. List of references of previous bridge projects that used the proposed system, including applicator and owner contacts

If the proposed equivalent system literature requires a higher degree of surface preparation/profile or greater film thickness than specified in this Section, follow the submittal requirements, with no additional compensation.

CONSTRUCTION REQUIREMENTS

513-3.01 SYSTEM DURABILITY AND CERTIFICATION. Require the coating manufacturer to review the project and the proposed service environment and issue written recommendations and instructions to the applicator to ensure maximum durability, proper surface preparation, and proper coating application. Make these documents available at the prepainting conference.

Require the coating system manufacturer to have a technical representative on the job site during the prepainting conference and also be available and on-call during construction.

Do not deviate from the coating manufacturer's written recommendations and instructions unless the manufacturer's technical representative authorizes the change in writing, and the Engineer approves.

After the project is completed, certify to the Department that the system was applied according to the manufacturer's recommendations and instructions.

513-3.02 PAINT APPLICATOR'S CERTIFICATIONS. Hire only paint crew members that are certified by the Alaska Department of Labor for completing the Alaska Hazardous Painting Certificate Course within the last 3 years. Contact the Alaska Department of Labor for certification information.

Crew members must provide either a resume showing experience with the paint system components specified in this Section or a letter of acceptance of experience from the paint system manufacturer.

Provide copies of certificates, resumes or letters to the Engineer at the prepainting conference.

513-3.03 REQUIRED CONTRACTOR EXPERIENCE. Hire a paint superintendent with experience with the coating system. Submit a list of the paint superintendent's projects and references at least 7 days before the prepainting conference.

For projects requiring removal of paint containing lead and/or chromium, hire a paint superintendent with experience in removing lead and/or chromium from steel structures. Include these references in the paint superintendent's list of references described above. The paint superintendent must know all current standards and regulations about containing hazardous debris generated during paint removal operations and disposing of contaminated surface preparation debris.

513-3.04 PREPAINTING CONFERENCE. Attend a prepainting conference at the Engineer's office after the preconstruction conference and before mobilizing on the site and beginning any work under this Section.

Submit a Containment and Disposal Plan to the Engineer for approval 30 days before the prepainting conference. Include plans and written guidelines for the following:

1. Containment structures and attachments to the bridge

2. Ventilation

3. Rigging

4. Handling and disposing of hazardous and non-hazardous waste

An Engineer registered in the State of Alaska must stamp all containment and rigging plans. The engineer must design the containment structures and rigging to include attachments to the bridge and to accommodate maximum high wind loads and maximum daily weight loads of abrasive blast grit, dry or wet.

Include in the Containment and Disposal Plan all measures necessary to contain paint during painting operations.

Require the following personnel to attend the prepainting conference:

5. Site Superintendent and/or Applicator Foreman

6. Quality Control Inspector

7. Chief Blast Cleaner

8. Chief Paint Applicator

9. Technical representative of the coating system manufacturer for this project

At the prepainting conference, submit the following in writing and discuss in detail:

10. Work plan for safety, health, containment, ventilation, pressure washing, rigging, lighting, abrasive blast cleaning, coating application, curing all coats, and quality control

11. Work plan for handling hazardous and non-hazardous waste, including but not limited to testing, handling, treatment, temporary storage, transportation, disposal, and applicable regulations and laws governing hazardous waste

12. Plans for record keeping for all work performed

13. Work schedule, including hours per shift, number of shifts and all manpower

14. List of all equipment in detail, including compressor sizes, number of blast personnel per shift, and coating applicators

Immediately after the prepainting conference, all parties must visit the project site. On site, explain the proposed methods of cleaning, coating, containing hazardous waste, and making attachments to the bridge. Submit the planned schedule of work typical of all sequences.

Submit all required certificates and resumes/letters for approval, including the paint manufacturer’s written recommendations and instructions.

Following receipt of written final approval of all submittals, notify the Engineer in writing of the actual project mobilization or start up. The Engineer will determine the minimum notification time at the end of the prepainting conference.

513-3.05 QUALITY CONTROL AND QUALITY ASSURANCE. Comply with the following quality control and quality assurance rules:

1. Use the best practices of the trade.

2. Use applicable portions of the SSPC-PA Volume 1, *Shop, Field and Maintenance Painting* when they do not conflict with contract Specifications.

3. Have current copies of SSPC-PA Volumes 1, 2, and 3 on site at all times. Supply them to your crew and Department personnel for reference.

4. Require your Quality Control Inspector to monitor and document daily all equipment, manpower, materials, surface preparation, ambient conditions, paint application and product millage to conform with the Specifications and with the coating system manufacturer's written recommendations and instructions given at the prepainting conference. Deliver a copy of each daily report to the Engineer on the following morning.

5. Prior to requesting an inspection by the Engineer, submit a report signed by the Quality Control Inspector, certifying that all work complies with the Plans and Specifications.

Correct the following defects without additional compensation or contract time:

6. Coats thinner than minimum dry film thickness specified

7. Coats with excessive millage (Remove coats with excessive millage according to the coating manufacturer's written instructions and recoat to Specifications.)

8. Unauthorized paint application (Remove and reclean the underlying surface.)

9. Incomplete stripe coat

10. Overspray, spatter, runs, and sags

11. Defects in the top coat, including abrasives or dust

Provide equipment and an operator for safe access to all areas of the work for quality assurance inspections by the State, as necessary.

The Engineer may hire a National Association of Corrosion Engineers (NACE) Certified Coating Inspector to inspect the work. Results of all such inspections will be documented. As a minimum, the following points will be inspected:

12. After pressure washing

13. After abrasive blast surface preparation and blowing all surfaces clean

14. After applying and curing the prime coat

15. After applying and curing the intermediate coat.

16. After applying and curing the finish coat

17. During final inspection of all work at the end of the project

513-3.06 MEASUREMENT OF DRY FILM THICKNESS. Measure and completely document coating thickness by calibrated magnetic film thickness gauge according to the requirements of SSPC-PA Volume 2, *Method for Measurement of Dry Paint Thickness with Magnetic Gauges*.

Destructive testing of the dry film thickness of each coat may be performed with a Tooke gauge. Repair damaged areas.

513-3.07 TRAINING. Train all crafts personnel, including three Department Inspectors, to comply fully with the General Industry Lead Standard 29 CFR 1910.1025. Furnish the necessary supplies, equipment, instruments, and facilities. Include the following subjects in the training:

1. Action Level

2. Permissible Exposure Limit

3. Exposure Monitoring

4. Compliance Plan

5. Respiratory Protection

6. Protective Work Clothing and Equipment

7. Housekeeping

8. Hygiene Facilities and Practices

9. Medical Surveillance

10. Medical Removal Protection

11. Employee Information and Training

12. Signs

13. Record Keeping

14. Observation of Monitoring

513-3.08 HEALTH AND SAFETY. Follow and enforce safety rules and requirements of the State, Resource Conservation and Recovery Act (RCRA), Federal codes, EPA, local laws, and SSPC-PA Guide 3, *A Guide to Safety in Paint Application.*

1. Equipment. Use explosion-proof lighting and electrical equipment in cleaning and applying coatings.

   Use compressors with in-line dryers that are rated to match the compressor's rated capacity. Regularly test the compressor's discharge air to make sure it is oil-free.

2. Air Alert. Notify all personnel and the Engineer when work on painted surfaces may contaminate the air above the action level, including, but not limited to, the following:

   a. Rivet busting

   b. Power tool cleaning without a vacuum system

   c. Welding

   d. Cutting or torch burning

   e. Abrasive blasting

   f. Clean-up activities, including containment structure movement

3. Data Sheets. Conspicuously post Material Safety Data Sheets at the work site.

4. Overspray. Take all necessary measures to contain paint during painting operations. Take appropriate action to prevent overspray paint or coating damage to adjacent property. Take remedial action for all overspray.

5. Sampling and Testing. Conduct an acceptable abrasive blast test before startup.

   Take a sample of blast abrasives from the accumulation of the first day's blast. Send the sample to an independent testing laboratory to determine contaminant levels. Deliver the report immediately to the Engineer. Take additional samples when the project is 25 percent and 75 percent complete or as the Engineer directs.

   Test with the Toxicity Characteristic Leaching Procedure (TCLP). Classify levels at or above 5 ppm of leachable lead as hazardous waste and levels below 5 ppm as non-hazardous. Until the lab confirms test results, consider all debris hazardous and implement all safety precautions.

   Take soil, water, and sediment samples at approved locations at the bridge site before beginning work and after completing the project. Send these samples to an independent testing lab for analysis. Submit the results to the Engineer. If the samples taken at the end of the project contain higher lead concentrations than the samples taken before beginning work,

clean up the area to reduce the lead concentration to or below the level found before work began.

Perform additional sampling and testing as results dictate, including tests for plant and aquatic life.

6. Adjacent Property. Coordinate bridge cleaning and painting operations with adjacent property owners before beginning.

7. Confined Spaces. At a minimum, whenever sandblasting and/or painting in confined area, ventilate area and furnish positive pressure respirators. Use the positive pressure respirators according to the coating manufacturer's written instructions.

8. Housekeeping. Maintain good housekeeping practices. Keep the work area, including the work platform, roadway, and adjacent areas, clean and uncluttered. Deposit all debris and rubbish in suitable containers at the end of each work day or as directed.

9. Final Clean Up. At the end of the project, clean all areas, including adjacent areas, and remove all debris. Ensure that the top coat on the complete bridge is free from abrasives and dust generated from the project.

513-3.09 CONTAINMENT AND DISPOSAL. Ensure that surface preparation debris test results fall below RCRA regulatory levels. Treat debris on-site using blast media additives that react with the lead to make it non-leachable in the abrasive blast media.

Obtain a site-specific EPA identification number for transporting and disposing of hazardous waste. List the Department as the waste generator for the project.

Use containment for all other structural steel work involving grinding, welding, or burning of the existing lead-based paint.

Provide all labor, equipment, and material for compliance with Specifications and regulations of RCRA, State, Federal, EPA, Local Laws, SSPC-Guide 6 (CON) *Guide for Containing Debris Generated During Paint Removal Operations*, and SSPC-Guide 7 (DIS) *Guide for Disposal of Lead-Contaminated Surface Preparation Debris*. Use SSPC Guides when they do not conflict with these Specifications. These regulations apply to sampling, testing, storing, containing, treating on site, transporting and disposing of all hazardous and non-hazardous waste.

Use filter fabric, drapes, or other appropriate methods to recover and contain loose paint and other debris generated during pressure washing.

Maintain liners, tarps, and drapes used to contain debris in good condition. If they are punctured, stop the work, repair the puncture, and capture the debris.

Stop abrasive blast cleaning and coating during high wind or precipitation, when containment is not in compliance, and when otherwise directed.

Use containment procedures meeting the following subsections of SSPC-Guide 6 (CON):

5.3 CONTAINMENT STRUCTURES FOR ABRASIVE BLASTING

5.3.1 Containment Materials, Type A1 (Rigid)
5.3.2 Air Impenetrable, Type B1
5.3.3 Support Structure, Type C1 (Rigid)
5.3.4 Joints, Type D1 (Full Seal)
5.3.5 Entryway, Type E3 (Overlapping)

5.4 VENTILATION SYSTEM COMPONENTS

5.4.1 Input Air Flow, Type G1 (Forced)
5.4.2 Air Pressure, Type H2 (Visual)
5.4.3 Air Movement, Type I1 (Minimum Specified)
5.4.4 Exhaust Air Flow/Dust Collection, Type J1 (Air Filtration Required)

5.5 METHODS FOR ASSESSING QUANTITY OF EMISSIONS

5.5.1 Visible Emissions, General Surveillance, 200 feet from containment structure and Level 2 Emissions
5.5.5 Soil Analysis for Toxic Metals

5.6 METHOD OF ASSESSING EFFICIENCY OF DEBRIS COLLECTION AND BULK ABRASIVE RECOVERY

5.6.1 Weight In/Weight Out Method

Dispose of waste according to Sections 5, 6 and 7 of SSPC-Guide 7 (DIS).

513-3.10 SURFACE PREPARATION. Before beginning any other cleaning, pressure wash all surfaces scheduled for painting. Remove all dirt, grease, loose chalky paint, salts, or other foreign material.

Do not pressure wash surfaces more than 2 weeks before painting or cleaning.

Use a pressure washer with at least 3000 psi at all elevations. Keep the nozzle tip no more than 12 inches from the surface during all phases of power washing.

Perform pressure washing with potable water. If needed, add a biodegradable detergent to the pressure washer feed water or apply it directly to the surface to be cleaned. Apply the detergent using methods that remove all surface contaminants.

Before abrasive blasting, grind smooth all metal defects, fins, slivers, burrs, weld spatter, and sharp edges resulting from shearing or similar operations, including flame-hardened edges resulting from cutting or burning. Grind flame-hardened edges a minimum of 1/16 inch. Document all weld defects and report them to the Engineer immediately.

Abrasive blast clean all metal to be coated to SSPC-SP10/NACE #2, Near-white Blast Cleaning. Remove all mill scale. Match the appearance of the abrasive blast cleaned area to Pictorial Standard SSPC-VIS-1-89 and NACE TMO170/NACE #2. Produce a surface profile neither detrimental to the coating performance nor contrary to the coating manufacturer's written instructions.

Repair all defects that become evident after abrasive blasting or applying a prime coat. Retexture the surface to match the blasted profile.

Clean all abrasive-blast-cleaned surfaces and staging surfaces by brushing, vacuum cleaning, or blowing with dry, oil-free compressed air. Do not wipe down surfaces with rags. Remove all loose blast material from the work area. Make sure all surfaces to be coated are free of contaminants and moisture.

Coat all abrasive blast cleaned surfaces in the same working shift. Reclean and inspect all surfaces not coated within 12 hours or if they show contamination or rust bloom. The Engineer may approve additional time between abrasive blast cleaning and coating under controlled humidity conditions.

To prevent contaminating cleaned or coated surfaces, do not pressure wash or abrasive blast clean in adjacent areas when also applying coatings or drying coated surfaces.

Prevent contaminating the cleaned surfaces with any oil, grease, soil, dust, foreign matter, salts, acids, alkali, or other corrosive chemicals before applying the prime coat and remaining coats. Remove any contamination from the surface before applying other coats.

513-3.11 WEATHER LIMITATIONS. Apply coatings within the environmental limitations recommended by the coating manufacturer. Do not apply coatings:

1. where dust is generated;

2. in fog, snow, or rain;

3. on surfaces that are wet or damp; or

4. when surface temperature is below 35 °F or above 120 °F.

When necessary, control the containment environment to comply with material specifications and meet the completion date.

513-3.12 PAINTING METAL SURFACES.

Supply enough materials on the job site to satisfy all coat time windows and recoating requirements.

Do not open paint containers until ready to use. Keep partial containers sealed.

Do not use paints that have begun to polymerize, solidify, gel or deteriorate.

Remove and discard paint skin before mixing. Do not use paint if the volume of skin on the surface or sides of the container exceeds 2 percent.

Use the oldest paint or component first. Apply coating by spraying. Use daubers or sheepskins when no other application method is practical in places that are difficult to access. Use dipping, roller coating, or flow coating only when specifically authorized.

Apply stripe coating before applying each coat. Spot paint or stripe all edges, corner crevices, rivets, bolts, welds, and sharp edges before fully coating the steel. Make sure that striping extends at least 2 inches from the edge. Evenly distribute the stripe coat and work it well into joints, corners, and crevices. Use coating techniques that result in a uniform wet pattern or that comply with the coating manufacturer's written instructions.

Apply paint to the following dry film thickness(DFT):

Prime Coat:	3 to 5 mils
Intermediate Coat:	3 to 5 mils
Top Coat:	3 to 5 mils

If necessary, apply several coats to achieve the proper thickness. Apply each coat as a continuous film of uniform thickness, free of pores. Make sure all coats are free of runs, sags, and dry spray. Repaint any thin spots or areas missed in the application.

Make sure each coat is properly cured or dried before applying the next coat.

If any applied coating is damaged, mud cracked, bubbling or blistering, permit it to dry first. Remove damaged areas of paint and prepare the surface again. Feather the edges of existing paint out to 1/2 inch surrounding the spot-cleaned area. Make sure no loose or abrupt edges of paint remain. Repaint the area with the same kind and number of coats as the undamaged area according to the manufacturer's written recommendations. Evenly blend the final spot coat of repair with the surrounding coating.

For final inspection, make sure the top coat is uniform and complete in coverage and appearance. The Engineer will visually inspect the top coat and determine acceptance by total DFT.

513-4.01 METHOD OF MEASUREMENT. See Section 109.

513-5.01 BASIS OF PAYMENT. Testing, sampling, and treatment of soil, washing water, stream water, sediment, and blast abrasive are subsidiary.

Containing, handling, and disposing of waste material is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
513.0001.____	Field Painting of Steel Structures	LS

SECTION 514
CONCRETE SURFACE TREATMENTS

514-1.01 DESCRIPTION. Provide an aesthetic fascia and anti-graffiti protection on exposed faces of precast and cast-in-place concrete.

514-1.02 SUBMITTALS. Submit shop drawings for approval that contain a minimum of the following information:

1. formliner brand, name, and model number
2. formliner sheet sizes
3. formliner layout and joint locations, including chamfer strip and form tie locations
4. panel coordination and details of cropped panels
5. installation sequence
6. methods to prevent formliner deflection due to pressure from concrete placement
7. panel elevations

Submit verification samples that are at least 18 inches square of the type and pattern specified in the Plans. Provide the formliner manufacturer's installation instructions and product data information.

514-2.01 MATERIALS.

1. Aesthetic Fascia. Provide standard reusable, non-porous formliners conforming to the pattern as specified on the Plans; or approved equal.
2. Anti-graffiti Protection. Use a two-step anti-graffiti protection system designed specifically for this use. The system shall consist of a single component clear acrylic base coat covered by a clear urethane finish coat. This material is not a sealer or vapor barrier and no discoloration is allowed.

514-3.01 AESTHETIC FASCIA. The wall dimensions and concrete quantities provided on the Plans are minimum and do not include allowances for the thickness of the formliners. Account for the thickness of the formliners. Do not decrease the required minimum clear cover when using aesthetic fascia. Measure provided clear cover at the point where it is a minimum due to the aesthetic fascia.

Cover the form leaving a maximum of 6 inches between the edge of liner and the finished top of the wall, pathway or ground grade at the bottom, and edge or expansion joints on the sides, or as recommended by the manufacturer. Do not place concrete until the Engineer approves the liner placement on the form.

514-3.02 ANTI-GRAFFITI PROTECTION. Let all concrete surfaces set at least 28 days before applying any coatings. Apply the system in accordance with the manufacturer's recommendations. Apply appropriate masking as required. Apply the system to concrete surfaces to a minimum of one-foot below finished grade.

514-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

1. Aesthetic Fascia. By the square foot of in-place surface area of aesthetic facia.
2. Anti-graffiti Protection. By the square foot of coated surface area.

514-5.01 BASIS OF PAYMENT. When Items 514.0001.____, or 514.0002.____ do not appear on the bid schedule, this work is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
514.0001.____	Aesthetic Fascia	SF
514.0002.____	Anti-Graffiti Protection	SF

SECTION 515
DRILLED SHAFTS

515-1.01 DESCRIPTION. Construct drilled shaft foundations where indicated in the plans. This work includes all labor, materials, equipment, incidentals and services necessary to perform all operations to complete drilled shaft installation.

515-1.02 QUALITY CONTROL. Provide a Quality Control Inspector to ensure that all materials, techniques and methods are suitable to meet or exceed the minimum requirements of the contract.

The Quality Control Inspector shall submit daily reports during drilled shaft installation and testing operations verifying the Contractor's compliance with requirements of the contract. Include field measurement data, procedural discrepancies, installation problems, names of personnel, equipment usage data, and all other significant information in the daily reports.

515-1.03 QUALIFICATIONS. Experience is required for constructing drilled shafts of at least 8 feet in diameter and lengths similar to those indicated on the plans for three separate projects during the previous 5 years. Experience must include drilling in deep water (greater than 30 feet), drilling in soils with ground water, in soils with large boulders, and in rock.

515-1.04 GENERAL REQUIREMENTS AND SUBMITTALS. Submit the following documents for review and approval no more than one week after the Notice to Proceed:

1. Project Experience. Provide a list of three drilled shaft projects performed by the Drilled Shaft Contractor that involved drilling in sand, gravel, large boulders and rock similar to those conditions expected at this project location. Provide the drilled shaft plans, logs of test holes, dates of work, type of work, description of work, and amount of work performed. Provide the name and telephone number of a contact person at the agency or company for which the work was completed.

2. Personnel Experience. Provide a list of the key personnel involved in the drilled shaft construction. Include the name of the superintendent and of the superintendent's assistants who will be performing and directing the actual drilling operations. Include a resume of each superintendent and assistant involved in drilled shaft construction indicating:

    a. A minimum of 5 years' experience in directing drilled shaft construction of which 2 years being in responsible charge or operating equipment proposed for this project.

    b. The number of years of recent continuous relevant experience in performing similar drilling operations and operating the contractor proposed equipment for this job.

    c. Detailed recent relevant experience (three project minimum) including project description, date of work, actual work performed by individual, and a reference for each project including telephone number.

    d. A list of relevant equipment operated including type of equipment and amount and nature of experience.

Only those personnel approved by the Engineer may work on the drilled shaft construction. The Engineer may suspend the drilled shaft work if the Contractor substitutes unauthorized personnel for authorized personnel during construction. If work is suspended due to unauthorized substitution of personnel, the Contractor shall be fully liable for all additional costs resulting from the suspension of work and no adjustment in contract time will be allowed.

3. Drilled Shaft Installation Plan. Submit a Drilled Shaft Installation Plan for review and approval no less than 45 days prior to the anticipated start of drilled shaft construction. Include the following:

a. Experience information identified in item numbers 1 and 2.

b. List the type, number and size of all proposed equipment, including cranes, barges, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, tremies, concrete pumps, casings, grout pumps, etc. Include manufacturer's recommended capacities for each piece of equipment.

c. Details and methods required for construction including temporary work structures and access roads.

d. Details of sequence of construction operations and sequence of shaft construction including dates and anticipated duration of work.

e. Details of shaft excavation methods.

f. Procedure for maintaining correct horizontal and vertical alignment during shaft installation.

g. Casing diameter and thickness required but not less than that indicated on the plans.

h. Method to advance casing.

i. Methods and equipment proposed to prevent displacement of casing and/or shafts throughout shaft construction.

j. Details for obstruction removal.

k. The casing grouting plan and procedure if required.

l. Details of proposed methods to clean shaft after initial excavation.

m. Details of shaft reinforcement, including methods to ensure centering/required cover, reinforcement cage integrity during placement, placement procedures, cage support, tie downs, etc.

n. Details of concrete placement, including proposed operational procedures for concrete tremie or pump, concrete placement rates, initial concrete placement procedure, method for raising tremie during concrete placement, and overfilling of the shaft concrete. Also provide provisions to ensure proper final shaft cutoff elevation.

o. Action plan for correcting defects in the shaft. Defects include but are not limited to the following: tilted casing, partially or completely collapsed casing, partially or completely collapsed reinforcement cage, improper concrete placement, and equipment failure.

p. Required submittals, including shop drawing, mill certification and concrete mix designs.

q. Welding Quality Control plan conforming to the requirements of AWS D1.1.

r. Details for Crosshole Sonic Logging (CSL) testing procedure including testing schedule, inspector's name, inspector's qualifications, required instrumentation and power sources.

s. Safety plan to be implemented to ensure employee safety. Provide worker safety procedures around the shaft excavation and in the shaft when personnel descend for inspection.

t. Details of environmental control procedures used to prevent loss of slurry, concrete or other shaft materials into waterways or other protected areas.

u. Wastewater and concrete disposal procedures.

v. Other information shown in the Plans, requested by the Engineer or deemed necessary by the Contractor.

The Engineer will evaluate the drilled shaft installation plan for conformance with the Contract Documents and will reject any portion of the plan that is unacceptable. Partial submittals will not be accepted for approval. Within 20 days after receipt of the complete plan, the Engineer will notify the Contractor of any additional information required and/or changes that may be necessary in the opinion of the Engineer to satisfy the Contract Documents. Submit agreed upon changes for reevaluation. The Engineer will notify the Contractor within 10 days after receipt of proposed changes of their acceptance or rejection. All approvals given by the Engineer are subject to trial and satisfactory performance in the field. Do not begin any drilled shaft work without an approved Drilled Shaft Installation Plan. Do not begin any drilled shaft work without the written approval of the Engineer.

Identify all Critical Path Schedule Items in the drilled shaft installation plan. Provide adequate lead time to obtain concrete mix design approval and permanent metal casing delivery.

4. CSL Report. Submit the CSL results within 5 days of testing. Provide the following in the CSL Report:

   a. The CSL logs for all tested tube pairs. Identify the CSL log for each test tube pair indicating the orientation relative to the structure.

   b. The traditional signal peak diagram (time versus depth).

   c. The computer first pulse arrival time verses depth.

   d. The computed pulse wave speed versus depth.

   e. The computed relative pulse energy or amplitude versus depth.

   f. Identification of defect zones, if any, on the CSL logs. Defect zones are defined by an increase in arrival time of more than 20 percent relative to arrival time in a nearby zone of good concrete.

515-1.05 CERTIFICATIONS. Provide certification that all available geotechnical information provided by the Department has been reviewed and considered in the bid preparation.

515-2.01 MATERIALS. Use materials that conform to the following:

DS Concrete	Section 501
DS Grout	Subsection 701-2.07
Reinforcing Steel	Section 503
Steel for Casing	ASTM A709, Grade 50T3
CSL Tubes	ASTM A53

CONSTRUCTION REQUIREMENTS

515-3.01 GENERAL METHODS AND EQUIPMENT. Perform the excavations required for the shafts through all materials encountered to the dimensions and elevations shown in the Contract Documents. Use methods and equipment suitable for the intended purpose and the materials encountered. Provide equipment capable of constructing shafts to a depth equal to the deepest shaft shown in the plans plus 3 times the shaft diameter.

Construct drilled shafts according to the Contract Documents except when permitted otherwise by the Engineer. An alternate method of shaft construction may be proposed. Acceptance of other

proposed shaft installation methods will be based upon the suitability of the method to the site conditions and the effect of the method on the structural system. Submit alternate methods of shaft construction for approval.

Maintain a construction method and soil log during shaft excavation. Submit copies of the log daily. Resolve all differences in the production logs between the Engineer and the Contractor within 24 hours of submittal to the Engineer. Provide the log to the CSL Inspector within 3 days of placing shaft concrete. Provide at least the following items in the log:

1. Description and approximate top and bottom elevation of each soil or rock material encountered

2. Location of all obstructions and time spent removing the obstruction

3. Drilling rate, down thrust, and torque

4. Seepage or groundwater

5. Remarks and comments

Barges, temporary work structures and roads may be required to install the drilled shaft foundation, piers, and bridge superstructure.

515-3.02 CONSTRUCTION METHOD. Use the permanent casing method.

Permanent Casing Method: Excavate through the casing and advance the casing until reaching the desired penetration. Overreaming the outside diameter of the casing before placing the casing may be necessary.

Casing may be placed in oversized holes, but must be grouted in place according to Subsection 515-3.09 If the annular space outside the casing is greater than 3 inches.

Vibratory and impact hammers may be used to install casing. Casing that is driven or vibrated into place need not be grouted.

Weld according to Section 504.

After the concrete has cured according to Section 501, cut the casing off at the prescribed elevation and leave the remainder of the casing in place.

515-3.03 POSITION AND ALIGNMENT. When drilling from a barge, provide a fixed template, adequate to maintain shaft position and alignment during all excavation and concreting operations. Do not use floating templates (attached to a barge). A fixed template for shafts drilled on land will not be required if the Contractor demonstrates satisfactorily to the Engineer that shaft position and alignment can be properly maintained. The Engineer will require a fixed template adequate to maintain shaft position and alignment during all excavation and concreting operations for shafts drilled on land when the Contractor fails to demonstrate to the Engineer's satisfaction that he can properly maintain shaft position and alignment without use of a template.

515-3.04 EXCAVATIONS AND EQUIPMENT. All shaft excavation from the groundline to the top of bedrock, including the rubble layer, is Unclassified Shaft Excavation. All shaft excavation from the top of bedrock to the bottom of the shaft is Special Shaft Excavation. Groundline, top of bedrock and bottom of shaft elevations are shown on the Plans. The Engineer may require Drilled Shaft Sidewall Overreaming.

1. Unclassified Shaft Excavation. All processes required to excavate a drilled shaft of the dimensions shown in the Contract Documents, completed and accepted. Include in the work all shaft excavation, whether the material encountered is soil, rock, boulders, weathered rock,

stone, natural or man-made obstructions, or any other materials. Special Shaft Excavation begins either when top of bedrock elevation is reached or when drilling operations using conventional equipment reach practical refusal. Practical refusal is defined as the point where the rate of hole advancement using earth augers with soil or rock teeth, drill buckets, and/or under reaming tools with the drilling equipment operating at maximum power, torque and downthrust, is less than 1 foot after 15 minutes of continuous drilling.

2. Special Shaft Excavation. All processes required to excavate a drilled shaft of the dimensions shown in the Contract Documents, completed and accepted. Include in the work all shaft excavation, whether the material encountered is soil, rock, boulders, weathered rock, stone, natural or man-made obstructions, or any other materials. Payment for excavation below the point where Special Shaft Excavation has been authorized will be for Special Shaft Excavation only and will not include payment for Unclassified Shaft Excavation.

3. Drilled Shaft Sidewall Overreaming. The excavation required to enlarge the drilled shaft diameter to accommodate the installation of the permanent metal casing. Increase the shaft radius a maximum of 6 inches by overreaming.

If the Engineer determines that the material encountered while drilling the shaft excavation is unsuitable and/or is not the same as anticipated in the design of the drilled shaft, extend the drilled shaft excavations as required by the Engineer.

Provide areas for the disposal of unsuitable materials and excess materials that are removed from shaft excavations, and dispose of them subject to permit requirements and in a manner meeting all requirements pertaining to the approved storm water pollution prevention (SWPP) plan.

Use excavation and drilling equipment having adequate capacity, power, torque, and downthrust to perform the work. Use excavation and overreaming tools of adequate design, size, and strength to perform the work. If the material encountered cannot be drilled using conventional earth augers and/or underreaming tools, provide special drilling equipment, including but not limited to rock augers, core barrels, rock tools, air tools, blasting materials, and other equipment as necessary to continue the shaft excavation to the size and depth required.

515-3.05 CASINGS. Use casings that are of ample strength to withstand handling and driving stresses and the pressure of concrete and surrounding earth materials. Casing may be thickened or reinforced to withstand applied stresses. Internally brace casing during shipping.

Use casings that are smooth and water tight. Provide a casing that is continuous along the entire length of the shaft. Use complete joint penetration (CJP) welds for casing splices. Verify weld quality by performing ultrasonic testing (UT) weld splices. Provide UT test reports to the Engineer for approval prior to advancing the casing.

Ensure that the inside diameter of casing is not less than the specified size of shaft. Oversized casing may be used with the Engineer's written approval. The Department will not provide extra compensation for excess concrete required to fill an oversize casing.

If the installed casing does not satisfy the requirements of Subsection 515-3.10, submit casing repair procedure for approval.

515-3.06 INSPECTION OF EXCAVATIONS. Do not enter the shaft unless the casing is installed and adequate safety equipment and procedures have been provided.

Inspect the excavations for the following:

1. Dimensions and Alignment. Provide equipment for checking the dimensions and alignment of each shaft excavation. Verify the dimensions and alignment of the shaft excavation under the observation and approval of the Engineer. Check the following:

   a. Shaft excavation dimensions and alignment.

   b. Casing dimensions and alignment periodically throughout the installation process.

   c. Casing dimension and alignment in final position.

2. Depth. Reference the depth of the shaft during drilling using marks on the Kelly bar or other suitable methods. Measure final shaft depths with a suitable weighted tape or other approved methods after final cleaning.

3. Shaft Cleanliness Requirements. Clean the shaft so that at least 50 percent of the base of each shaft has less than 3/4 inch of sediment at the time of concrete placement. Ensure that the maximum depth of sedimentary deposits or other debris does not exceed 1½ inches at any location on the bottom of the excavation. The Engineer will approve shaft cleanliness based on visual inspection for dry shafts. The Engineer will approve shaft cleanliness using divers, Shaft Inspection Device (SID) or other appropriate methods for wet shafts.

4. Casing. Visually inspect casings above water. Use a SID, diver, or other methods as directed by the Engineer to examine the casings below water for defects.

515-3.07 REINFORCING STEEL CONSTRUCTION AND PLACEMENT.

1. Reinforcement Cage Construction and Placement. Tie all intersections of drilled shaft reinforcing steel with cross ties or "figure 8" ties. Use double strand ties or ties with larger tie wire when necessary. The Engineer will give final approval of the cage construction subject to satisfactory performance in the field.

   Assemble and place as a single unit the cage of reinforcing steel consisting of; longitudinal bars, ties, spirals, cage stiffener bars, CSL tubes and all other components. Place the cage immediately after the Engineer inspects and accepts the shaft excavation and immediately prior to placing concrete. The Engineer will give final approval of the placement subject to satisfactory performance in the field.

2. Splicing Reinforcement Cage. If the bottom of the constructed shaft elevation is lower than the bottom of the shaft elevation in the plans, extend a minimum of one half of the longitudinal bars required in the lower portion of the shaft the additional length. Continue the tie bars throughout the extra depth and extend the stiffener bars to the final depth. Splice the longitudinal bar extensions as required.

3. Support, Alignment, and Tolerance. Tie and support the reinforcing steel in the shaft so that the reinforcing steel will remain within allowable tolerances as specified in Section 515-3.10.

   Use concrete wheels or other approved, non-corrosive spacing devices near the bottom and at intervals not exceeding 15 feet up the shaft to ensure concentric spacing for the entire length of the cage. Do not use block or wire type spacers. Use a minimum of one spacer for each 30 inches of cage circumference.

   Provide concrete or other Engineer-approved spacers at the bottom of the drilled shaft reinforcing cage. Maintain the specified distance between the bottom of the cage and the bottom of the shaft. Use one spacer per longitudinal bar unless otherwise approved by the Engineer. Use spacers sized to prevent vertical movement of the cage. Use spacers constructed of material equal in quality and durability to the shaft concrete. Submit spacer information for approval.

Check the elevation of the top of the steel cage before and after placing the concrete. If the cage is not maintained within the specified tolerances, correct it as approved by the Engineer. Do not construct additional shafts until modifying the reinforcement cage support in a manner satisfactory to the Engineer.

515-3.08 FLUID IN EXCAVATION AT TIME OF CONCRETE PLACEMENT. Prior to placing concrete in any shaft excavation, ensure that contaminated suspensions, which could impair the free flow of concrete from the tremie pipe, have not accumulated in the bottom of the shaft. Take samples of the fluid in the shaft starting 1 foot from the base of the shaft and at intervals not exceeding 10 feet up the shaft, using an approved sampling tool. Ensure that the density of the fluid in the shaft excavation prior to concreting is less than 70 lb/ft^3 for mineral slurries including bentonite and attapulgite and less than 64 lb/ft^3 for polymer slurries according to ASTM D 4380. If desanding equipment is required, ensure that the sand content does not exceed 4 percent by volume. Take whatever action is necessary to modify the fluid in the shaft excavation prior to placing the concrete to bring the fluid within the contract requirements.

515-3.09 CONCRETE PLACEMENT. Place concrete in accordance with Section 501 and the requirements herein.

At no expense to the Department, furnish the additional drilled shaft concrete (over the theoretical amount required to fill the shaft as shown in the Plans) required to complete filling shafts larger than required by the Plans or authorized by the Engineer.

If the pressure head is lost during concrete placement for any reason, the Engineer may direct the Contractor to perform integrity testing at no expense to the Department.

Cure the top surface of the shaft in accordance with Section 501.

Install grout in all voids between the casing and shaft excavation after placing shaft concrete. For drilled shaft foundation casings installed in oversized holes or where gaps exist between the shaft excavation and the casing, grout the zone between the casing and the soil with DS Grout. Grout the casing the full depth of the shaft. Use at least six grout placement tubes placed uniformly around the perimeter the full length of the casing. Grout the casing in one continuous operation. Withdraw the grout tubes vertically during grout placement operations. Provide at least two water relief/release pipes on opposite sides of the casing. Withdraw the water relief/release pipes vertically during the grout placement operations.

Submit the grout placement procedure for approval.

Pressure wash all concrete and grout overflow from the outside surface of the shaft casing. Do not allow loose concrete and other debris generated during pressure washing the casing to flow into adjoining bodies of water.

515-3.10 CONSTRUCTION TOLERANCES. Conform to the following:

1. Ensure that the top of the drilled shaft is no more than 3 inches laterally from the position indicated in the plans.

2. Ensure that the vertical alignment of the shaft excavation does not vary by more than ¼ inch horizontally for each foot of depth.

3. After placing all the concrete, ensure that the top of the reinforcement cage is no more than 2 inches above and no more than 3 inches below plan position.

4. Ensure that the column and shaft reinforcement cages are concentric with the shaft within a tolerance of 1 inch. Ensure that concrete cover is within 1½ inches of the plan dimension.

5. Ensure that the top elevation of the drilled shaft concrete is within 6 inches of the top of shaft elevation shown in the plans.

6. Do not exceed a difference between the major and minor outside diameters at any point along the length of the permanent metal casing (out-of-roundness) of 1 percent of the nominal diameter. The circumference of the permanent metal casing shall not vary more than 3/16 inch from the nominal circumference.

7. Ensure that the cutting edges of excavation equipment are normal to the vertical axis of the equipment within a tolerance of ±3/8 inch per foot of shaft diameter.

8. The completed shaft excavation shall have a flat bottom as shown on the plans. The flat bottom of the shaft excavation shall be fully founded on rock and be level within ±3/8 inch per foot of shaft diameter.

9. Provide a solid concrete shaft without voids or sections of unsound concrete as determined by CSL.

515-3.11 INSTRUMENTATION AND DATA COLLECTION.

1. Shaft Inspection Device. The Engineer may use a SID comprised of a television camera sealed inside a watertight jacket to inspect the bottoms of the shafts. Cooperate with the Engineer in using this device. Place the device in position for inspection and removing it after the inspection. Furnish 110 V single-phase current (minimum 30 A service), 220 V single-phase current (minimum 15 A service), and a 150 psi compressor (230 in^3/s minimum) to operate the SID.

2. Crosshole Sonic Logging. Provide CSL inspection of all drilled shaft foundations along their entire lengths. Provide an independent CSL inspector with at least 3 years' experience in CSL testing to inspect the drilled shaft and prepare the CSL report.

   Secure CSL tubes (steel pipes) to the inside of the reinforcing steel cage on regular intervals not exceeding 3 feet. Place CSL tubes as near parallel and plumb as possible and around the reinforcement cage perimeter as indicated on the plans. Extend the CSL tube from the bottom of the shaft to at least 3 feet above the top of the shaft or as approved by the Engineer.

   Do not damage CSL tubes. Prior to beginning CSL testing, assure that the test probes can pass through every tube to the bottom. If a tube is obstructed, at your expense core a hole that is near to the obstructed tube and extends to its full depth. The corehole should be large enough to accommodate the CSL probe.

   Prior to coring, submit for approval a coring plan including corehole locations and coring equipment and procedures. Provide for complete core recovery and minimize abrasion and erosion of the core. Place the core hole at a position in the shaft that will not produce damage to the reinforcing steel in the shaft. Log the core hole and submit the log. Indicate in the log voids and defects located in the core hole. Preserve the cores and make them available for inspection by the Engineer. Commence downhole testing with the core hole treated as an access tube.

   CSL tubes shall be schedule 40 pipes that provide an inside diameter of at least 2 inches. Provide CSL tubes with smooth, regular inside surface free of defects and obstructions (including pipe joints) to permit the free movement of a 1¼ inch diameter probe over the entire length of the tube.

   Use mechanical couplers to extend CSL tubes. Seal all CSL tube joints. Do not weld CSL tube joints.

Provide CSL tubes that are watertight. Provide a watertight cap at the bottom of the CSL tube. Provide a watertight, removable cap at the top of the CSL tube. Fill CSL tubes with potable water prior to or within 1 hour after placement of shaft concrete.

The exterior surface of CSL tubes must be free from corrosion, oil, and coatings so that a good bond is provided between the concrete and the tube.

Test the drilled shaft no sooner than 3 days and no later than 10 days after placement of drilled shaft concrete.

Perform CSL testing between all adjacent tube pairs and across at least two major diagonals. Perform additional diagonal testing if shaft defects are identified. At your expense, perform as many additional diagonal tests as needed to determine the extent of the shaft defect.

If the CSL results indicate a potential defect, the core the location of the defect as described above for blocked CSL tubes.

If the cores indicate the presence of a defect, submit a repair procedure for review and approval. Repair the shaft at your expense and at no extra cost to the Department. If a defect is not observed in the cores, the Department will pay for all coring costs.

After CSL testing has been completed and accepted by the Engineer, remove water from the CSL tube, cut the tube flush with the top of the shaft, and fill the tube with DS Grout.

515-3.12 DRILLED SHAFT EXCAVATIONS CONSTRUCTED OUT OF TOLERANCE. Do not construct drilled shaft foundations in such a manner that the concrete shaft cannot be completed within the required tolerances. If the contract tolerances are not met, the Contractor may request design changes in the pier to incorporate shafts installed out of tolerance. The Contractor shall bear the costs of redesign and all related costs resulting from approved design changes to incorporate shafts installed out of tolerance. Furnish additional materials and work necessary, including engineering analysis and redesign, to implement corrections of out of tolerance drilled shafts at no expense to the Department.

Provide a proposal on correcting out of tolerance shafts. Do not begin any redesign until the proposal has been reviewed for acceptability and approved by the Engineer in writing.

A Professional Engineer registered in the State of Alaska must perform all redesign to correct for out of tolerance shafts. The Registered Professional Engineer performing the redesign is subject to the approval of the Engineer.

515-4.01 METHOD OF MEASUREMENT.

1. Drilled Shaft. This item will not be measured for payment.

2. Unclassified Shaft Excavation. The quantity to be paid for will be the length, in feet, of unclassified shaft excavation of the diameter shown in the plans, completed and accepted. The length will be measured along the centerline of the shaft.

3. Special Shaft Excavation. The quantity to be paid for will be the length, in feet, of special shaft excavation of the diameter shown in the plans, completed and accepted. The length will be measured along the centerline of the shaft.

4. Shaft Casings. The sum of the lengths, in feet, of the casing in place in the completed structure. The length will be measured along the casing from the top to the bottom of the casing at each shaft location.

5. Shaft Instrumentation and Data Collection. This item will not be measured for payment.

515-5.01 BASIS OF PAYMENT.

1. Drilled Shaft. Payment will be full compensation for furnishing, erecting, operating, maintaining, dismantling and transporting all drilled shaft equipment necessary to drill foundation shafts and place the casing as indicated on the plans.

   Payment will be full compensation for all Quality Control Inspection.

   Payment will be full compensation for the design, fabrication, installation, maintenance and removal of all temporary work structure(s) required to construct the bridge substructure and superstructure.

   Payment of 85 percent of the amount bid for this bid item will be made when all equipment is at the site, assembled and ready to begin operation, and all temporary structures required for the installation of the drilled shafts are installed and ready for use.

   Payment of 10 percent will be made when the all shafts have been drilled, all shaft concrete is in place to the top of the shaft, all Instrumentation and Data Collection is complete, and after all shafts have been accepted by the Engineer.

   Payment of the remaining 5 percent will be made after the temporary work structure(s) has been removed in its (their) entirety.

2. Unclassified Shaft Excavation. Payment will be full compensation for the shaft excavation; sidewall overreaming; removal from the site and disposal of excavated materials; preparation of the site as required; cleaning and inspecting shaft excavations; using desanding equipment as necessary; using drilling equipment; and furnishing all other labor and materials necessary to complete the work.

3. Special Shaft Excavation: Payment will be full compensation for the shaft excavation; sidewall overreaming; removal from the site and disposal of excavated materials; preparation of the site as required; cleaning and inspecting shaft excavations; using desanding equipment as necessary; using drilling equipment; and furnishing all other labor and materials necessary to complete the work.

4. Shaft Casing: Payment will be full compensation for all costs necessary for furnishing and placing the casing in the shaft excavation.

5. Shaft Instrumentation and Data Collection: Payment will include all labor, equipment, materials, transportation, storage, and insurance required for the instrumentation, data collection and reporting of shaft testing.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
515.0001.____	Drilled Shaft	LS
515.0002.____	Unclassified Shaft Excavation, (Shaft Size)	LF
515.0003.____	Special Shaft Excavation, (Shaft Size)	LF
515.0004.____	Shaft Casing, (Shaft Size)	LF
515.0005.____	Shaft Instrumentation and Data Collection	LS

SECTION 516
EXPANSION JOINTS, BEARINGS, AND WATERSTOPS

516-1.01 DESCRIPTION. Furnish and install expansion joints, bearings, and waterstops.

516-2.01 MATERIALS. Use materials that conform to the following:

Grout	Subsection 701-2.03
Bridge Seals	Subsection 705-2.03
Expanded Polyethylene	Subsection 705-2.06
Structural Steel	Section 716
Elastomeric Bearing Pads	Subsection 720-2.01
Epoxy Adhesive for Elastomeric Bearing Pads	Subsection 720-2.02
Polytetrafluoroethylene (PTFE) Bearings	Subsection 720-2.03
Waterstops	Section 723

CONSTRUCTION REQUIREMENTS

516-3.01 EXPANSION JOINTS. Locate and form expansion joints as shown on the Plans.

1. Shop Drawings. Provide shop drawings for expansion joints having a total movement of more than 1.75 inches. Submit drawings showing installation procedures and joint assembly details. Install joints only after shop drawings are approved.

2. Manufacture and Fabrication.

   a. Open Joints. Place open joints where shown on the Plans. Remove forms without chipping or breaking the corners of the concrete. Do not extend reinforcement across an open joint, unless shown on the Plans.

   b. Filled Joints. Construct expansion joints with expanded polyethylene joint filler as thick as the width of the joint.

      Cut the joint filler to the same shape and size as the adjoining surfaces. Fix the joint filler against the concrete surfaces in place to keep the joint filler from displacing when concrete is placed.

      Immediately after removing the forms, inspect the expansion joints. Remove concrete or mortar that has sealed across the joint.

   c. Compression Seals. Shape the joint as shown on the Plans. Install the seal according to the manufacturer’s instructions.

      Install the seal in one piece for the full width of the roadway joint. Install the seal immediately after the curing period of the concrete.

   d. Strip Seals. Use expansion joint strip seals in one piece for the length of the joint. Shape the steel components to conform to the section of the concrete. Ensure that the surface in the finished plane is true and free of warping. When placing the joints, use methods to keep them in correct position during concrete placement that do not affect or modify the structure or joint.

      Install the expansion joints according to the manufacturer's recommendations. Adjust the joint opening for the dimensions indicated on the Plans.

   e. Steel Joints. At the shop, shape the plates, angles, or other structural components to conform to the section of the concrete. Fabricate and paint structural shapes to meet the specifications covering those items. Ensure that the surface in the finished plane is true

and free of warping. When placing the joints, use methods to keep them in correct position during concrete placement that do not affect or modify the structure or joint. Meet the joint opening dimension shown on the Plans.

f. Modular Seals. Shape the joint as shown on the Plans. Use expansion joint modular seals in one piece for the length of the joint. Ensure that the surface in the finished plane is true and free of warping. When placing the joints, use methods to keep them in correct position during concrete placement that do not affect or modify the structure or joint.

Install the expansion joints according to the manufacturer's recommendations. Adjust the joint opening for the dimensions indicated on the Plans.

g. Silicone Expansion Joint Seals. Prepare concrete surface by sandblasting each face until the surface is roughened and all contaminants are removed. Ensure all joint faces are sound, clean, dry, and free of frost immediately prior to sealant application. Install a bond breaking backing material that is configured per the sealant manufacturer's specifications. Install the sealant according to the manufacturer's recommendations.

3. Tolerances. Install expansion joints conforming to the following tolerances:

a. Top Surface Profile: 1/4 to 5/8 inch recessed from the finished roadway profile.

b. Surface Irregularities (deviation from a 10-foot straight edge): ±1/8 inch.

c. Gap Width: ±1/4 inch.

516-3.02 BEARINGS. Install bearing at locations shown on the Plans.

1. Shop Drawings. Provide shop drawings showing all details of the bearings and of the materials proposed for use. Fabricate bearings only after shop drawings are approved.

2. Packaging, Handling, and Storage. Prior to shipment from the point of manufacture, package the bearings in a manner to ensure that each bearing will be protected from damage during shipment, handling, and storage. Store the bearings in an area that provides protection from environmental and physical damage. Prior to installation, clean the bearings of all foreign substances.

3. Construction and Installation. Set the bearing plates, sole plates and elastomeric bearing pads as shown on the Plans in the exact position with full and even bearing on properly finished bearing seats. Do not use shims to set bearing plates, sole plates, or elastomeric bearing pads.

Finish bearing areas or grind them to elevation and parallel to the roadway grade and parallel to the roadway cross slope or crown, unless otherwise shown on the Plans.

When shown on the Plans, place grout under masonry plates. Mix and place grout according to the manufacturer's written recommendations. Clean concrete areas that will contact the grout. Remove loose or foreign matter that would prevent the bond between the mortar and the concrete surfaces.

Tightly pack the grout under the masonry plates to provide full bearing. After placing, cover exposed surfaces of grout pads with a heavy thickness of burlap saturated with water for 3 days. Do not place a load on the grout until the grout has attained a compressive strength of 5000 psi as determined by field specimen.

Locate sole plates to correspond with the temperature during erection. Anchor bearing securely. Adjust the nuts on anchor bolts at the expansion ends of spans to permit the span to move freely. Burr threads sufficiently to prevent removal of nuts.

Apply epoxy adhesive to the bottom surface of the elastomeric bearing pads before placing them. Do not move the pad until the epoxy has cured and full adhesion is achieved. Do not apply epoxy adhesive to elastomeric bearings used in PTFE bearing assemblies.

4. Tolerances. Install bearings conforming to the following tolerances:

   a. Horizontal Position: ±1/8 inch

   b. Elevation: ±1/8 inch

   c. Grade and cross slope: ±1/16 inch per foot.

516-3.03 WATERSTOPS.

Furnish a waterstop that is capable of accommodating joint movement equal to half the bearing pad height or as shown on the Plans.

1. Waterstop Sealing Systems. Furnish and install a waterstop sealing system where specified on the Plans. Use full-length segments of waterstop strip tape for straight portions of joints.

   Prepare the surface and install the waterstop sealing system following the manufacturer's instructions. Overlap strip tape according to the manufacturer's recommendations, but not less than 2 inches

2. Embedded Waterstop. Furnish and install embedded waterstop where and as specified on the Plans. Use full-length segments of embedded waterstop for straight portions of joints. Follow the manufacturer's instructions for the embedded waterstop and concrete application.

Remove and replace damaged waterstops.

516-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Expansion Joint. The sum of the lengths of joints complete in place, measured along the centerline of the joint.

2. Bearings. Measured per unit, complete in place.

3. Waterstops. The sum of the lengths of waterstops complete in place, measured along the centerline of the waterstop.

516-5.01 BASIS OF PAYMENT.

When Items 516.0001.____, 516.0002.____, or 516.0003.____ do not appear on the bid schedule, this work is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
516.0001.____	Expansion Joint,_____	LF
516.0002.____	Bearings, (Type)	EACH
516.0003.____	Waterstops	LF

SECTION 520
TEMPORARY CROSSINGS

520-1.01 DESCRIPTION. For each site where public traffic uses a temporary crossing or a Contractor uses a temporary crossing that is elevated over a public route, construct and maintain the temporary crossing. Remove temporary crossings after use and cleanup the site.

Design temporary bridges, change the preliminary design of approach roads to accommodate temporary bridges, and have an independent design check performed. Inspect and perform quality acceptance on temporary bridges.

520-1.02 DEFINITIONS.

DESIGNER OF RECORD (DOR). A civil engineer registered as a Professional Engineer in the State of Alaska, and in responsible charge of the work described. The DOR must have adequate and relevant prior bridge design and inspection experience. The DOR may delegate portions of design, quality acceptance, and inspection work, to qualified technicians. The DOR and qualified technicians must not be supervised by, or under the direction of the Contractor's temporary crossing superintendent and work crew.

INDEPENDENT ENGINEER (IE). An engineer registered as a Professional Engineer in the State of Alaska, and in responsible charge of the independent design check. The engineer responsible for the check must have adequate and relevant prior bridge design experience. The engineer responsible for the check shall not be employed by the Contractor or the same firm as the Designer of Record; or employed by a firm managed or owned by the Contractor or the Designer of Record; nor shall the engineer performing the work manage or own the Contractor or the firm employing the Designer of Record.

INDEPENDENT DESIGN CHECK (IDC). An independent design check of the temporary bridge package including but not limited to: design, location and dimensions of the foundation, structural members, connections, erection plan and temporary bracing (when required), safety barrier, and independent calculations of design loads, member stress, material properties, hydraulic capacity and scour protection.

TEMPORARY BRIDGE. A temporary bridge used by the public or over a public route, including abutments, piers, safety barrier and railing, foundation scour protection, and other incidentals.

TEMPORARY BRIDGE PACKAGE (TBP). Design calculations from the DOR and IE, working drawings, specifications, load rating, and all items identified on Form 25D-080, necessary to construct a temporary bridge.

TEMPORARY CROSSINGS. A detour route that includes temporary bridges, approach roads and other incidentals.

MATERIALS AND DESIGN

520-2.01 MATERIALS. New or used materials must meet the requirements of the design and the Contract. The DOR must verify the quality of temporary bridge materials before incorporation into the project.

520-2.02 GEOTECHNICAL DATA AND HYDROLOGY REPORT. The Department may provide records of geotechnical investigations. The Contractor is responsible for obtaining all additional geotechnical data necessary for design and construction of the temporary crossings.

The Department may provide a preliminary hydrology and hydraulics report. The Contractor is responsible for obtaining all additional hydrology and hydraulics data necessary for design and construction of the temporary crossings.

520-2.03 TRAFFIC CONTROL PLAN. Submit a traffic control plan for temporary crossing according to the Plans and Section 643.

520-2.04 DESIGN REQUIREMENTS. Retain the services of a DOR to design temporary bridges, and to provide a TBP. When the temporary bridges are used as a construction platform for the Contractor's equipment or workers, then design and construct temporary bridges that are wide enough for traffic lanes and construction areas, and strong enough to support design traffic and construction loads.

The Department will provide preliminary designs for approach roads. The DOR may change the design of approach roads to accommodate temporary bridges.

1. Design temporary crossings according to the following documents:

   a. *DOT&PF Standard Specifications for Highway Construction* for recommended construction methods, material properties, and sampling and testing methods;

   b. *AASHTO LRFD Bridge Design Specifications, AASHTO Guide Specifications for LRFD Siesmic Bridge Design,* and the *DOT&PF Bridges and Structures Manual* for temporary bridge design criteria, as modified by Subsection 520-2.04; and

   c. *DOT&PF Preconstruction Manual* for design criteria for changes to approach roads.

2. Provide working drawings for temporary bridges including:

   a. All information and details necessary to construct temporary bridges including all items listed on Form 25D-080;

   b. All dimensions controlling the temporary bridge design and erection, including beam length and spacing, post location and spacing, vertical distance between connections in diagonal bracing, height of bents, and similar design controlling dimensions;

   c. All design loads and material properties;

   d. The soil bearing values;

   e. The openings required to allow the passage of traffic, including horizontal and vertical clearances, and the location of railing or barrier;

   f. Water design flow, opening size and elevations under superstructure, the high water elevation, and the maximum water flow elevation, and vertical clearances; and

   g. When a bridge is built over a traveled way show where temporary bracing is used during erection or removal of the bridge, show the sequence of erection and removal, and show details of the temporary bracing used.

3. Design temporary bridges to conform to the following requirements:

   a. To support 100 percent of HL-93 live loads or the Contractor's maximum construction load whichever is greater, without overstress. Indicate the HL-93 live load and the governing live load (when different than HL-93) on working drawings;

   b. Design for half the seismic acceleration value of the permanent bridge shown on the Plans;

   c. Include the capacities and demands of load-supporting members in the design calculations;

d. Provide a clear roadway and clear pathway widths equal to or greater than the widths indicated on the plans. Construct the temporary bridge and approach embankments wide enough to provide the widths indicated on the plans, and to safely pass contractor's equipment during all phases of constructing the new bridge;

e. Design vertical clearance for the life of the temporary structure. A minimum vertical clearance of 16.5 feet is required above a state highway, local road, or street open to the public. A minimum vertical clearance of 23 feet is required above the Alaska Railroad. For navigable waters a minimum vertical clearance of 17 feet is required between the low elevation of the superstructure and (1) the ordinary high fresh water elevation or (2) mean high salt water elevation;

f. Minimum vertical clearance of one foot between the low elevation of the superstructure and the maximum water flow elevation within the proposed construction opening. Calculate the design water discharge for each temporary bridge;

g. To support equipment used to install and remove the temporary bridge, and construct or renovate the existing bridge. List equipment type, size, capacity, lifting locations, and traffic patterns during lift on the working drawings. Indicate maximum construction loads and locations of applied construction loads;

h. Provide a concrete F-shape barrier system on the bridge and bridge approaches. Anchor barrier system to prevent deflection when impacted. Locate barrier so outside edge is setback a minimum of 12 horizontal inches from outside edge of bridge deck;

i. Construct roadway surface of concrete or asphalt. Construct skid-resistant bridge deck surface of concrete, asphalt, timber or steel;

j. Design to comply with the requirements of permits and environmental commitments, including time windows during which work may occur. Apply for and obtain additional permits or modifications to existing permits as needed;

k. Do not use existing bridge components on the project site for temporary bridge construction; and

l. To support loads from utilities identified in the Contract.

4. Provide load ratings of the temporary bridge according to the most recent version, including interim version, of the AASHTO *Manual for Bridge Evaluation* (*MBE*) and the *Alaska Bridges and Structures Manual*. Do not submit a temporary bridge with load factors less than 1.0. Load rate steel and concrete bridges using the Load Factor Rating (LFR) and Load and Resistance Factor Rating (LRFR) methods. Load rate timber bridges using the Allowable Stress Rating (ASR) method and Load and Resistance Factor Rating (LRFR) methods.

   Include values for moment, shear and, where applicable, axial stresses. Specify live load type, placement for maximum stress, distribution, and impact. Do not include the Contractor's construction loads.

   Include the following cases for LFR load ratings:

   a. inventory and impact included

   b. operating and impact not included

   c. operating with one lane centered on the bridge and impact not included.

   Include the following LRFR load ratings:

d. design inventory and impact included

e. design operating and impact included

f. design operating with one lane centered on the bridge and impact not included.

Provide a LFR and LRFR load rating summary table with the general geometry of the structure, assumptions made, and each load rating value. Provide updated load ratings as necessary to reflect the current condition of the temporary bridge.

6. Design changes to approach roads must conform to permit requirements, and Department design standards applicable to the design criteria listed on the plans.

520-2.05 DESIGN SUBMITTAL AND REVIEW. Comply with the following:

1. Retain a DOR to design temporary bridges and design changes to the approach roads, and to provide load ratings for temporary bridges. The design drawings and load ratings in the TBP must be stamped with the seal of, dated by, and signed by the DOR;

2. Retain an IE to perform an IDC; and to stamp with their seal, date, and sign an IDC letter certifying: “The TBP meets the AASHTO LRFD Bridge Design Specifications and the Contract requirements”; and

3. Submit the IDC letter with the TBP (except calculations may be one set), and with three sets of design changes to the approach roads, to the Engineer for review and approval at least 30 days prior to beginning construction of the temporary bridge.

520-2.06 VALUE ENGINEERING CHANGE PROPOSALS. Base your bid on supplying temporary bridge structures according to the Contract documents. After Award you may submit construction value engineering change proposals to the Engineer. Proposals must include permitting requirements and timelines for construction. The Department will consider value engineering change proposals in accordance with Subsection 104-1.06.

CONSTRUCTION REQUIREMENTS

520-3.01 TRAFFIC MAINTENANCE. Protect and control traffic according to Section 643 and the approved traffic control plan.

520-3.02 CONSTRUCTION AND MAINTENANCE REQUIREMENTS. Construct temporary crossings entirely within the right-of-way and within permitted areas. Construct the temporary bridge according to the approved TBP. Construct the approach roads according to the Plans and Specifications, as modified by the DOR and approved by the Engineer. Construct according to the Standard Specifications for Highway Construction with exceptions noted by the DOR and this Section 520.

Bolted steel connections must use load indicating washers. Weld according to Subsection 504-3.01.7 Welding.

Maintain structure, safety appurtenances, and wearing surface of temporary crossings until substantial completion. Maintain temporary crossings in a safe and functional condition. Keep bracing and connections tight, and immediately replace any damaged members or damaged connections. Promptly remove debris caught against, under or inside, temporary bridges.

Limit surface deviations to 3/8 inch, as measured from the testing edge of a 10-foot straightedge, between two contacts on the driving surface of the temporary crossings.

520-3.03 WINTER MAINTENANCE. The Department may accept the maintenance responsibility for winter snow and ice removal only. The Contractor retains responsibility for all repairs and maintenance, in accordance with Subsections 105-1.13 and 107-1.15.

520-3.04 INSPECTION. The Contractor is responsible for Quality Control, and for the construction of temporary crossings, including temporary bridges and approach roads, to conform to the working drawings, specifications and the Contract requirements.

The DOR is in responsible charge of Quality Acceptance and inspection, of temporary bridge materials and construction work. The DOR must verify in writing that the quality of bridge materials and construction work meet the design and Contract requirements. The DOR or qualified technician is required to be on-site and to inspect critical work including but not limited to abutments, piers, pile driving, welding, structural elements, fastening of structural elements, reinforcing steel placement, concrete pours, and foundation scour protection.

The Engineer may sample and test materials, and may reject materials that do not meet the requirements of the design. The Engineer may inspect the construction of temporary crossings at any phase of construction and reject unacceptable work. The Engineer will inspect the finished construction of temporary crossings before public use; however, inspection by the Engineer will not relieve the Contractor from any responsibility for defective work.

520-3.05 APPROVALS. Obtain the following written approvals from the Engineer:

1. TBP prior to beginning temporary bridge construction;

2. Design changes to temporary approach roads prior to construction of approach roads;

3. Temporary bridge construction prior to opening the bridge to traffic; and

4. Approach road construction prior to opening the road to traffic.

Such approvals will not relieve the Contractor of the responsibility for defective work. The Contractor shall remain responsible for all aspects of the design, location and dimensions of the temporary crossing, including but not limited to materials, foundation, structural members, connections, safety barrier, and for satisfactory and safe construction of all work.

The Engineer's review and approval of the TBP shall not be construed as a complete review, but will indicate only that the general method of construction and working drawings are acceptable to the Department, that the TBP appears complete, and that a certification of an IDC was provided.

The request to open the temporary bridge to traffic must be supported by a final inspection report that is stamped with the seal of, dated by, and signed by the DOR; and that certifies: "The temporary bridge has reached Substantial Completion as defined in Subsection 101-1.03, conforms to the requirements of the TBP and the Contract, and can support design traffic loads and construction loads, and is suitable for public use."

520-3.06 CLEANUP. Remove temporary crossings, cleanup site, and stabilize site from erosive forces before final completion. Return the site substantially to its original condition. Additional cleanup conditions may be listed in the permits. Remove piling to a minimum of one foot below ground level.

520-4.01 METHOD OF MEASUREMENT. See Section 109.

520-5.01 BASIS OF PAYMENT.

Temporary Crossings. The lump sum payment is full compensation for all design, engineering, load rating, inspection, labor, equipment and materials necessary to furnish, install, repair,

maintain and remove temporary crossings in their entirety. The lump sum payment also includes all traffic control and traffic maintenance within the limits of the temporary crossings.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
520.0001.____	Temporary Crossings	LS

SECTION 550
COMMERCIAL CONCRETE

550-1.01 DESCRIPTION. Furnish, place, finish, and cure Portland cement concrete for manholes, inlets, sidewalk, curb, gutter and other minor structures and incidental construction as shown on the Plans.

550-2.01 MATERIALS. Use materials conforming to Subsection 501-2.01.

550-2.02 COMPOSITION OF MIXTURE – JOB MIX DESIGN. Provide a Job Mix Design, JMD, meeting the requirements of Table 550-1 for each class of concrete included in the Contract.

TABLE 550-1
COMMERCIAL CONCRETE DESIGN REQUIREMENTS

Class	B	W
Water-Cement Ratio, lbs/lbs, maximum	0.45	0.50
Total Air Content, %	5.5 – 6.5	4.0 – 6.5
Coarse Aggregate Gradation, AASHTO M 43	No. 57 or 67	No. 7, 8, 57, or 67
Compressive Strength, psi, minimum	4,000	3,000

Alternative sizes of coarse aggregate, as shown in AASHTO M 43, may be used when approved in writing.

Calculate the water-cement ratio based on the total weights of all water and all cementitious material. Portland cement, blended hydraulic cement, fly ash, ground granulated blast-furnace slag, and silica fume are cementitious materials.

Fly ash, ground granulated blast-furnace slag, silica fume, and combinations of these materials may be used as a substitute for Portland cement provided the quantity meets the limits of Table 550-2 and the total combined quantity of fly ash, ground granulated blast-furnace slag, and silica fume does not exceed 40 percent of the total cementitious material by weight.

TABLE 550-2
SUPPLEMENTARY CEMENTITIOUS MATERIAL LIMITS

Fly Ash, maximum	35%
Ground Granulated Blast-Furnace Slag, maximum	40%
Silica Fume, maximum	10%

Maximum percent includes initial quantities in blended cement plus supplementary cementitious materials.

1. Submittals. Submit a JMD and materials documentation at least 15 days prior to scheduled production.

   a. JMD. Submit concrete mixture proportions per cubic yard and test results for the proposed JMD. Submit the following:

      (1) Weights of cementitious materials

      (2) Weights of aggregates in saturated surface dry condition

      (3) Volume or weight range of each admixture.

      (4) Weight of water

      (5) Water-cement ratio

      (6) Percentage of air by volume test results

(7) 7-day and 28-day compressive strength test results

b. Cementitious Materials. Submit the following:

(1) Type/Class

(2) Brand

(3) Producer

(4) Plant location

(5) Certified test reports confirming the cementitious material meets these specifications.

c. Aggregates. Submit the following:

(1) Pit or quarry location(s)

(2) Saturated surface dry specific gravities

(3) Absorption values

(4) Gradations and AASHTO size number

d. Admixtures. Submit the following:

(1) Type

(2) Manufacturer

(3) Manufacturer's product data sheet giving the procedure for admixture use, recommended dosage range, and demonstrating admixture compatibility.

e. Water. Submit the source of supply for water.

2. Approval. Obtain the Engineer's approval of each mix design prior to use. Approval of the JMD does not constitute acceptance of produced concrete and will not obligate the Department to accept or pay for concrete not meeting the requirements of this Section.

CONSTRUCTION REQUIREMENTS

550-3.01 BATCHING, MIXING, AND DELIVERY. Batch concrete according to the approved JMD. Mix ingredients into a thoroughly intermingled uniform mixture. Hand mixing is not allowed.

Do not retemper concrete mixtures except that additional water may be added on-site provided the total amount of water, including that added on site, is within the proportion tolerances of 550-3.02. Account for the actual volume of concrete remaining in the mixer. Complete all water additions within 30 minutes of the introduction of mixing water to the cementitious materials. If additional water is added, provide additional mixing to ensure a thoroughly intermingled uniform mixture is attained.

Discharge the concrete within 1.5 hours of adding the mixing water to the cementitious materials, and within 1.5 hours of adding the cementitious materials to the aggregates. The Engineer may extend the time for placement if provided for in the approved JMD.

550-3.02 EVALUATION OF MATERIAL FOR ACCEPTANCE. The Engineer may accept concrete based on conformance with the approved JMD according to this Subsection. Sampling and testing is not required for acceptance. However, the Engineer reserves the right to sample, test, evaluate, and reject concrete according to Subsection 501-3.03.

1. Batch Tickets. Provide a printed ticket with each batch of concrete delivered to the project. Include the following information:

   a. Manufacturer plant (batching facility)

   b. Department Contract Number

   c. Date

   d. Batch number

   e. Time Batched

   f. Truck Number

   g. Quantity (volume batched this load)

   h. Type of concrete by class and producer's mix design identification number

   i. Weight of every type of cementitious material

   j. Weight of each aggregate type

   k. Weight or volume of each admixture

   l. Weight or volume of water added at the plant

   m. Total moisture and absorption percentage for each aggregate

   n. Volume or weight of any water added after batching

   o. Signature of Contractor's representative, affirming the accuracy of the information provided.

2. Tolerance. Meet the proportion requirements of the approved JMD within the following proportion tolerances:

a.	Total Cementitious Material, weight	±2%
b.	Aggregates, weight	±3%
c.	Total Water, weight or volume	±4%
d.	Admixtures, weight or volume	According to approved JMD

   If the total cementitious material weight is made up of different components, keep the component weights within the following tolerances:

(1)	Portland Cement	±2%
(2)	Fly Ash	±5%
(3)	Ground Granulated Blast-Furnace Slag	±5%
(4)	Silica Fume	±10%

   Proportion tolerance will be calculated using consistent units for M_{JMD} and M_A as follows:

$$P = \frac{(M_A - M_{JMD})}{M_{JMD}} \times 100$$

Where: P = Proportion tolerance, percentage
M_{JMD} = Weight or Volume of component per approved JMD
M_A = Weight or Volume of actual batched component

550-3.03 PLACING CONCRETE. Prepare foundations according to Section 204 or as specified for the applicable pay item. Use forms designed and constructed according to Section 512 or as specified for the applicable pay item. Ensure forms, reinforcing steel, and other embedded items are free of concrete splatter and other foreign material. Remove standing water from within the forms. Moisten foundations and forms with water before the concrete is placed. Prevent movement of forms, reinforcing steel, and other embedded items.

Ensure the concrete temperature is between 50°F and 90°F when placed. Place and consolidate each layer before the preceding layer takes initial set. Limit layer thickness to the capacity of the vibrators to consolidate and merge the concrete with the previous layer. Do not place concrete that has developed initial set.

Place concrete as near as possible to its final position. Prevent segregation of the mix. Do not deposit a large quantity of concrete and run or work the concrete along the forms. Limit the free-fall height of the concrete to less than 5 feet. When pumping concrete use a pump producing a continuous stream of concrete without air pockets.

550-3.04 CONSOLIDATION OF CONCRETE. Consolidate fresh concrete within 15 minutes of placement. Consolidate concrete using mechanical vibrators to make an impervious, dense, homogeneous mass free of voids and rock pockets. Vibrate in a uniform pattern spaced less than 1.5 times the radius of visible effectiveness. Effectively vibrate the full depth of each layer.

Do not vibrate concrete that has initially set. Do not hold vibrators against reinforcing steel or use vibrators to flow or spread the concrete into place. Do not allow the concrete to segregate, form pools of mortar, or form laitance on the surface.

550-3.05 FINISHING CONCRETE SURFACES. After the concrete is consolidated and prior to the application of curing materials, strike-off unformed concrete surfaces to the required elevation and slope. Finish the surface by floating to remove local irregularities. Leave sufficient mortar to seal the concrete surface. Do not use mortar topping for concrete surfaces. Do not use aluminum finishing equipment.

Complete initial floating operations before bleed water or excess moisture is present on the surface and before the concrete develops initial set. Complete final finishing before final set occurs. Do not use finishing aids or additional water to assist in finishing concrete surfaces. Do not finish concrete surfaces if bleed water is present.

1. Ordinary Finish. Immediately after removing the forms, remove the devices holding the forms in place and passing through the body of the concrete, or cut them back at least 1 inch beneath the concrete surface. Remove fins of mortar and irregularities caused by form joints. Ensure the surface is true and even.

   Patch cavities greater than ¼ inch. Fill the cavity with stiff mortar composed of one part Portland cement to two parts fine aggregate with only enough water to form a ball when squeezed gently by hand. Clean and wet the cavity before filling. Thoroughly tamp the mixture into place. Float the surface of the mortar before initial set to make the surface neat in appearance. Cure the patch according to Subsection 550-3.06.

2. Curb, Curb Ramp, and Sidewalk. Broom finish exposed faces of curb, curb ramp, and sidewalk to true surfaces. Broom finish sidewalks perpendicular to the direction of traffic.

550-3.06 CURING CONCRETE. Begin curing immediately after final finishing. Maintain curing for at least 72 hours. During the curing period, keep the concrete at a satisfactory moisture content and at a temperature of at least 50°F.

1. Water Curing. Completely cover exposed concrete surfaces with wet burlap or wet cotton mats. Keep mats completely wet during the curing period. Do not allow concrete surfaces to dry or alternate with wetting and drying cycles. If wood forms can remain in place during the curing period, do not loosen forms and keep the forms moist at all times to prevent opening at joints.

2. Membrane Curing. Uniformly apply two coats of liquid membrane-forming compound, with the second coat at a right angle to the first, until the original color of the concrete is obscured. Apply liquid membrane-forming compound according to the Manufacturer's instructions. Re-apply liquid membrane-forming compound if the membrane becomes cracked or damaged.

550-3.07 PROTECTION OF CONCRETE. Protect concrete from damage. Do not apply loads to the concrete until curing operations are completed and until the concrete has attained sufficient strength to safely carry the applied loads without damage. Forms may be removed after the concrete has cured for at least 24 hours and will not be damaged. Remove and replace concrete damaged by rain, flowing water, frost action, or overheating at no cost to the Department.

1. Rain Protection. Provide materials and equipment on site to protect concrete until final set. During precipitation, or when the Engineer determines precipitation is likely before final set, employ materials and equipment to protect the concrete until final set occurs. Do not expose the concrete to rain or flowing water before final set occurs.

2. Cold Temperature Protection. Protect the concrete during cold weather operations. At least 5 days before placing submit a cold weather concreting plan when air temperatures below 40°F are expected during placement or curing. Obtain the Engineer's approval of the plan and put it into effect before placing any concrete when the air temperature in the shade, away from artificial heat, is below 40°F or, in the opinion of the Engineer, will likely become so during placement or curing.

   Have in place the materials and equipment required to prevent the concrete from freezing. Before placing concrete, warm forms and reinforcing steel to remove frost, ice, and snow from surfaces that will contact fresh concrete. When fresh concrete will contact hardened concrete, warm the surface of the hardened concrete to at least 40°F. Do not place concrete on a frozen foundation.

   Maintain concrete curing temperature and moisture. Do not expose concrete surfaces to air with a temperature greater than 90°F. At the end of the curing period, remove the protection so the concrete drops in temperature gradually and not more than 30°F in the first 24 hours. If water curing is used, allow the concrete surface to dry prior to exposure of the concrete to freezing temperatures.

   Protection may be terminated when the air temperature in the shade rises to 40°F and is expected to remain at least 40°F until the end of the curing period.

3. Hot Temperature Protection. Protect the concrete during hot weather operations. At least 5 days before placing submit a hot weather concreting plan when air temperatures above 90°F are expected during placement or curing. Obtain the Engineer's approval of the plan and put it into effect before placing any concrete when the air temperature in direct sunlight is above 90°F or in the opinion of the Engineer, will likely become so during placement or curing.

   Have in place materials and equipment required to prevent the concrete from overheating. Before placing concrete, cool forms and reinforcing steel to less than 90°F. When fresh

concrete will contact hardened concrete, cool the surface of the hardened concrete to less than 90°F.

Maintain concrete curing temperature and moisture. Keep the concrete temperature from exceeding 90°F before final set and exceeding 150°F during the curing period.

Protection may be terminated when the air temperature in direct sunlight drops to 90°F and is expected to remain no greater than 90°F until the end of the curing period.

550-3.08 ANCHOR BOLTS, DUCTS, PIPES, AND CONDUITS. When anchor bolts, ducts, pipes, or conduits will be encased in concrete, secure them in the forms before placing the concrete. When installing anchor bolts in pipe sleeves, pre-cast holes, cored holes, or drilled holes, completely fill the cavity with grout meeting Subsection 701-2.03.

550-4.01 METHOD OF MEASUREMENT. See Section 109 and the following.

Cubic Yard. The lesser of the actual volume placed or neat line volume of concrete accepted in place.

550-5.01 BASIS OF PAYMENT. If Items 550.0001.____, 550.0002.____, 550.0003.____, or 550.0004.____do not appear in the Bid Schedule concrete is subsidiary to other items.

Material not appearing in the Bid Schedule and is contained within, embedded, or attached to concrete elements is subsidiary. Repairing unacceptable concrete is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
550.0001.____	Class B Concrete	LS
550.0002.____	Class W Concrete	LS
550.0003.____	Class B Concrete	CY
550.0004.____	Class W Concrete	CY

DIVISION 600–MISCELLANEOUS CONSTRUCTION

SECTION 601
METAL FLUME DOWNDRAINS

601-1.01 DESCRIPTION. Furnish and install tapered inlet assemblies, metal flume downdrains, and anchor assemblies, at the locations shown on the Plans.

601-2.01 MATERIALS. Fabricate tapered inlets and flume downdrains using any one of the base metals listed in AASHTO M 36 or AASHTO M 196. Use a minimum sheet thickness of 0.060 inches. Use steel nuts and bolts, galvanized according to AASHTO M 232.

601-3.01 CONSTRUCTION REQUIREMENTS. Fabricate downdrains according to the details and dimensions shown on the Plans. Weld bulkheads and flume pieces to the inlet assembly to form watertight connections.

Do not use dissimilar metal at any one installation. Anchor assemblies shown on the Plans may be used with an aluminum installation if the anchor assemblies are electrically insulated.

Connect flume downdrain sections together and to the inlet assembly using galvanized bolts as shown on the Plans.

601-4.01 METHOD OF MEASUREMENT. See Section 109, measured along the invert from the lower end of the inlet assembly, not including flume stub, to the lower end of the flume.

601-5.01 BASIS OF PAYMENT. The contract price includes the inlet, anchor assemblies, miscellaneous hardware, and excavation for the installation.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
601.0001.____	Metal Flume Downdrain	LF

SECTION 602
STRUCTURAL PLATE PIPE

602-1.01 DESCRIPTION. Construct galvanized corrugated steel plate or aluminum alloy plate pipes, at the locations shown on the Plans.

602-2.01 MATERIALS. Use materials that conform to the following:

Pipe	Subsection 707-2.04
Bedding and backfill	Subsection 204-2.01

602-3.01 CONSTRUCTION REQUIREMENTS. Lay field-assembled plate pipes in conformance to the lines and grades approved by the Engineer. Excavation, grading, and backfill must conform to Subsection 204-3.01.

Repair damage to the zinc coating according to AASHTO M 36.

Pre-shape bedding material to fit the lower portion of the pipe. Pre-shape to a depth of one-tenth of the pipe height and wide enough to permit compaction under the haunches. Strutting is not permitted.

When elongated pipes are specified, form the plate sections at the factory so that the pipe's vertical dimension is increased by 5 percent of the specified diameter.

Provide the Engineer with a copy of the manufacturer's recommendations and instructions and comply with them.

602-4.01 METHOD OF MEASUREMENT. See Section 109, measured along the invert of each pipe of the type and size specified.

602-5.01 BASIS OF PAYMENT. Structure excavation, bedding, and backfill for structural plate pipe is paid for under Section 204.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
602.0001.____	Structural Plate Pipe ___Diameter, ___Gauge	LF
602.0002.____	Structural Plate Pipe-Arch ___Span, ___Rise, ___Gauge	LF
602.0003.____	Structural Plate Arch, ___Span, ___Rise, ___Gauge	LF

SECTION 603
CULVERTS AND STORM DRAINS

603-1.01 DESCRIPTION. Construct or reconstruct culverts and storm drains (pipe), to the lines and grades shown on the Plans.

603-2.01 MATERIALS. Use materials that conform to the following:

Bedding and Backfill	Subsection 204-2.01
Joint Mortar	Subsection 705-2.04
Flexible Watertight Gaskets	Subsection 705-2.05
Non-Reinforced Concrete Pipe	Subsection 706-2.01
Reinforced Concrete Pipe	Subsection 706-2.02
Corrugated Polyethylene Pipe (Unperforated)	Subsection 706-2.07
Corrugated Steel Pipe and Pipe Arches	Subsection 707-2.01
Bituminous Coated Corrugated Steel Pipe and Pipe Arches	Subsection 707-2.02
Corrugated Aluminum Pipe	Subsection 707-2.03

When Item 603(17), Pipe, is listed in the bid schedule, furnish either Corrugated Steel Pipe (CSP), Corrugated Aluminum Pipe, Reinforced Concrete Pipe, or Corrugated Polyethylene Pipe. End Sections for Metal Pipe must be of the same material as the pipe.

When extending in-place metal culverts and/or reattaching end sections with dissimilar metal, provide an electrical insulating material to separate the dissimilar materials. The insulating material must be at least 1/16 inch thick and be approved by the Engineer.

Select pipe for each installation which meets or exceeds the requirements shown on the Plans for height of cover.

CONSTRUCTION REQUIREMENTS

603-3.01 GENERAL. Excavation, bedding, and backfill must conform to the requirements of Subsections 204-2.01 and 204-3.01, and the details on the Plans.

603-3.02. LAYING PIPE. Begin the pipe laying at the downstream end of the pipe. Keep the lower segment of the pipe in contact with the shaped bedding throughout its full length. Place bell or groove ends of rigid pipe and outside circumferential laps of flexible pipe facing upstream.

Lay paved or partially lined pipe so that the longitudinal center line of the paved segment coincides with the flow line. Install elliptical conduit and circular conduit reinforced with other than a full circular cage or cages so the orientation of a vertical plane through the longitudinal axis of the conduit does not vary more than 5 degrees from the design orientation.

Repair damaged metallic coating on metal pipe according to AASHTO M 36.

603-3.03 JOINING PIPE.

1. Rigid Pipe. Use either bell and spigot or tongue and groove joints. Join pipe sections so that the ends are fully entered and the inner surfaces are reasonably flush and even.

   Use one or more of the following joint materials, or any other if approved:

   a. Portland cement mortar

   b. Portland cement grout

   c. Rubber gaskets

d. Oakum and mortar

e. Oakum and joint compound

f. Coupling bands

g. Preformed plastic sealing compound

Make mortar joints using an excess of mortar to form a bead around the outside of the pipe. Finish the joint smooth on the inside.

For grouted joints, use molds or runners to retain the poured grout. Install rubber ring gaskets to form a flexible, watertight seal. When using oakum, caulk the joint and then seal it with the specified material.

When using portland cement mixtures, protect the completed joints against rapid drying using suitable covering material.

2. Metal Pipe. Join metal pipe firmly using one of the following types of coupling bands. Use bands that are no more than two nominal sheet thicknesses lighter than the pipe being joined, and in no case more than 0.052 inches lighter.

   a. Primary Band. Furnish and install corrugated bands so that the band corrugations match and conform to the corrugations of the pipe. Conform to the following guidelines:

      (1) The gap between the pipe being joined is in the center of the band and is no wider than one corrugation width.

      (2) Bands for 12-inch through 30 inch diameter pipe are at least 12 inches wide.

      (3) Bands for pipe with diameters greater than 30 inches are at least 22 inches wide.

   b. Secondary Band. Use this band only where it is not physically possible to use primary bands, such as on field-cut pipe ends, joining new pipe to existing pipe, etc. Furnish and install deformed metal sheet bands (dimple bands) so that the projections match and are the same depth as the pipe corrugations. Form these projections in circumferential rows with one projection for each corrugation of the helical pipe.

      Conform to the following guidelines:

      (1) The gap between the pipe being joined is in the center of the band and is no wider than 2 inches.

      (2) Bands for 12-inch diameter pipe are at least 12 inches wide and have one circumferential row of projections for each pipe end being joined.

      (3) Bands for pipe with diameters greater than 12 inches are at least 24 inches wide and have two circumferential rows of projections for each pipe end being joined.

      (4) Furnish and install these bands with a gasket that resists infiltration and leakage.

3. Polyethylene Pipe. Ensure that polyethylene pipe couplings are corrugated to match the pipe corrugations and that their width is not less than one half the nominal pipe diameter.

Furnish all bolted connections on coupling bands with cutwashers placed between the nut and the angle bracket or use nuts with integral washers.

Take up any pipe that is out of alignment, unduly settled, or damaged and re-lay or replace it.

603-4.01 METHOD OF MEASUREMENT. See Section 109, and as follows:

1. Culvert Pipe. The length of pipe, measured in place, along the invert.

2. Pipes for Storm Drains. The length of pipe, measured in place, along the invert, from center to center of structures. No deduction will be made for length through inlets, catch basins, or manholes.

3. End Sections. The number of units installed.

4. Branch Connections and Elbows. The number of units installed when listed on the bid schedule. Included in the length measurement for pipe when not listed on the bid schedule.

603-5.01 BASIS OF PAYMENT. Coupling bands and other items necessary for the proper joining of the sections are subsidiary.

Excavation, bedding, and backfill are paid for under Section 204.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
603.0001.____	CSP ___ Inch	LF
603.0002.____	___ Inch CSP Arch	LF
603.0003.____	End Section for CSP ___ Inch	Each
603.0004.____	End Section for ___ Inch CSP Arch	Each
603.0005.____	Bituminous Coated CSP ___ Inch	LF
603.0006.____	Bituminous Coated CSP Arch ___ Inch	LF
603.0007.____	End Section for Bituminous Coated CSP ___ Inch	EACH
603.0008.____	End Section for Bituminous Coated CSP Arch ___ Inch	EACH
603.0009.____	Corrugated Aluminum Pipe ___ Inch	LF
603.0010.____	___ Inch Corrugated Aluminum Pipe Arch	LF
603.0011.____	End Section for Corrugated Aluminum Pipe ___ Inch	EACH
603.0012.____	End Section for ____ Inch Corrugated Aluminum Pipe Arch	EACH
603.0013.____	Reinforced Concrete Pipe, ___ Inch, Class ___	LF
603.0014.____	Reinforced Concrete End Section, ___ Inch	EACH
603.0015.____	Elbow, (Type & Size)	EACH
603.0016.____	Branch Connection, (Type & Size)	EACH
603.0017.____	Pipe ___ Inch	LF
603.0018.____	Bituminous Coated Paved Invert CSP __ Inch, __ Gauge	LF
603.0019.____	___ Inch Pipe Arch	LF
603.0020.____	End Section for Pipe ___ Inch	EACH
603.0021.____	Corrugated Polyethylene Pipe ___ Inch	LF
603.0022.____	End Section for Corrugated Polyethylene Pipe ___ Inch	EACH

SECTION 604
MANHOLES AND INLETS

604-1.01 DESCRIPTION. Construct, reconstruct, relocate, or adjust manholes and inlets.

604-2.01 MATERIALS. Use materials that conform to the following:

Concrete	Section 550, Class B
Clay or Shale Brick	Subsection 704-2.01
Concrete Brick	Subsection 704-2.02
Concrete Masonry Block	Subsection 704-2.03
Joint Mortar	Subsection 705-2.04
Flexible Watertight Gaskets	Subsection 705-2.05
Reinforcing Steel	Subsection 709-2.01
Precast Concrete Manhole Sections	Subsection 712-2.05
Frames, Grates, and Covers,	Subsection 712-2.06
Corrugated Metal Units	Subsection 712-2.07

604-3.01 CONSTRUCTION REQUIREMENTS. Install precast concrete manholes consisting of a base, risers, cone or flat top; with steps, pipe boots, frame and cover as shown on the Plans. Use flexible watertight gaskets between concrete sections. Tighten watertight boots over all pipes, then grout pipes in place.

Install inlets consisting of a precast concrete catch basin box, risers, metal frame and grate as shown on the Plans. Grout pipes into place.

Construct cast-in-place concrete manholes and inlets to conform to the requirements of Section 550 and the details shown on the Plans.

Use full mortar joints no more than 1/2 inch wide.

Set metal frames in full mortar bed.

When specified, plaster the outside face of concrete structures with a 1/2 inch thick cement-sand mortar coat.

Cure exposed surfaces of concrete and masonry with wet burlap for at least 48 hours.

Fit each pipe section flush on the inside of the structure wall and to project far enough outside to connect properly with the next pipe section.

Fit masonry neatly and tightly around the pipe.

Construct invert channels in all manholes used for sanitary or combined sanitary and storm sewers. Construct channels to be smooth and semicircular to conform to the inside of the adjacent sewer sections. Make changes in flow direction along a smooth curve with as large a radius as the manhole size permits. Make gradual and even changes in channel size and grade.

Form invert channels by using any of the following methods:

1. Directly in manhole concrete base

2. Built up with brick and mortar

3. Laying half tile in concrete

4. Breaking out the top one-half of full sections of pipe, laid through the manhole, after the surrounding concrete has hardened

Construct smooth floor outside the invert channel so that it slopes towards the channel not less than 1 inch or more than 2 inches per foot.

Adjust existing manhole, manhole top section, or inlet by raising or lowering the frame or ring casting 12 inches or less, without reconstructing the cone section.

Reconstruct or replace components of existing manhole or manhole top section by using one or more of the following methods:

1. Bring the manhole frame and cover to grade if you remove the cone for lowering.
2. Raise the manhole frame and cover more than 12 inches.
3. Reconstruct a portion of the manhole with no change in line or grade.
4. Tap one or more additional pipes into an existing manhole.
5. Rotate the manhole cone to align the lid to the shoulder, lane line, or middle of driving lane.
6. Rotate the manhole cone to align the inlet casting to the curb line.
7. Align the access stairs by rotating the barrel sections or install new steps.

Reconstruct the manhole or manhole top section to the required elevation so that it conforms to plan details. Complete this work according to the requirements for new construction. Reuse material only if the Engineer approves.

Align manholes designed to fall within the paved roadway surface so that the casting is not in the driving lane wheel path or in the gutter pan flow line.

In roadways, set the manhole frame and cover flush with or no more than 3/8 inch below the finished pavement surface. In walkways and bike paths, set the manhole frame flush with the surface.

Do not impede existing sewer flow during construction.

Relocate inlet by removing and reinstalling inlet box, frame, and grate at new location.

Relocate manhole by removing and reinstalling manhole barrel, cone, frame, and cover at new location.

604-4.01 METHOD OF MEASUREMENT. The number of units installed and accepted.

604-5.01 BASIS OF PAYMENT. Excavation and backfill are paid for under Section 204.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
604.0001.____	Storm Sewer Manhole	EACH
604.0002.____	Sanitary Sewer Manhole	EACH
604.0003.____	Reconstruct Existing Manhole	EACH
604.0004.____	Adjust Existing Manhole	EACH
604.0005.____	Inlet, Type ___	EACH
604.0006.____	Relocate Inlet	EACH
604.0007.____	Relocate Manhole	EACH
604.0008.____	Reconstruct Manhole	CS

604.0009.____	Reconstruct Manhole Top Section	EACH
604.0010.____	Reconstruct Inlet	EACH
604.0011.____	Replace Manhole Top Section	EACH
604.0012.____	Replace Inlet Frame and Grate	EACH
604.0013.____	Replace Inlet Grate	EACH
604.0014.____	Remove and Replace Sewer Manhole Frame and Lid	EACH
604.0015.____	Remove and Replace Storm Drain Manhole Frame and Lid	EACH
604.0016.____	Adjust Inlet Frame and Grate	EACH

SECTION 605
UNDERDRAINS

605-1.01 DESCRIPTION. Construct underdrains and blind drains, underdrain outlets, cleanouts, and marker posts.

605-2.01 MATERIALS. Use materials that conform to the following:

Porous Backfill Material	Subsection 703-2.10
Perforated Concrete Pipe	Subsection 706-2.03
Perforated PVC Pipe	Subsection 706-2.06
Perforated Corrugated Polyethylene Pipe	Subsection 706-2.07
Corrugated Steel Pipe	Subsection 707-2.01
Bituminous Coated Corrugated Steel Pipe	Subsection 707-2.02
Corrugated Aluminum Pipe	Subsection 707-2.03
Gray Iron Casting	Subsection 719-2.02
Marker Post	Subsection 730-2.05

CONSTRUCTION REQUIREMENTS

605-3.01 PIPE INSTALLATION. Excavate trenches to the dimensions and grade required by the Plans or as directed. Place and compact a 3-inch minimum bedding layer of porous backfill material in the bottom of the trench for its full width and length.

Use coupling bands for 6 inch, 8 inch, and 10 inch diameter corrugated underdrain that are 2 piece, 7 inch minimum width and corrugated to match the corrugations of the pipe.

Place perforated pipe with the perforations down. Join pipe end sections securely with the appropriate coupling fittings or bands. Plug or cap up-grade ends of subdrain pipe to prevent entry of soil materials.

After the pipe installation has been inspected and approved, place porous backfill material to a height of 12 inches above the top of pipe. Place and compact the remainder of the porous backfill material as specified in Section 204, to the required height. Fill trench above the porous backfill with specified material.

605-3.02 UNDERDRAIN OUTLETS. Excavate trenches for underdrain outlets to the width and depth shown on the Plans. Lay pipe in the trench with ends firmly joined. Backfill the trench after inspection and approval of the pipe installation.

605-3.03 BLIND DRAINS. Excavate trenches for blind drains to the width and depth shown on the Plans. Fill the trench with specified backfill materials to the depths required by the Plans. Compact all backfill material.

605-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Underdrains, including outlets, and blind drains are measured along the invert.

Porous backfill material is measured by calculated volume, using Plan dimensions for trench width, depth, and measured invert length of perforated pipe.

605-5.01 BASIS OF PAYMENT. When not listed in the bid schedule, porous backfill material is subsidiary.

Pipe cleanouts, including the cast iron cover and marker post are subsidiary.

Excavation is paid for under Section 204.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
605.0001.____	Perforated Corrugated Steel Pipe for Underdrain ___ Inch	LF
605.0002.____	Perforated Corrugated Aluminum Pipe for Underdrain ___ Inch	LF
605.0003.____	Perforated Pipe Underdrain ___ Inch	LF
605.0004.____	Blind Drain	LF
605.0005.____	Porous Backfill Material	CY
605.0006.____	Perforated Corrugated Polyethylene Pipe for Underdrain ___ Inch	LF
605.0007.____	Perforated PVC Pipe for Underdrain ___ Inch	LF

SECTION 606
GUARDRAIL

606-1.01 DESCRIPTION. Construct new guardrail, terminal sections, and transition rail of the kind and type specified.

Remove and reconstruct or remove and dispose of existing guardrail, terminal sections, and transition rail.

606-2.01 MATERIALS. Use materials that conform to the following:

Concrete	Section 550, Class B
Flexible Delineator Posts	Section 730-2.05
Guardrail Connection Plate	Section 722
Guardrail Hardware	Subsection 710-2.07
Guardrail Posts and Blockouts	Subsection 710-2.06
High Strength Bolts	Section 722
Metal Beam Rail	Subsection 710-2.04
Terminals	Subsection 710-2.11
Wire Cable	Subsection 709-2.02

Terminal Markers. Single piece marker, meeting the requirements of Section 730-2.05 Flexible Delineator Posts.

Post-mounted flexible delineators. Single piece marker, meeting the requirements of Section 730-2.05 Flexible Delineator Posts.

Furnish terminal markers, color as shown on the plans, nominally 0.125 by 3.75 inches by 66 inches long or as shown on the plans, with a 3 inch by 12 inch retroreflective sheeting matching the color of the adjacent lane line, or as shown on the plans.

Furnish post-mounted flexible delineators with retroreflective sheeting, color and dimensions as shown on the plans.

Fabricate side-mounted guardrail reflector assembly brackets from aluminum alloy.

Retroreflective sheeting for terminal markers, post-mounted flexible delineators, and side-mounted guardrail reflectors shall meet ASTM D4956 requirements for Type VIII, IX, or XI.)

CONSTRUCTION REQUIREMENTS

606-3.01 GENERAL. Install guardrail and terminals at the locations shown on the Plans. Conform with the Alaska Standard Plans and these Specifications.

At locations where public traffic is adjacent to guardrail work, have all materials on site, including crashworthy terminals, that are required to completely install a segment of guardrail before beginning work on that segment.

Start guardrail installation at the “upstream” end (the end adjacent traffic will encounter first) by either installing a crashworthy terminal or connecting to an existing barrier. Continue installation in the direction of traffic. Exception: if the guardrail run will connect to existing barrier, buried in the backslope, or guardrail, existing or new bridge railing, or other existing structure at the “downstream” end, guardrail installation may be started at the point of connection.

Do not leave posts installed for guardrail within the clear zone for more than 48 hours before installing the rail. At the end of each work shift, install drums or Type II barricades with flashing warning lights to delineate incomplete sections of guardrail and terminal sections.

If guardrail runs are not completed within 10 calendar days after beginning installation, install temporary crash cushions meeting Subsection 643-2.02 at all non-crashworthy guardrail ends within the clear zone. Apply Traffic Price Adjustment if the Contractor does not comply with the crash cushion requirement.

Where necessary, adjust the height of existing guardrail to provide a smooth transition to new guardrail. Use 25 linear feet of guardrail or two 12’ 6” pieces of guardrail to transition to match the existing or new guardrail elements and/or end treatments.

After shaping the slopes and staking proposed guardrail terminal section locations, request the Engineer to field verify their locations. Receive approval of the staked locations before installing terminal sections.

Treat field cuts to timber posts and blockouts according to AWPA standard M 4.

Install blockouts according to manufacturer’s recommendations and as shown on the plans.

Install side-mounted guardrail reflectors and post-mounted flexible delineators as follows:

1. At intervals noted on the plans or Alaska Standard Plans, starting with the first mid-span hole beyond terminal sections

2. With the retroreflective sheeting facing approaching traffic

3. With retroreflective sheeting on both sides, on two-way roadways

4. Not on the terminal sections

Attach terminal markers, in a vertical position, to the P.T. post of Short Radius Guardrail sections and to the post where the flare begins for parallel guardrail terminals. Coordinate terminal marker locations with the Engineer.

At the end of each work shift, install drums or Type II barricades with flashing warning lights to delineate incomplete sections of guardrail and terminal sections.

606-3.02 POSTS. Set posts to accommodate the line, grade, and curvature shown on the Plans.

Use either wood or steel posts when allowed by the type of guardrail specified, subject to the following:

1. Use one type of post material on the project unless extending an existing run of guardrail.

2. Match existing post material to extend an existing run of guardrail.

Set posts as follows:

3. Set posts plumb, in the location and to the depth shown on the Plans or Alaska Standard Plans.

4. Choose an installation method that does not damage the post, adjacent pavement, structures, utility conduits, and final slopes. Repair all damage to the satisfaction of the Engineer, or replace the damaged item, as per subsection 105-1.11.

5. Set wood or steel posts in dug, drilled, or pre-punched holes. Steel posts may also be set by ramming or driving if:

    a. The underlying material is no larger than six inch; and

    b. The posts are not damaged during installation.

6. For placement in solid rock or broken rock embankment greater than six inch, set wood or steel posts in pre-dug, pre-drilled, or pre-punched holes.

7. Backfill and compact around posts with material as specified in the typical section to firmly support the post laterally and vertically. Compact under and around posts to the Engineer's satisfaction.

606-3.03 BEAM RAIL. Fabricate metal work in the fabricator's shop. Bend curved guardrail elements with radii less than or equal to 100 feet in the fabricator's shop or with an approved bending apparatus.

Receive approval before field punching, cutting, or welding. Repair damaged spelter coat areas on galvanized rail elements according to AASHTO M 36.

Lap rail elements so that the exposed ends face away from approaching traffic in the adjacent lane.

Use bolts long enough to extend at least 1/4 inch beyond the nuts. Except where required for adjustments, do not extend bolts more than 1 inch beyond the nuts.

Locate bolts at expansion joints at the center of the slotted holes.

Tighten bolts at expansion joints to snug-tight. Make all other bolts fully-tight.

606-3.04 CABLE RAIL. Install cable guardrail according to the Plans and Specifications. Install at the locations shown on the Plans.

606-3.05 TERMINAL SECTIONS.

1. Parallel Terminals. Install terminal sections according to the manufacturer's recommendations for the entire length of the terminal then, if required, transition rail height over 25' to match guardrail height and splice location. Install where shown on the Plans.

   Follow Section 203 for excavation and embankment requirements.

   Install ASTM D4956 Type III, IV, or V retroreflective sheeting on the end section of parallel terminals consisting of yellow and black bars sloping 45 degrees downward toward the traffic side of the terminal according to guidance for Object Markers for Obstructions Adjacent to the Roadway in Chapter 2C of the *Alaska Traffic Manual*.

2. Buried-in-Backslope Terminals. Install buried-in-backslope terminals where shown on the plans. If required, transition rail height over 25' to match guardrail height and splice location.

Attach terminal markers, in a vertical position, to the first post of each parallel guardrail terminal, and to the post where the flare begins for parallel guardrail terminals and buried-in-backslope terminals. Orient terminal markers to face traffic approaching in the near lane. Coordinate terminal marker locations with the Engineer.

606-3.06 REMOVAL AND RECONSTRUCTION OF GUARDRAIL. Remove and reconstruct guardrail as specified. Replace lost or damaged materials without extra compensation.

606-3.07 REMOVAL AND DISPOSAL OF EXISTING GUARDRAIL. Remove the existing guardrail shown on the Plans, including the rail, cable elements, terminal sections, hardware, posts, concrete bases, and steel tubes. Backfill resulting holes with material in 6-inch layers that is similar to the existing embankment and compact to the same approximate density. Removed items become your property.

606-3.08 ADJUST EXISTING GUARDRAIL. When called for on the Plans, reset existing guardrail to the height shown on the applicable Alaska Standard Plan, measured from the top of the rail to the finished shoulder surface below the rail. Raise and lower the posts several times to prevent settlement and then re-drive them to the height shown on the Plans. Use other methods if approved.

606-3.09 INSTALL NEW GUARDRAIL. Install guardrail as shown on the applicable Alaska Standard Plan, measured from the top of the rail to the finished shoulder surface below the rail.

Install MASH Test Level 3-compliant W31 guardrail as shown on the plans. Install new guardrail in conformance with tolerances shown on the plans.

606-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

1. Guardrail. Measured along the face of the rail or cable, from the center of the end posts.

   Short Radius Guardrail. Per each, installed in place.

   When the guardrail is connected to a terminal section, the pay limit for the rail ends where the specified terminal section begins.

2. Terminals. Per each, installed in place.

3. Transition Rail (Bridge Rail Thrie Beam Transition). Per each accepted connection.

606-5.01 BASIS OF PAYMENT.

Payment for temporary crash cushions installed to protect motorists from guardrail installations that have not been completed within 10 calendar days of beginning installation is subsidiary to other items.

1. Guardrail. Side-mounted guardrail reflectors, post-mounted flexible delineators, terminal markers, guardrail beam, posts, blockouts, and associated hardware are subsidiary. Installation of downstream anchors, transitions for rail height and splice locations, long span guardrail sections, and guardrail stiffening sections are subsidiary to guardrail installation.

2. Short radius guardrail sections. The contract price includes all materials from the terminal anchor to and including the first wood or steel post of standard guardrail or guardrail end terminal, and including the terminal anchor assembly, in-line anchor, terminal posts, CRT posts, rail elements, terminal markers, and associated hardware required for a complete installation.

3. Terminal Sections.

   a. Parallel Guardrail Terminal. The contract price includes rail elements, posts, blockouts, pipe sleeves, cable assemblies, guardrail extruders, terminal markers, and all associated hardware required for a complete installation.

   b. Buried in Backslope Guardrail Terminal. The contract price includes rail elements, posts, blockouts, anchors, and all associated hardware required for a complete installation.

4. Transition Rail. The contract price includes all brackets, beam sections, transition pieces, and all posts and associated hardware required for a complete connection of the guardrail section to a bridge rail or barrier.

All material required for embankment widening for guardrail and terminal sections is paid for under the appropriate pay items shown in the bid schedule.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
606.0001.____	W-Beam Guardrail	LF
606.0002.____	Thrie Beam Guardrail	LF
606.0003.____	Box Beam Guardrail	LF
606.0004.____	Cable Guardrail	LF
606.0005.____	Removing and Reconstructing Guardrail	LF
606.0006.____	Removing and Disposing of Guardrail	LF
606.0008.____	Double-faced, W-Beam Guardrail	LF
606.0009.____	Short Radius Guardrail	EACH
606.0013.____	Parallel Guardrail Terminal	EACH
606.0014.____	Buried in Backslope Guardrail Terminal	EACH
606.0015.____	Adjust Existing Guardrail	LF
606.0016.____	Transition Rail	EACH
606.0017.____	Removing and Disposing of Guardrail	LS

SECTION 607
FENCES

607-1.01 DESCRIPTION. Construct fence and gates. Reconstruct fences previously removed. Include barbed wire, where shown on the Plans.

Woven wire fence consists of galvanized woven wire fence fabric, metal posts, and all fittings and hardware.

Chain link fence consists of chain link fence fabric, metal posts, and all fittings and hardware. The height of chain link fences must conform to the Plans or as designated in the bid schedule.

Barbed wire consists of galvanized barbed wire and all fittings and hardware required for fastening to either a woven wire fence or a chain link fence, as shown on the Plans.

607-2.01 MATERIALS. Use materials that conform to the following:

Concrete	Section 550, Class W
Barbed Wire	Subsection 710-2.01
Woven Wire	Subsection 710-2.02
Chain link Fabric	Subsection 710-2.03
Fence Posts	Subsection 710-2.05

Any one of the types of chain link fabric specified in Section 710 may be furnished under Item 607.0003.____, Chain link Fence. Intermixing fabric types is not allowed.

607-3.01 CONSTRUCTION REQUIREMENTS. Clear and grub as necessary to construct the fence to the required grade and alignment.

Before installing fence, grade the existing ground along the fence line to a smooth, uniform surface so there are no abrupt grade changes between adjacent fence posts.

At locations where breaks in a run of fencing are required, or at intersections with existing fences, adjust post spacing to conform to the requirements for the type of closure indicated.

When the Plans require that posts, braces, or anchors be imbedded in concrete, install temporary guys or braces as required to hold the posts in proper position until the concrete has set sufficiently to hold the posts. Do not install any materials on posts or place strain on guys and bracing set in concrete until 7 days after placing the concrete.

Set the tops of all posts to the required grade and alignment. Do not cut the tops of the posts.

In areas where muck excavation is designated on the Plans or in unstable areas as determined by the Engineer, drive fence posts as shown on the Plans or as directed.

Attach the required size and type of wire or fencing firmly to the posts and braces in the manner indicated. Stretch all wire taut and install it to the required elevations.

At each location where an electric transmission, distribution, or secondary line crosses any of the types of fences covered by these Specifications, furnish and install a ground rod and connection to the fence meeting the requirements of Section 9 of the NESC.

Place ground rods and connectors at maximum intervals of 400 feet along the fence. When fence runs are less than 400 feet long, place one ground rod with connection to the fence.

Coordinate fence construction operations so that livestock do not escape. Connect existing cross fences to the new posts. Place braces for every direction of strain at the junction with existing fences. Fasten the wire in both fences properly to the posts. At bridges, cattle passes, and at

culverts if shown on the Plans, connect the new fence to the structure so that livestock can pass freely through or under the structure.

Fasten fence fabric and wire to the highway side of the posts.

Treat changes in line where the angle of deflection is 30 degrees or more as a corner. Install corner posts.

Treat changes in line where the angle deflection is between 15 and 30 degrees as alignment angles. Fasten adjacent posts to the angle posts using wire. If using wire is impracticable, brace the posts as detailed on the Plans for gate, end, and center posts.

At all grade deflections and alignment angles where stresses tend to pull the posts from the ground, snub or guy the fencing at the critical point using a double strand of 9 gage galvanized wire. Connect the wire to each horizontal line of barbed wire, or to the top and bottom of wire mesh fabric, and to a deadman weighing approximately 100 pounds, buried in the ground not less than 2 feet. Pull the fencing snug to the ground before snubbing or guying.

Erect reconstructed fences carefully using approved salvaged materials. Match any new materials required for reconstructed fence with the existing materials as closely as possible.

607-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Fence. Measured at the base of the fence parallel to the ground, not including gates.

Barbed Wire. Measured at the base of the fence parallel to the ground, not including gates, for each strand.

Gate. Each complete unit of the size and type specified.

607-5.01 BASIS OF PAYMENT. Concrete post foundations, fence posts, ground rods, and connections are subsidiary.

Clearing, grubbing, and grading are subsidiary.

New materials necessary for reconstructed fence are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
607.0001.____	Barbed Wire	LF
607.0002.____	Woven Wire Fence	LF
607.0003.____	Chain Link Fence	LF
607.0004.____	Reconstructed Fence	LF
607.0005.____	Drive Gate	EACH
607.0006.____	Walk Gate	EACH
607.0007.____	Chain Link Fence	LS

SECTION 608
SIDEWALKS

608-1.01 DESCRIPTION. Construct, or retrofit asphalt or concrete sidewalks and curb ramps.

608-2.01 MATERIALS. Use materials that conform to the following:

1. Concrete Sidewalk

Bed Course Material	Subsection 703-2.03
Joint Fillers	Subsection 705-2.01
Joint Sealer	Subsection 705-2.02
Concrete	Section 550, Class B

2. Asphalt Sidewalk

Bed Course Material	Subsection 703-2.03
Asphalt Binder	Subsection 702-2.01 (Use PG 52-28 if no Grade is specified.)
Aggregate, Type II or III	Subsection 703-2.04

Mix design Requirements (ATM 417):

Marshall Stability, lb., min.	1000
Percent Voids, Total Mix	2-5
Compaction, Blows/side	50

3. Detectable Warnings

Cast iron detectable warning plates with truncated dome pattern, a slip resistant surface, and with handle or flange on bottom or approved equal. Detectable warning plates shall be coated with yellow polymer soaked finish. Detectable warnings shall be manufactured according to the 2006 U. S. DOT ADA Standards for Transportation Facilities.

CONSTRUCTION REQUIREMENTS

608-3.01 CONCRETE SIDEWALKS. Excavate to the required depth and to a width necessary to install and brace the forms. Shape and compact the foundation to a firm, even surface conforming to the section shown on the Plans. Replace soft and yielding material with approved material. Compact bed course material according to Subsection 203-3.04.

Use full depth forms made of wood or metal. Use forms that are straight, free from warp, and strong enough to resist the pressure of the concrete without springing. Coat forms with an approved form-release agent. Brace and stake the forms so that they maintain their position until their removal.

Thoroughly moisten the foundation immediately before placing the concrete.

Finish the surface according to Section 550-3.05. Do not plaster the surface. Edge all outside slab edges and all joints to a 1/4 inch radius.

Make expansion joints to the dimensions and spacing shown on the Plans and fill with the type of preformed expansion joint filler specified.

Divide the sidewalk into specified sections using dummy joints formed by a jointing tool or other acceptable means. Make dummy joints 1/3 the depth of the concrete and approximately 1/8 inch wide.

Form construction joints around all appurtenances such as manholes, utility poles, buildings, or bridges, extending into and through the sidewalk. Install preformed expansion joint filler 1/2 inch thick in construction joints. Extend the expansion joint material the full depth of the walk.

Apply joint sealer evenly to completely seal all joints.

Cure the concrete according to Section 550-3.06. During the curing period, exclude all pedestrian and vehicular traffic. Exclude vehicular traffic for additional time as directed.

608-3.02 ASPHALT SIDEWALKS. Place bed course material in layers. Compact it according to Subsection 203-3.04.

Place asphalt material on the compacted bed course in one or more courses as indicated on the Plans. Compact it uniformly to the required depth. Use a power roller of an acceptable type and weight. In areas inaccessible to the roller, use other approved methods.

608-3.03 CURB RAMPS. Construct curb ramps according to the details and the locations shown on the Plans. Follow the construction requirements of Subsection 608-3.01. Give the exposed concrete surface a coarse broom finish. Install detectable warnings.

608-3.04 DETECTABLE WARNINGS. Construct detectable warnings according to the details and the locations shown on the Plans. Install detectable warning plates by embedding plate flanges into cast in place concrete construction so there are no vertical changes in grade exceeding 0.25 inch or horizontal gaps exceeding 0.5 inch. Align pattern on a square grid in the predominant direction of travel. Install the same type of detectable warning plate throughout the project.

Detectable warnings shall be installed according to the 2006 U. S. DOT ADA Standards for Transportation Facilities.

608-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Concrete Sidewalk. By area of finished surface, including ramps.

Asphalt Sidewalk. By weight of asphalt mixture placed or by area of finished surface, including ramps.

Bed Course Material. By weight or by volume measured in final position.

Curb Ramp. By each installation, complete in place, including detectable warnings, ramp runs, backing curbs, flares, and landings necessary to provide a single street-level access.

Curb Ramp, Retrofit. By each installation, complete in place.

608-5.01 BASIS OF PAYMENT. Excavation, backfill, reinforcement, expansion joint material, and other related miscellaneous items are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
608.0001.0004	Concrete Sidewalk, 4 inches thick	SY
608.0001.0006	Concrete Sidewalk, 6 inches thick	SY
608.0002.____	Asphalt Sidewalk	TON
608.0003.____	Asphalt Sidewalk	SY
608.0004.____	Bed Course Material, Grading ___	TON
608.0005.____	Bed Course Material, Grading ___	CY

608.0006.____	Curb Ramp	EACH
608.0007.____	Curb Ramp, Retrofit	EACH
608.0008.0004	Concrete Sidewalk, 4 Inches thick	LS
608.0008.0006	Concrete Sidewalk, 6 Inches thick	LS

SECTION 609
CURBING

609-1.01 DESCRIPTION. Construct curb, gutter, or combination curb and gutter. The types of curbing are designated as follows:

Type 1: Cast-in-place concrete curb
Type 2: Precast concrete curb
Type 3: Asphalt curb

609-2.01 MATERIALS. Use materials that conform to the following:

Concrete	Section 550, Class B
Bed Course Material	Subsection 703-2.03
Joint Filler	Subsection 705-2.01
Joint Sealer	Subsection 705-2.02
Joint Mortar	Subsection 705-2.04
Precast Concrete Curb	Subsection 712-2.04

Asphalt material for curbing must conform to the following requirements:

Asphalt Binder	Subsection 702-2.01 (Use PG 52-28 if no Grade is specified.)
Aggregate, Type II or III	Subsection 703-2.04

Mix design Requirements (ATM 417):

Marshall Stability, lb., min.	1000
Percent Voids, Total Mix	2-5
Compaction, Blows/side	50

CONSTRUCTION REQUIREMENTS

609-3.01 GENERAL. Excavate to the required depth. Compact the base upon which curbs, gutters, and ramps are to be set to a firm, even surface according to Subsection 203-3.04.

Make expansion joints in concrete units that comply with the dimensions and spacing shown on the Plans. Fill expansion joints with the type of preformed expansion joint filler specified.

Make repairs to concrete units by removing and replacing the entire unit between scoring lines or joints. Clean all discolored concrete.

The Engineer will test the finished surface with a 10-foot straightedge. Variations of more than 1/4 inch from the edge of the straightedge to the top or face of the curb or the surface of gutters and ramps, except at grade changes or curves, are unacceptable.

609-3.02 CAST-IN-PLACE CONCRETE CURBING. Use full-depth forms made of wood or metal that are straight, free from warp, and constructed so that they will not interfere with the inspection of grade or alignment. Brace and secure forms to prevent deflection from alignment or grade during concrete placement. Coat forms with an approved form-release agent.

Thoroughly moisten the foundation immediately before placing the concrete.

Compact concrete in the forms by vibration or other acceptable methods. Leave forms in place until the concrete sets sufficiently so that the forms can be removed without damaging the concrete.

Finish the surface according to Section 550-3.05.Immediately upon removing the forms, rub the exposed face to a uniform surface. Do not plaster the surface.

Make weakened plane contraction joints, spaced at 13 feet maximum intervals. Form each joint as a minimum 1/8 inch wide by 1/2 inch deep slot, continuous across the top and down the sides of the section. Make this slot either by sawing or scoring with a tool that will leave the corners rounded.

If approved, construct the curb using a curb forming or slip-form machine.

Cure the concrete according to Section 550-3.06. During the curing period, exclude all pedestrian and vehicular traffic. Exclude vehicular traffic for additional time as directed.

After the concrete sets sufficiently, refill the spaces in front and back of the curb to the required elevation with the specified material and thoroughly compact it.

609-3.03 PRECAST CONCRETE CURB. Set the curb so that the front, top line conforms to the line and grade required.

Lay curb with joints 3/8 inch to 1 inch wide. Fill the joints with joint mortar.

After the mortar has set, backfill any remaining excavated areas with the specified material and thoroughly compact it.

609-3.04 ASPHALT CURB. When the curb is to be constructed on a cured or aged portland cement concrete base, asphalt pavement, or asphalt treated base, thoroughly sweep and clean the bed using compressed air. Thoroughly dry the surface and, immediately before placing the asphalt mixture, place a tack coat of asphalt material of the approved type and grade onto the surface.

Construct asphalt curb using an approved, self-propelled automatic curb machine or a paver with curbing attachments that is heavy enough to compact the curb without riding above the foundation. For short sections or sections with short radii, use other approved means.

Make the curb uniform in texture, shape, and density.

If painting or sealing is required, curb must be clean, dry, and at ambient temperature.

609-3.05 BACKING CURB. Construct backing curb at curb ramp locations, according to the details and the locations shown on the Plans.

609-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Curb and Curb and Gutter. Measured along the front face of the curb at the finished grade elevation. No deduction in length will be made for drainage structures or ramps installed in the curb.

Backing Curb. Measured along the front face of the curb.

Bed Course Material. By weight or by volume measured in final position.

609-5.01 BASIS OF PAYMENT. Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
609.0001.____	Curb, Type ___	LF
609.0002.____	Curb and Gutter, Type ___	LF
609.0003.____	Backing Curb	LF
609.0004.____	Asphalt Curb	LF
609.0005.____	Bed Course Material, Grading ___	TON

609.0006.____	Bed Course Material, Grading ___	CY
609.0007.____	Curb and Gutter, Type ___	LS

SECTION 610
DITCH LINING

610-1.01 DESCRIPTION. Construct ditch lining at the locations on the Plans or as staked.

610-2.01 MATERIALS. Use stones that are sound and durable, are no larger than 8 inches in greatest dimension, and not more than 50 percent by weight passing a 3-inch sieve, and not more than 5% passing a 1-inch sieve, as determined by ATM 304.

610-3.01 CONSTRUCTION REQUIREMENTS. Excavate to the dimensions shown on the Plans. Place and spread ditch lining materials so that the finished face is reasonably uniform and conforms with the lines and slope shown on the Plans or as directed.

610-4.01 METHOD OF MEASUREMENT. See Section 109.

610-5.01 BASIS OF PAYMENT. Excavation required below normal ditch grade is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
610.0001.____	Ditch Lining	CY
610.0002.____	Ditch Lining	TON
610.0003.____	Ditch Lining	STA
610.0004.____	Ditch Lining	LS

SECTION 611
RIPRAP

611-1.01 DESCRIPTION. Construct riprap bank and slope protection.

611-2.01 MATERIALS. Evenly graded stones that are hard, angular, and have no more than 50 percent wear at 500 revolutions as determined by AASHTO T 96. Use stones with breadth and thickness at least 1/4 of its length. Do not use rounded boulders or cobbles on slopes steeper than 2:1.

Meet the following gradation for the class specified. Percentages are by total weight, weights are for each stone:

1. Class I — 0-50% weighing up to 25 pounds
   0-10% weighing more than 50 pounds

2. Class II — 50-100% weighing 200 pounds or more
   0-15% weighing up to 25 pounds
   0-10% weighing more than 400 pounds

3. Class III — 50-100% weighing 700 pounds or more
   0-15% weighing up to 25 pounds
   0-10% weighing more than 1400 pounds

4. Class IV — 50-100% weighing 2000 pounds or more
   0-15% weighing up to 400 pounds
   0-10% weighing more than 5400 pounds

611-3.01 CONSTRUCTION REQUIREMENTS. Provide a level, compact area large enough to dump and sort typical loads of riprap at approved location(s). Dump the loads specified in this area and assist the Engineer as needed to sort and measure the stones in the load to determine if the riprap is within specifications. Provide the equipment needed to assist in this sorting.

Excavate a footing trench along the toe of the slope as shown on the Plans.

Place stones to the thickness, height, and length shown on the Plans, or as staked, in a well-graded mass with a minimum of voids. Fill in unacceptable voids with smaller stones. Place riprap to its full course thickness in one operation. Avoid displacing the underlying material. Do not place riprap in layers or use methods likely to cause segregation.

Manipulate the rock sufficiently using a backhoe, rock tongs, or other suitable equipment to secure a reasonably regular surface and stability.

611-4.01 METHOD OF MEASUREMENT. See Section 109, by neat line volume or by weight.

611-5.01 BASIS OF PAYMENT. Excavation and backfill are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
611.0001.____	Riprap, Class ___	CY
611.0002.____	Riprap, Class ___	TON
611.0003.____	Riprap, Class ___	LS

SECTION 612
SACKED CONCRETE SLOPE PROTECTION

612-1.01 DESCRIPTION. Construct sacked Portland cement concrete slope protection.

612-2.01 MATERIALS. Use materials that conform to the following:

Portland Cement. See Section 701

Aggregate. Plasticity Index of 5 maximum, as determined by ATM 204 and ATM 205. Meet the following gradation, as determined by ATM 304:

Sieve	Percent Passing
2-1/2 inch	100%
No. 4	45 - 80%
No. 200	0 - 10%

Concrete Mix. Cement content: 4 sacks per cubic yard. Slump: 3 to 5 inches.

Sacks. Use new or sound reclaimed sacks made of at least 10-ounce burlap or equivalent and approximately 19-1/2 by 36 inches, measured inside the seams when the sack is laid flat. The capacity of each sack must be approximately 1.25 cubic feet.

612-3.01 CONSTRUCTION REQUIREMENTS. Smoothly finish the slopes on which the sacked concrete is to be placed within 0.2 foot of the design grade.

Place approximately 1 cubic foot of concrete in each sack. Immediately close the sack, place it in position, and lightly tamp it to conform with the slope and the adjacent sacks in place.

“Stretcher,” as used herein, means a filled sack placed with its long dimension parallel to the contour of the slope. “Headers” are filled sacks placed at right angles to the stretchers.

Lay the courses as follows:

1. First Course. Lay a double row of stretchers in a neatly trimmed trench.

2. Second Course. Lay a single row of headers.

3. Third and Remaining Courses. Place a single row of stretchers so that joints in succeeding courses are staggered.

Place stretchers so that the folded ends will not be adjacent to one another. Place headers with the folds in toward the bank.

Remove all dirt and debris from the top of the sacks before laying the next course on top. Do not place more than 4 courses of sacks in any tier until initial set has taken place in the first course of the tier.

If delays occur in placing succeeding layers of sacks, apply dry cement to the joint before placing the succeeding course, as directed.

Cure sacked concrete slope protection by sprinkling with a fine spray of water every 2 hours during the daytime for 3 days.

612-4.01 METHOD OF MEASUREMENT. By each sack complete in place.

612-5.01 BASIS OF PAYMENT. Excavation and backfill are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
612.0001.____	Sacked Concrete Slope Protection	EACH

SECTION 613
MONUMENTS AND MARKERS

613-1.01 DESCRIPTION. Furnish and install right-of-way monuments and culvert marker posts.

613-2.01 MATERIALS. Use materials that conform to the following:

Concrete	Section 550, Class W
Reinforcing Steel	Section 503
Paint	Acrylic resin or synthetic latex alkyd emulsion. Medium chrome yellow.
Marker Posts	Subsection 730-2.05 and the details on the Plans

613-3.01 CONSTRUCTION REQUIREMENTS. Install right-of-way monuments according to the Plans or as staked. Compact the foundation and backfill. Paint the portion of the monument that is above the ground.

Install culvert marker posts at the following locations:

1. The approach side of storm drain outfalls 30 inches and smaller

2. Field inlets that are not in paved parking lots

3. End sections to all cross culverts

After driving, leave a 42-inch length of post above ground.

613-4.01 METHOD OF MEASUREMENT. By each installation, complete in place.

613-5.01 BASIS OF PAYMENT. Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
613.0001.____	Right-of-Way Monument	EACH
613.0002.____	Culvert Marker Post	EACH

SECTION 614
CONCRETE BARRIER

614-1.01 DESCRIPTION. Furnish and install concrete barrier.

614-2.01 MATERIALS. Use materials that conform to the following:

Concrete	Section 550, Class B
Reinforcing Steel and Wire Rope	Subsection 709-2.01
Retroreflective Sheeting Material	ASTM D4956, Type III, IV, or V
Reflector Assemblies	Side-mounted or top-mounted as shown on the Plans.

614-3.01 CONSTRUCTION REQUIREMENTS. Use precast or cast-in-place concrete barrier meeting the lines, dimensions, and requirements shown on the Plans.

Give all exposed surfaces a smooth finish.

Where the concrete barrier is not placed on pavement, shape, compact, and finish the supporting material to the lines and grades shown on the Plans or as directed.

Attach reflector assemblies to concrete barriers according to the manufacturer's recommendations at 50-foot intervals on the side(s) and top as shown in the Plans. Reflector assemblies are required on both sides of median barriers.

614-4.01 METHOD OF MEASUREMENT. See Section 109.

Each. Per concrete barrier segment, 12.5 foot nominal length.

614-5.01 BASIS OF PAYMENT. Reflector assemblies and hardware required to install the barrier are subsidiary.

Unless otherwise noted, all material required to widen embankment for concrete barrier as detailed in the Plans and Special Provisions will be measured and paid for under the appropriate pay items shown in the bid schedule.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
614.0001.____	Concrete Barrier	LF
614.0002.____	Concrete Barrier	EACH

SECTION 615
STANDARD SIGNS

615-1.01 DESCRIPTION. Furnish and install standard signs and delineators. Remove and relocate or remove and dispose of existing signs and markers, as specified.

615-2.01 MATERIALS. Use materials that conform to the following Subsections:

Sheet Aluminum	730-2.01
High Density Overlaid Plywood	730-2.02
Retroreflective Sheeting	730-2.03
Sign Posts	730-2.04
Delineator Posts	730-2.05
Acrylic Prismatic Reflectors	730-2.06
Sign Support Fasteners	730-2.07

1. Shop Drawings. Submit shop drawings, for all signs that must meet the ASDS letter width and spacing charts, for approval before fabrication. Submit 4 sets of collated shop drawings prepared according to Subsection 105-1.02. Show the following on each sign drawing:

   a. Dimensions of all horizontal and vertical characters and spaces

   b. Overall dimensions

   c. Sign material and sheeting material type

   d. Panel thickness

   e. Legend and letter series

   f. Whether the sign will be framed

2. Sign Fabrication. Use ASTM D4956 Type IV retroreflective sheeting (for lettering, symbols, borders, and background) on sheet aluminum panels for all signs except the following:

   a. Orange Background Signs:

      Use ASTM D4956 Type VIII, IX, or XI fluorescent orange retroreflective sheeting. For temporary installations, place reflective sheeting on sheet aluminum, plastic, or plywood panels.

      For Roll-Up signs use 3M series RS 24, Reflexite Marathon Orange, or approved equal (based on durability and reflectivity, as determined by the Engineer). Use flexible signs with fluorescent retroreflective sheeting that is ASTM D4956 Type VI or better.

   b. Railroad Crossbucks and Vertical Crossbuck Supports: Use white ASTM D4956 Type VIII, IX, or XI retroreflective sheeting for background of sign and all strips.

   c. Non-Illuminated Overhead Signs with White Legends on Green Backgrounds: Use ASTM D4956 Type IX, or XI retroreflective sheeting for legends and background. Create the legend in one of the following ways:

      (1) Cut border and legend from white ASTM D4956 Type IX, or XI retroreflective sheeting and adhere them to a green ASTM D4956 Type IX background, or

      (2) Cut stencil of border and legend out of green transparent acrylic film and use transparent adhesive to overlay the film on a white ASTM D4956 Type IX, or XI retroreflective background.

   d. Fluorescent Yellow-Green School Area Signs: Use ASTM D4956 Type VIII, IX, or XI retroreflective sheeting for background.

Use a manufacturer-recommended clear coat on all screened signs.

Use sign layouts (including characters, symbols, corner radii, and borders) that conform to the ASDS.

Frame all rectangular signs over 53 inches (measured along the horizontal axis) and all diamond shape signs 60 x 60 inches and larger. Construct the frames of aluminum as indicated on the Plans.

3. Sign Posts and Bases. Use sign posts and bases of the types specified. Do not splice sign posts.

   Use Class A concrete meeting the requirements of Section 501 for overhead sign support foundations.

   Use Class B concrete for steel-reinforced roadside sign foundations meeting the requirements of Section 550. Concrete for other sign foundations may be Class W.

4. Delineators. Use delineator assemblies that conform to the requirements shown on the Plans. Fabricate flexible delineators using ASTM D4956 Type III, IV, V, IX, or XI Retroreflective Sheeting.

5. Reflective Sheeting Warranty. Supply manufacturer's warranty for reflective sheeting, including retention of fluorescent yellow-green (measured in accordance with ASTM E2301) for ten years according to the following criteria:

   a. Minimum Fluorescent Luminance Factor Y_F: 20%

   b. Minimum Total Luminance Factor Y_T: 35%

   The warranty shall stipulate that: If the sheeting fails to meet the minimum fluorescence values within the first 7 years from the date of fabrication of the sign, the manufacturer shall, at the manufacturer's expense, restore the sign surface to its original effectiveness. If the reflective sheeting fails to meet the minimum fluorescence values within the 8th through 10th year from the date of fabrication, the manufacturer shall, at the manufacturer's expense, provide enough new replacement sign sheeting to the Department to restore the sign surface to its original effectiveness.

615-3.01 CONSTRUCTION REQUIREMENTS.

1. Place wooden posts in excavated holes to the depth shown on the Alaska Standard Plans.

2. Backfill the space around the posts in the holes to finish ground with selected earth or sand, free of rocks or deleterious material. Place backfill in layers approximately 6 to 12 inches thick and thoroughly compact it.

3. Dispose of surplus excavated material neatly along the adjacent roadway as directed.

4. Install flexible delineator posts according to the manufacturer's recommendations.

5. Attach sign panels to posts, electroliers, traffic signal standards, bridge rails, piers, and abutments using the types and sizes of fastening hardware shown on the Plans.

6. If using existing signs and mileposts that are removed and relocated, ensure they conform to the details shown on the Plans or as directed.

7. Notify the Engineer 5 working days prior to beginning sign salvage activities. The Engineer will physically identify those signs to be salvaged. Protect all items from damage during salvaging and delivery. For each sign so designated, disconnect sign post from panel and group the panels together. Group posts together with their hardware. Deliver sign panels, posts and hardware to the State Maintenance Yard noted in the Special Provisions. Do not

deliver salvaged materials until they have been inspected and approved by the Engineer. Replace any items damaged by you at no additional cost to the Department.

Remove and dispose of project signs and/or parts designated for removal and not selected for salvage.

Dispose of foundations from salvaged existing signs in a manner approved of by the Engineer (remove and dispose, abandoned in place, or otherwise). If they are abandoned in place, remove the tops of the foundations, reinforcing steel, anchor bolts, and conduits to a depth of not less than 12 inches below roadway subgrade or unimproved ground, whichever applies. All signs and posts at a single installation will be considered as one unit.

8. All materials and finished signs are subject to inspection and acceptance in place.

   a. Surfaces exposed to weathering must be free of defects in the coating that impair serviceability or detract from general appearance or color match.

   b. Finished signs must be clean and have no chatter marks, burrs, sharp edges, loose rivets, delaminated reflective sheeting, or aluminum marks. Do not make repairs to the face sheet.

9. Install the various breakaway assemblies according to the manufacturer's written instructions. Meet MASH crashworthiness requirement for breakaway hardware, unless approved by the Engineer.

10. Secure the anchors in templates and install them according to the manufacturer's written instructions.

11. Finish the foundation according to these tolerances:

    a. Do not use more than two shims per coupling.

    b. Do not use more than three shims to plumb each post.

12. Remove and replace all foundations requiring more than three shims to plumb a post without extra compensation.

13. Construct the top of any foundation located on a slope so that the finished slope passes through the top center of the foundation. Grade the area 24 inches up and down slope of the foundation edge so that no portion of the foundation projects above the surrounding slope and water will drain away from the foundation.

14. Attach a label to the back of all standard signs in the lower right corner. Make the label at least 15 square inches and show the year the sign was purchased from the manufacturer. Show the last two digits of the year in clear and bold numbers. Make the label from ASTM D4956 Type I or brighter retroreflective sheeting. Use background and legend colors meeting Table 615-1.

TABLE 615-1
DECAL COLORS

YEAR	BACKGROUND COLOR	LEGEND COLOR
XXX1	Yellow	Black
XXX2	Red	White
XXX3	Blue	White
XXX4	Green	White
XXX5	Brown	White
XXX6	Orange	Black
XXX7	Black	White
XXX8	White	Black

YEAR	BACKGROUND COLOR	LEGEND COLOR
XXX9	Purple	White
XXX0	Strong Yellow-Green	Black

Central values and tolerance limits for each color, as referenced in the MUTCD, are available from the Federal Highway Administration, (HHS-30), 400 7th St. SW, Washington, D.C. 20590

615-3.02 SIGN PLACEMENT AND INSTALLATION. The location and type of installation will be as shown on the Plans. Sign locations are approximate and subject to field adjustment by the Engineer.

Do not allow the top of the embedded steel tube to extend more than 2 inches above the surrounding ground and concrete foundation.

On all signs, install 2-inch diameter wind washers, colored to match the sign face, between the fastener head and the sign. Use rust-resistant washers fabricated from a material equal in strength to the sign blank.

Mount signs on mast arms level.

Bring existing signs that are to remain, into conformance with Alaska Standard Plan S-05. Keep existing signs in service until they are no longer needed.

615-4.01 METHOD OF MEASUREMENT.

Standard Signs and Object Markers. By the total area of legend-bearing sign panel erected in place. No deductions in quantity for corner rounding will be made. Nominal dimensions for sign sizes indicated on the Plans will be used to calculate sign pay quantities. Octagons and round signs will be measured as rectangles. Only one side of each double-faced sign will be measured for payment.

Removal and Relocation. By each, complete in place.

Delineators. By each, complete in place. A single delineator consists of one post equipped with two reflectors.

Salvage Sign. By each complete sign delivered in acceptable condition.

615-5.01 BASIS OF PAYMENT. Sign posts, bases, and mounting hardware are subsidiary.

When Items 615.0002.____, 615.0003.____, or 615.0006.____ do not appear on the bid schedule, this work is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
615.0001.____	Standard Sign	SF
615.0002.____	Remove and Relocate Sign	EACH
615.0003.____	Remove and Relocate Milepost	EACH
615.0004.____	Delineator, Rigid	EACH
615.0005.____	Delineator, Flexible	EACH
615.0006.____	Salvage Sign	EACH
615.0007.____	Salvage and Dispose Sign	EACH

SECTION 616
THAW PIPE AND THAW WIRES

616-1.01 DESCRIPTION. Furnish, fabricate, and install thaw pipes or electric thaw wire.

MATERIALS

616-2.01 THAW PIPE. Use materials that conform to the following:

Pipe	ASTM A53, Galvanized
Fittings	ASTM A197, galvanized per AASHTO M 232
Pipe Hangers	AASHTO M 218
Braces for Stand Pipe	ASTM A36, galvanized per AASHTO M 111
Bolts and Nuts	ASTM A307, galvanized per AASHTO M 232

616-2.02 THAW WIRE. Provide materials, devices, fittings, and hardware meeting NEMA standards and bearing the approval of a third party certification, meeting ANSI Z 34.1.

All electrical devices, components, and materials that will be installed in and/or around classified (hazardous) areas shall be rated for the Class, Division, Group Letter, and Temperature Code for the area in which they are installed. The electrical installation shall comply with the applicable Articles of NEC Chapter 5.

Deliver all warranties and guarantees provided by the manufacturer to the Engineer before acceptance of this work.

1. Conduit and Fittings.

   a. Use conduit, couplings, elbows, and nipples that are rigid, hot-dip galvanized steel meeting ANSI C80.1. Install them as indicated on the applicable drawings. Use threaded type couplings, elbows, and nipples.

   b. Use fittings and miscellaneous conduit hardware that are vapor-proof, galvanized cast iron or steel meeting ANSI/NEMA FB-1 and are compatible with the rigid conduit furnished and installed. Use threaded type fittings.

2. Heat Cable.

   a. Use heat cable that meets the following standards:

      (1) Parallel-circuit, 120, 208, or 240 VAC, 16 AWG minimum copper bus wire, with self-limiting conductive core

      (2) Modified polyolefin inner jacket, tinned copper or nickel-clad metallic braid, and fluoropolymer overjacket

      (3) Rated in conduit at the W/ft output as specified on the drawings. If heat trace cable output is not specified, use 8 W/ft. at 50 °F

      (4) UL Listed or FM approved specifically as a culvert deicing system in conduit

   b. All connection components shall be rated for the areas in which they are installed. Use power connections and seals specifically designed for use with the particular type and size of heat cable.

3. Controls.

a. Use a thermostat that is heavy duty, single stage, line voltage type. Operating temperature range: 25 to +125 °F. Provide with capillary bulb for remote sensing.

b. Use a contactor that is electrically held, 30 amp rated, lighting type.

c. Use a switch that is heavy duty hand-off-auto type with a gloved hand selector switch knob.

d. Components listed in this section shall be provided in enclosures of the types specified on the drawings. If enclosure types are not specified on the drawings, provide enclosures rated for the areas in which the components are to be installed. Reference NEMA enclosure types and NEC Table 110.28.

4. Conductors. Use copper conductors with insulation rated for 300 volt minimum where the impressed voltage is 100 volts or less and 600 volt where the impressed voltage is between 100 and 600 volts. Use 75°C-rated conductor insulation minimum.

   a. Service and Feeder Cables. Use No. 8 AWG, or larger, with type USE, THWN, THHN, or XHHW insulation.

   b. Underground Wire. Use No. 6 AWG with type XHHW or USE insulation where buried in conduit.

   c. Branch Circuit Wire. Use No. 12 AWG with type USE or XHHW insulation.

   d. Control Wire. Use No. 16 AWG with stranded conductor with type SIS insulation within control panels.

   e. Splices for Copper Conductors. Use solderless, preinsulated, compression set type only with heat-shrink tubing jacket. When making splices between power leads and heat cable cold leads, use splicing kits designed specifically for that purpose.

   f. Terminations. Use compression set or bolted type.

5. Device, Junction, and Pull Boxes.

   a. Boxes Installed Above Grade. Use boxes that are hot dipped galvanized cast iron or corrosion resistant alloy complete with conduit hubs. Use boxes designed for damp or wet locations.

   b. Boxes Installed Below Grade (exposed to earth). Use concrete boxes as required or shown in the drawings. Provide covers constructed of ribbed cast metal alloy.

   c. Cast Thermoplastic or Fiberglass Boxes. Use where indicated in the drawings.

6. Receptacles, Remote Power. Use remote power receptacles that are 2-pole, 3-wire grounding, male, 30 amp, 120 or 240 VAC, NEMA L6-30.

7. Circuit Breakers.

   a. Provide 1- or 2-pole circuit breakers as scheduled in the drawings. Multiple breakers must operate all poles simultaneously. Use circuit breakers that operate manually for normal ON-OFF switching and automatically for overload and short-circuit conditions. Ensure that the operating mechanism will not prevent trip action when held in the ON position. Provide symmetrical interrupting capacity ratings greater than the calculated available fault current, 10,000 amperes minimum. Provide bolt-in type with a molded case.

b. Use Ground Fault Interrupter (GFI) circuit breakers that sense ground fault current, that trip at 30±1 milliamperes within 2 cycles, and that have the following:

(1) Internal circuitry to prevent nuisance tripping caused by voltage spikes, radio frequency interference, and electromagnetic interference.

(2) A 'TEST' button that provides approximately 30 milliamperes of simulated ground fault current to verify the operation of the sensing and tripping devices. The button must reset the trip unit within the circuit breaker.

(3) Type b auxiliary contacts to close when the circuit breaker is tripped or shutoff.

8. Grounding.

a. Electrodes. Use electrodes that are copper-clad steel rods with a minimum diameter of 5/8 inch. Increase diameter as required to drive to the necessary depth without being damaged.

b. Splices and Connections. Use an exothermic weld for all connections and joints in inaccessible locations. Use standard clamps and connectors in accessible locations.

9. Terminal Posts. Use terminal posts that are 6 X 8-inch treated wood posts 8 feet long.

10. Branch Circuit Panelboard. Use panelboards that meet the following:

a. Sized and rated according to the panel schedules in the drawings

b. Have multiple lugs (as required), a neutral terminal bar, and a ground terminal bar if ground conductors are terminated in the panelboard

c. Use panelboards that are braced for the calculated maximum available symmetrical RMS fault current.

d. With copper or aluminum bus bars

CONSTRUCTION REQUIREMENTS

616-3.01 THAW PIPE.

1. Pipe Hangers. Drill or field punch the bolt holes and then ream them. Ensure that the diameter of the hole does not exceed the diameter of the bolt by more than 1/8 inch. Draw the bolt heads and nuts tightly against the pipe.

2. Pipe Jointing. Remove all scale from the pipe. After cutting, ream all pipe. Assemble all pipe and fittings using an application of pipe compound.

3. Installation. Prevent dirt or other foreign matter from entering the pipe. After the thaw pipe is fully assembled and installed, flush it thoroughly with water.

Repair damage to galvanized coatings per AASHTO M 36.

616-3.02 THAW WIRE. Meet all applicable requirements and recommendations of the NEC and the NESC.

Furnish the Engineer with circuit and wiring diagrams.

When required on the Plans, install a post and meter combination for each individual thaw wire or a single post and meter combination for any group of thaw wires as specified and paid for under Section 661.

1. Conduit and Fittings.

   a. Use galvanized rigid steel (GRS) conduit for direct burial at depths required by NEC Articles 300 and 426, unless noted otherwise. Repair damage to galvanized coatings per AASHTO M 36. Route power conductors to each heat trace circuit in minimum 2 inch conduit.

   b. Provide bituminous asphalt coating for all ferrous conduit installed directly in earth. Apply 2 coats after conduit is completely assembled. Use conduit with factory-applied protective coating in lieu of asphalt if suitable touch-up materials are used to seal couplings and repair injuries to the factory-applied coat.

   c. Cut and ream all conduit squarely at the ends. Make fittings tight.

   d. Route concealed conduit in a direct path with a minimum number of bends. Use bends of long radii where possible.

   e. Keep all bends free from dents or flattening.

   f. Install conduit mechanically and electrically continuous from termination to termination. Connect securely to cabinets, junction boxes, and device boxes using a locknut on the outside and a grounding bushing on the inside. Bushings and locknuts are not required where conduits are screwed into threaded connections.

   g. Before the installation of conductors, use caps or corks to keep foreign material out of open conduits.

2. Heat Cable. Install per manufacturer’s instructions and as indicated on the electrical plans. Install in GRS conduit as indicated on the electrical plans. Use a minimum of 3/4 inch and a maximum of 1-1/2 inch, ensuring conduit fill does not exceed the fill allowed by the NEC. Do not splice heat cable. Do not exceed the manufacturer's published maximum heat trace cable length per circuit.

3. Controls. Install the controls as indicated on the electrical plans. Refer to the detail drawings.

4. Conductors.

   a. Install all conductors in conduit.

   b. Clean all conduit before installing conductors.

   c. Install conductors continuously from box to box. Splice only at device or junction boxes.

   d. Circuit all feeder and branch circuits as shown in the drawings.

   e. Install all conductors in a single raceway at one time so that conductors do not cross one another while being pulled into place. Leave sufficient conductor length at all fittings and boxes.

   f. Stay within the pulling tensions specified by the manufacturer or as noted elsewhere in this division.

   g. Maintain bending radii in excess of those allowed by the manufacturer.

   h. Use lubricants according to UL, the conductor, and raceway manufacturers’ requirements.

   i. Neatly bundle and form conductors to fan into terminals at regular intervals inside panels.

j. Coordinate conductor insulation temperature rating and ampacity rating with the temperature and ampacity rating of the circuit protection devices.

k. The heat trace power conductors shall be sized to limit the voltage drop on the branch circuit conductors to no more than 3%, or to limit the total voltage drop on the feeder and branch circuit conductors to no more than 5%.

5. Color Coding.

a. Color all conductors #6 AWG and smaller continuously. Conductors larger than #6 may be either continuously colored or marked at each end and at every accessible point with appropriately colored paint, tape, or adhesive labels.

b. Mark or color grounding conductors according to the NEC.

c. Mark or color grounded conductors according to paragraph d. and according to the NEC.

d. Mark or color ungrounded conductors according to the following convention:

Nominal Voltage/Phase	Grounded	Ungrounded
120 volt, single phase, 2 wire	White	Black
120/240 volt, single phase, 3 wire	White	Black Red

6. Device, Junction, and Pull Boxes.

a. Anchor device boxes to structural members so there is no apparent movement when the device is operated.

b. Install junction and pull boxes in permanently accessible locations only. Size boxes according to NEC, Article 314.

c. Mount all boxes square and plumb.

7. Grounding.

a. General. Create an equipotential ground plane for the installation as shown on the drawing and as required at the service meter/disconnect cabinet. Connect the following items to the service entrance ground bar:

(1) The grounded neutral conductor for the utility service.

(2) Ground electrode(s).

(3) All non-current-carrying electrical equipment, conduit, and enclosures.

(4) Metal culvert and/or end sections.

(5) Heat cable metal sheath.

b. Resistance. Ensure that the resistance between the service entrance ground electrode and earth ground, as measured using a multiple ground rod method and a ground resistance tester, is as close to zero as possible with the design shown in the drawings. Give the resistance measurement to the Engineer in writing. Include the environmental conditions during testing. Ground resistance testing shall be performed per IEEE 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

c. Conductors. Size conductors according to the drawings or, if not shown on drawings, as required by NEC Article 250. Grounding electrode conductors shall be sized per Table 250.66 and equipment grounding conductors shall be sized per Table 250.122. Protect conductors from physical damage.

d. Electrodes. The grounding electrode system installation shall comply with NEC Article 250.50. Drive ground rods at least 8 feet deep.

8. Controls. Install the controls as indicated on the electrical plans. Refer to the detail drawings.

9. Branch Circuit Panelboard.

a. Mounting. Mount panelboard interiors inside load center cabinet after the enclosure has been installed as shown on the Plans and as described under Section 661.

b. Circuit Breakers. Install circuit breakers in the order specified in the drawing panelboard schedules. Type the circuit directory with circuit descriptions as they are shown in the drawing panelboard schedules. Make the directory configuration identical to the circuit breaker configuration.

616-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Thaw Pipe. By the length, measured along the line and grade of the thaw pipe, complete in place, or by each complete unit.

Thaw Wire. By the measured length of the heated sections complete in place, or by each complete unit.

616-5.01 BASIS OF PAYMENT. All fittings, including standpipes, are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
616.0001.____	Thaw Pipe ___ Inch Diameter	LF
616.0002.____	Thaw Pipe ___ Inch Diameter	EACH
616.0003.____	Thaw Wire Installation	LF
616.0004.____	Thaw Wire Installation	EACH

SECTION 617
RAILROAD CROSSINGS

617-1.01 DESCRIPTION. Construct railroad grade crossings and foundations for automatic signal equipment.

617-1.02 DEFINITIONS.

1. Railroad. The corporation or agency responsible for managing and operating the railroad.

2. Chief Engineer. The Railroad's Chief Engineer.

617-2.01 MATERIALS. Use materials that conform to the kind, grade, type, and size specified on the Plans or as listed below:

Anchor Bolts	ASTM A307, Galvanize per AASHTO M 232, Class A
Rigid Metal Conduit Couplings, and Fittings	UL Standard UL-6, NEMA Standard C 80.1, hot-dip galvanized
Concrete	Section 501 (Class A)
Railroad Crossing Pads	Rubber, composite, or precast reinforced polymer concrete crossing systems as manufactured by: OMNI Products Inc. 3911 W. Dayton St., McHenry, IL 60050; HiRAIL Corporation 100 Kraiburg Boulevard, Lisbon, IA 52253; LT Resources, Inc. 15814 Champion Forest Drive, #302, Spring, TX 77379; TRANSPO Industries, Inc. 20 Jones Street, New Rochelle, NY 10801 or an approved equal

Repair damage to galvanized coatings according to AASHTO M 36.

617-3.01 CONSTRUCTION REQUIREMENTS.

1. General.

   a. Conduct all work on the railroad crossing in strict accordance with the rules and regulations governing the railroad and according to Subsection 107-1.08.

   b. Remove the track from service only at the times authorized by the Chief Engineer. Restore the track to service within the time period specified. Should the embankment construction not be completed on time, liquidated damages will be charged at the rate specified in the written authorization allowing the excavation or at the rate specified in Paragraph 6, Train Delays, Subsection 107-1.08 of the Special Provisions, whichever is greater. The Department will collect the amount of liquidated damages from the Contractor and pay them to the Railroad.

   c. The Railroad will accomplish all track work involving, but not limited to, removing and replacing ties, rails, and appurtenances. The Department will pay for all costs for this work.

   d. The Railroad will furnish and install conduit runs from junction boxes to railroad signal bases only, except advance flasher bases. The Railroad will furnish and install all wire,

signal equipment, and all other work and materials necessary to obtain a complete and operational system. The Department will pay all costs for this work.

2. Railroad Signal and Relay Case Foundation.

   a. Perform foundation work for automatic signal equipment, according to the applicable sections of these Specifications.

   b. After completing each signal foundation, install a protective cap securely over the foundation to protect the conduit end and anchor bolt threads. Fabricate the protective cap using wood, galvanized sheet metal, or other approved material.

3. Electrical Conduit.

   a. Trench Excavation. Excavate trenches to the depth shown on the Plans and the necessary width for proper placement of conduit. Make the sidewalls of the trenches as vertical as practicable. Grade the bottom of the trenches accurately to provide a uniform bearing and support for the conduit along its entire length. Remove material unsuitable for bedding, to 6 inches below the bedding surface. Replace with suitable material and compact it according to Subsection 203-3.04.

   b. Placing Conduit.

      (1) Lay conduit on a firm foundation in the trench without damage to the coating.

      (2) Ream the ends of all conduits, whether shop or field cut, to remove burrs and rough edges. Make cuts square and true so that the ends will butt or come together for their full circumference. Do not use slip joints or running threads for coupling conduit. When you cannot use a standard coupling, use an approved threaded union coupling. Paint the threads on all conduit with a rust preventative paint before couplings and fittings are made up. Draw all couplings tight until the ends of the conduits are brought together, providing a good electrical connection throughout the entire length of the conduit run.

      (3) Repair any damage to conduit coating with a rust preventative paint. Cap all conduit ends.

      (4) Install a No. 12 AWG galvanized pull wire in all conduits. Double back at least 2 feet of pull wire into the conduit at each termination.

      (5) Install all electrical conduit to conform to the installation requirements of the NEC.

   c. Backfilling. Do not backfill the trenches until conduit placement is approved. Backfill the trenches carefully with the excavated materials approved for backfilling consisting of earth, loam, sandy clay, sand and gravel, soft shale, or other approved materials. Use materials that are free from large clods of earth, large stones, roots, and sticks. Place the backfill material in 6-inch layers and compact it thoroughly and carefully for the entire depth of the trench. Use extreme care when backfilling the bottom 12 inches of the trench to prevent injury or damage to the conduit. Compact backfill according to Subsection 203-3.04.

4. Railroad Crossing. Confine work to the construction limits of each crossing. Railroad crossing construction consists of removing the existing crossing surface, excavating to the depth shown on the Plans, furnishing and installing geotextile material, furnishing and backfilling with railroad ballast to the original elevation, and furnishing and installing new railroad crossing pads. Furnish and install detours as required.

The Railroad is responsible to remove the existing track material before excavation, raise the grade when called for on the Plans, and furnish and install new track material at their expense. The Railroad will raise the grade in 3- to 4-inch lifts.

Provide a front end loader for use by the Railroad to lift out the existing track assembly.

Coordinate the crossing construction and the grade raise through the Chief Engineer.

After each lift of the grade raise, furnish and install a wood plank crossing, grade the approaches to the crossing, and temporarily open the roadway to traffic. Remove the wood planks before each lift of the grade raise. The type of planking material required will be specified in the Plans.

After completing the grade raise and before final surfacing of the crossing, allow a minimum of 3 days' rail traffic over the crossing. During this time, furnish and install a wood plank crossing, grade the approaches, and open the crossing to vehicular traffic. The Railroad will huckbolt the rail joints after final surfacing.

Install the Railroad crossing pads according to the manufacturer's recommendations.

617-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

1. Cantilever Signal Foundations, Railroad Furnished Signal Bases, Type IA and Type II Junction Boxes, and Railroad Signal Load Centers. Per each, complete in place and accepted.

2. Rigid Metal Conduit with pull wire. By the linear foot installed in place and accepted. The measurement will be straight line from the center of one junction box or foundation to the center of another junction box or foundation.

617-5.01 BASIS OF PAYMENT. Lump sum items include all excavation and backfill required.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
617.0001.____	Railroad Crossing	LS
617.0002.____	Railroad Signal and Relay Case Foundations	LS
617.0003.____	Cantilever Signal Foundation	EACH
617.0004.____	Railroad Furnished Signal Base	EACH
617.0005.____	Rigid Metal Conduit with Pull Wire	LF
617.0006.____	Type IA Junction Box	EACH
617.0007.____	Type II Junction Box	EACH
617.0008.____	Railroad Signal Load Center	EACH

SECTION 618
SEEDING

618-1.01 DESCRIPTION. Establish a perennial stand of grass or other specified living vegetative cover, by seeding, in the areas indicated on the Plans. Maintain the cover for the term of the Contract.

618-2.01 MATERIALS. Use materials that conform to the Special Provisions and the following:

Seed	Section 724
Fertilizer	Section 725
Water	Subsection 712-2.01

CONSTRUCTION REQUIREMENTS

618-3.01 SOIL PREPARATION. Clear all areas to be seeded of stones 4 inches in diameter and larger and of all weeds, plant growth, sticks, stumps, and other debris or irregularities that might interfere with the seeding operation, growth of grass, or subsequent maintenance of the grass-covered areas.

Make areas to be seeded reasonably free of ruts, holes, and humps.

When specified, apply topsoil according to Section 620.

Roughen the surface to be seeded by grooving the soil in a uniform pattern that is perpendicular to the fall of the slope. Use one or more of the following grooving methods prior to the application of seed:

1. Manual raking with landscaping rakes;

2. Mechanical track walking with track equipment; or

3. Mechanical raking with a scarifying slope board. Form one inch wide grooves spaced no more than six inches apart.

You may round the top and bottom of slopes to facilitate tracking or raking and to create a pleasant appearance, but you may not disrupt drainage flow lines.

618-3.02 SEEDING SEASONS. Seed and fertilize during the local growing season.

Do not seed during windy conditions or when climatic conditions or ground conditions would hinder placement or proper growth.

Seed disturbed areas that require seeding within fourteen days of the permanent cessation of ground-disturbing activities in that area.

Seed between May 15 and August 15, or obtain written approval from the Engineer to seed at a different date.

618-3.03 APPLICATION. Apply seed mix, fertilizer, and mulch (if required) at the rate specified in the special provisions. If no seed mix, seed mix application rate, or fertilizer rate are specified in the special provisions, use the recommendations of the Alaska Department of Natural Resources (DNR) and the Revegetation Manual for Alaska.

Do not seed areas of bedrock, plant beds, and areas indicated on the plans as “no seeding”.

Water and fertilizer required for application are subsidiary to the Seeding bid item.

Use any of the following methods:

1. Hydraulic Method.

   a. Furnish and place a slurry made of seed, fertilizer, water, and other components as required by the Special Provisions.

   b. Use hydraulic seeding equipment that will maintain a continuous agitation and apply a homogeneous mixture through a spray nozzle. The pump must produce enough pressure to maintain a continuous, nonfluctuating spray that will reach the extremities of the seeding area with the pump unit located on the roadbed. Provide enough hose to reach areas not practical to seed from the nozzle unit situated on the roadbed.

   c. If mulch material is required, it may be added to the water slurry in the hydraulic seeder after adding the proportionate amounts of seed and fertilizer. Add seed to the slurry mixture no more than 30 minutes before application.

   d. Mix the slurry and apply it evenly.

2. Dry Methods.

   a. Use mechanical spreaders, seed drills, landscape seeders, aircraft, cultipacker seeders, fertilizer spreaders, or other approved mechanical spreading equipment when seed and fertilizer are to be applied in dry form.

   b. Spread fertilizer separately at the specified rate.

618-3.04 MAINTENANCE AND WATERING. Protect seeded areas against traffic by approved warning signs or barricades. Repair surfaces gullied or otherwise damaged following seeding. Maintain seeded areas in a satisfactory condition until final acceptance of work.

Water and maintain seeded areas. Water applied by this Subsection is a paid contract item. If, in the opinion of the Engineer, too much water is being applied, reduce amount of water as directed.

Reseed areas not showing evidence of satisfactory growth within 3 weeks of seeding. Bare patches of soil more than 10 square feet in area must be reseeded. Erosion gullies over 4 inches deep must be filled and reseeded. Fill the entire erosion gully to surrounding grade, even the portions less than 4 inch deep.

Contact DNR for advice or corrective measures, when seeded areas are not showing evidence of satisfactory growth. You are responsible for retracking, reseeding, refertilizing and remulching areas that do not show satisfactory growth, and those actions are subsidiary.

618-3.05 ACCEPTANCE. The Engineer will perform a visual inspection of seeding to determine final stabilization. During the visual inspection each station and each side of the road will be considered a separate area. The Engineer will accept seeding that has become a vegetative matt with 70 percent cover density in the inspection area.

Reseed areas that are not acceptable to the Engineer.

618-3.06 PERIOD OF ESTABLISHMENT. Establishment periods extend for one complete growing season following acceptable seeding. Employ all possible means to preserve the new vegetative matt in a healthy and vigorous condition to ensure successful establishment. Reseed areas that do not meet the specifications. Watering and reseeding after the final inspection are subsidiary.

The Engineer may, but is not required to, determine the Project is complete except for the period of establishment, and issue a letter of final acceptance. After final acceptance, work or materials

due under this subsection during any remaining period of establishment are considered warranty obligations that continue to be due following final acceptance in accordance with Subsection 105-1.16.

618-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Seeding by the Acre. By the area of ground surface acceptably seeded and maintained.

Seeding by the Pound. By the weight of dry seed acceptably seeded and maintained.

Water for Seeding. If weighed, a conversion factor of 8.34 pounds per gallon will be used to convert weights to gallons.

Seeding by the Square Yard. By the area of ground surface acceptably seeded and maintained.

618-5.01 BASIS OF PAYMENT. Mulching will be paid for under Section 619. Soil preparation, fertilizer, and water required for hydraulic method are subsidiary.

Seeding by the Acre. Payment is for established vegetative matt.

Seeding by the Pound. Payment is for established vegetative matt.

Water for Seeding. Water applied for growth of vegetative matt. Water for hydraulic seeding, fertilizing or mulching is subsidiary. Water after project completion is subsidiary.

Seeding by the Square Yard. Payment is for established vegetative matt.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
618.0001.____	Seeding	ACRE
618.0002.____	Seeding	LB
618.0003.____	Water for Seeding	MGAL
618.0004.____	Seeding	SY
618.0005.____	Seeding	LS

SECTION 619
SOIL STABILIZATION

619-1.01 DESCRIPTION. Furnish, place, and maintain mulch or matting material where shown on the Plans.

619-2.01 MATERIALS. Use materials that conform to the following:

Mulch	Subsection 727-2.01
Matting	Subsection 727-2.02
Staples	Subsection 727-2.03

CONSTRUCTION REQUIREMENTS

619-3.01 SURFACE PREPARATION. Smooth the surface and backfill all gullies and potholes before application.

Remove all sticks and other foreign material that prevent contact of the mulch or matting and surface.

Ensure that the surface is moist at the time of placement.

619-3.02 APPLICATION. Apply mulch material at the rate specified in the Special Provisions.

If seeding is specified, complete the application of mulch or matting within 24 hours after seed is placed.

Staple matting every 5 feet at joints and edges or as recommended by the manufacturer.

Do not use vehicles or equipment which cause rutting or displacement of the subgrade or topsoil.

619-3.03 MAINTENANCE. Reshape and reseed any damaged areas and repair the mulch or matting as required.

Maintain the mulch or matting until all work on the project is complete and accepted.

619-4.01 METHOD OF MEASUREMENT. See Section 109, measured on the slope of the ground surface.

619-5.01 BASIS OF PAYMENT. Water, maintenance, and repair are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
619.0001.____	Mulching	SY
619.0002.____	Matting	SY

SECTION 620
TOPSOIL

620-1.01 DESCRIPTION. Furnish and spread topsoil where shown on the Plans.

620-2.01 MATERIALS. Use materials that conform to the following:

Topsoil Section 726

620-3.01 PLACING. Spread the topsoil evenly on the designated areas to the depth (after settlement) shown on the Plans. Do not place when the ground or topsoil is frozen, excessively wet, or in a condition detrimental to the work. Keep the roadway surfaces clean of topsoil during hauling and spreading operations.

620-3.02 MAINTENANCE AND REPAIR. Maintain the areas covered by topsoil until subsequent seeding or landscaping is accomplished. Complete any repairs or topsoil replacement, including damage or loss resulting from winter shutdown, without extra compensation.

620-4.01 METHOD OF MEASUREMENT. See Section 109, measured on the slope of the ground surface.

620-5.01 BASIS OF PAYMENT. Stockpiling and rehandling of topsoil during the stripping operations or during placement are subsidiary.

Topsoil repair, maintenance, and replacement are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
620.0001.____	Topsoil	SY
620.0002.____	Topsoil	CY
620.0003.____	Topsoil	LS

SECTION 621
PLANTING TREES AND SHRUBS

621-1.01 DESCRIPTION. Furnish, plant or transplant, and maintain trees, shrubs, and other plants on prepared areas in conformance with the Plans.

MATERIALS

621-2.01 PLANT STOCK. Furnish plants that are true to type and name according to the current edition of *Standardized Plant Names*, American Joint Committee on Horticultural Nomenclature. Furnish plants and plant bundles labeled with durable and legible labels according to size, botanical genus, and common plant name.

Furnish the variety and species specified in the Special Provisions. Furnish plants that are typical of the species or variety and that conform to American Standard for Nursery Stock (ANSI Z60.1) for type and grade.

Furnish nursery grown plants unless collected plants are specified. Furnish plants that are grown or conditioned to an environment similar to the project site, including elevation, annual precipitation, soil conditions, and climate. Furnish plants free from disease, injurious insects, mechanical wounds, broken branches, decay, or other defects.

1. Nursery Stock.

    a. Furnish trees and shrubs furnished from a nursery that have been root pruned during their growing period in the nursery according to standard nursery practice to produce a fibrous compact root system suitable for the various species and sizes called for on the Plans. Use nursery stock that has been growing for at least 2 full growing seasons.

    b. Furnish container grown plants that have been growing for at least 1 year but no more than 2 years in the same container. Only ground cover plants may exhibit a “pot-bound” condition.

    c. Provide trees with straight trunks, well-branched with symmetrical tops and no unhealed scars more than ¾ inch in diameter.

2. Collected Stock. Collect healthy plants growing under natural conditions in soils and in locations which lend themselves to proper collecting practices. Ensure that the root systems or balls for collected stock is at least 25 percent larger than those specified for nursery-grown material.

3. Balled and Burlapped Plants.

    a. Meet the ball diameters and depths specified in the *American Standard for Nursery Stock* (ANSI Z60.1).

    b. Furnish plants with a firm ball of earth from the original and undisturbed soil in which the plant was growing. Wrap the ball with burlap or similar approved material and lace it tightly to hold the ball firm and intact. Plant material that arrives at the planting site with broken or loose balls or with manufactured earth, are unacceptable. Handle balled and burlapped plants by the earth ball only and protect against drying and freezing.

4. Substitutions. No substitutions are permitted without written approval.

    Notify the Engineer in writing within 6 weeks of target planting date if any specified plant is not obtainable or available. The Engineer will evaluate the plant availability and may consider allowing the nearest available size and similar variety, with corresponding adjustment to the contract unit price.

5. Storage and Packing. Handle and pack all plant material according to good nursery practices as required by soil and climatic conditions. Plants that show signs of improper storage or handling are unacceptable.

6. Inspection.

   a. Make all planting stock available for inspection in the nursery or collecting field before it is dug. At least 10 working days before digging operations, furnish complete and detailed information about the supply source for each item of plant materials.

   b. Final inspection and acceptance for size of ball or roots, color, absence of defects, and for other requirements will be made at the planting site before placing the plants in their permanent positions.

The Engineer will reject plants:

1. Listed on the Alaska Department of Natural Resources Division of Agriculture webpage with an Alaska Natural Heritage Program Invasiveness Ranking greater than 70;

2. Without labels or plants from which labels have been removed;

3. Lacking proper proportions, have injuries to the bark or roots, broken branches, insect pests, diseases;

4. Showing signs of improper storage or handling, or have damaged or loose earth balls; or

5. Containing prohibited noxious weeds (as listed in 11 AAC 34.020(a)) in the earth ball or containers.

621-2.02 FERTILIZER. Use fertilizer that meets Section 725. Meet the chemical proportions specified in the Special Provisions.

621-2.03 LIMESTONE. Use limestone that meets Subsection 712-2.03.

621-2.04 MULCH. Use mulch that meets Section 727.

621-2.05 BACKFILL MIX. Use backfill mix that meets Section 726.

621-2.06 STAKES. Use stakes that are strong and fit for the purpose intended.

621-2.07 TREE WOUND DRESSING. Use tree wound dressing that is antiseptic, waterproof, and contains no materials harmful to the living tissue of trees.

CONSTRUCTION REQUIREMENTS

621-3.01 TEMPORARY STORAGE. Where temporary storage or heeling-in of plants is required, provide and prepare a suitable heeling-in ground or a well-ventilated and cool storage shed, located near the planting site, before shipping planting stock.

Heel-in or properly store all acceptable planting stock if not planted within 24 hours, as follows:

1. Balled and Burlapped Plants. Temporarily store in a protected area with balls 6 inches apart. Fill voids with moist mulch up to and including the top of the ball.

2. Bare-Rooted Plants. Puddle immediately, then heel-in by placing the plants, properly spread, in a trench and covering the roots with moist topsoil.

Protect bare root plants adequately at all times. Plants left out of the ground unprotected overnight, left with roots exposed to the sun, or improperly protected during transit, unloading, heeling-in, or during the planting operation, are unacceptable.

Protect the roots of plants stored in a shed at all times using moist straw or other approved material. Water as required.

621-3.02 ADVANCE PREPARATION AND CLEANUP. After clearing and grubbing of the area is complete, remove any stones, sticks, stumps, clods, and other debris which might interfere with growth or maintenance. Repair any subsequent damage from erosion or other causes.

Prepare areas which will receive group plantings with generally curving outlines.

621-3.03 PLANTING. Perform all planting work using good horticultural practices.

1. Plant Season.

    a. Locally Grown: Transplant Alaska-grown native or exotic species in the fall of the year, following leaf drop.

    b. Imported: Handle and transplant out-of-state plants, according to the nursery recommendations.

2. Excavation.

    a. Keep topsoil separate from underlying layers and render it loose and friable. Remove any material detrimental to plant growth and dispose of it at approved locations.

    b. Make pits for trees at least 2-5 times the diameter of the root ball or the spread root system of bare-root trees. Make the depths of pits for trees at least 2 feet and as much deeper as may be necessary to provide a minimum depth of 9 inches below the bottom of the ball or spread root system of the tree when placed at the proper elevation.

    c. Make pits for shrubs at least 2 times the diameter of the root ball or spread root system. Keep the depths of pits for shrubs at least 12 inches and as much deeper as may be necessary to provide 6 inches minimum below the bottom of the ball or spread root system when the shrub is placed at the proper elevation.

    d. Ensure that the dimensions of pits, pockets, or trenches for vines, ground covers, and similar types of plants will provide space for the spread root system. Keep the depth and width at least 6 inches below and around the root system.

3. Pruning.

    a. Roots. Prune all damaged or broken main roots with a clean, oblique cut immediately above the point of damage.

    b. Branches. Use pruning techniques that conform to the best horticultural practices with due regard to natural or desired form and growth characteristics of the individual species. Preserve a single terminal leader when pruning. On all deciduous plants, remove 1/3 to 1/2 of the potential leaf-bearing surface. Treat all cut surfaces that are 3/4 inch or more in diameter with tree wound dressing.

4. Transplanting. Relocate plant material, within the limits of the project, designated for transplanting to areas shown on the drawings or as specified. Dig this material with root systems or balls as specified for collected stock and replant it the same way as new stock.

5. Placing Plants.

a. Set plants plumb on lightly tamped backfill mix and at a level so that the root collar will bear the same relation to the planting site as it bore to the ground from which it was dug.

b. Handle balled and burlapped plants by the earth ball and not by the plant itself. Place the plants in holes without removing the burlap.

c. Fill the hole with water before placing the plant. Place the backfill gradually, allowing the soil to soak up the water.

6. Backfilling. Work backfill mix around the roots and firmly tamp it as it is filled into the holes to eliminate air pockets. Avoid bruising or breaking the roots while tamping or firming the backfill mix about them. Hold upright plants plumb during the backfilling operation. When the backfilling is 2/3 completed, loosen the exposed burlap and lay it back from the ball or cut off excess. After thorough watering, complete the backfilling. During backfilling, remove stocks, sod, clods, or other material that tend to form air pockets. Except in areas for shrub beds, construct a shallow basin of backfill mix approximately 3 inches deep and as wide as the diameter of the hole around each plant. On steep slopes, pull enough soil to the lower side of the plants to form shallow basins to catch and hold water. After the backfilling is completed, water the plant basins thoroughly.

7. Wrapping. When specified, wrap the trunks of all deciduous shade and flowering trees with 4-inch-wide waterproof paper, overlapping 1-1/2 inches, between the lowest main branches to the ground line. Tie the wrapping in at least 5 places, including top, middle, and bottom. Complete these protective measures within 4 days after planting.

8. Staking and Guying.

a. Immediately after planting, brace all evergreen trees 4 to 6 feet high and all deciduous trees 6 feet and over in height and less than 1-1/2 inch in diameter. Use a single stake measuring at least 2 inches by 2 inches by 6 feet and place it 2 feet deep into the ground on the windward side to avoid injury to the root system. Connect the stake to the tree using approved binding straps.

b. Immediately guy all deciduous trees 1-1/2 inches and over in diameter, and all evergreen trees 6 feet and over in height using 3 cables spaced approximately 120 degrees apart around the tree. Use cables each made of 2 No. 12 galvanized steel wires, free from bends and kinks, twisted into a strand. Fasten cables around the trunk immediately above a substantial limb wherever possible. Fasten cables around the trunk at a distance from the ground equal to 1/2 to 2/3 of the total height of the tree. Anchor cables to the ground at an equal distance away from the trunk. Protect the tree from damage caused by the cable using an approved method.

c. Use other anchor stakes that are at least 2 inches x 2 inches x 2 feet. Drive the stakes at right angles to the guy wire. Ensure that the stakes do not extend more than 3 inches above the ground. Notch or drill the stakes to prevent cables from slipping.

621-3.04 PERIOD OF ESTABLISHMENT. Establishment periods extend for one complete growing season following acceptable planting. Employ all possible means to preserve the plants in a healthy and vigorous condition to ensure successful establishment. During this period, perform the necessary weeding, spraying (with approved insecticides or fungicides), cultivating, remulching, and tightening or replacing guy wires and stakes as may be required. Water all shade, evergreen, and flowering trees as frequently as necessary to keep the immediate root areas moist at all times.

The Engineer may, but is not required to, determine the Project is complete except for the period of establishment, and issue a letter of final acceptance. After final acceptance, work or materials due under this subsection during any remaining period of establishment are considered warranty

obligations that continue to be due following final acceptance in accordance with Subsection 105-1.16.

621-3.05 CLEANUP. Remove from planting sites any quantities of subsoil, rock, and other spoils resulting from excavation after planting. Dispose of them as directed. On slopes 3:1 and steeper, you may scatter or dispose of material other than rock and coarse debris. Leave all planting sites in an acceptable condition.

621-3.06 PLANT REPLACEMENTS. Before project completion, replace all trees, shrubs, crowns, and vines that are not alive and healthy with plants of the same species, size, and quality without extra compensation. Where replanting is performed, the Engineer may accept all plant material in a living, healthy condition, including replacements, at the time of final inspection.

621-3.07 MAINTENANCE. Protect the planted areas using signs, barricades, or other approved means. Keep the planted areas watered.

621-4.01 METHOD OF MEASUREMENT. See Section 109, by the number of plants or length of hedge alive and healthy at the time of final inspection.

621-5.01 BASIS OF PAYMENT. Excavation, top soil, backfill, fertilization, and disposal of all unsuitable and surplus material are subsidiaryWater for maintenance will be paid for under item 618(3).

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
621.0001.____	Tree,	EACH
621.0002.____	Shrub,	EACH
621.0003.____	Hedge,	LF
621.0004.____	Vine,	EACH

SECTION 622
REST AREA FACILITIES

622-1.01 DESCRIPTION. Construct one or more of the following rest area facilities at locations shown on the Plans:

1. Sanitary facilities with screen fences
2. Wooden picnic tables and shelter houses
3. Litter can racks with litter cans, lids, and locking devices
4. Fireplaces
5. Well, casing (if required), pump cylinder, and hand pump assembly
6. Treated timber curb
7. Rest area signs
8. Litter barrels

MATERIALS

622-2.01 GENERAL. Use only new materials that conform to plan details, or as specified.

622-2.02 GALVANIZING. Meet AASHTO M 111 or M 232. Repair damage to galvanized coatings according to Subsection 716-2.07.

622-2.03 HAND PUMP DRINKING FOUNTAIN. Use a sanitary drinking fountain pump stand meeting details shown on the Plans. Provide a pump complete with an Ohio pattern base, stuffing box, air vent, and drainpipes. Use a brass or brass-lined pump cylinder with an inside diameter of 1-11/16 inch, 6-inch minimum stroke. Provide a plunger with two leathers. Thread the top and bottom of the cylinder to 2-inch pipe size. Use ball or spool valves. Tap the plunger valve to allow screwing to the top of the check valve. Use a check valve designed to be withdrawn through the cylinder and drop pipe with the plunger. Use a check valve equipped with a cup leather similar to the plunger cup leathers.

622-2.04 WELL CASINGS. Case the well with standard weight black or galvanized steel pipe, 6-inch diameter, meeting ASTM A53.

622-2.05 WELL SCREENS. Determine screen length, area, size of openings, and material after exploring water-bearing strata and analyzing samples from the strata. The Engineer will approve screen criteria depending on thickness and uniformity of water-bearing strata, analysis of aquifer samples, well requirements, and the screen manufacturer's recommendations. Obtain representative samples of sands and water in the aquifer. Take the sand sample after obtaining a satisfactory yield according to Subsection 622-3.05. Submit the samples and a copy of the drilling log to the screen manufacturer. Give the Engineer copies of transmittals to and from the screen manufacturer.

Use a final length of screen as recommended by the screen manufacturer and approved by the Engineer. Use the largest diameter that can be installed in the casing.

Use a screen made of either silicon steel or stainless steel, based on chemical analysis of the well water. Screen must be strong enough to resist damage during installation and external force after installation. Do not change screen alignment after installation.

Provide fittings of the same material as the screen needed to seal top of screen tightly to casing and to close bottom of screen. If screen is installed inside casing, provide a lead packer seal at top of screen with 12-inch minimum overlap of casing and screen. If screen is attached to casing, provide suitable coupling or weld screen to casing.

622-2.06 DROP PIPE. Use 2-inch galvanized steel pipe with galvanized couplings meeting ASTM A53. Ream the ends of the pipe before installation so that you can withdraw the pump rod and

valves through the drop pipe. Drill a 1/8 inch diameter weep hole in the drop pipe below the frost level as shown on the Plans.

622-2.07 PUMP ROD. Use a minimum 3/8 inch galvanized rod on all installations up to 50 feet deep. If the well is deeper than 50 feet, install first quality 1-1/8 inch octagon ash wood pump rod with butt-type galvanized coupling to the nearest even length below the weep hole. From this point to the surface, use 1/2 inch galvanized rod as shown on the Plans.

622-2.08 LUMBER. Meet the requirements in Section 713.

622-2.09 TREATED TIMBER. Meet Section 714 and details on the Plans.

622-2.10 CONCRETE. Use Class W concrete meeting the requirements of Section 550.

622-2.11 LITTER BARRELS. Use clean, rust-free and undamaged 55 gallon steel barrels with tops removed and free of projections or sharp edges.

Paint litter barrels highway orange and stencil “Litter” on both sides in white letters 5 inches high.

622-2.12 REST AREA SIGNS AND POSTS. Meet all applicable requirements of Section 615.

CONSTRUCTION REQUIREMENTS

622-3.01 GENERAL. Locate all specified rest area facilities approximately as shown on the Plans. Make minor location adjustments if topographic conditions dictate better placement.

622-3.02 CLEARING AND GRUBBING. Clear and grub to conform to the applicable portions of Section 201.

Make every effort to retain the natural state of the landscape within the rest area. Do not damage natural ground cover.

622-3.03 GENERAL PATHS. Construct all foot paths and picnic table areas with a gravel mat as shown on the Plans, to the length and width as directed. Place, level, and compact material to a firm surface using mechanical compaction.

622-3.04 EXCAVATION. Make excavations for support posts, curbs, and screen fences large enough to allow working space for tamping backfill. Dispose of excess excavated material away from the rest area.

622-3.05 CONSTRUCTING WATER WELL.

1. General. Drill, develop, case, and test wells. Furnish and place all materials at the sites as detailed on the Plans. Procure all required permits, certificates, and licenses.

   Well depth shown on the Plans is approximate. The Department does not guarantee the presence of water at the anticipated depth. The exact depth will depend on adequate yield.

2. Protection of Site. Protect all structures, trees, shrubbery, etc., during the work. Remove from the site all cuttings, drillings, debris, and unused materials. After completing the work, restore the site as nearly as possible to its original condition. Conduct water pumped from the well to a designated place where you can dispose of it without causing erosion or other damage to property or creating a nuisance.

3. Bore and Casing. Drill the well straight, plumb, and large enough to receive the size of casing specified. Either weld or thread casing joints. Make the inside of the casing reasonably smooth and watertight.

4. Boring Log. Keep an accurate log of all materials encountered and the depths at which the changes in the formations occur, together with other information as required. Take samples of the materials found in each stratum at intervals of 5 feet or less. Preserve samples in your own receptacles. Mark the samples plainly to show the depth below the ground surface at which the sample was obtained. Include full, descriptive notes of everything found during drilling and of all difficulties or unusual conditions. Describe all waterbearing strata in detail. Indicate whether the material is loose or compact, what color it is, and, if the material is gravel, whether it is water-worn or angular. Note the presence of any clay. After completing the well, deliver one copy of the log and results of the yield test to the Engineer for transmittal to the State according to AS 41.08.

5. Protecting Water Supply. Take all precautions as directed or necessary to prevent contaminated water, or water with undesirable physical or chemical characteristics, from entering the stratum from which the well will draw its supply through the opening you made. Take all necessary precautions during construction to prevent contaminated water, gasoline, etc., from entering the well through the opening or seeping through the ground surface.

6. Corrective Work. If the well becomes contaminated, or if water with undesirable physical or chemical characteristics enters the well due to your neglect, perform corrective work at your expense. Supply casings, seals, sterilizing agents, or other necessary materials to eliminate the contamination or shut off the undesirable water.

7. Temporary Capping. At all times during the work, protect the well to prevent tampering or contamination with foreign matter. After completing the well, provide and set a substantial screwed or flanged cap at least 12 inches but not more than 24 inches above the normal ground surface, or as directed.

8. Developing and Testing.

   a. Yield Test. After completing the bore or as directed, bail or pump to determine the yield. The Engineer will determine the approximate level of water in the well before and immediately after you complete the yield test. The desired yield is 4 gallons per minute with a sustained yield of 25 gallons per hour.

      Furnish, install, and operate equipment of approved size and type for measuring the flow of water and depth to the water level in the well. Use a suitable flow measuring device such as a weir box, orifice, or water meter.

      If the yield test is unsuccessful, allow 10 working days for the State to evaluate the geologic and hydrologic well data and decide on another course of action.

      After receiving approval for a satisfactory yield test, but before developing the well, take a water sample and submit it to the Alaska Department of Environmental Conservation for a bacteriological and chemical examination. Pay for all costs of samples and analysis.

   b. Developing. After completing drilling, develop and clean out the well. Develop the well with a suitable surge plunger or other device designed to develop wells in the waterbearing formation you encounter. Develop to give the maximum practical yield of water per foot of drawdown. Develop to extract from the water-bearing formation the practical maximum quantity of such fine materials that may, during the life of the well, be drawn into the casing when the well is pumped under maximum drawdown conditions. After completing developing, remove all sediment to the full depth of the well. Your equipment and material remain your property; remove them at the end of the work.

9. Grouting.

   a. When the well is accepted, ream the upper 10 feet of the bore to a diameter at least 8 inches greater than the casing OD. Center the casing in this section and hold it in place with enough spacers to maintain true alignment. Place grout in the area around the casing. Use grout consisting of 1 part portland cement and 3 parts sand mixed with only enough water to form a workable mix. Place the grout so that surface water and other impurities cannot infiltrate the well along the bore and casing. Use an approved grouting method. Force grout from the bottom of grout space toward the ground surface. Use a continuous grouting operation. Use continuous spacers of clean, durable material suitable for concrete aggregate.

   b. Allow the grout to set for 3 days before doing any work that may disturb it or cause it to crack. Take care to protect the grout from damage and ensure proper curing during the 3-day setting period.

10. Abandonment of Well.

   a. If water supply is not satisfactory, abandon the well. Plug the abandoned well bore with impervious material as required. Compensation for abandoning well bores and deleting other items of work necessary for completing the well and pump assembly will be made under Subsection 109-1.05.

   b. If you must abandon drilling at one location and begin drilling at another because of your operations, or if you fail to complete a satisfactory well bore as specified or required, plug the abandoned bore as specified. No compensation will be made for any work performed at the abandoned site. Salvaged materials remain your property.

622-3.06 HAND PUMP ASSEMBLY. Install the well screen, drop pipe, pump rod, and cylinder as detailed on the Plans. Set the pump plumb on the casing. Furnish and install the hand pump and all required miscellaneous hardware not specified or detailed so that the water system will operate properly.

On the basis of the yield test, the Engineer will stipulate the depth to the bottom of casing and the depth to which you must set the pump cylinder.

Construct a concrete pump platform and drain as shown on the Plans.

622-3.07 DISINFECTION. After completing the pump assembly, disinfect the well. Use the following amount for each 100 gallons of water in the well:

Chlorinated Lime	2.5 teaspoons
Chlorine Laundry Bleach	1 pint
HTH	12 tablespoons

Mix the disinfectant with 5 gallons of water. Pour the disinfectant mixture into the well, down the sides of the casing and the drop pipe. Let the disinfectant stand overnight. Pump out the well until the water no longer tastes of chlorine.

Obtain sample bottles from the State Department of Health and Social Services. Collect water samples and submit them to their Public Health Laboratory for testing. If the sample does not meet Public Health requirements, disinfect again and draw more samples until results are satisfactory.

622-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Item 622.0004.____ Treated Timber Curb. By the length of curb, excluding gaps.

Iem 622.0005.____ Well and Casing. By the length of casing installed or the depth of hole measured from the ground surface if the well is abandoned.

Item 622.0006.____ Rest Area Signs. By the area of legend-bearing sign panel erected in place. No deductions will be made for corner rounding. Nominal dimensions for sign sizes indicated on the Plans will be used to calculate sign pay quantities.

Items 622.0007.____ through 622.0014.____ Rest Area Facilities. By the number of facilities completed and accepted.

622-5.01 BASIS OF PAYMENT. Excavation, backfill, grading, and cleanup are subsidiary.

622.0001.____ Rest Area. The contract price includes rest area site, all facilities, paths, and picnic areas. Clearing will be measured under Section 201. Subbase and borrow will be measured under Section 304 and 203 respectively.

622.0002.____ Water System Complete. The contract price includes well, casing, pumping facilities and all incidentals specified or required to complete the installation.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
622.0001.____	Rest Area	LS
622.0002.____	Water System Complete	LS
622.0003.____	Screen Fence	LF
622.0004.____	Treated Timber Curb	LF
622.0005.____	Well and Casing	LF
622.0006.____	Rest Area Signs	SF
622.0007.____	Pit Toilet, ___ Seat	EACH
622.0008.____	Table, Class ___	EACH
622.0009.____	Litter Can with Rack	EACH
622.0010.____	Fireplace, Class ___	EACH
622.0011.____	Special Vault Toilet	EACH
622.0012.____	Shelter House, Case ___	EACH
622.0013.____	Hand Pump Assembly	EACH
622.0014.____	Litter Barrel	EACH

SECTION 623
BLOCK SODDING

623-1.01 DESCRIPTION. Establish a perennial stand of grass or other specified living vegetative cover, by sodding, in areas shown on the Plans. Maintain the cover for the term of the Contract.

623-2.01 MATERIALS.

1. Sod. Use living native plants and grasses that grow in the more fertile soils near the project. Preferred plants include willow, alder, fireweed, calamagrostis, bearberry, red top, and other natural species. Establish fertility by observing the quality and quantity of the plants and grasses in their natural location.

   Collect sod out of sight of the roadway and within the right-of-way if possible. Obtain authority to remove sod from areas outside the right-of-way. Obtain approval of the sod in its original position before cutting.

   Cut sod in blocks of at least 6 ft^2. Obtain approval to use different dimensions. Include an intact root system with natural soil at least 4 inches thick.

2. Fertilizer. Use a 28-8-4 mixture in 300-grain pellets, meeting the requirements of Section 725.

623-3.01 CONSTRUCTION REQUIREMENTS. Prepare the area to be sodded by removing oversize rocks, logs, wood, soil clods, paper, and other debris. Dispose of debris out of sight of the roadway. Smooth any rivulets eroded into the face of the slope, by tapering the edges into the depressions. Smooth the area enough to allow planting sod.

1. Keep sod moist at all times. Water sod if necessary prior to cutting. Keep as much soil as possible in the natural state around the roots during digging, hauling and planting.

2. Use approved mechanized methods wherever possible to obtain and place sod.

3. Place sod on the designated slopes without excavating holes and within 6 inches of the locations specified on the Plans. Place each piece tightly against adjoining pieces. On slopes steeper than 3:1, peg sod pieces as directed.

4. Fill and pack voids with suitable soil from the sod source. Tamp or roll sod firmly in place, to eliminate air pockets provide a smooth plane, level with the adjacent slope.

5. Fertilize the sod using 2 pellets per sod block. Water sod within one hour of placing. Continue watering sod blocks until project completion.

623-4.01 METHOD OF MEASUREMENT. See Section 109, measured on the slope of the ground surface.

623-5.01 BASIS OF PAYMENT. Watering will be paid for under item 618(3).

The contract price includes all cutting, hauling, placing, slope preparation, fertilizing, and cleanup.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
623.0001.____	Sodding	SY

SECTION 624
CALCIUM CHLORIDE FOR DUST CONTROL

624-1.01 DESCRIPTION. Furnish and apply calcium chloride on the subgrade, base, or aggregate surface course to control dust during construction operations. Use calcium chloride at locations and times specified or directed.

624-2.01 MATERIALS. Use materials that conform to the following:

Calcium Chloride AASHTO M 144, Type S, Grade 3

624-3.01 CONSTRUCTION REQUIREMENTS. Moisten the surface as directed before and after applying dry calcium chloride.

Uniformly distribute and mix dry or liquid calcium chloride in the top 1-1/2 inches of road surface. Spread first application of calcium chloride at a rate of 1 pound per square yard of dry form equivalent for the full width of roadway. Apply additional calcium chloride at a rate of 1/2 pound per square yard for the full width of previously treated roadway.

Shape and compact the roadway surface to final grade as specified in Section 203.

Keep traffic off of the treated surface for 2 hours after application, or as directed.

624-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Bulk. By weighing in dry form.

Packaged. By manufacturer's packed net weight.

624-5.01 BASIS OF PAYMENT. Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
624.0001.____	Calcium Chloride	TON

SECTION 625
PIPE HAND RAIL

625-1.01 DESCRIPTION. Furnish and place pipe handrail with galvanized steel pipe members, concrete bases, and other required materials in conformance with the Plans.

625-2.01 MATERIALS. Use materials that conform to the following;

Concrete	Section 550, Class W
Pipe	ASTM A53, Galvanized, Schedule 40

625-3.01 CONSTRUCTION REQUIREMENTS. Set posts plumb in concrete base. Weld galvanized steel pipe members at rail-to-post connections and intermediate rail connections, as shown on the Plans. Erect railing smoothly and continuously so that it is parallel to the sidewalk grade.

Repair all welds and damaged galvanizing to conform to AASHTO M 36.

625-4.01 METHOD OF MEASUREMENT. See Section 109.

625-5.01 BASIS OF PAYMENT. Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
625.0001.____	Pipe Hand Rail	LF

SECTION 626
SANITARY SEWER SYSTEM

626-1.01 DESCRIPTION. Construct or reconstruct sanitary sewers and appurtenances to conform to the Plans. This Section refers to conduit used for sanitary sewers as “sewer conduit.”

626-2.01 MATERIALS. Use materials that conform to the following:

Bedding and Backfill	Subsection 204-2.01
PVC Pipe	Subsection 706-2.05
Polypropylene Pipe	Subsection 706-2.09
HDPE Pipe	Subsection 706-2.08
Ductile Iron Pipe	Subsection 707-2.05

626-3.01 CONSTRUCTION REQUIREMENTS. Complete the sanitary sewer system and make sure it operates properly at the time of acceptance of the work. Furnish and install all incidental parts not shown on the Plans or specified in this Section that are necessary to complete the sanitary sewer system.

Meet the applicable provisions of Sections 201, 204, and 603 for all clearing and grubbing, excavation, bedding, backfill, conduit, and appurtenances.

If sewer conduit is directly connected to or supported by rigid structures such as manholes, it must have a joint or flexible connection located 5 feet or less from the point of connection or support.

Lay sewer conduit accurately to the staked line and grade. Install all service connections as indicated on the Plans. Provide suitable fittings and adapters when connecting existing service sewers.

Clean all foreign matter from sewer conduit. Keep water out of trenches until joints are completed. Plug or cover open ends of conduit and fittings when work is not in progress to keep out foreign matter and rodents.

Join pipe according to manufacturer’s recommendations, or as detailed on the Plans.

When sewer conduit is laid within a 10-foot horizontal radius of an existing or a new water main, and is above or 3 feet below the water main, use cast-iron pipe.

Remove trench sheeting and bracing above the elevation of the conduit. Do not pull, remove, or disturb sheeting below the conduit.

626-3.02 TESTING. With the Engineer present, test the sewer for grade, alignment, and leakage. Grade and alignment must conform to staking with no deviation allowed that would inhibit flow.

Test for infiltration if the normal groundwater table lies above the invert of the sewer conduit. Infiltration must not exceed 4 gallons per inch of conduit diameter per 1000 feet of pipe per day.

Test for exfiltration when no groundwater exists above the conduit invert. Leakage must not exceed 5 gallons per inch of conduit diameter per 1000 feet of pipe per day. Use minimum test pressure of 4 feet of water column above the crown at the upper end of the conduit.

Correct all leakage before backfilling.

After backfilling, test each run of conduit for obstructions and alignment by placing a light at one end. The light must be visible through the sewer conduit at the next manhole.

626-4.01 METHOD OF MEASUREMENT.

Slopes of 10 percent or less. By the length of the horizontal projection of the conduit from center to center of manholes or cleanouts.

Slopes of more than 10 percent. By the length along the centerline of the conduit from center to center of manholes or cleanouts.

626-5.01 BASIS OF PAYMENT. Branch connections and service fittings are subsidiary.

Excavation, bedding, and backfill are paid for under Section 204.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
626.0001.____	Sanitary Sewer Conduit, ___ Inch	LF
626.0002.____	Sanitary Sewer Service Connection	EACH

SECTION 627
WATER SYSTEM

627-1.01 DESCRIPTION. Furnish and place water main improvements and replacements, including all appurtenances, as shown on the Plans or specified in this Section. Remove, salvage and reinstall or abandon existing fire hydrants, valve boxes, and water meters, as specified.

The term "water conduit" refers to all conduits used for water mains. The term "service pipe" refers to service lines.

627-2.01 MATERIALS. Use materials that conform to the following:

Bedding and Backfill	Subsection 204-2.01
Concrete for Thrust Blocks	Subsection 550, Class W
HDPE Pipe	Subsection 706-2.08
Ductile Iron Pipe	Subsection 707-2.05
Service Pipe	Subsection 707-2.06
Corporation Stops	Subsection 712-2.09
Gate Valves	Subsection 712-2.10
Valve Boxes	Subsection 712-2.11
Hydrants	Subsection 712-2.12

CONSTRUCTION REQUIREMENTS

627-3.01 GENERAL. Complete the water system and make sure it operates properly at the time of acceptance of the work. Furnish and install all incidental parts not shown on the Plans or specified in this Section that are necessary to complete the water system.

Meet the applicable provisions of Sections 201, 204, and 603 for all clearing and grubbing, excavation, bedding, backfill, conduit, and appurtenances.

Consult the Plans for estimated locations of existing sewers, water mains, and other utilities near the construction. Use this data for information only. The Department does not guarantee their accuracy. Confirm and mark the exact locations of all existing utilities before starting work.

Excavate, bore, or probe by hand ahead of your work where necessary to determine the exact location of underground conduit or other features that might interfere with construction. Support and protect conduits or other services that cross the trench. Immediately repair or replace any existing utilities that you break or damage. Immediately replace any existing valves, valve boxes, or water lines that you break or damage.

Notify the local Fire Department at least 24 hours before removing or interrupting service to fire hydrants.

Give at least 24 hours' notice before interrupting water service to any area. Restore disrupted water service as soon as possible, or make temporary service connections. Use hoses or other suitable methods.

If your operations cause service interruptions, you are responsible for all damages.

Furnish and install concrete thrust blocks as shown on the Plans or specified in this Section. Place blocks against firm natural ground at the trench site. When the trench is in soft, unstable soil, remove the soft soil and replace it with a ballast backing large and heavy enough to resist the thrust.

Connect to existing water lines and structures, avoiding contamination of water in lines that are in use.

Where water mains under this contract approach within 10 feet horizontal clearance and are below or less than 3 feet above existing sanitary sewers, encase the sanitary sewer with a jacket of Class W concrete 3 inches thick for 10 feet on each side of the crossings, as shown on the Plans.

Concrete encasement is not required if the existing sewer is constructed of ductile iron pipe with joints at least 8 feet from the water main, or if you replace the existing sewer with such ductile iron pipe.

627-3.02 INSTALLATION OF CONDUIT. Install conduit and fittings according to these Specifications or the manufacturer's recommendations. Lay conduit to the grades and lines shown on the Plans.

Remove all foreign matter from conduit interiors before lowering conduit into the trench. When work is not in progress, securely close all open ends of conduit and fittings to keep out trench water, earth, rodents or other substances.

Keep trenches dry to avoid laying conduit in water. Do not lay conduit when weather or trench conditions are unsuitable. Keep water away from new joints, until the joint materials have hardened.

Use methods to cut conduit that will produce tight joints and will not damage the conduit.

Inspect conduit before lowering it into the trench. Replace defective, damaged, or unsound conduit.

Place conduit bedding to conform to plan details. Place bedding, if required, to give conduit a uniform bearing for its full length. Do not permit couplings to rest on solid or original trench bottoms.

Conduit bends must not exceed the manufacturer’s recommended limits. If the specified or required alignment requires deflections beyond the limits, furnish special bends or enough shorter lengths of conduit to provide angular deflection within the limits.

Use standard lengths of conduit except where fittings require short lengths, or where conduit passes through a rigid structure.

Make service and other connections to conform to the Plans. Valve, plug or cap conduit ends for future connections as shown on the Plans and provide thrust blocks.

627-3.03 FIRE HYDRANTS. Install, relocate, or adjust fire hydrants to the locations and grades shown on the Plans. Where required, furnish and install new fire hydrant extensions and any required conduit.

Clean all foreign matter from inside hydrants before installation.

Connect the hydrant to the main with 6-inch ductile iron conduit or the same size as the main, whichever is smaller. Provide with an auxiliary valve and cast iron valve box of the same size as the connecting conduit. Use a mechanical connection between the hydrant and the auxiliary valve.

Set hydrants at elevations that drain the connecting conduit to the main. Set the hydrant on a slab of stone or concrete at least 4 inches thick and 15 inches square. Firmly block the back of the hydrant with concrete at least 1 square foot in area against the vertical face of the trench. If the character of the soil does not allow the hydrant to be securely wedged, use bridle rods and rod collars of at least 3/4 inch stock and coated with acid-resisting paint.

Place at least 7 cubic feet of approved broken stone or clean gravel around the base of the hydrant to ensure drainage. Thoroughly compact the backfill around hydrant to the grade line in a satisfactory manner.

Tighten stuffing boxes and inspect the hydrants in opened and closed positions to make sure that all parts are in working condition.

When removing a fire hydrant from an existing main, plug the tee in the main and test for leakage according to Subsection 627-3.06.

Adjust existing fire hydrants for grade, using barrel extensions according to the hydrant manufacturer's recommendations.

627-3.04 VALVES. Install gate valves as shown on the Plans, on a firm base, and plumb. Remove all foreign matter from the interior before installation.

627-3.05 VALVE BOXES. Install valve boxes over the gate valves as shown on the Plans. Center box over valve and rest base section on well-compacted backfill. Set top section to allow equal movement above and below finished grade, with final elevation 1 inch below finished grade. Set top of base section approximately on line with nut at top of valve stem. The entire assembly must be plumb.

Place a concrete collar on valve boxes installed in pavement, as shown on the Plans.

Adjust existing valve boxes by raising or lowering to conform to the final grade and the details shown on the Plans. Salvage and reuse the existing cast iron valve box and cover. If the valve box is adjustable, adjust it with adaptable extension pieces. If the valve box is constructed with steel conduit, weld additional steel conduit to raise the cover. Lower by cutting the existing valve box pipe.

627-3.06 TESTING WATER SYSTEM. Test all water main and service connection work for both pressure and leakage after laying. Leave conduit joints fully exposed. Place only enough backfill between joints to hold the conduit in place during testing. Test services before insulation. Open corporation stops after successful tests. Conduct all tests with the Engineer present.

Furnish all testing equipment, labor, materials, and supplies. The Engineer has the right to test and approve all gauges used.

Where connection is made to an existing main with no valve present, blank off or plug the outlet leading to the existing main before testing.

Conduct tests after completing installation of the system or any portion thereof, before backfilling and after thoroughly flushing the test portion. Fill all lines with water and eliminate all air.

Use test pressure equal to the strength classification of the pipe. Use either pneumatic or hydraulic pressure. Maintain pressure on the tested portion for at least 2 hours. Allowable leakage during the test must not exceed the amount established by the AWWA. If visible leakage other than minor sweating occurs, immediately stop the test and tighten the joint to eliminate leakage when pressure is resumed. Replace leaking fittings, nipples, or lengths of conduit. Do not caulk or use paints, asphalts, enamels or other types of compounds to eliminate leaks.

Complete backfilling after acceptance of the tests.

627-3.07 DISINFECTION. After acceptance of pressure and leakage tests, disinfect all portions of the water system, including valves and stops and any portion of the existing connecting system that may have been contaminated during construction.

Use calcium hypochlorite as the disinfecting medium. Use “HTH,” Perchloron, or a similar commercial product with approximately 70 percent available chlorine. Make a 5 percent solution by mixing 5 percent of powder with 95 percent water (by weight). Mix the solution into a paste, thin it to slurry by adding water, and add it to the system. Place enough disinfecting material in the system to ensure a chlorine dosage of 50 ppm. This dosage is equivalent to 10 ounces of commercial hypochlorite powder to each 1,000 gallons of water.

After adding the chlorine solution, open and leave open all taps, valves, etc., until you notice a strong chlorine odor in the water coming from the outlets; then close the taps, valves, etc. Keep chlorinated water in the system for at least 24 hours; then thoroughly flush the system. During the retention period, operate all valves, stops, and other appurtenances to assist disinfection.

After treating the system, thoroughly flush. Then take samples from representative points in the system. Place samples in sterile bottles and submit them to proper authorities as directed for bacteriological examination. If the bacteriological examination report is unsatisfactory, repeat disinfection until you obtain satisfactory results.

627-4.01 METHOD OF MEASUREMENT.

1. Water Conduit. By the length, along the slope of the conduit, from center to center of fittings and valves, and center of tee in main to center of fire hydrant gate valve. No deduction in length will be made for valves and fittings.

2. Fire Hydrant Adjustment. By the number of fire hydrants adjusted only for grade.

3. Fire Hydrant Installation, Relocation, or Removal. By the number of fire hydrants installed, relocated, or removed.

4. Water Service Connection. By the number of water services installed.

5. Gate Valves and Valve Boxes. By the number of valves and valve boxes adjusted or installed.

627-5.01 BASIS OF PAYMENT. Barrel extensions for fire hydrant adjustment are subsidiary.

The contract prices for Fire Hydrant Installation, Relocation, and Removal include the tee in the main, auxiliary gate valve with service box, conduit between the fire hydrant and the gate valve and all fittings and materials required. If no item for water conduit exists, then all conduit removal or installation required between the main and the auxiliary gate valve is subsidiary

The contract price for Water Service Connection includes installation of a curb stop, valve box, service pipe and connection to a new or existing water main with a service saddle, tapped coupling or corporation stop, as shown on the Plans.

Excavation, bedding, and backfill are paid for under Section 204.

Clearing and grubbing, landscaping, disinfection, testing, couplings and/or thrust blocks, and encasement or replacement of existing sewer lines are subsidiary.

Any costs involved in service changeovers and providing temporary water service are subsidiary.

Removing or abandoning existing water lines or appurtenances designated on the Plans is subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
627.0001.____	Ductile Iron Water Conduit, ___ Inch, Class ___	LF
627.0002.____	Steel Water Conduit, __ Inch	LF
627.0003.____	Install Valve Box	EACH
627.0004.____	Fire Hydrant Adjustment	EACH
627.0005.____	Fire Hydrant Installation	EACH
627.0006.____	Fire Hydrant Relocation	EACH
627.0007.____	Fire Hydrant Removal	EACH
627.0008.____	Water Service Connection	EACH
627.0009.____	Gate Valve, ___ Inch	EACH
627.0010.____	Adjustment of Valve Box	EACH

SECTION 630
GEOTEXTILE FOR EMBANKMENT AND ROADWAY SEPARATION, STABILIZATION AND REINFORCEMENT

630-1.01 DESCRIPTION. Prepare ground surface, and furnish and place geotextiles for separation, stabilization, and/or reinforcement as shown on the Plans.

630-2.01 MATERIALS. Use materials that conform to the following:

Geotextiles and Sewn Seam Strength	Subsection 729-2.01
Sewing Thread.	Use high strength polypropylene, or polyester. Do not use nylon thread. Use thread of contrasting color to that of the geotextile itself.

630-3.01 CONSTRUCTION.

1. Surface Preparation. Prepare ground surface by removing stumps, brush, boulders, and sharp objects. Fill holes and ruts over 3 inches deep, with material shown on the Plans or as approved by the Engineer.

2. Geotextile Placement. Unroll geotextile directly onto the prepared surface. Stretch geotextile to remove any creases, folds or wrinkles. Do not drag the geotextile through mud or over sharp objects that could damage the geotextile. Do not expose geotextiles to sunlight for longer than 14 days after removal of protective covering. Do not allow geotextiles to get wet prior to installation.

   a. Separation and Stabilization. Lay geotextile for embankment separation and stabilization parallel to roadway centerline. On horizontal curves, place in segment lengths not exceeding those listed in Table 630-1, with butt ends cut to match and sewn or overlapped. On tangents, straighten the geotextile and sew or overlap butt ends. Shingle overlaps in the same direction as fill placement. Prevent overlapped edges from lifting during construction.

   b. Reinforcement. Lay the machine direction of the geotextile for embankment reinforcement perpendicular to the roadway centerline or as shown on the Plans. Join segments by sewing or an approved bonding or attachment process. Shingle overlaps in the same direction as fill placement if seams are not sewn. Prevent overlapped edges from lifting during construction.

TABLE 630-1
GEOTEXTILE PLACEMENT ON CURVES

Degree of Curve	Maximum Segment Length (ft.)
1	125
2	9
3	7
4	6
5	5
6	5

3. Joining. Join adjacent geotextiles for separation or stabilization by overlapping or sewing. Join adjacent geotextiles for reinforcement by sewing or as shown on the Plans.

   a. Sew seams with a Butterfly or J-Seam using a double-thread chain stitch (lock stitch). Bring adjacent sections of geotextile together and fold so that the stitching penetrates

four layers of geotextile for the full seam length. Make the stitching line 1-1/4 inches (±1/4 inch) from the folded edge of the seam and at least 1/2 inch from the free edge of the geotextile. Sew seams so that they face upward and can be easily inspected by the Engineer. Illustrations showing correct stitch formation and seam configurations are provided in Figure 1-2 (page 1-28) of the FHWA publication, *Geosynthetic Design & Construction Guidelines*, FHWA-NHI-07-092, August 2008.

b. Overlap geotextile sections by a minimum of 3 feet at all longitudinal and transverse joints. Place the beginning of each new roll beneath the end of the previous roll to prevent the advancing fill from lifting the geotextile. Shingle in the direction of construction.

4. Material Placing and Spreading. During placing and spreading of material, maintain a minimum depth of 12 inches of cover material; or a minimum depth equal to the separation distance between multiple layers of geotextile as shown on the Plans when this separation distance is less than 12 inches; at all times between the geotextile and the wheels or tracks of the construction equipment. Limit the size and weight of construction equipment to reduce rutting in the initial lift above the geotextile to not greater than 3 inches deep to prevent overstressing the geotextile.

   Spread the material in the direction of the upper overlapped geotextile. Maintain proper overlap and geotextile continuity. If sewn or bonded seams are used, place the cover material and spread in only one direction for the entire length of the geotextile. On weak subgrades limit height of dumped cover material to prevent localized subgrade and/or geotextile failure. Do not drop stones or frozen material larger than 1 foot in diameter directly onto the geotextile from a height of more than 1 foot.

   Compact using a smooth drum roller. Do not allow construction equipment to make sudden stops, starts, or turns on the cover material. Do not allow turning of vehicles on the initial lift of cover material above the geotextile. Fill any ruts over 3 inches deep occurring during construction with material shown on the Plans; do not grade adjacent material into rut; and compact to the specified density.

5. Geotextile Repair. Repair and replace damaged geotextile (torn, punctured, or disturbed at the overlaps or sewn joints). For damage evidenced by visible geotextile damage, subgrade pumping, intrusion, or embankment distortion, remove the backfill around and under the damaged or displaced area, and repair with material matching the damaged material. Make patches overlap or sew patches to the existing geotextile..

   a. Separation and Stabilization. Overlay torn area with geotextile with a minimum 3 foot overlap around the edges of the torn or damaged area or sew and bond according to Subsection 630-3.01.3.a. Ensure the patch remains in place when cover material is placed over the affected area.

   b. Reinforcement. Sew according to Subsection 630-3.01.3.a unless joining by overlap is shown on the Plans. Ensure the patch remains in place when cover material is placed over the affected area.

630-4.01 METHOD OF MEASUREMENT. By multiplying plan neat line width by the measured length in final position parallel to installation centerline along the ground surface. No allowance will be made for overlap, whether at joints or patches.

630-5.01 BASIS OF PAYMENT. Payment will be made at the contract unit price per square yard. Material used to fill ruts and holes will be paid for under separate materials pay items.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
630.0001.0003	Geotextile, Separation, Class 3	SY
630.0002.0001	Geotextile, Stabilization, Class 1	SY
630.0003.____	Geotextile, Reinforcement - Type ____	SY

SECTION 631

GEOTEXTILE FOR SUBSURFACE DRAINAGE AND EROSION CONTROL

631-1.01 DESCRIPTION. Prepare ground surface, and furnish and place geotextiles for subsurface drainage and erosion control, as shown on the Plans.

631-2.01 MATERIALS. Use materials that conform to the following for the class specified in the bid schedule:

Geotextiles and Sewn Seam Strength	Subsection 729-2.01
Sewing Thread.	Use high strength polypropylene, or polyester. Do not use nylon thread. Use thread of contrasting color to that of the geotextile itself.

631-3.01 CONSTRUCTION.

1. Surface Preparation. Prepare ground surface by removing stumps, brush, boulders, and sharp objects. Fill holes and ruts over 3 inches deep, with material shown on the Plans or as approved by the Engineer. Construct smooth and stable trench walls.

2. Geotextile Placement. Unroll geotextile directly onto the prepared surface. Stretch geotextile to remove any creases, folds or wrinkles. Place geotextile in a manner which will ensure intimate contact between the trench wall and the geotextile (i.e., no voids, folds, or wrinkles). The geotextile may be held in place with securing pins at 3-foot spacing along all edges (but not closer than 2 inches from the edge) to prevent movement during construction. Do not expose geotextiles to sunlight for longer than 14 days after removal of protective covering. Do not allow geotextile rolls to get wet prior to installation.

   a. Subsurface Drainage. In trenches, after placing the geotextile and material shown on the Plans, fold the geotextile over the top of the material shown on the Plans to produce a minimum overlap of 12 inches, for trenches greater than 12 inches wide. In trenches less than 12 inches wide, make the overlap equal to the width of the trench. Then cover the geotextile with the subsequent course of material.

   b. Erosion Control. Place and anchor geotextile on the approved surface so it will not be torn or excessively stretched by placement of the overlying materials. Secure the geotextile to the slope but secure it loosely enough so that the geotextile will not tear when riprap or other cover material is placed on the geotextile. The geotextile shall not be keyed at the top of the slope until the riprap or other cover material is in place at the top of the slope. Anchor the terminal ends of the geotextile using key trenches or aprons with a minimum of 24 inches depth into the soil substrate at the crest and toe of slope, or as shown on the Plans. Place geotextile with the machine direction parallel to the direction of water flow (normally parallel to the slope for erosion control runoff and wave action, and parallel to the stream or channel).

3. Joining. Join geotextile by sewing or overlapping.

   a. Sew seams with a Butterfly or J-Seam using a double thread chain stitch (lock stitch). Bring adjacent sections of geotextile together and fold so that the stitching penetrates four layers of geotextile for the full seam length. Make the stitching line 1-1/4 inches (±1/4 inch) from the folded edge of the seam and at least 1/2 inch from the free edge of the geotextile. Sew seams so that they can be easily inspected by the Engineer or representative. Illustrations showing correct stitch formation and seam configurations are provided in Figure 1-2 (page 1-28) of the FHWA publication,

Geosynthetic Design & Construction Guidelines, FHWA-NHI-07-092, August 2008. Conform both factory and field sewn seams to the strength requirements of Table 1 as outlined in the AASHTO M288 for subsurface drainage and erosion control applications.

b. Overlap geotextile sections by a minimum of 3 feet at all longitudinal and transverse joints. Overlap successive geotextile sheets in the direction of flow so that the upstream sheet is placed over the downstream sheet and/or upslope over downslope. In trenches, where overlapped seams are constructed in the longitudinal trench direction, make the overlap equal to the width of the trench.

4. Placement of Cover Material. Following placement of the geotextile on the prepared surface, place cover material of the type shown on the Plans. Place the cover material and armor from the bottom to the top of the slope using methods which minimize tearing and/or excessive stretching of the geotextile. In underwater applications, place the geotextile and the required thickness of cover material in the same day. Maintain proper overlap and geotextile continuity. Do not exceed the allowable drop heights for cover material shown in Table 631-1. Do not allow stones with a weight of more than 100 pounds to roll down the slope on the geotextile. Do not grade the slope in a way that will disturb the cover material or armor stone once it has been placed. Backfill all voids in the riprap or other cover material, which allows the geotextile to be visible, with material shown on the Plans, so that the geotextile is completely covered.

TABLE 631-1
ALLOWABLE DROP HEIGHT FOR GEOTEXTILE

INDIVIDUAL STONE Max. Weight (lbs)	**ALLOWABLE DROP HEIGHT (ft)**	
	UNPROTECTED GEOTEXTILE	PROTECTED GEOTEXTILE*
< 5	3	3
5-250	0	3
> 250	0	0**

* Protected geotextile is defined as having a gravelly covering (cushion layer) at least 6 inches thick.
** If stones greater than 250 pounds must be dropped or if a height of drop greater than 3 feet is required, then perform field trials to determine the minimum cushion thickness and/or maximum height of safe drop without damaging the geotextile.

Maintain a minimum depth of 12 inches of cover material between the geotextile and the wheels or tracks of the construction equipment.

5. Geotextile Repair. Should the geotextile be torn, punctured, or the overlaps or sewn joints disturbed – as evidenced by visible geotextile damage – remove the backfill around the damaged area and repair or replace the damaged area at no additional expense to the State. Make repairs to the damaged area with a patch of the same type of geotextile originally placed. Overlay torn area with geotextile with a minimum 3 foot overlap around the edges of the torn area. Ensure that the patch remains in place when material is placed over the affected area.

631-4.01 METHOD OF MEASUREMENT. By multiplying plan neat line width by the measured length in final position parallel to installation centerline along the ground surface No allowance will be made for geotextile in key trenches or for overlap, whether at joints or patches.

631-5.01 BASIS OF PAYMENT. Payment will be made at the contract unit price per square yard. Material used to fill ruts and holes will be paid for under separate materials pay items at the unit price for the type of material used.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
631.0001.0002	Geotextile, Drainage, Class 2	SY
631.0002.0001	Geotextile, Erosion Control, Class 1	SY

SECTION 632

PAVING FABRIC

632-1.01 DESCRIPTION. Furnish and install geotextile paving fabric where shown on the Plans.

632-2.01 MATERIALS. Use materials that conform to the following:

Paving Fabric	Subsection 729-2.03
Emulsified Asphalt	Subsection 702-2.03

632-3.01 CONSTRUCTION.

1. Surface Preparation. Prepare the surface on which the fabric is to be placed as follows:

   a. Remove excess asphalt material, loose aggregate, and other foreign materials from the surface.

   b. Fill all potholes and cracks wider than 1/4 inch with emulsified asphalt (CSS-1) sand slurry.

2. Application of Sealant. Apply asphalt sealant (emulsified asphalt, tack coal) by distributor meeting all requirements set forth under Subsection 402-3.02. Apply asphalt sealant uniformly at 0.20 to 0.30 gallons per square yard and at a temperature shown in Table 702-1 or as recommended by the Paving Fabric manufacturer. Do not apply asphalt material on a wet surface or when the ambient air temperature is below 45 °F or when other conditions would prevent proper application.

3. Fabric Laydown Equipment. Use approved mechanical laydown equipment to place fabric.

4. Fabric Placement. Place fabric directly on top of the asphalt sealant (emulsified asphalt, tack coat) before the sealant has cooled and lost its tackiness. Lay fabric in full rolls without wrinkles and/or folds. Place the fabric per the manufacturer's recommendations. Overlap geotextile joints to ensure full closure of the joint, but do not exceed 6 inches of overlap. Overlap transverse joints in the direction of paving. Apply 0.20 gallons per square yard of additional asphalt sealant beneath all fabric joints. Remove and replace damaged geotextiles. Removal and replacement of damaged geotextiles is subsidiary to Section 632 Pay Items.

5. Bituminous Surface Course Overlay. Place the bituminous surface course closely following the fabric laydown to avoid exposure of uncovered fabric overnight or to traffic or inclement weather. Do not allow the temperature of the hot-mix asphalt to exceed manufacturer's recommendations. If asphalt sealant bleeds through the fabric before the placement of the overlay, apply sand or bituminous surface course evenly over the affected area to prevent fabric pick-up by construction equipment. Prevent paver or other construction equipment from turning and/or pivoting on the fabric.

632-4.01 METHOD OF MEASUREMENT. By multiplying plan neat line width by the measured length in final position parallel to installation centerline along the ground surface. No allowance will be made for overlap, whether at joints or patches.

632-5.01 BASIS OF PAYMENT. Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
632.0001.____	Paving Fabric	SY

SECTION 633

SILT FENCE

633-1.01 DESCRIPTION. Furnish, install, maintain, and remove temporary silt fence as shown on the Plans or as directed.

633-2.01 MATERIALS. Use materials that conform to the following:

Geotextile	Subsection 729-2.01
Silt Fence	Subsection 729-2.04
Posts	Wood 1.5-inch x 1.5-inch x 36-inch min., steel, or approved synthetic material.
Prefabricated Silt Fence	Meet the Plans and Section 633 requirements.
Attachment Devices	Staples; wire; self-locking nylon, plastic, wire ties; or other approved means to attach fabric to posts.
Support Mesh between Posts	14-gage welded wire fencing, metal chain-link fabric, or geosynthetic mesh with equivalent strength. Use maximum mesh spacing of 6 inches. Use height shown on the Plans, or specified in the Bid Schedule.

633-3.01 CONSTRUCTION. Install silt fence according to Plans. Use Trenchless Detail when installing silt fence over permanently frozen ground. Drill holes for support posts, if required.

When joining to another roll, place both end posts together and wrap them with silt fence by turning them one full rotation. Drive the wrapped posts.

633-3.02 MAINTENANCE. Maintain the integrity of the fence to contain sediment in runoff until final stabilization.

633-3.03 REMOVAL. After disturbed area has been accepted as permanently stabilized or when sediment protection is no longer needed, remove silt fence.

633-4.01 METHOD OF MEASUREMENT. See Section 109. Measure silt fence by the length of fence installed. No allowance will be made for overlap, whether at joints or patches.

633-5.01 BASIS OF PAYMENT. The contract price includes installation, maintenance, removal and disposal of the silt fence.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
633.0001.____	Silt Fence	LF
633.0002.____	Support Mesh Reinforced Silt Fence	LF

SECTION 634

GEOGRID FOR EMBANKMENT AND ROADWAY

STABILIZATION AND REINFORCEMENT

634-1.01 DESCRIPTION. Furnish and install geogrid material as shown on the Plans.

634-2.01 MATERIALS. Use materials that conform to the following:

Geogrid	Subsection 729-2.04

634-3.01 CONSTRUCTION

1. Surface Preparation.

   a. Soft Ground (CBR ≤3). Prepare surface by removal of stumps, brush, boulders, and sharp objects. Fill holes and ruts over 3 inches deep, with material shown on the Plans or as approved by the Engineer.

   b. Firm Ground (CBR >3). Compact and finish subgrade or subbase prior to placement of the geogrid.

2. Geogrid Placement. Unroll geogrid directly onto the prepared ground surface in the direction of advancing construction, parallel to the centerline of the roadway or according to the Plans. Do not drag the geogrid across the subgrade. Install the geogrid in the longest continuous practical length, free from folds, creases or wrinkles. Hold the geogrid in place with pins, staples, sandbags or piles of granular material. Do not expose geogrids to sunlight for longer than 14 days after removal of protective covering.

   a. Soft Ground (CBR ≤3). Overlap geogrid panels a minimum of 24 inches at all joints with the upper geogrid in the direction that fill will be placed. Tie panels together securely with cable ties or hog rings at 20 foot intervals, or according to the manufacturer's recommendations.

   b. Firm Ground (CBR >3). Overlap geogrid panels a minimum of 12 inches at all joints in the direction that fill will be placed. Tie panels together securely with cable ties or hog rings at 20 foot intervals and hand-tension geogrid and stake to the ground at the edges, overlaps, and in the center of each roll, at 30 foot intervals or as shown on the Plans**.**

   Place the beginning of each new roll beneath the end of the previous roll to prevent the advancing fill from lifting the geogrid. Stagger end overlaps at least 10 feet from other end overlaps in adjacent rolls.

3. Placement of Cover Material. Do not operate equipment directly on the unprotected geogrid. Spread fill material in the direction of the fabric overlap. Compact using a smooth drum roller. Do not allow construction equipment to make sudden stops, starts, or turns on the cover material.

   a. Very Soft Ground (CBR < 1). End-dump material onto previously placed material and spread over the geogrid with a low ground pressure dozer to the depth permitted. Maintain a minimum depth of 12 inches of cover material at all times between the geogrid and the wheels or tracks of the construction equipment unless otherwise shown on the Plans. Do not dump material directly onto the geogrid. To prevent a mud wave, end-dump fill along the edges of the geogrid to form toe berms or access roads that extend one to two panel widths ahead of the remainder of the embankment fill placement. After constructing the two berms, spread fill in the area between the toe berms by placing material parallel to the alignment and symmetrical from the toe berms inward toward the

center to maintain a U-shaped leading edge (i.e., concave outward) to contain the mud wave. Limit height of dumped piles above the geogrid to avoid local bearing failure. Traffic on the first lift should be parallel to the embankment alignment. Do not allow construction equipment to turn on the first lift. Compact first lift by tracking in place with dozers or end-loaders. Compact with specified compaction equipment once embankment is at least 2 feet above the geogrid.

b. Soft Ground (1 ≤ CBR ≤ 3). End-dump material onto previously placed material and spread over the geogrid with a low ground pressure dozer to the depth permitted. Maintain a minimum depth of 6 inches of cover material at all times between the geogrid and the wheels or tracks of the construction equipment unless otherwise shown on the Plans. Place the end-dumped material along the roadway centerline and spread it outward to the roadway edges to prevent the development of wrinkles or movement of the geogrid during construction. Fill in any ruts that form during construction with material shown on the Plans. Do not cut down the fill adjacent to the ruts.

c. Firm Ground (CBR > 3). Maintain a minimum depth of 6 inches of cover material at all times between the geogrid and the wheels or tracks of the construction equipment.

4. Geogrid Repair. Should the geogrid be torn, punctured, or the overlaps disturbed – as evidenced by visible geogrid damage – remove the backfill around the damaged area and repair or replace the damaged area at no additional expense to the State. Make repairs to the damaged area with a patch of the same type of geogrid originally placed. Overlay torn area with geogrid with a minimum 3 foot overlap around the edges of the torn area and secure as recommended by the geogrid manufacturer.

634-4.01 METHOD OF MEASUREMENT. By multiplying plan neat line width by the measured length in final position parallel to installation centerline along the ground surface. No allowance will be made for overlap, whether at joints or patches.

634-5.01 BASIS OF PAYMENT. Payment will be made at the contract unit price per square yard. Material used to fill ruts and holes will be paid for at the unit price for the type of material used.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
634.0001.____	Geogrid, Stabilization, Class ___	SY
634.0002.____	Geogrid, Reinforcement, Class ___	SY

SECTION 635
INSULATION BOARD

635-1.01 DESCRIPTION. Furnish and install polystyrene insulation board where shown on the Plans.

635-2.01 MATERIALS. Use materials that conform to the following:

1. Insulation Board. AASHTO M 230, Type VI, except that extrusion is not required, and the maximum water absorption is 0.3 percent by volume, as determined by ASTM C272. Insulation board must meet or exceed the minimum thickness called out in the plans, and have a 20-year warranted thermal resistance (R-Value) @ 75°F of 4.5 per inch of thickness as determined by ASTM C177 or ASTM C518. The required thickness is shown on the Plans and is actual thickness, not nominal thickness.

2. Sand Blanket. Subsection 703-2.12, except meet the following gradation as tested by ATM 304.

TABLE 635-1
SAND BLANKET MATERIAL GRADATION

SIEVE	PERCENT PASSING BY WEIGHT
2 in.	100
No. 4	15-65
No. 200	0-6

635-3.01 CONSTRUCTION REQUIREMENTS. Prior to placing the insulation board, blade, shape, and compact the area per Section 203. Place a sand blanket leveling course at least four inches thick. Finish the leveling course surface so it does not vary more than 0.10 foot when tested using a ten foot straightedge.

Set each board accurately to the line and grade established and anchor firmly in place by driving a minimum of 2 wood dowels per panel. Place insulation to the required thickness, using a minimum of two layers. Stagger all joints between layers.

Cover the insulation board with twelve inches of sand blanket material prior to placing subsequent lifts. Use approved spreading and compacting equipment.

635-4.01 METHOD OF MEASUREMENT. See Section 109.

Sand blanket material will be paid for under 203.0006._____ Borrow.

635-5.01 BASIS OF PAYMENT. Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
635.0001.____	Insulation Board	MBM
635.0002.____	Insulation Board	SF

SECTION 636
GABIONS

636-1.01 DESCRIPTION. Construct wire gabion bank protection at locations shown on the Plans.

636-2.01 MATERIALS. Use materials that conform to the following:

Gabions	Subsection 712-2.13
Gabion Backfill	Subsection 703-2.11

636-3.01 CONSTRUCTION REQUIREMENTS. Construct gabions to the lines and grades as staked. Meet the details shown on the Plans.

Assemble gabion baskets per the manufacturer's recommended procedures. Align each row or tier of gabion baskets before filling the baskets. Install tie wires in both directions horizontally so that layers between ties are not more than 14 inches thick. Space tie wires not more than 14 inches apart horizontally within any gabion basket cell. Loop tie wires around at least 3 meshes of the gabion basket and tie or twist securely. Fill each gabion basket so the lid, when secure, will bear on the gabion filler. Securely fasten gabion baskets to all adjacent baskets, using sufficient wire to provide the same strength as the body of the mesh.

Meet Section 204 for all excavation and backfill for gabions.

636-4.01 METHOD OF MEASUREMENT. By the calculated neat line volume of gabion baskets in place using the manufacturer's specified dimensions.

636-5.01 BASIS OF PAYMENT. Excavation for gabions will be paid for under Section 204.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
636.0001.____	Gabion	CY

SECTION 639
DRIVEWAYS

639-1.01 DESCRIPTION. Construct residential or commercial driveways at the locations shown on the Plans.

639-2.01 MATERIALS. Use materials that conform to the standards for the main roadway.

639-3.01 CONSTRUCTION. Construct driveways to the dimensions shown on the Plans.

639-4.01 METHOD OF MEASUREMENT. By the number of driveways constructed as shown on the Plans or as directed.

639-5.01 BASIS OF PAYMENT. Excavation required beyond the limits of the adjacent mainline is subsidiary.

Materials required to construct driveways will be paid for separately under the respective items listed in the bid schedule.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
639.0001.____	Driveway	EACH
639.0002.____	Driveway, Residential	EACH
639.0003.____	Driveway, Commercial	EACH

SECTION 640
MOBILIZATION AND DEMOBILIZATION

640-1.01 DESCRIPTION. Perform work and operations necessary to

1. move personnel, equipment, supplies, and incidentals to the project site;

2. establish offices, buildings, and other facilities, except as provided under Section 644;

3. perform other work and operations and pay costs incurred, before beginning construction;

4. complete similar demobilization activities; and

5. furnish required submittals such as as-builts, certificates, payrolls, civil rights reports, and equipment warranties.

6. comply with the Alaska Department of Labor and Workforce Development (DOLWD) requirements for Worker Meals and Lodging, or Per Diem; as described in the Laborers' and Mechanics' Minimum Rates of Pay (Pamphlet 600), current issue. On Federal-aid projects, PL 109-59, 119 STAT. 1233, Sec. 1409(c) also applies.

7. ensure subcontractors comply with the Federal and State DOLWD requirements.

Ensure facilities meet the Alaska Administrative Code 8 AAC 61.1010 and 8 AAC 61.1040 Occupational Safety and Health Standards, 18 AAC 31 Alaska Food Code, and U. S. Code of Federal Regulations 29 CFR Section 1910.142 Temporary Labor Camps.

Do not consider the cost of Meals and Lodging, or Per Diem in setting wages for the worker or in meeting wage requirements under AS 23.10.065 or AS 36.05.

640-2.01 MATERIALS. None.

640-3.01 CONSTRUCTION REQUIREMENTS. None.

640-4.01 METHOD OF MEASUREMENT.

Numbered items 1. through 4. apply only to items 640.0001.__ and 640.0002.__:

1. When you earn 4 percent of the original contract amount from other bid items: 40 percent of the amount bid for mobilization and demobilization, or 4 percent of the original contract amount, whichever is less, will be paid.

2. When you earn a total of 8 percent of the original contract amount from other bid items: An additional 40 percent of the amount bid for mobilization and demobilization, or an additional 4 percent of the original contract amount, whichever is less, will be paid.

3. The remaining balance of the amount bid for Mobilization and Demobilization will be paid after all submittals required under the Contract are received and approved.

4. Progress payments for Worker Meals and Lodging, or Per Diem will be computed as equivalent to the percentage, rounded to the nearest whole percent, of the original contract amount earned.

Under Item 640.0005, the pay unit is calculated by calendar day.

640-5.01 BASIS OF PAYMENT. Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
640.0001.____	Mobilization and Demobilization	LS
640.0004.____	Worker Meals and Lodging, or Per Diem	LS
640.0005.____	Worker Meals and Lodging, or Per Diem	CDAY

SECTION 641
EROSION, SEDIMENT, AND POLLUTION CONTROL

641-1.01 DESCRIPTION. Provide project administration and Work relating to control of erosion, sedimentation, and discharge of pollutants, according to this section and applicable local, state, and federal requirements, including the APDES Construction General Permit. The state APDES program is administered by DEC. Section 301(a) of the Clean Water Act (CWA) and 18 AAC 83.015 provide that the discharge of pollutants to water of the U.S. is unlawful except as allowed by the CGP.

641-1.02 DEFINITION. These definitions apply only to Section 641.

ACTIVE TREATMENT SYSTEM (ATS) OPERATOR. The Contractor's qualified representative who is responsible for maintaining and operating an active treatment system (as defined in the CGP) for stormwater runoff.

ALASKA CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (AK-CESCL). A person who has completed training, testing, and other requirements of, and is currently certified as, an AK-CESCL from an AK-CESCL Training Program (a program developed under a Memorandum of Understanding between the Department and others). The Department recognizes AK-CESCLs as "qualified personnel" required by the CGP. An AK-CESCL must be recertified every three years. (See Qualified Person.)

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION (DEC). The state agency authorized by EPA to administer the Clean Water Act's National Pollutant Discharge Elimination System.

ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM (APDES). A system administered by DEC that issues and tracks permits for stormwater discharges.

BEST MANAGEMENT PRACTICES (BMPS). Temporary or permanent structural and non-structural devices, schedules of activities, prohibition of practices, maintenance procedures, and other management practices to prevent or minimize the discharge of pollutants to waters of the United States. BMPs also include, but are not limited to, treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from material storage.

CLEAN WATER ACT (CWA). Federal Water Pollution Control Amendments of 1972, as amended (33 U.S.C. 1251 et seq.).

CONSTRUCTION ACTIVITY. Physical activity by the Contractor, Subcontractor or utility company; that may result in erosion, sedimentation, or a discharge of pollutants into stormwater. Construction Activity includes soil disturbing activities (e.g. clearing, grubbing, grading, excavating); and establishment of construction materials or equipment storage or maintenance areas (e.g. material piles, borrow area, concrete truck chute washdown, fueling); and industrial activities that may discharge stormwater and are directly related to the construction process (e.g. concrete or asphalt batch plants).

CONSTRUCTION GENERAL PERMIT (CGP). The permit authorizing stormwater discharges from Construction Activities, issued and enforced by Alaska DEC. It authorizes stormwater discharges provided permit conditions and water quality standards are met.

CORPS OF ENGINEERS PERMIT (COE PERMIT). A U.S. Army Corps of Engineers Permit for construction in waters of the US. Such permit may be issued under Section 10 of the Rivers and Harbors Act of 1899, or Section 404 of the Clean Water Act.

ELECTRONIC NOTICE OF INTENT (ENOI). The electronic Notice of Intent submitted to DEC, to obtain coverage under the CGP.

ELECTRONIC NOTICE OF TERMINATION (ENOT). The electronic Notice of Termination submitted to DEC, to end coverage under the CGP.

ENVIRONMENTAL PROTECTION AGENCY (EPA). A federal agency charged to protect human health and the environment.

ERODIBLE STOCKPILE. Any material storage area or stockpile consisting of mineral aggregate, organic material, or a combination thereof, with greater than 5 percent passing the #200 sieve, and any material storage where wind or water transports sediments or other pollutants from the stockpile. Erodible Stockpile also includes any material storage area or stockpile, where the Engineer determines there is potential for wind or water transport, of sediments or other pollutants away from the stockpile.

EROSION AND SEDIMENT CONTROL PLAN (ESCP). The Department's project specific document that illustrates measures to control erosion and sediment on the project. The ESCP provides bidders with the basis for cost estimating and guidance for developing an acceptable Storm Water Pollutant Prevention Plan (SWPPP).

FINAL STABILIZATION. Is defined in this section as it is defined in the CGP, Appendix C.

HAZARDOUS MATERIAL CONTROL PLAN (HMCP). The Contractor's detailed project specific plan for prevention of pollution from storage, use, transfer, containment, cleanup, and disposal of hazardous material (including, but are not limited to, petroleum products related to construction activities and equipment). The HMCP is included as an appendix to the SWPPP.

INSPECTION. An inspection required by the CGP or the SWPPP, usually performed together by the Contractor's SWPPP Manager and Department's Stormwater Inspector.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) PERMIT. A DEC stormwater discharge permit issued to certain local governments and other public bodies, for operation of stormwater conveyances and drainage systems. See CGP for further definition.

MULTI-SECTOR GENERAL PERMIT (MSGP). The Alaska Pollutant Discharge Elimination System General Permit for stormwater discharges associated with industrial activity.

OPERATOR(S). The party or co-parties associated with a regulated activity that has responsibility to obtain permit coverage under the CGP. "Operator" for the purpose of the CGP and in the context of stormwater associated with construction activity, means any party associated with a construction project that meets either of the following two criteria:

1. The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or

2. The party has day to day operational control of those activities at a project which are necessary to ensure compliance with a SWPPP for the site or other permit conditions (e.g. they are authorized to direct workers at a site to carry out activities required by the SWPPP or comply with other permit conditions).

POLLUTANT. Any substance or item meeting the definition of pollutant contained in 40 CFR § 122.2. A partial listing from this definition includes: dredged spoil, solid waste, sediment, sewage, garbage, sewage sludge, chemical wastes, biological materials, wrecked or discarded equipment, rock, sand, cellar dirt and industrial or municipal waste.

PROJECT ZONE. The physical area provided by the Department for Construction. The Project Zone includes the area of highway or facility under construction, project staging and equipment

areas, and material and disposal sites; when those areas, routes and sites, are provided by the Contract.

Material sites, material processing sites, disposal sites, haul routes, staging and equipment storage areas; that are furnished by the Contractor or a commercial operator, are not included in the Project Zone.

QUALIFIED PERSON. A person knowledgeable in the principles and practice of erosion and sediment controls. A Qualified Person must be certified either under the Alaska Certified Erosion and Sediment Control Lead (AK-CESCL) training program. One of the following training and certification programs may substitute for AK-CESCL certification: CPESC, CESSWI, CPSWQ, or CISEC (CGP, Appendix C).

RECORDS. Any record, report, information, document or photograph required to be created or maintained pursuant to the requirements of the CGP, the CGP stormwater requirements of the Clean Water Act; and applicable local, state, and federal laws and regulations regarding document preservation.

SPILL PREVENTION, CONTROL AND COUNTERMEASURE PLAN (SPCC PLAN). The Contractor's detailed plan for petroleum spill prevention and control measures that meet the requirements of 40 CFR 112.

SPILL RESPONSE FIELD REPRESENTATIVE. The Contractor's representative with authority and responsibility for managing, implementing, and executing the HMCP and SPCC Plan.

STORM EVENT. A rainfall event that produces more than 0.5 inch of precipitation in 24 hours and that is separated from the previous storm event by at least 3 days of less than 0.1 inch of rain per day.

STORM WATER POLLUTION PREVENTION PLAN (SWPPP). The Contractor's detailed project specific plan to minimize erosion and contain sediment within the Project Zone, and to prevent discharge of pollutants that exceed applicable water quality standards. The SWPPP includes, but is not limited to, amendments, records of activities, inspection schedules and reports, qualifications of key personnel, and all other documentation, required by the CGP and this specification, and other applicable local, state, and federal laws and regulations.

STORM WATER POLLUTION PREVENTION PLAN TWO (SWPPP2). The Contractor's detailed project specific plan to comply with CGP or MSGP requirements, for Contractor construction-related activities outside the Project Zone.

SUBCONTRACTOR SPILL RESPONSE COORDINATOR. The subcontractor's representative with authority and responsibility for coordinating the subcontractor's activities in compliance with the HMCP and SPCC Plan.

SUBCONTRACTOR SWPPP COORDINATOR. The subcontractor's representative with authority to direct the subcontractor's work, and who is responsible for coordination with the Superintendent and SWPPP Manager, and for the subcontractor's compliance with the SWPPP.

SUPERINTENDENT. The Contractor's duly authorized representative in responsible charge of the work. The Superintendent has responsibility and authority for the overall operation of the Project and for Contractor furnished sites and facilities directly related to the Project.

SWPPP AMENDMENT. A revision or document that adds to, deletes from, or modifies the SWPPP.

SWPPP MANAGER. The Contractor's qualified representative who conducts Inspections, updates SWPPP records, and has authority to suspend work and to implement corrective actions required for CGP compliance.

SWPPP PREPARER. The Contractor's qualified representative who is responsible for developing the initial SWPPP.

TEMPORARY STABILIZATION. Protecting soils from erosion and sediment loss by rainfall, snow melt, runoff, or wind with a temporary vegetative and/or non-vegetative protection cover. Temporary stabilization may include a combination of seeding, geotextiles, mulches, surface tackifiers, rolled erosion control products, low erodible gravel or paving, or the mentioned BMP's combined together with trackwalking.

UTILITY SPILL RESPONSE COORDINATOR. The Utility's representative with authority and responsibility for coordinating the Utility's activities in compliance with the HMCP and SPCC Plan.

UTILITY SWPPP COORDINATOR. The Utility's representative with authority to direct the Utility's work, and who is responsible for coordination with the Superintendent and SWPPP Manager, and for the Utility's compliance with the SWPPP.

641-1.03 PLAN AND PERMIT SUBMITTALS.

For plans listed in Subsection 108-1.03.5 (SWPPP, HMCP, and SPCC), use the Contractor submission and Department review deadlines identified in Subsection 641-1.03.

Partial and incomplete submittals will not be accepted for review. Any submittal that is re-submitted or revised after submission, but before the review is completed, will restart the submittal review timeline. No additional Contract time or additional compensation will be allowed due to delays caused by partial or incomplete submittals, or required re-submittals.

1. Storm Water Pollution Prevention Plan. Submit an electronic copy and three hard copies of the SWPPP to the Engineer for approval. Deliver these documents to the Engineer at least 21 days before beginning Construction Activity. Organize and bind the SWPPP and related documents for submittal according to the requirements of Subsection 641-2.01.2.

   The Department will review the SWPPP submittals within 14 days after they are received. Submittals will be returned to the Contractor, and marked as either "rejected" with reasons listed or as "approved" by the Department. When the submittal is rejected, the Contractor must revise and resubmit the SWPPP. The 14 day review period will restart when the contractor submits an electronic copy and three hard copies of the revised SWPPP to the Engineer for approval.

   After the SWPPP is approved by the Department, the Contractor must sign and certify the approved SWPPP using Form 25D-111. See Subsection 641-1.03.4 for further SWPPP submittal requirements.

2. Hazardous Material Control Plan. The HMCP Template can be found at the following webpage: http://www.dot.state.ak.us/stwddes/dcsconst/pop_constforms.shtml. Submit an electronic copy and three hard copies of the HMCP, as an appendix to the SWPPP, to the Engineer for approval. The HMCP submittal and review timeline, and signature requirements are the same as the SWPPP.

3. Spill Prevention, Control and Countermeasure Plan. When a SPCC Plan is required under Subsection 641-2.03, submit an electronic copy and three signed hard copies of the SPCC Plan to the Engineer. Deliver these documents to the Engineer at least 21 days before beginning Construction Activity. The Department reserves the right to review the SPCC Plan and require modifications.

4. CGP Coverage. The Contractor is responsible for permitting of Contractor and subcontractor Construction Activities related to the Project. Do not use the SWPPP for Construction

Activities outside the Project Zone where the Department is not an operator. Use a SWPPP2 for Construction Activities outside the Project Zone.

After Department approval of the SWPPP and prior to beginning Construction Activity, submit an eNOI with the required fee to DEC for coverage under the Construction General Permit (CGP). Submit a copy of the signed eNOI and DEC's written acknowledgement (by letter or other document), to the Engineer as soon as practicable and no later than three days after filing eNOI or receiving a written response.

Do not begin Construction Activity until the conditions listed in Subsection 641-3.01.1 are completed.

The Department will submit an eNOI to DEC for Construction Activities inside the Project Zone. The Engineer will provide the Contractor with a copy of the Department's eNOI and DEC's written acknowledgment (by letter or other document), for inclusion in the SWPPP.

Before Construction Activities occur, transmit to the Engineer an electronic copy of the approved and certified SWPPP, with signed Delegations of Signature Authorities on Forms 25D-107 and 25D-108, SWPPP Certifications on Forms 25D-111 and 25D-109, both permittee's signed eNOIs and DEC's written acknowledgement.

5. Ending CGP Coverage. Submit an eNOT to DEC within 30 days after the Engineer has determined the conditions listed in Subsection 641-3.01.6 have been met. Submit a copy of the signed eNOT and DEC's acknowledgement letter to the Department within three days of filing the eNOT or receiving a written response.

6. DEC SWPPP Review. When CGP Part 2.1.3, requires DEC SWPPP review:

   a. Transmit a copy of the Department-approved SWPPP to DEC using delivery receipt confirmation;

   b. Transmit a copy of the delivery receipt confirmation to the Engineer within seven (7) days of receiving the confirmation; and

   c. Retain a copy of delivery receipt confirmation in the SWPPP.

7. Local Government SWPPP Review. When local government or the CGP Part 2.1.4, requires local government review:

   a. Transmit a copy of the Department-approved SWPPP and other information as required to local government, with the required fee. Use delivery receipt confirmation;

   b. Transmit a copy of the delivery receipt confirmation to the Engineer within seven days of receiving the confirmation;

   c. Transmit a copy of any comments by the local government to the Engineer within seven days of receipt;

   d. Amend the SWPPP as necessary to address local government comments and transmit SWPPP Amendments to the Engineer within seven days of receipt of the comments;

   e. Include a copy of local government SWPPP review letter in the SWPPP; and

   f. File a notification with local government that the project is ending.

8. Modifying Contractor's eNOI. When required by the CGP Part 2.7, modify your eNOI to update or correct information within 30 calendar days of the change. Reasons for modification include a change in start or end dates, change in Owner/Operator address and

contact information, change in site information, any changes in number of acres to be disturbed, change in decision to use or not use treatment chemicals, or change in location of SWPPP records.

The Contractor must submit an eNOT and then submit a new eNOI instead of an eNOI modification when the operator has changed.

641-1.04 PERSONNEL QUALIFICATIONS. Provide documentation in the SWPPP that the individuals serving in these positions meet the personnel qualifications.

1. The SWPPP Preparer.

   a. Total disturbed acreage 20 acres or less, must meet at least one of the following qualifications:

      (1) Current certification as a Certified Professional in Erosion and Sediment Control (CPESC);

      (2) Current certification as AK-CESCL, and at least two years' experience in erosion and sediment control, as a SWPPP Manager or SWPPP writer, or equivalent. Provide documentation including project names, project timelines, and work responsibilities demonstrating the experience requirement; or

      (3) Professional Engineer registered in the State of Alaska with current certification as AK-CESCL.

   b. Total disturbed acreage greater than 20 acres, meet 641-1.04.1.a. above, and complete a SWPPP Preparation course.

2. The Superintendent must meet the following qualifications:

   a. Current certification as AK-CESCL; and

   b. Duly authorized representative, as defined in the CGP, Appendix A, Part 1.12.3.

3. The SWPPP Manager must have current certification as AK-CESCL. The SWPPP Manager must meet the experience, and authority requirements identified in the CGP for the Stormwater Lead and Stormwater Inspector positions.

4. The Active Treatment System (ATS) operator must have current certification as AK-CESCL, and be knowledgeable in the principles and practices of treatment systems in general, and the operation of the project-specific ATS. The ATS operator must have at least three months field experience with ATS, or completion of an ATS manufacturer's training course, or completion of system operator certification course.

5. The Department accepts people having any of the following certificates as equivalent to AK-CESCL, if the certificates are current according to the sponsoring organization's policies:

   a. CPESC, Certified Professional in Erosion and Sediment Control; or

   b. CISEC, Certified Inspector in Sediment and Erosion Control.

641-1.05 SIGNATURE/CERTIFICATION REQUIREMENTS AND DELEGATIONS.

1. <u>eNOI and eNOT.</u> The eNOI and eNOT must be signed and certified by a responsible corporate officer according to CGP Appendix A, Part 1.12. Signature and certification authority for the eNOI and eNOT cannot be delegated.

2. Delegation of Signature Authority for Other SWPPP Documents and Reports. Use Form 25D-108 to delegate signature authority and certification authority to the Superintendent position, according to CGP Appendix A, Part 1.12.3, for the SWPPP, Inspection Reports and other reports required by the CGP. The Superintendent position is responsible for signing and certifying the SWPPP, Inspection Reports, and other reports required by the CGP, except the eNOI and eNOT.

   The Engineer will provide the Department's delegation on Form 25D-107, which the Contractor must include in the SWPPP.

3. Subcontractor Certification. Subcontractors must certify on Form 25D-105, that they have read and will abide by the CGP and the conditions of the project SWPPP.

4. Signatures and Initials. Handwrite signatures or initials on CGP documents and SWPPP forms, wherever a signature or initial is required.

641-1.06 RESPONSIBILITY FOR STORM WATER PERMIT COVERAGE.

1. The Department and the Contractor are jointly responsible for permitting and permit compliance within the Project Zone.

2. The Contractor is responsible for permitting and permit compliance outside the Project Zone. The Contractor has sole responsibility for compliance with DEC, COE and other applicable federal, state, and local requirements, and for securing all necessary clearances, rights, and permits. Subsection 107-1.02 describes the requirement to obtain permits, and to provide permit documents to the Engineer.

3. An entity that owns or operates, a commercial plant (as defined in Subsection 108-1.01.4) or material source or disposal site outside the Project Zone, is responsible for permitting and permit compliance. The Contractor has sole responsibility to verify that the entity has appropriate permit coverage. Subsection 107-1.02 describes the requirement to obtain permits, and to provide permit documents to the Engineer.

4. The Department is not responsible for permitting or permit compliance, and is not liable for fines resulting from noncompliance with permit conditions:

   a. For areas outside the Project Zone;
   b. For Construction Activity and Support Activities outside the Project Zone; and
   c. For commercial plants, commercial material sources, and commercial disposal sites.

641-1.07 UTILITY. (RESERVED FOR REGIONS)

641-2.01 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) REQUIREMENTS.

1. SWPPP Preparer and Pre-Construction Site Visit.

   Use a SWPPP Preparer to develop the SWPPP and associated documents, according to the requirements of the CGP and COE permit. The SWPPP Preparer must put their name, qualifications (including the expiration date of any certifications), title and company name in the SWPPP.

   The SWPPP Preparer must conduct a pre-construction inspection at the Project site before construction activity begins. If the SWPPP Preparer is not a Contractor employee, the SWPPP Preparer must visit the site accompanied by the Contractor. Give the Department at least seven days advance notice of the site visit, so that the Department may participate.

   During the pre-construction inspection, the SWPPP Preparer must identify, or if a draft of the SWPPP has already been prepared verify that the SWPPP fully addresses and describes:

a. Opportunities to phase construction activities;

b. Appropriate BMPs and their sequencing; and

c. Sediment controls that must be installed prior to beginning Construction Activities.

Document the SWPPP Preparer's pre-construction inspection in the SWPPP on Form 25D-106, SWPPP Pre-Construction Site Visit, including the names of attendees and the date.

2. Developing the SWPPP.

Use the Department's ESCP, Environmental commitments, and other Contract documents as a starting point for developing the SWPPP. The approved SWPPP replaces the ESCP.

Develop the SWPPP with sections and appendices, according to the current DOT&PF SWPPP template. Include information required by the Contract and described in the CGP Part 5.0.

a. Obtain the following forms after they have been completed by the Department and include them in the SWPPP:

(1) SWPPP Delegation of Signature Authority – DOT&PF (25D-107)

(2) SWPPP Certification for DOT&PF (25D-109)

(3) SWPPP Delayed Action Item Report (25D-113), if needed

b. Use the following Department forms for recording information in the SWPPP:

(1) SWPPP Amendment Log (25D-114)

(2) SWPPP Certification for Contractor (25D-111)

(3) SWPPP Construction Site Inspection Report (25D-100)

(4) SWPPP Corrective Action Log (25D-112)

(5) SWPPP Daily Record of Rainfall (25D-115)

(6) SWPPP Delegation of Signature Authority – Contractor (25D-108)

(7) SWPPP Grading and Stabilization Activities Log (25D-110)

(8) SWPPP Pre-Construction Site Visit (25D-106)

(9) SWPPP Project Staff Tracking (25D-127)

(10) SWPPP Subcontractor Certification (25D-105)

(11) SWPPP Training Log (25D-125)

(12) SWPPP Noncompliance (25D-143)

SWPPP Template, forms, and instructions are available online at: http://www.dot.state.ak.us/stwddes/dcsconst/pop_constforms.shtml

Compile the SWPPP in three ring binders with tabbed and labeled dividers for each section and appendix.

3. SWPPP Considerations and Contents.

a. The SWPPP must provide erosion and sediment control measures for all Construction Activity within the Project Zone. Construction activity outside the Project Zone must have permit coverage, using a separate SWPPP2, and separate Contractor Inspections.

b. The SWPPP must consider the activities of the Contractor and all subcontractors and utility companies performing work in the Project Zone. The SWPPP must describe the roles and responsibilities of the Contractor, subcontractors, utility companies, and the Department with regard to implementation of the SWPPP. The SWPPP must identify all operators for the Project, including utility companies performing Construction Activity, and identify the areas:

(1) Over which each operator has operational control; and

(2) Where the Department and Contractor are co-operators.

c. For work outside the Project Zone the SWPPP must identify the entity that has stormwater permit coverage, the operator, and the areas that are:

(1) Dedicated to the Project and where the Department is not an operator; and

(2) Not dedicated to the project, but used for the project.

d. Account for the Contractor's construction methods and phasing. Identify the amount of mean annual precipitation.

e. Comply with the CGP Part 1.4.3 Authorized Non-Storm Water Discharges. List locations where authorized non-stormwater will be used, including the types of water that will be used on-site.

f. Include the Department's Antidegradation Analysis in the SWPPP if stormwater from the Project Zone discharges into receiving water that is considered a high quality water and that constitutes an outstanding national resource, according to CGP Part 2.1.6.

g. Where the project intersects a Public Water System (PWS), the Engineer will notify the PWS contact for the Department and Contractor according to the CGP Part 4.10. Contractor Amend a copy of the communications in Appendix Q.

h. There are special requirements in the CGP Part 3.2, for stormwater discharges into an impaired water body, and they may include monitoring of stormwater discharges. For Projects meeting the permit criteria, the Contractor shall implement a monitoring plan approved by the Department for the stormwater within the Project Zone, and shall provide the required information and reports for inclusion in the SWPPP. The Contractor is responsible for monitoring and reporting outside the Project Zone.

i. Preserve natural topsoil unless infeasible. Delineate the site according to CGP Part 4.2.1. Use stakes, flags, or silt fence, etc. to identify areas where land disturbing activities will occur and areas that will be left undisturbed. Minimize the amount of soil exposed during Construction activity according to CGP Part 4.2.2.

j. Comply with CGP Part 4.4, and the DEC General Permit for Excavation Dewatering (AKG002000), requirements for dewatering for trenches and excavations.

k. The SWPPP must identify specific areas where potential erosion, sedimentation, or pollution may occur. The potential for wind erosion must be addressed. The potential for erosion at drainage structures must be addressed.

l. Describe methods and time limits, to initiate temporary or final soil stabilization, CGP Part 4.5.1.1. Begin stabilization no later than the end of the next work day, following the day when the earth-disturbing activities have permanently ceased on any portion of the site or temporarily ceased on any portion of the site and will not resume for a period exceeding:

   (1) Seven days for areas with mean annual precipitation 40 inches or greater; or

   (2) Fourteen days for areas with mean annual precipitation less than 40 inches.

   Time allotted to complete temporary and final stabilization, Subsection 641-2.01, 3.m.

m. Within seven days of initiating final stabilization, CGP Part 4.5.1.4, either complete final stabilization or continue maintenance of work until final stabilization is complete. Complete temporary stabilization within fourteen days of initiating stabilization, CGP Part 4.5.1.2.

n. Include in the “Stabilize Soils” section of the SWPPP, a description of how you will minimize the amount of disturbed and unstabilized ground in the fall season. Identify anticipated dates of fall freeze-up and spring thaw. Describe how you will stabilize areas when it is close to or past the seasonal time of snow cover or frozen conditions, and before the first seasonal thaw. Include a plan for final stabilization.

o. Plans for Active Treatment Systems must be submitted to DEC for review at least 14 days prior to use of the system and the Operator of the ATS identified in the SWPPP. Any use of treatment chemicals must be identified on the NOI, documented in the SWPPP, and meet with the requirements in the CGP Part 4.6.

p. The SWPPP must provide designated areas for equipment and wheel washing, equipment fueling and maintenance, chemical storage, staging or material storage, waste or disposal sites, concrete washouts, paint and stucco washouts, and sanitary toilets. These activities must be done in designated areas that are located, to the extent practicable, away from drain inlets, conveyance channels, and waters of the US. No discharges are allowed from concrete washout, paint and stucco washout; or from release oils, curing compounds, fuels, oils, soaps, and solvents. Equipment and wheel washing water that doesn’t contain detergent may be discharged on-site if it is treated before discharge.

q. Design temporary BMPs for a 2 year 24 hour precipitation amount. Describe BMPs in the SWPPP and in SWPPP Amendments, including source controls, sediment controls, discharge points, and temporary and final stabilization measures. Describe the design, placement, installation, and maintenance of each BMP, using words and drawings as appropriate. Describe the design capacity of sediment basins (including sediment ponds and traps). Provide a citation to the BMP Manual or publication used as a source for the BMP, including the manufacturer’s or BMP manual specifications for installation (CGP Part 5.3.6.2). If no published source was used to select or design a BMP, then the SWPPP or SWPPP amendment must state that “No BMP manual or publication was used for this design.”

r. Describe the sequence and timing of activities that disturb soils and of BMP implementation and removal. Phase earth disturbing activities to minimize unstabilized areas, and to achieve temporary or final stabilization quickly. Whenever practicable incorporate final stabilization work into excavation, embankment and grading activities. Include drawings showing each phase of the project with the BMPs implemented in the phase.

s. Provide a legible site map or set of maps in the SWPPP, showing the entire site and identifying boundaries of the property where construction and earth-disturbing activities will occur, as described in the CGP Part 5.3.5. Include all BMPs on the site map.

t. Identify the inspection frequency in the SWPPP.

(1) For areas of the state where the mean annual precipitation is less than 40 inches:

(a) Inspect at least once every seven calendar days; or

(b) Inspect at least once every 14 calendar days and within 24 hours of the end of a storm event that resulted in a discharge from the site.

(2) For areas of the state where the mean annual precipitation is 40 inches or greater:

(a) Inspect at least once every seven calendar days.

u. Linear Project Inspections, described in CGP Part 6.5, are not applicable to this contract.

v. The SWPPP must cite and incorporate applicable requirements of the Project permits, environmental commitments, COE permit, and commitments related to historic preservation. Make additional consultations or obtain permits as necessary for Contractor specific activities that were not included in the Department's permitting and consultation.

w. The SWPPP is a dynamic document. Keep the SWPPP current by noting installation, modification, and removal of BMPs, and by using amendments, SWPPP amendment logs, Inspection Reports, corrective action logs, records of land disturbance and stabilization, and any other records necessary to document stormwater pollution prevention activities and to satisfy the requirements of the CGP and this specification. See Subsection 641-3.03 for more information.

4. Recording Personnel and Contact Information in the SWPPP.

Identify the SWPPP Manager as the Stormwater Lead and Stormwater Inspector positions in the SWPPP. Document the SWPPP Manager's responsibilities in Section 2.0 Stormwater Contacts, of the SWPPP template and:

a. Identify that the SWPPP Manager does not have authority to sign inspection reports (unless the SWPPP Manager is also the designated project Superintendent).

b. Identify that the SWPPP Manager cannot prepare the SWPPP unless the SWPPP Manager meets the Contract requirements for the SWPPP Preparer.

Include in the SWPPP proof of AK-CESCL or equivalent certifications for the Superintendent and SWPPP Manager, and for any acting Superintendent and acting SWPPP Managers. If the Superintendent or SWPPP Manager is replaced permanently or temporarily, by an acting Superintendent or acting SWPPP Manager; record in the SWPPP (use Form 25D-127) the names of the replacement personnel, the date of the replacement. For temporary personnel record their beginning and ending dates.

Provide 24 hour contact information for the Superintendent and SWPPP Manager. The Superintendent and SWPPP Manager must have 24 hour contact information for all Subcontractor SWPPP Coordinators and Utility SWPPP Coordinators.

Include in the SWPPP proof of AK-CESCL or equivalent certifications of ATS operators. Record names of ATS operators and their beginning and ending dates, on Form 25D-127.

The Department will provide proof of AK-CESCL, or equivalent certifications for the Department's Project Engineer, Stormwater Inspectors, and Monitoring Person (if applicable), and names and dates they are acting in that position. Include the Department's staff certifications in Appendix E. Include Department's staff names, dates acting, and assignments, in Section 2.0 of the SWPPP.

641-2.02 HAZARDOUS MATERIAL CONTROL PLAN (HMCP) REQUIREMENTS.

1. Prepare the HMCP using the DOT&PF template located at the following DOT&PF link; (http://www.dot.state.ak.us/stwddes/dcsconst/pop_constforms.shtml) for prevention of pollution from storage, use, containment, cleanup, and disposal of all hazardous material, including petroleum products related to construction activities and equipment. Include the HMCP as an appendix to the SWPPP. Compile Material Safety Data Sheets in one location and reference that location in the HMCP.

2. Designate a Contractor's Spill Response Field Representative with 24-hour contact information. Designate a Subcontractor Spill Response Coordinator for each subcontractor. The Superintendent and Contractor's Spill Response Field Representative must have 24-hour contact information for each Subcontractor Spill Response Coordinator and the Utility Spill Response Coordinator.

3. List and give the location and estimated quantities of hazardous materials (Including materials or substances listed in 40 CFR 117 and 302, and petroleum products) to be used or stored on the Project. Hazardous materials must be stored in covered storage areas. Include secondary containment for all hazardous material storage areas.

4. Identify the locations where fueling and maintenance activities will take place, describe the activities, and list controls to prevent the accidental spillage of petroleum products and other hazardous materials. Controls include placing absorbent pads or other suitable containment under fill ports while fueling, under equipment during maintenance or repairs, and under leaky equipment.

5. List the types and approximate quantities of response equipment and cleanup materials available on the Project. Include a list and location map of cleanup materials, at each different work site and readily available off site (materials sources, material processing sites, disposal sites, staging areas, etc.). Spill response materials must be stored in sufficient quantity at each work location, appropriate to the hazards associated with that site.

6. Describe procedures for containment and cleanup of hazardous materials. Describe a plan for the prevention, containment, cleanup, and disposal of soil and water contaminated by spills. Describe a plan for dealing with contaminated soil and water encountered during construction. Clean up spills or contaminated surfaces immediately.

7. Describe methods of disposing of waste petroleum products and other hazardous materials generated by the Project, including routine maintenance. Identify haul methods and final disposal areas. Assure final disposal areas are permitted for hazardous material disposal.

8. Describe methods of complying with the requirements of AS 46.04.010-900, Oil and Hazardous Substances Pollution Control, and 18 AAC 75. Include contact information for reporting hazardous materials and petroleum product spills to the Project Engineer and reporting to federal, state, and local agencies.

641-2.03 SPILL PREVENTION, CONTROL AND COUNTERMEASURE PLAN (SPCC PLAN) REQUIREMENTS.

Prepare and implement an SPCC Plan when required by 40 CFR 112 when both of the following conditions are present on the Project:

1. Oil or petroleum products from a spill may reach navigable waters (as defined in 40 CFR 112); and

2. Total above ground storage capacity for oil and any petroleum products is greater than 1,320 gallons (not including onboard tanks for fuel or hydraulic fluid used primarily to power the movement of a motor vehicle or ancillary onboard oil-filled operational equipment, and not including containers with a storage capacity of less than 55 gallons)

Reference the SPCC Plan in the HMCP and SWPPP.

641-2.04 RESPONSIBILITY AND AUTHORITY OF THE SUPERINTENDENT AND SWPPP MANAGER.

The Superintendent is responsible for the overall operation of the Project and all Contractor furnished sites and facilities directly related to the Project. The Superintendent shall sign and certify the SWPPP, Inspection Reports, and other reports required by the CGP, except the NOI and NOT. The Superintendent may not delegate the task or responsibility of signing and certifying the SWPPP submitted under Subsection 641-1.03.1, Inspection Reports, and other reports required by the CGP.

The Superintendent may assign certain duties to the SWPPP Manager.

1. Ensuring Contractor's and subcontractor's compliance with the SWPPP and CGP;

2. Ensuring the control of erosion, sedimentation, or discharge of pollutants;

3. Directing and overseeing installation, maintenance, and removal of BMPs;

4. Performing Inspections; and

5. Updating the SWPPP including adding amendments and forms.

When Bid Item 641.0007.____ is part of the Contract, the SWPPP Manager must be available at all times to administer SWPPP requirements, and be physically present within the Project Zone or the project office, for at least eight hours per day when construction activities are occurring.

The Superintendent and SWPPP Manager shall be knowledgeable in the requirements of this Section 641, the SWPPP, CGP, BMPs, HMCP, SPCC Plan, environmental permits, environmental commitments, and historic preservation commitments.

The Superintendent and SWPPP Manager shall have the Contractor's complete authority and be responsible for suspending construction activities that do not conform to the SWPPP or CGP.

641-2.05 MATERIALS.

Use materials suitable to withstand hydraulic, wind, and soil forces, and to control erosion and trap sediments according to the requirements of the CGP and the Specifications.

Use the temporary seed mixture specified in the contract or as directed by the Engineer.

Use soil stabilization material as specified in Section 727.

Use silt fences as specified in Section 729.

Use straw and straw products certified weed free of prohibited and restricted noxious weed seed and quarantined pests, according to Alaska Administrative Code, Title 11, Chapter 34 (11 AAC 34). When straw or straw products certified according to 11 AAC 34 are not available, use non-certified products manufactured within Alaska before products manufactured in another state,

country or territory. Grass, legumes, or any other herbaceous plants produced as hay, shall not be substituted for straw or straw products.

Use Oregon Scientific RGR126 wireless rain gauge with temperature, or Taylor 2751 Digital Wireless Rain Gauge with Thermometer, or approved equivalent

641-3.01 CONSTRUCTION REQUIREMENTS.

Comply with the SWPPP and the requirements of the CGP Part 5.0.

1. Before Construction

   The following actions must be completed before Construction Activity begins:

   a. The SWPPP Preparer must visit the Project, the visit must be documented in the SWPPP Form (25D-106), and the SWPPP must be developed (or amended) with findings from the visit;

   b. The SWPPP must be approved by the Engineer on Form 25D-109;

   c. The Contractor must be authorized to begin by the Engineer;

   d. The Project eNOIs for the Department and for the Contractor, as well as any other eNOIs if there are additional operators, must be listed as Active Status on the DEC website;

   e. The Department approved SWPPP must be submitted to DEC and Local Government (when required); and

   f. The Contractor has transmitted to the Engineer an electronic copy and at least one hardcopy of the approved SWPPP.

   g. The Delegation of Authority (Forms 25D-108 and 25D-107) for both the Contractor and DOT&PF Engineer are signed.

   h. Begin winter construction activity according to CGP Part 4.12.2, provided actions a, c, and g are completed. If winter construction activities may extend beyond spring thaw, the following actions must be completed before spring thaw:

      (1) Actions a through g, listed above, and

      (2) Appropriate control measures to minimize erosion and sediment runoff during spring thaw and summer rainfall are installed.

   i. Post notices. Include the following information:

      (1) Copy of all eNOIs related to this project;

      (2) Location of the SWPPP.

      Post notices on the outside wall of the Contractor's project office, and near the main entrances of the construction project. Protect postings from the weather. Locate postings so the public can safely read them without obstructing construction activities or the traveling public (for example, at an existing pullout). Do not use retroreflective signs for the SWPPP posting. Do not locate SWPPP signs in locations where the signs may be confused with traffic control signs or devices. Update the notices if the listed information changes.

j. Install an outdoor rain gauge per manufacturer's guidance in a readily accessible location on the Project. Projects may utilize the nearest National Weather Service (NWS) precipitation gauge station, if within 20 miles of the project, to determine rainfall amounts during storm events.

k. Delineate the site for both land disturbing activities and areas that will be left undisturbed.

l. Install sediment controls and other BMPs that must be placed prior to the initiation of Construction Activity.

2. During Construction.

Before subcontractors or utility companies begin soil disturbing activities, provide to them copies of applicable portions of the SWPPP, and require them to sign a SWPPP Subcontractor Certification, Form 25D-105. Include SWPPP Subcontractor Certifications as an appendix to the SWPPP. Ensure subcontractors and utility companies understand and comply with the SWPPP and the CGP. Inform subcontractors and utility companies of SWPPP amendments that affect them in a timely manner. Coordinate with subcontractors and utility companies doing work in the Project Zone so BMPs, including temporary and final stabilization are installed, maintained, and protected from damage.

Provide on-going training to employees and subcontractors, on control measures at the site and applicable stormwater pollution prevention procedures. Training must be specific to the installation, maintenance, protection, and removal of control measures CGP 4.14. Training must be given at a frequency that will be adequate to ensure proper implementation and protection of control measures, and no less frequently than once a month during construction activity. Document on the SWPPP Training Log, Form 25D-125, the dates and attendees to these trainings. Include the SWPPP Training Log as an appendix to the SWPPP.

Notify the Engineer immediately if the actions of any utility company or subcontractor do not comply with the SWPPP and the CGP.

Comply with Subsection 107-1.11 Protection and Restoration of Property and Landscape. Concrete washout must be fully contained.

Comply with CGP Part 4.8.2 for fueling and maintenance activities. Place absorbent pads or other suitable containment under fill ports while fueling, under equipment during maintenance or repairs, and under leaky equipment.

Comply with requirements of the HMCP and SPCC Plan, and all local, state and federal regulations that pertain to the handling, storage, containment, cleanup, and disposal of petroleum products or other hazardous materials.

Keep the SWPPP and HMCP current (refer to Subsection 641-2.01.3, SWPPP Considerations and Contents)

3. Pollutant Reporting Requirements.

If an incident of non-compliance occurs that may endanger health or the environment a report must be made, CGP, Appendix A, Part 3.4:

a. Verbally, immediately report the incident to the Engineer,

b. Verbally report to DEC within 24 hours after the permittee becomes aware of the incident, and

c. In writing, report to DEC within five days after the permittee becomes aware of the circumstances. To report in writing, complete the written noncompliance report on Form

25D-143, and file the written report with DEC. Coordinate the report with the Engineer. Include in the report:

(1) A description of the noncompliance and its causes;

(2) The exact dates and times of noncompliance;

(3) If not yet corrected the anticipated time the project will be brought back into compliance; and

(4) The corrective action taken or planned to reduce, eliminate and prevent reoccurrence.

Notify the Engineer and COE Regulatory Program immediately if there is incident of noncompliance with COE Permits.

4. Hazardous Materials Reporting Requirements.

Any release of a hazardous substance must be reported immediately, to the Engineer as soon as the person has knowledge of the discharge.

Report spills of petroleum products or other hazardous materials to the Engineer and other agencies as required by law, and according to CGP Part 9.3.

a. To water; any amount released must be reported immediately to the Engineer, DEC, and the Coast Guard.

b. To land:

(1) Any release of a petroleum product in excess of 55 gallons must be reported as soon as the person has knowledge of the discharge CGP Part 9.3.2.

(2) Any release of a petroleum product in excess of 10 gallons but less than 55 gallons must be reported to the Engineer and must be reported to DEC within 48 hours after the person has knowledge of the discharge CGP Part 9.3.2.

(3) Any release of a petroleum product in excess of 1 gallon to 10 gallons must be recorded and logged and provided to DEC on a monthly basis.

c. Use the HMCP and SPCC Plan (if available) for contact information to report spills to regulatory agencies.

d. Within seven calendar days of knowledge of the release, provide a description of the release, the circumstances leading to the release, and the date of the release to the nearest DEC Area Response Team Office listed CGP Part 9.3.2.

e. Implement measures to prevent the reoccurrence of and to respond to such releases.

5. Corrective Action and Maintenance of BMPs.

Implement maintenance as required by the CGP, SWPPP, and manufacturer's specifications, whichever is more restrictive.

a. Implement corrective action:

(1) If an incident of noncompliance with the SWPPP, or CGP is identified;

(2) If an Inspection or the Engineer identifies the SWPPP or any part of the SWPPP is ineffective in preventing erosion, sedimentation or the discharge of pollutants;

(3) If a required BMP was not installed according to the SWPPP schedule or phasing, or was installed incorrectly, or was not installed according to the CGP Part 4.0;

(4) If a BMP is not operating as intended, has not been maintained in an effective operation condition, or is unable to effectively perform the intended function;

(5) If sediment accumulates more than one-third of the distance of the above-ground height of the silt fence;

(6) If sediment accumulates to more than one-half retention height for an inlet BMP, check dam, berm, wattle, or other control measures;

(7) If a prohibited discharge of pollutants, as specified in CGP Part 4.7, is occurring or will occur; or

(8) If there is accumulation of sediment or other pollutants, that is in or near any stormwater conveyance channels, or that may enter a discharge point or storm sewer system. If there is accumulation of sediment or other pollutants that is being tracked outside the project zone.

b. Implement corrective actions so that they comply with the following time requirements:

(1) For conditions that are easily remedied (i.e. removal of tracked sediment, maintenance of control measure, or spill clean-up), initiate corrective action within 24 hours and complete as soon as possible;

(2) If a discharge occurs during a local 2-year, 24-hour storm event, initiate a corrective action the day after the storm event ends;

(3) If installation of a new control measure is needed or an existing control measure requires redesign and reconstruction or replacement to make it operational, the corrective action must be completed within seven calendar days from the time discovered.

(4) For all other conditions initiate corrective actions so both of the following requirements are met:

(a) Corrective action is completed in time to protect water quality; and

(b) Corrective action is completed no later than the Complete-by-Date that was entered in an Inspection Report (see Subsection 641-3.03.2 for more information).

If a corrective action is not implemented within the time requirements of this section, document the situation in the SWPPP, notify the Engineer and implement corrective action as soon as possible.

If a corrective action could affect a subcontractor, notify the subcontractor within three days of taking the corrective action. Require in your written subcontract, that subcontractors must notify the Contractor within 24 hours of becoming aware of a condition that requires a corrective action.

6. Stabilization.

a. Stabilization may be accomplished using temporary or permanent measures. Initiate stabilization of disturbed soils, erodible stockpiles, disposal sites, and of erodible aggregate layers so that all of the following conditions are satisfied:

(1) Not later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased (CGP 4.5.1.1).

(2) As soon as necessary to avoid erosion, sedimentation, or the discharge of pollutants; and

(3) As identified in the SWPPP.

b. Land may be disturbed and stabilized multiple times during a project. Coordinate work to minimize the amount of disturbed soil at any one time. Do not disturb more soil than you can stabilize with the resources available.

c. Temporarily stabilize from wind and water erosion portions of disturbed soils, portions of stockpiles, and portions of disposal sites, that are not in active construction. Temporary stabilization measures may require a combination of measures including but not limited to vegetative cover, mulch, stabilizing emulsions, blankets, mats, soil binders, low-erodible cover, dust palliatives, or other approved methods.

d. When temporary or permanent seeding is required, provide a working hydro seeding equipment located within 100 miles of the project by road; with 1,000 gallon or more tank capacity, paddle agitation of tank, and the capability to reach the seed areas with an uniform mixture of water, seed, mulch and tackifier. If the project is located in an isolated community the hydro-seeder must be located at the project.

e. Before applying temporary or permanent seeding, prepare the surface to be seeded to reduce erosion potential and to facilitate germination and growth of vegetative cover. Apply seed and maintain seeded areas. Reseed areas where growth of temporary vegetative cover is inadequate to stabilize disturbed ground.

f. Apply permanent seed according to Sections 618 and 724, within the time periods allowed by the CGP and the contract, at locations where seeding is indicated on the plans and after land-disturbing activity is permanently ceased.

g. When installing a culvert or other drainage structure where stream bypass is not used, install temporary or final stabilization concurrently or immediately after placing the culvert or drainage structure in a manner that complies with the SWPPP, applicable project permits and prevents discharge of pollutants. Install temporary or final stabilization:

(1) At the culvert or drainage structure inlet and outlet; and

(2) In the areas upstream and downstream that may be disturbed by the process of installing the culvert, culvert end walls, culvert end sections, or drainage structure.

h. Before deactivating a stream bypass or stream diversion used for construction of a bridge, culvert, or drainage structure, install final or temporary stabilization when approved by the Engineer:

(1) At the inlet and outlet of the culvert, drainage structure, or bridge;

(2) In the area upstream and downstream of the culvert, drainage structure, or bridge, that is disturbed during installation or construction of the culvert, drainage structure, or bridge; and

(3) Under the bridge.

Within seven days of initiating final stabilization, either complete final stabilization or continue maintenance of work until final stabilization is complete, CGP Part 4.5.1.5.

Complete temporary stabilization within 14 day of initiating stabilization, CGP Part 4.5.1.2.

7. Ending CGP Coverage and BMP Maintenance in the Project Zone.

   a. The Engineer will determine the date that all the following conditions for ending CGP coverage have been met within the Project Zone:

      (1) Land disturbing activities have ceased;

      (2) Final Stabilization has been achieved on all portions of the Project Zone, according to the CGP PART 4.5.2 (including at Department furnished material sources, disposal sites, staging areas, equipment areas, etc.); and

      (3) Temporary BMPs have been removed.

   b. After the Engineer has determined the conditions for ending CGP coverage have been met, the Department will:

      (1) Send written notice to the Contractor with the date that the conditions were met;

      (2) Submit an eNOT to DEC; and

      (3) Provide a copy of the eNOT and DEC's acknowledgement letter to the Contractor.

   The Contractor is responsible for ending permit coverage within the Project Zone, by submitting an eNOT to DEC within 30 days of meeting the conditions for ending CGP coverage. The Contractor is responsible for BMP maintenance and SWPPP updates until permit coverage is ended.

   If the Contractor's CGP eNOI acreage includes Support Activities and any other areas where the Department is not an Operator, the Contractor may not be able to file an eNOT at the same time as the Department. In this case, the Contractor must amend the SWPPP and separate SWPPP2(s), to indicate the Department's CGP coverage has ended, and the Department is no longer an Operator within the Project Zone.

   The Contractor must indicate in the SWPPP the areas that have reached Final Stabilization, and the dates land disturbing activities ended and Final Stabilization was achieved. The Contractor must submit an eNOT to DEC, and insert copies of the Department's and the Contractor's eNOTs with DEC's acknowledgement letters in the appendix of the SWPPP.

   The Contractor must submit a copy of each signed eNOT and DEC's acknowledgement letter to the Department within three days of filing the eNOT or receiving a written response.

   The Contractor is responsible for coordinating local government inspections of work and ending permit coverage with local government. See Subsection 641-1.03.5 for more information.

8. Transmit final SWPPP.

   Transmit one copy of the final SWPPP, including all amendments, appendices and maps, to the Engineer; when the project eNOTs are filed, or within 30 days of the Department's eNOT being filed, whichever is sooner. Transmittal must be by both electronic and at least one hard copy.

641-3.02 SWPPP DOCUMENTS, LOCATION ON-SITE, AVAILABILITY, AND RECORD RETENTION.

The SWPPP and related documents maintained by the Contractor are the Record for demonstrating compliance with the CGP. Copies of SWPPP documents transmitted to the Engineer under the requirements of this specification are informational and do not relieve the Contractor's responsibility to maintain complete records as required by the CGP and this specification.

Keep the SWPPP, HMCP and SPCC Plan at the on-site project office. If there is not an on-site project office, keep the documents at a locally available location that meets CGP requirements and is approved by the Engineer. Records may be moved to another office for record retention after the eNOTs are filed. Records may be moved to another office during winter shutdown. Update on-site postings if records are relocated during winter shutdown. Provide the Department with copies of all Records.

Retain Records and a copy of the SWPPP, for at least three years after the date of eNOT. If EPA or DEC inspects the project, issues a Notice of Violation (NOV), or begins investigation for a potential NOV before the retention period expires, retain the SWPPP and all Records related to the SWPPP and CGP until at least three years after EPA and/or DEC has determined all issues related to the investigation are settled.

The SWPPP and related documents must be made available for review and copy, to the Department and other regulatory agencies that request them. See CGP Parts 5.10, 6.6 and 9.5.

641-3.03 SWPPP INSPECTIONS, AMENDMENTS, REPORTS, AND LOGS.

Perform Inspections, prepare Inspection Reports, and prepare SWPPP Amendments in compliance with the SWPPP and the CGP. Update SWPPP Corrective Action Log Form 25D-112, SWPPP Amendment Log Form 25D-114, SWPPP Grading and Stabilization Activities Log Form 25D-110, SWPPP Project Staff Tracking Form 25D-127, and SWPPP Daily Record of Rainfall Form 25D-115. For active projects update the Records daily.

1. Inspection during Construction.

   Conduct Inspections according to the schedule and requirements of the SWPPP and CGP.

   Inspections required by the CGP and SWPPP must be performed by the Contractor's SWPPP Manager and the Department's Stormwater Inspector jointly, unless approved by the Engineer, when:

   a. One of the inspectors is not on site, access is only by air, and weather delayed or canceled flights;

   b. One of the inspectors is sick;

   c. The project is on a reduced frequency inspection schedule with no staff on site, the only access to the site is by air, and it is economical to send only one inspector; or

   d. When the Engineer determines a safety concern that makes joint inspection impracticable.

   When this is the case, the Operator who conducts the Inspection must provide a copy of the Inspection Report to the other Operator within three days of the Inspection date and document the date of the report transmittal.

2. Inspection Reports.

   Use only the DOT&PF SWPPP Construction Site Inspection Report, Form 25D-100 to record Inspections. Changes or revisions to Form 25D-100 are not permitted; except for adding or

deleting data fields that list: Location of Discharge Points, and Site Specific BMPs. Complete all fields included on the Inspection Report form; do not leave any field blank.

Insert a Complete-by-Date for each corrective action listed that complies with:

a. Section 641-3.01 (4), and

b. The CGP.

Provide a copy of the completed, unsigned Inspection Report to the Engineer by the end of the next business day following the inspection.

The Superintendent must review, correct errors, and sign and certify the Inspection Report, within three days of the date of Inspection. The Engineer may coordinate with the Superintendent to review and correct any errors or omissions before the Superintendent signs the report. Corrections are limited to adding missing information or correcting entries to match field notes and conditions present at the time the Inspection was performed. Deliver the signed and certified Inspection Report to the Engineer on the same day the Superintendent signs it.

The Engineer will sign and certify the Inspection Report and will return the original to the Contractor within three working days.

The Engineer may make corrections after the Superintendent has signed and certified the Inspection Report. The Engineer will initial and date each correction. If the Engineer makes corrections, the Superintendent must recertify the Inspection Report by entering a new signature and date in the white space below the original signature and date lines. Send a copy of the recertified Inspection Report to the Engineer on the day it is recertified.

If subsequent corrections to the certified Inspection Report are needed, document the corrections in an amendment memo that addresses only the omitted or erroneous portions of the original Inspection Report. The Superintendent and the Engineer must both sign and certify the amendment memo. The issuance of an amendment memo does not relieve the Contractor of liquidated damages that may have been incurred as a result of the error on the original certified inspection report.

3. Inspection before Seasonal Suspension of Work.

Conduct an Inspection before seasonal suspension of work to confirm BMPs are installed and functioning according to the requirements of the SWPPP and CGP.

4. Reduced Inspection Frequencies.

Conduct Inspections according to the inspection schedule indicated in the approved SWPPP. Any change in inspection frequency must be approved by the Engineer, and beginning and ending dates documented as an amendment to the SWPPP.

If the Engineer approves and the entire site is stabilized, the frequency of inspections may be reduced to at least one inspection every 30 days. At actively staffed sites, inspect within two business days of the end of a storm event that results in a discharge from the site.

When work is suspended due to fall freeze-up, the Engineer may suspend inspection requirements after fourteen days of freezing conditions if:

a. Soil disturbing activities are suspended; and

b. Soil stabilizing activities are suspended.

Inspections must resume according to the normal inspection schedule identified in the SWPPP, at least 21 days before anticipated spring thaw. See CGP Part 6.2.3.

The Engineer may waive requirements for updating the Grading and Stabilization Activities Log and Daily Record of Rainfall during seasonal suspension of work. If so, resume collecting and recording weather data on the Daily Record of Rainfall form one month before thawing conditions are expected to result in runoff. Resume recording land disturbance and stabilization activities on the Grading and Stabilization Activities Log when Construction Activity resumes.

5. Stabilization before Fall Freeze up and Spring Thaw.

Stabilize Construction Activities within the Project Zone with appropriate BMPs prior to the anticipated date of fall freeze up, in accordance with the CGP, Part 4.12.

Exceptions to stabilization prior to anticipated date of fall freeze up include:

a. When stabilization activities are precluded by snow cover or frozen ground conditions prior to the anticipated date of fall freeze up, or

b. When winter construction activity is authorized by the Engineer and conducted according to the contract.

Stabilize Construction Activities within the Project Zone with appropriate BMPs prior to spring thaw, as defined in the CGP.

6. Inspection before Project Completion.

Conduct Inspection to ensure Final Stabilization is complete throughout the Project, and temporary BMPs that are required to be removed are removed. Temporary BMPs that are biodegradable and are specifically designed and installed with the intent of remaining in place until they degrade, may remain in place after project completion.

7. Items and Areas to Inspect.

Conduct Inspections of the areas required by the CGP and SWPPP.

8. SWPPP Amendments and SWPPP Amendment Log.

The Superintendent and the SWPPP Manager are the only persons authorized to amend the SWPPP and update the SWPPP Amendment Log, Form 25D-114. The Superintendent or the SWPPP Manager must sign and date amendments to the SWPPP and updates to the SWPPP Amendment Log.

SWPPP Amendments must be approved by the Engineer.

Amendments must occur:

a. Whenever there is a change in design, construction operation, or maintenance at the construction site that has or could cause erosion, sedimentation or the discharge of pollutants that has not been previously addressed in the SWPPP;

b. If an Inspection identifies that any portion of the SWPPP is ineffective in preventing erosion, sedimentation, or the discharge of pollutants;

c. Whenever an Inspection identifies a problem that requires additional or modified BMPs

d. Whenever a BMP is modified during construction, or a BMP not shown in the original SWPPP is added;

e. If the Inspection frequency is modified (note beginning and ending dates); or

f. When there is a change in personnel who are named in the SWPPP, according to Subsection 641-2.01.4.

Amend the SWPPP narrative as soon as practicable after any change or modification, but in no case, later than seven days following identification of the need for an amendment. Every SWPPP Amendment must be signed and dated. Cross-reference the amendment number with the Corrective Action Log or SWPPP page number, as applicable. When a BMP is modified or added, describe the BMP according to Subsection 641-2.01.3.

Keep the SWPPP Amendment Log current. Prior to performing each scheduled Inspection, submit to the Engineer a copy of the pages of the Amendment Log that contain new entries since the last submittal. Include copies of any documents amending the SWPPP.

Keep the SWPPP Amendment Log as an appendix to the SWPPP.

9. Site Maps.

Document installation, routine maintenance, and removal of BMPs by making notes on the SWPPP Site Maps. Include the date and the recording person's initials by these notes. Identify areas where Construction Activities begin, areas where Construction Activities temporarily or permanently cease, and areas that are temporarily or permanently stabilized.

10. Corrective Action Log.

The Superintendent and SWPPP Manager are the only persons authorized to make entries on the SWPPP Corrective Action Log, Form 25D-112. Document the need for corrective action within 24 hours of either:

a. Identification during an inspection; or

b. Discovery by the Department's or Contractor's staff, a subcontractor, or a regulatory agency inspector.

Modification or replacement of a BMP, installation of a new BMP not shown in the original SWPPP, overdue BMP maintenance, or other reasons listed as corrective actions in 641-3.01.4 must be documented on the Corrective Action Log.

Within 24 hours of discovery, update the Corrective Action Log, Form 25D-112, with the date of discovery and proposed corrective action. If discovered during an inspection, update log with inspection date and proposed corrective actions noted on the Inspection Report. If discovered outside of an inspection, update the log with the date of discovery, the proposed corrective action, and the date the corrective action was completed.

After the corrective action has been accomplished, note in the Corrective Action Log the action taken and if a SWPPP amendment was needed. Date and initial the entry.

Keep the Corrective Action Log current and submit a copy to the Engineer prior to performing each scheduled SWPPP Inspection.

Keep the Corrective Action Log as an appendix to the SWPPP.

11. Grading and Stabilization Activities Log.

The Superintendent and SWPPP Manager are the only persons authorized to date and initial entries on the SWPPP Grading and Stabilization Activities Log, Form 25D-110. Use the SWPPP Grading and Stabilization Activities Log, to record land disturbance and stabilization activities.

Keep the Grading and Stabilization Activities Log current and submit a copy to the Engineer prior to performing each scheduled SWPPP Inspection. Keep the Grading and Stabilization Activities Log organized and completed to demonstrate compliance with the CGP Part 4.5.

Keep the Grading and Stabilization Activities Log as an appendix to the SWPPP.

12. Daily Record of Rainfall.

    Use SWPPP Daily Record of Rainfall, Form 25D-115, to record weather conditions at the Project. Update the form daily and include the initials of the person recording each day's entry. Submit a copy to the Engineer prior to performing each scheduled Inspection. Keep the Daily Record of Rainfall as an appendix to the SWPPP.

13. Staff Tracking Log.

    Use the SWPPP Project Staff Tracking Form 25D-127, to keep staff records current. Include Records of the AK-CESCL or equivalent qualifications for the Superintendent, SWPPP Manager, ATS operator, any acting Superintendent and acting SWPPP Managers, and beginning and end dates for temporary personnel assignments related to administration of the CGP or Section 641. Update the SWPPP Staff Tracking Log within 24 hours of any changes in personnel, qualifications, or other staffing items related to administration of the CGP or Section 641.

641-3.04 FAILURE TO PERFORM WORK.

The Engineer has authority to suspend work and withhold monies according to Subsections 105-1.01 and 108-1.06 for the reasons listed under subsection 108-1.06 and for an incident of noncompliance with the CGP or SWPPP, that may endanger health or the environment or for failure to perform work related to Section 641.

An incident of noncompliance includes, but is not limited to, the Contractor's failure to:

1. Obtain appropriate permits before Construction Activities occur;

2. Perform SWPPP Administration;

3. Perform timely Inspections;

4. Update the SWPPP;

5. Transmit updated SWPPP, Inspection Reports, and other updated SWPPP forms to the Engineer;

6. Maintain effective BMPs to control erosion, sedimentation, and pollution in accordance with the SWPPP, the CGP, and applicable local, state, and federal requirements;

7. Perform duties according to the requirements of Section 641; or

8. Meet requirements of the CGP, SWPPP, or other permits, laws, and regulations related to erosion, sediment, or pollution control.

9. Any other requirements established or included in the contract.

No additional Contract time or additional compensation will be allowed due to delays caused by the Engineer's suspension of work.

641-3.05 ACCESS TO WORK.

The Project, including any related off-site areas or support activities, must be made available for inspection, or sampling and monitoring, by the Department and other regulatory agencies. See CGP Part 6.6.

641-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Items 641.0001.____, 641.0003.____and 641.0007.____, are lump sum.

Items 641.0002.____, 641.0004.____ and 641.0005.____, measured on a contingent sum basis as specified by the Directive authorizing the work.

Item 641.0006.____measured on a contingent sum basis with withholding determined by the Department.

TABLE 641-1 BMP VALUES – RESERVED

Liquidated Damages assessed according to Table 641-2 are not an adjustment to the Contract amount. These damages charges are related to Contract performance but are billed by the Department to the Contractor, independent of the Contract amount. An amount equal to the Liquidated Damages may be withheld for unsatisfactory performance, from payment due under the Contract, until the Contractor remits payment for billed Liquidated Damages.

TABLE 641-2 - VERSION C
EROSION, SEDIMENT AND POLLUTION CONTROL – LIQUIDATED DAMAGES

Code	Specification Section Number and Description	Deductible Amount in Dollars	Cumulative Deductible Amounts in Dollars
A	641-1.04 Failure to have a qualified (AK-CESCL or equivalent) SWPPP Manager	Calculated in Code B or F	
B	Failure to meet SWPPP requirements of: (1) 641-2.01.1 Name of SWPPP Preparer (2) Not Applicable (3) 641-3.03.8 Sign and Date SWPPP amendments by qualified person (4) 641-3.02 Records maintained at project and made available for review	$750 per omission	
C	Not Applicable		
D	641-3.03.5 Failure to stabilize a Project prior to fall freeze up.	$5,000 per Project per year	
E	641-2.01.1 Failure to conduct pre-construction inspections before Construction Activities on all projects greater than 1 acre.	$2,000 per Project	
F*	641-3.03. Failure to conduct and record CGP Inspections 641-3.03.1 Personnel conducting Inspections and Frequency 641-3.03.2 Inspection Reports, use Form 25D-100, completed with all required information	$750 per Inspection	Additional $750 for every additional 7 day period without completing the required inspection.
G	641-3.01.4 Corrective action, failure to timely	$500 per	

Code	Specification Section Number and Description	Deductible Amount in Dollars	Cumulative Deductible Amounts in Dollars
	accomplish BMP maintenance and/or repairs. In effect until BMP maintenance and/or repairs is completed.	Project per day	
H	641-3.01.3 Failure to provide to the Engineer and DEC a timely oral noncompliance report of violations or for a deficient oral noncompliance report	$750 for the first day the report is late or deficient	Additional $750 for every 14 day period with- out the required information
I	641-3.01.3 Failure to provide to the Engineer and DEC a timely written noncompliance report, use Form 25D-143, of violations or for a deficient written noncompliance report	$750 for the first day the report is late or deficient	Additional $750 for every 14 day period without the required information
J	641.3.04 Failure to comply with the requirements of the CGP, approved SWPPP, and Section 641, except as listed above	$750 per occurrence for the first day of noncomplianc e	Additional $750 for every day the deficiency remains uncorrected

Code F* Liquidated Damages according to Code F will not be billed for typographic errors and minor data entry errors, except the liquidated damages will be assessed for these errors when:

a. the contractor has previously been notified and subsequent inspection reports repeat the same or similar error,
b. multiple inspection reports are submitted after the submission due date and the same or similar errors are repeated on multiple overdue reports,
c. an error in recording the inspector's AK-CESCL certification date results in an inspector performing the inspection during a period when their certification was lapsed or was otherwise invalid.

641-5.01 BASIS OF PAYMENT.

See Subsection 641-3.04 Failure to Perform Work, for additional work and payment requirements.

Item 641.0001.____ Erosion, Sediment and Pollution Control Administration. At the Contract lump sum price for administration of all work under this Section. Includes, but is not limited to, SWPPP and HMCP and SPCC Plan preparation, agency fees for SWPPP reviews, SWPPP amendments, pre-construction Inspections, Inspections, monitoring, reporting, and Record keeping or copying Records related to the SWPPP and required by the CGP, and Record retention.

Item 641.0002.____ Temporary Erosion, Sediment and Pollution Control. At the contingent sum prices specified for all labor, supervision, material, equipment, and incidentals to install, maintain, remove and dispose of approved temporary erosion, sedimentation, and pollution control BMPs required to implement the SWPPP and SPCC Plan.

Item 641.0003.____ Temporary Erosion, Sediment and Pollution Control. At the Contract lump sum price for all labor, supervision, material, equipment, and incidentals to install, maintain, remove and dispose of temporary erosion, sedimentation, and pollution control BMPs identified in the SWPPP and SPCC Plan.

Item 641.0004.____ Temporary Erosion Sediment and Pollution Control Additives. At the contingent sum prices specified in the Directive to authorize the work, for all labor, supervision, materials, equipment, and incidentals for extra, additional, or unanticipated work, to install, maintain, remove and dispose of temporary erosion, sedimentation, and pollution control BMPs not covered by Item 641.0003.____. All additional Erosion, Sediment, and Pollution Control

Administration necessary due to this item will not be paid for separately but will be subsidiary to other bid items.

Item 641.0005.____ Temporary Erosion Sediment and Pollution Control by Directive. At the contingent sum prices specified in the Directive using time and materials to authorize the work, for all labor, supervision, materials, equipment, and incidentals to install, maintain, remove and dispose of temporary erosion, sedimentation, and pollution control BMPs. Prices for this item will by time and materials according to Subsection 109-1.05, or by mutual agreement between the Engineer and Contractor. All additional Erosion, Sediment, and Pollution Control Administration necessary due to this item will not be paid for separately but will be subsidiary to other bid items.

Item 641.0006.____ Withholding. The Engineer may withhold an amount equal to Liquidated Damages, assessed according to Section 641, from payment due the Contractor. Liquidated Damages for violations of the Contract, CWA, CGP, are determined by the Engineer according to Table 641-2. The Engineer may withhold payment due the Contractors until the Contractor pays the Liquidated Damages to the Department.

The Department will not release performance bonds until Liquidated Damages assessed according to Section 641 are paid to the Department, and all requirements according to Subsection 103-1.05 are satisfied.

Item 641.0007.____ SWPPP Manager. At the Contract lump sum price for a SWPPP Manager that conforms to this specification. When Item 641.0007._____appears in the Bid Schedule, the SWPPP Manager must be a different person than the superintendent, and must be physically present during construction activity with duties and authority as described in Subsection 641-2.04. When Item 641.0007._____ does not appear in the Bid Schedule, the SWPPP Manager is subsidiary to Item 641.0001.____.

Subsidiary Items. Temporary erosion, sediment and pollution control measures that are required outside the Project Zone are subsidiary. Work required by the HMCP and SPCC Plan including hazardous material storage, containment, removal, cleanup and disposal, are subsidiary to Item 641.0001.____Erosion, Sediment and Pollution Control Administration.

Work under other pay items. Work that is paid for directly or indirectly under other pay items will not be measured and paid for under Section 641. This work includes but is not limited to:

1. Dewatering;
2. Shoring;
3. Bailing;
4. Permanent seeding;
5. Installation and removal of temporary work pads;
6. Temporary accesses;
7. Temporary drainage pipes and structures;
8. Diversion channels;
9. Settling impoundment; and
10. Filtration.

Permanent erosion, sediment and pollution control measures will be measured and paid for under other Contract items, when shown on the bid schedule.

Work at the Contractor's Expense. Temporary erosion, sediment and pollution control measures that are required due to carelessness, negligence, or failure to install temporary or permanent controls as scheduled or ordered by the Engineer, or for the Contractor's convenience, are at the Contractor's expense.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
641.0001.____	Erosion, Sediment and Pollution Control Administration	LS
641.0002.____	Temporary Erosion, Sediment and Pollution Control	CS
641.0003.____	Temporary Erosion, Sediment and Pollution Control	LS
641.0004.____	Temporary Erosion, Sediment and Pollution Control Additives	CS
641.0005.____	Temporary Erosion, Sediment and Pollution Control by Directive	CS
641.0006.____	Withholding	CS
641.0007.____	SWPPP Manager	LS

SECTION 642
CONSTRUCTION SURVEYING AND MONUMENTS

642-1.01 DESCRIPTION. Perform surveying and staking essential for the completion of the project and perform the necessary calculations required to accomplish the work in conformance with the Plans and Specifications and standard engineering and survey practice.

Furnish and install survey monuments and monument cases in conformance with the Plans or as directed.

Adjust existing monuments and monument cases to conform to the new elevations.

642-1.02 DEFINITIONS.

1. Monument: A fixed physical object marking a point on the surface of the earth; used to commence or control a survey; mark the boundaries of a parcel of land; or the centerline of a right-of-way corridor. Monuments will be Primary or Secondary, as shown on the Plans.

2. Point: An identified spot located on the surface of the earth. For purposes of this definition, a point can be a PK nail, wooden hub, rebar, large nail or other structure capable of being utilized as a marker.

3. Witness Corner: A material mark or point usually placed on a property or survey line, at a known distance from a property corner or other survey point. A witness corner is employed to witness the location of a corner/point that cannot be monumented at its true location.

4. Reference Monument: A material mark or point placed at a known distance and direction from a property corner or other survey point, usually not on a property or survey line. A reference monument is employed to perpetuate a corner/point that cannot be monumented at its true location or where the corner monument is subject to destruction.

5. Surveyor: The Contractor's Professional Land Surveyor, currently registered in the State of Alaska.

642-2.01 MATERIALS.

1. Monument Cases: Use castings meeting AASHTO M 105, Class No. 30A. Coat castings with a bituminous damp-proof coating. Use tops that bear evenly on the frames.

2. Primary Monument: A minimum 2-inch diameter nonferrous pipe at least 30 inches long, with a minimum 4-inch flange at the bottom and having magnets attached at the top and bottom. A minimum 2-3/8 inch diameter nonferrous metal cap must be permanently attached to the top. Mark the cap around the outside edge with the words "STATE OF ALASKA DOT&PF". Permanently stamp every monument with the Surveyor's registration number, the year set, and the point/corner identification. Orient cap so that the data may be read when the reader is facing north, except for centerline monuments that will be oriented to be read facing up-station.

3. Secondary Monument: A minimum 5/8 inch x 30 inches rebar with a 2-inch aluminum cap attached to the top. Permanently stamp every secondary monument with the Surveyor's registration number, the point/corner identification, and the year set.

CONSTRUCTION REQUIREMENTS

642-3.01 GENERAL. Use competent, qualified personnel and suitable equipment for the layout work required and furnish traffic control, stakes, templates, straight-edges and other devices necessary for establishing, checking and maintaining the required points, lines and grades.

Furnish computer services to accomplish the work. Check data received from the computer for completeness and accuracy. As soon as practical after completion of the work, and in no case later than acceptance of the project, deliver field books, computer forms and computer output data to the Engineer. This data becomes the property of the Department.

Supervise construction surveying personnel. Correct errors resulting from the operations of said personnel at your expense. The Contractor is responsible for the accuracy of the work.

Work classified as Land Surveying under AS 08.48, and work involving the location, control, and monumentation of construction centerline and right-of-way, must be performed by or under the responsible charge of a Professional Land Surveyor.

Follow the Department's *Construction Surveying Requirements*.

The Department will provide sufficient centerline or reference thereto, and at least 2 benchmarks per mile to enable the establishment of planned elevations and centerline.

Keep field notes in standard hardbound notebooks in a clear, orderly, and neat manner consistent with Departmental procedures, including titles, numbering, and indexing. Make field books available for inspection by the Engineer's project personnel at any time. Store the field books in the Engineer's Project Office during periods of non-use.

Perform the following:

1. Staking necessary to delineate clearing and/or grubbing limits.
2. Cross sections necessary for determination of excavation and embankment quantities, including intermediate and/or remeasure cross sections as needed. Take cross sections after clearing and grubbing has been completed.
3. Slope staking.
4. Staking of signs, culverts, minor drainage structures and other appurtenances, including the necessary checking to establish the proper location and grade to best fit the conditions on site.
5. Bridge staking.
6. Setting finishing stakes.
7. Measurement of pay quantities that require measurement.
8. Staking of right-of-way and material source limits.
9. Staking, referencing and other actions required to preserve or restore land monuments and property corners.
10. Other surveying and staking necessary to complete the project.

When the project centerline points have been established as a part of the Department's Preconstruction surveys, the Department will furnish the Contractor with copies of the reference field books or control sheets depicting reference point information. Recover these control points and independently verify these references. Reestablish missing points from the Department's references before clearing, grubbing, or excavation.

When the Department has not established the project centerline points but the survey control points were established as a part of the Department's Preconstruction surveys (as detailed on the project Survey Control Sheet) recover these points and use them as the basis for establishing the

project centerline. Verify the position of these points and establish new points where required to replace missing points, before clearing, grubbing, or excavation.

Notify the Engineer immediately if a Department-established reference point is discovered to be in error or a reset point is not in harmonious relationship to the adjacent centerline points.

Furnish a notekeeper to record field survey notes, including documentation for quantity computations for payment. Ensure that the notekeeper is thoroughly familiar with generally accepted standards of good survey notekeeping practice and the Department's *Construction Surveying Requirements*.

The Engineer may randomly spot check surveying, staking and computations. After the survey or staking has been completed, provide the Engineer with a minimum of 72 hours notice before performing work, and furnish the appropriate data, to allow for random spot checking. The Department assumes no responsibility for the accuracy of the work.

642-3.02 CROSS-SECTION SURVEYS. When required, obtain right-angle cross sections to the construction centerline at the interval detailed in the Department's *Construction Surveying Requirements*.

The Department will supply following:

1. Construction Plans and Specifications

2. Design Cross Sections, if any

3. State of Alaska Land Survey Monument Record forms

4. Department's *Construction Surveying Requirements* (one copy)

5. Design centerline grades, unless Item 642.0002.____, Office Engineering is used

Perform the following:

6. Furnish hardbound field books (Level, Cross-Section, Slope Stake, etc.). Use "Rite-in-the-Rain" or similar weather resistant books. Field books become the property of the Department upon completion of the work.

7. Label the books and number the pages. Make a heading in the appropriate book (date, weather, names and duties of crew members) at the beginning of each day's work.

8. Update the index of the appropriate book at the end of each day's work.

9. Reduce, check, and adjust level notes.

10. The notekeeper shall compute the cross-section level notes and slope stake catches and a different crew member shall check the computation on a continual basis in the field.

11. Enter the grade data, shoulder width and/or ditch distance, stationing, slope, etc., in the slope stake books.

12. Maintain the position and identifying marks of slope stakes and reference points until used for their intended purpose.

13. Correct errors by drawing a line through them and writing the correct entry directly above. Erasures are not allowed.

14. Return field books or copies of the field books to the Project office at the end of each work day or as directed.

15. Provide copies of grade sheets and temporary bench mark elevations to the Engineer 48 hours before beginning work on unclassified excavation or embankment.

16. Ensure that survey crews comply with approved traffic control plans. Coordinate crews activities with the Worksite Traffic Supervisor.

17. Keep a daily survey Party Chief diary, and give a copy of the diary to the Engineer each day. The diary shall contain the following information:

    a. Date

    b. Weather

    c. Crew members' names and duties

    d. Type and location of work performed

    e. Hours worked

    f. Type of equipment used (brand) and date equipment was double centered or "peg" test was performed

    g. Signature of person in responsible charge

18. Submit the survey field notes for the specific area, relating to monument referencing, before beginning clearing, grubbing, or excavation.

642-3.03 MONUMENTS. Install primary and secondary monuments, as called for in the Plans, at the positions determined by the Department. Reference property markers/corners, monuments, or accessories that may be disturbed or buried during construction. Prepare and record Monument Record Forms in the appropriate Recorder's Office before disturbing monuments. Monument Record Forms may be obtained from the Engineer. Reestablish monuments in their original position before completion of the project. Prepare and file a Monument Record Form for each reestablished monument.

Keep records and report to the Engineer evidence that a monument has been disturbed and is no longer reliable or cannot be located and is presumed to be lost or obliterated. Establish a minimum of two in-line reference points, or three swing-tie reference points in situations where in-line referencing is not desirable. Set reference points outside of the construction limits. Measure distances from the monument to the nearest 0.01 foot. Record referencing of monuments in a separate field book stamped by the Surveyor.

Replace existing monuments disturbed by construction with Primary or Secondary Monuments meeting the requirements of subsection 642-2.01. When it is impractical to establish a monument in its original position, install a witness corner (WC). Place the WC to a property corner on the property line when the other property corner that defines said line is existing or there has been sufficient retracement to define said line. In other cases, place a reference monument (RM) perpendicular to the centerline at the station of the original position and at a distance from the original position measured in whole feet.

Replacing monuments not shown on the Plans will be considered additional work and paid by 642.0003.____, Three Person Survey Party. Those monuments found that are not shown on the Plans will be recognized by the Department when the Surveyor provides timely field notes identifying type and location of the monument, and a description of the point the monument marks, with the reason to preserve its location.

The Surveyor must complete and stamp a State of Alaska Land Survey Monument Record form for each primary and secondary monument removed, installed, relocated, or replaced. Provide the required survey information on the form in accordance with statutory requirements, including section, township, and range. Meet requirements for recording at the District Recorder's Office in which the project is located for each monument record. Deliver conforming copies of the recorded forms to the Engineer before monument removal or disturbance and after setting any final monuments requiring monument records.

Set each monument and monument case accurately to lines established at the required location and in a manner as to ensure being held firmly in place. Set existing monuments and monument cases to be adjusted to new elevations in the manner and at the elevations directed.

642-3.04 OFFICE ENGINEERING. Calculate finish grades for the roadway as specified according to Plans and/or Specifications. Use information available in the field, on as-builts, or as provided by the Engineer. Perform the work by, or under the responsible charge of, a person registered in the State of Alaska as a Professional Land Surveyor or a Professional Engineer.

642-3.05 FINAL TRAVERSE. Within 30 days after the Engineer receives a letter stating that construction activities that may disturb the monuments have ceased, the Surveyor shall run a final closed traverse to verify the positional accuracy of installed survey monuments. Begin and end this traverse at different Department-provided control points. Tie into the traverse the primary and secondary monuments placed or replaced and undisturbed Department-provided control points. Do not run the final traverse more than 2.5 miles without a tie to a Department-provided monument/control point. Meet the requirements of a secondary monument for traverse points established during this work. Have the Surveyor sign and stamp a letter that lists each monument and its coordinates and certify that the monuments are each located within 0.2 feet of their proposed position based on the project survey control points provided by the Department. Deliver the certification letter and field notes for this work to the Engineer.

642-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Item 642.0002.____ Office Engineering. By the project mile along centerline for completed office engineering accepted.

Item 642.0003.____ Three Person Survey Party. By the hour for extra, additional, or unanticipated work made necessary by changes in the project, as directed, and as supported by certified payrolls.

If staking for extra, additional or unanticipated work, as stated above, is performed by a two person survey party, measurement will be made at 75 percent of the hours worked and paid under Item 642.0003.____, Three Person Survey Party. If a single person is required for additional office computations or other work requiring only one person, payment will be made at 32 percent of the hours worked and paid under Item 642.0003.____.

Items 642.0004.____ through 642.0008.____. The actual number of monuments installed, replaced, or adjusted as shown on the "State of Alaska Land Survey Monument Record" forms delivered to and accepted by the Engineer.

Item 642.0009.____ Reference Existing Monument. The actual number of monuments referenced as shown in the recorded Monument Record Forms delivered to and accepted by the Engineer.

Items 642.0010.____ and 642.0011.____. The actual number of monument cases furnished and installed, or adjusted to new elevation, and accepted.

Item 642.0013.____ Three Person Survey Party. Contingent sum work will be measured according to subsections 101-1.03 and 109-1.02 or 109-1.05. This item, when appearing on the

Bid Schedule, will be used only for additional or unanticipated work made necessary by changes in the Contract.

Department personnel will perform calculations of pay quantities.

642-5.01 BASIS OF PAYMENT. Construction Surveying and Final Traverse includes field and office work required to accomplish the work, including furnishing necessary personnel, equipment, transportation and supplies. Payment for Final Traverse is based on the Engineer's acceptance of the Surveyor's certification letter and field notes.

When bid item 642.0009.____ Reference Existing Monument does not appear in the bid schedule, work necessary to reference existing monuments, and prepare and file Monument Record Forms is subsidiary to Item 642.0001.____ Construction Surveying. Five percent of the contract lump sum bid price for Item 642.0002.____ will be withheld until the Monument Record Forms are prepared and recorded in the local Recorder's Office and accepted by the Engineer.

When bid item 642.0009.____ Reference Existing Monument appears in the bid schedule, payment will be made after the Monument Record Forms are prepared and recorded in the local Recorder's Office and accepted by the Engineer.

Office Engineering when required is in addition to Construction Surveying. Both items will appear on the bid schedule.

Traffic control devices necessary for the survey parties are considered subsidiary.

Survey monuments placed on bridges are subsidiary.

Payment for Traffic Control Plans will be paid under Section 643, Traffic Maintenance.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
642.0001.____	Construction Surveying	LS
642.0002.____	Office Engineering	MILE
642.0003.____	Three Person Survey Party	HR
642.0004.____	Set Primary Monument	EACH
642.0005.____	Set Secondary Monument	EACH
642.0006.____	Replace Existing with Primary Monument	EACH
642.0007.____	Replace Existing with Secondary Monument	EACH
642.0008.____	Adjust Existing Monument	EACH
642.0009.____	Reference Existing Monument	EACH
642.0010.____	Monument Case	EACH
642.0011.____	Adjust Existing Monument Case	EACH
642.0012.____	Final Traverse	LS
642.0013.____	Three Person Survey Party	CS

SECTION 643
TRAFFIC MAINTENANCE

643-1.01 DESCRIPTION. Protect and control traffic during the contract. Furnish, erect, maintain, replace, clean, move and remove the traffic control devices required to ensure the traveling public's safety. Perform all administrative responsibilities necessary to implement this work.

Maintain all roadways and pedestrian and bicycle facilities affected by the work in a smooth and traversable condition. Construct and maintain approaches, crossings, intersections, and other necessary features throughout the project for the life of the contract.

Illuminate construction activities listed in Table 643-4 during hours of night work on roads open to the public within project limits.

643-1.02 DEFINITIONS. These definitions apply only to Section 643.

ATM. When used in this Section, ATM stands for the *Alaska Traffic Manual*, which is comprised of the Manual on Uniform Traffic Control Devices (MUTCD), the Alaska Traffic Manual Supplement, any adopted revisions or interim addenda to either document issued subsequently, and corrections to known errors to either document.

BALLOON LIGHT. Light surrounding by a balloon-like enclosure kept inflated by pressurized air or helium, and producing uniform light through 360 horizontal degrees.

CONSTRUCTION PHASING PLAN. A plan for each phase of the project showing how to accommodate traffic. Show the sequence of work by segment or phase, if required.

FIXED OBJECTS. Private vehicles, parked flagger vehicles, idle construction equipment, construction material stockpiles, culvert ends, individual trees, power poles, utility poles and appurtenances, and other items deemed by the Engineer to present a hazard to motorists, pedestrians, or bicyclists traveling through the work zone.

NIGHT WORK. Work occurring between sunset and sunrise on all days except the "No Lighting Required" period shown in the Table 643-1 below:

TABLE 643-1
PROJECT LOCATIONS – NIGHT TIME ILLUMINATION EXCLUSION

Latitude (degrees)	No Lighting Required		Nearby Cities
	Start	End	
South of 61	Lighting Required All Year		Everything South of Hope
61	June 11	July 1	Anchorage, Valdez, Girdwood
62	June 2	July 13	Wasilla, Palmer, Glennallen, Talkeetna
63	May 27	July 17	Cantwell, Paxson, McGrath
64	May 22	July 21	Tok, Delta, Nome
65	May 18	July 25	Fairbanks
66	May 14	July 29	Circle City
67	May 10	August 2	Coldfoot, Kotzebue
68	May 7	August 6	Galbraith Lake
69	May 3	August 9	Happy Valley
70	April 30	August 12	Deadhorse
71	April 27	August 15	Barrow
72	April 24	August 19	

TRAFFIC. The movement of vehicles, pedestrians, and bicyclists through road construction, maintenance operations, utility work, or similar operations.

TRAFFIC CONTROL PLAN (TCP). A drawing or drawings indicating the method or scheme for safely guiding and protecting motorists, pedestrians, bicyclists, and workers in a traffic control zone. The TCP depicts the traffic control devices and their placement and times of use.

TRAFFIC CONTROL ZONE. A portion of a road construction project, maintenance operation, utility work or similar operation that affects traffic and requires traffic control to safely guide and protect motorists, pedestrians, bicyclists, or workers.

643-1.03 TRAFFIC CONTROL PLAN. Implement an approved TCP before beginning work within the project limits.

The TCP includes, but is not limited to, signs, barricades, traffic cones, plastic safety fence, sequential arrow panels, portable changeable message board signs, special signs, warning lights, portable concrete barriers, crash cushions, flaggers, pilot cars, interim pavement markings, temporary lighting, temporary roadways and all other items required to direct traffic through or around the traffic control zone according to these Specifications and the ATM. Address in the TCPs placement of traffic control devices, including location, spacing, size, mounting height and type. Include code designation, size, and legend per the ATM and the Alaska Sign Design Specification (ASDS). Include longitudinal buffer space for the posted speed limit, according to Table 6C-2 of the ATM unless project conditions or geometric features prohibit including all or a portion of the buffer length.

When a TCP is included in the Plans, use it, modify it, or design an alternative TCP. When a TCP is omitted from the Plans, provide one according to this Section and the ATM.

Submit new or modified TCPs to the Engineer for approval. All TCPs must include the following information:

1. Project name and number.
2. A designated TCP number and name on each page.
3. For TCPs more than one page, each page must be numbered.
4. The posted speed limit for each roadway.
5. Existing striping width, lane width, and road surfacing.
6. Construction lane widths, striping layout, and temporary pavement marker layout.
7. Provisions for Pedestrian, Bicycle, and ADA travel through the work zone.
8. Dates and times the TCP will be in effect and why it is being used.
9. The Worksite Traffic Supervisor's signature certifying that all TCPs conform with the ATM and the Contract.
10. The Project Superintendent's signature confirming the TCP is compatible with the work plan.
11. The name(s) of the Worksite Traffic Supervisor, his/her alternate and their 24 hour telephone number(s).
12. Signs to be used and the ASDS designation number and size.
13. Location and spacing of all devices and signs.
14. A plan to address any possible slopes, drop offs, paving joints, or similar temporary features that may occur during use of the TCP.
15. For TCPs proposed to be used at night, note how the requirements will be met for the required lighting and retroreflective material.

TCPs submitted for approval without all the required information will be rejected. Allow 7 days for review of each TCP submittal. All required modifications to a TCP require a new submission and an additional 7 days for review.

A minor revision to a previously approved TCP during construction requires 48 hours for review and approval by the Engineer.

The TCPs, Plans, and Alaska Standard Plans show the minimum required number of traffic control devices. If unsafe conditions occur, the Engineer may require additional traffic control devices.

Use of oversize and overweight equipment within the project must conform to an approved TCP, including all traffic control devices these operations require.

643-1.04 WORKSITE TRAFFIC SUPERVISOR. Provide a Worksite Traffic Supervisor responsible for maintaining 24-hour traffic operations.

1. Qualifications. The Worksite Traffic Supervisor shall be knowledgeable and experienced regarding the requirements of the ATM and the implementation of those requirements. The Worksite Traffic Supervisor shall be familiar with the Plans, the Specifications, proposed operations, and certified as one of the following:

   a. Traffic Control Supervisor, American Traffic Safety Services Association (ATSSA)

   b. Work Zone Temporary Traffic Control Technician, or Work Zone Safety Specialist, International Municipal Signal Association (IMSA)

   Certify according to Form 25D-124 that the Worksite Traffic Supervisor has a minimum 4000 hours of temporary traffic control work experience, is competent and capable, and has the authority to perform the duties and responsibilities in accordance with this section.

   c. Temporary traffic control work experience shall demonstrate an understanding of concepts, techniques, and practices in the installation and maintenance of traffic control devices, and skill in reading, interpreting, implementing, and modifying TCPs.
   d. Temporary traffic control work experience includes: flagging; installing traffic control devices in accordance with TCPs; monitoring traffic control devices and TCP performance; and recognizing and reporting deficiencies in traffic control devices and TCPs for correction.
   e. Temporary traffic control work experience is gained while serving as a Worksite Traffic Supervisor-in-training, temporary traffic control support personnel, and Flagger.
   f. Four thousand hours of experience serving solely as a Flagger does not satisfy these requirements.

   Worksite Traffic Supervisors shall maintain current certification and be able to show their certification anytime they are on the project.

2. Duties.

   a. Prepare the TCPs and public notices and coordinate traffic control operations between the Project Superintendent and the Engineer.

   b. Physically inspect the condition and position of all traffic control devices used on the project at least twice each day and at approximately 12 hour intervals. Ensure that traffic control devices work properly, are clean and visible, and conform to the approved TCP. Complete and sign a detailed written report of each inspection within 24 hours. Use Traffic Control Daily Review Form 25D-104.

   c. Supervise the repair or replacement of damaged or missing traffic control devices.

   d. Review and anticipate traffic control needs. Make available proper traffic control devices necessary for safe and efficient traffic movement.

   e. Review work areas, equipment storage, and traffic-safety material handling and storage.

f. Hold traffic safety meetings with superintendents, foremen, subcontractors, and others as appropriate before beginning construction, prior to implementing a new TCP, and as directed. Invite the Engineer to these meetings.

g. Supervise all traffic control workers, flaggers, and pilot car drivers.

h. Certify that all flaggers are certified as required by Subsection 643-3.04.4. Submit a copy of all flagger certifications to the Engineer.

i. Supervise lighting for night work.

3. Authority. The Worksite Traffic Supervisor shall have the Contractor's authority to stop work and implement immediate corrective action to unsafe traffic control, in locations where unsafe traffic control is present.

643-1.05 CONSTRUCTION PHASING PLAN. Submit a Construction Phasing Plan for approval no less than 5 working days prior to the preconstruction conference. Include the following:

1. Form 25D-124 designating the Worksite Traffic Supervisor, providing the 24-hour telephone number, and certifying minimum 4,000 hours of work experience as described in 643-1.04 Worksite Traffic Supervisor.

2. A construction phasing plan for each phase or segment of the project.

3. TCPs for the first phase of the project. Show permanent and temporary traffic control measures, including the times each TCP will be used.

Submit any changes to the Engineer for approval 7 days before proposed implementation.

643-1.06 TRAFFIC MAINTENANCE SETUP. When shown on the bid schedule, Traffic Maintenance Setup items are site specific and are detailed as individual TCPs on the plan sheets. They depict the method or scheme required to route traffic safely and efficiently when any of the following restrictions occur:

1. Lane Closure. The closure of one or more lanes on a roadway.

2. Detour. The redirection of traffic through or around a traffic control zone.

3. Road Closure. The closure of a roadway with or without a specified detour route.

4. One Lane Road. A two-way roadway reduced to a single-lane roadway with flaggers, pilot cars, traffic signals, stop signs, or yield signs.

643-2.01 MATERIALS. Provide traffic control devices meeting the following requirements:

1. Signs. Use signs, including sign supports, that conform to Section 615, the ATM, and ASDS.

   a. Construction Signs: Regulatory, guide, or construction warning signs designated in the ASDS.

   b. Permanent Construction Signs: As designated on the Plans or an approved TCP.

   c. Special Construction Signs: All other signs are Special Construction Signs. Neatly mark the size of each sign on its back in 3-inch black numerals.

2. Portable Sign Supports. Use wind-resistant sign supports with no external ballasting. Use sign supports that can vertically support a 48 X 48 inch traffic control sign at the height above the adjacent roadway surface required by the ATM.

3. Barricades and Vertical Panels. Use barricades and vertical panel supports that conform to the ATM. Use Type III Barricades at least 8 feet long. Use retroreflective sheeting that meets ASTM D4956 Type II or III.

4. Portable Concrete Barriers. Use portable concrete barriers that conform to the Contract. For each direction of traffic, equip each 12.5-foot section of barrier with at least two side-mounted retroreflective tabs placed approximately 6 to 8 feet apart, or a continuous 4-inch wide horizontal retroreflective stripe mounted 6 inches below the top of the barrier. Use yellow tabs or stripe when barriers are placed at centerline. Use white tabs or stripe when barriers are placed on the roadway shoulder. Use retroreflective sheeting that meets ASTM D4956 Type III, IV or V.

5. Warning Lights. Use Type A (low intensity flashing), Type B (high intensity flashing) or Type C (steady burn) warning lights that conform to the ATM.

6. Drums. Use plastic drums that conform to the requirements of the ATM. Use retroreflective sheeting that meets ASTM D4956 Type II or III.

7. Traffic Cones and Tubular Markers. Use reflectorized traffic cones and tubular markers that conform to the requirements of the ATM. Use traffic cones and tubular markers at least 28 inches high. Use retroreflective sheeting that meets ASTM D4956 Type II or III.

8. Interim Pavement Markings. Apply markings according to Section 670 and the manufacturer's recommendations. Use either:

    a. Paint meeting Subsection 708-2.03 with glass beads meeting Subsection 712-2.08,

    b. Preformed Marking Tape (removable or non-removable) meeting Subsection 712-2.14, or

    c. Temporary Raised Pavement Markers meeting Subsection 712-2.15 or 712-2.16, as appropriate.

9. High-Level Warning Devices. Use high-level warning devices that conform to the ATM.

10. Temporary Crash Cushions. Use retroreflective sheeting that meets ASTM D4956 Type III, IV or V. Application of crash cushion must be appropriate for the intended use and be installed per manufacturer’s recommendation. Temporary crash cushions that are barrels or barricade filled with sand or water may only be used when the forecasted temperature during their use is above 32 degrees Fahrenheit.

11. Sequential Arrow Panels. Use Type A (24 X 48 inch), Type B (30 X 60 inch) or Type C (48 X 96 inch) panels that conform to the ATM.

12. Portable Changeable Message Board Signs. Use truck or trailer mounted portable changeable message board signs with a self-contained power supply for the sign and with the following features:

    a. Message sign panel large enough to display 3 lines of 9 inch high characters

    b. Eight character display per message line

    c. Fully programmable message module

    d. The capacity to create, preview, and display new messages and message sequences

    e. A waterproof, lockable cover for the controller keyboard

    f. An operator’s manual, a service manual, and a wiring diagram

g. Quick release attachments on the display panel cover

h. Variable flash and sequence rates

i. Manual and automatic dimming capabilities on lamp bulb matrix models

j. Locate the bottom of the sign panel at least 7 feet above the pavement

k. Operate with a battery pack a minimum of 2 hours under full load

l. Power cords shall comply with the National Electrical Code (NEC) Article 600.10 Portable or Mobile Signs, paragraphs 600.10(C)(1) Cords and 600.10(C)(2) Ground-Fault Circuit Interrupter (GFCI). The cord will have integral GFCI protection located in either the attachment plug or 12-inches or less from the plug.

13. Plastic Safety Fence. Use 4 foot high construction orange fence manufactured by one of the following companies, or an approved equal:

    a. “Safety Fence” by Jackson Safety, Inc., Manufacturing and Distribution Center, 5801 Safety Drive NE, Belmont, Michigan, 49306. Phone (800) 428-8185.

    b. “Flexible Safety Fencing” by Carsonite Composites, LLC, 19845 U.S. Highway 76, Newberry, South Carolina, 29108. Phone (800) 648-7916.

    c. "Reflective Fencing" by Plastic Safety Systems, Inc., 2444 Baldwin Road, Cleveland, Ohio 44104. Phone (800) 662-6338.

14. Temporary Sidewalk Surfacing. Provide temporary sidewalk surfacing as required by an approved TCP and the following:

    a. Use plywood at least 1/2 inch thick for areas continuously supported by subgrade. Use plywood at least 1 inch thick for areas that are not continuously supported.

    b. Do not use unsupported 1-inch plywood longer than 30 inches.

    c. Use plywood with regular surfaces. Do not overlap plywood joints higher than 1/2 inch. Bevel overlap joints so the maximum slope of the overlapping edge is 2 horizontal to 1 vertical.

    d. Fasten so wind and traffic will not displace temporary surfacing.

15. Temporary Guardrail. Use temporary guardrail that meets Section 606, except that posts may require placement under special conditions, such as in frozen ground.

16. Flagger Paddles. Use flagger paddles with 24 inches wide by 24 inches high sign panels, 8 inch Series C lettering (see ASDS for definition of Series C), and otherwise conform to the ATM. Use retroreflective sheeting that meets ASTM D4956 Type VIII, IX, or XI. Use background colors of fluorescent orange on one side and red on the other side.

17. Truck Mounted Attenuator, TMA. The TMA shall be mounted on a vehicle with a minimum weight of 15,000 pounds and a maximum weight per the manufacturer’s recommendations.

18. Portable Steel Barriers. Use portable steel barriers that conform to the contract. For each direction of traffic, equip each section of barrier with side-mounted retroreflective tabs placed approximately 6 to 8 feet apart, or a continuous 4-inch wide horizontal retroreflective stripe mounted 6 inches below the top of the barrier. Use yellow tabs or stripe when barriers are placed at centerline. Use white tabs or stripe when barriers are placed on the roadway shoulder. Use retroreflective sheeting that meets ASTM D4956 Type III, IV or V.

643-2.02 CRASHWORTHINESS. Temporary Work Zone devices, including portable barriers, manufacturered after December 31, 2019, must have been successfully tested to the 2016 edition of Manual for Assessing Safety Hardware (MASH). Such devices manufacturered on or before this date, and successfully tested to National Cooperative Highway Research Program (NCHRP) Report 350 or the 2009 edition of MASH, may continue to be used throughout their normal service lives.

Submit documentation, by the method indicated on Table 643-2, that the following devices comply with Test Level 3 requirements of NCHRP Report 350 or MASH. Submit documentation of compliance to the Engineer before installing devices on the project.

TABLE 643-2
WORK ZONE TRAFFIC CONTROL DEVICE AND BARRIER CRASH TESTING COMPLIANCE

Category	Devices	Devices Manufactured Before Dec. 31, 2019 [1]	Devices Manufactured After Dec. 31, 2019 [1]	Method of Documentation
1	Low-mass single-piece devices w/o attachments: traffic cones, tubular markers, single piece drums, delineators	NCHRP 350, MASH 2009, or MASH 2016	MASH 2016	Manufacturer's Certification for devices exceeding height and weight limits
2	Category 1 devices with attachments, barricades, portable sign supports, drums w/lights, other devices weighing less than 100 pounds but not included in category 1	NCHRP 350, MASH 2009, or MASH 2016	MASH 2016	FHWA eligibility letter, if available, at Test Level 3 [2], or DOT&PF eligibility determination
3	Fixed sign supports, truck mounted attenuators, temporary crash cushions, bridge railing, bridge and guardrail transitions, and guardrail and barrier end treatments.	NCHRP 350, MASH 2009, or MASH 2016	MASH 2016	FHWA eligibility letter, if available, at Test Level 3 [2], or DOT&PF eligibility determination
	Portable concrete and steel barriers	NCHRP 350, MASH 2009, or MASH 2016	MASH 2016	FHWA eligibility letter, if available, at Test Level 3, or DOT&PF eligibility determination, unless otherwise required in the contract.

[1] The Engineer will determine whether a device is in serviceable condition. Serviceable means the device will function equivalent to a new device of the same manufacture.

[2] When no test level is specified in an FHWA Eligibility letter; it is implied that the tests were run for Test Level 3.

In Table 643-2, Category 1 devices that exceed the following weights and heights require certification that they meet the evaluation criteria of NCHRP Report 350 or MASH, Test Level 3. This certification may be a one-page affidavit signed by the vendor. Documentation supporting the certification (crash tests and/or engineering analysis) must be kept on file by the certifying organization. No certification is required for devices less than or equal to both the weight and height on the schedule below:

Device	Composition	Weight	Height
Cones	Rubber	20 lb.	36 in.
	Plastic	20 lb.	48 in.

Candles	Rubber	13 lb.	36 in.
	Plastic	13 lb.	36 in.
Drums	Hi Density Plastic	77 lb.	36 in.
	Lo Density Plastic	77 lb.	36 in.
Delineators	Plastic or Fiberglass	N/A	48 in.

643-3.01 GENERAL CONSTRUCTION REQUIREMENTS. Keep the work, and portions of the project affected by the work, in good condition to accommodate traffic safely. Provide and maintain traffic control devices and services inside and outside the project limits, day and night, to guide traffic safely.

Unless otherwise provided in this Section, keep all roadways, business accesses, and pedestrian facilities within the project limits open to traffic. Obtain the Engineer's approval before temporarily closing residential, commercial, or street approaches. Provide access through the project for emergency vehicles and school and transit buses. Properly sign and/or flag all locations where the traveling public is redirected or stopped. Organize construction operations so the total of all construction related stoppages experienced by a vehicle traveling through the project does not exceed 20 minutes except when indicated otherwise in the Contract.

Stop equipment at all points of intersection with the traveling public unless an approved TCP shows otherwise.

Continue to operate all illumination and signalization according to the requirements of Subsection 660-3.09. When moving approach lanes, realign signal heads as necessary according to the ATM. Coordinate any modifications to existing traffic signals with the agency that maintains and operates them. Operate flood lighting at night according to the ATM. Adjust flood lighting so that it does not shine into oncoming traffic.

Provide and maintain safe routes for pedestrians and bicyclists through or around traffic control zones at all times, except when regulations prohibit pedestrians or bicyclists.

Immediately notify the Engineer of any traffic related accident that occurs within the project limits as soon as an employee, or a subcontractor becomes aware of the accident.

643-3.02 ROADWAY CHARACTERISTICS DURING CONSTRUCTION. Obtain an approved TCP before reducing existing roadway lane and shoulder widths and before starting construction. Maintain a clear area with at least 2 feet between the edge of traveled way and the work area. Use barricades, traffic cones, or drums to delineate this area. Place traffic control devices on the work side of the clear area. Space them according to the ATM.

If maintaining traffic on an unpaved surface, provide a smooth and even surface that public traffic can use at all times. Properly crown the roadbed surface for drainage. Before beginning other grading operations, place sufficient fill at culverts and bridges to permit traffic to cross smoothly and unimpeded. Use part-width construction techniques when routing traffic through roadway cuts or over embankments under construction. Excavate the material or place it in layers. Alternate construction activities from one side to the other. Route traffic over the side opposite the one under construction.

Detour traffic when the Plans or an approved TCP allows. Maintain detour routes so that traffic can proceed safely. When detours are no longer required, obliterate the detour. Topsoil and seed appropriate areas.

If two-way traffic cannot be maintained on the existing roadway or detour, you may use half-width construction or a road closure if it is shown on an approved TCP. Make sure the TCP indicates closure duration and conditions. Schedule roadway closures so you do not delay school buses or peak-hour traffic. For road closures, post closure-start and road-reopen times at the closure site, within view of waiting traffic.

643-3.03 PUBLIC NOTICE. Give notice at least 3 days before major changes, delays, lane restrictions, or road closures to local officials and transportation organizations, including but not necessarily limited to:

1. Alaska Trucking Association
2. Alaska State Troopers
3. Division of Measurement Standards
4. Local Police Department
5. Local Fire Department
6. Local Government Traffic Engineer
7. School and Transit Authorities
8. Local Emergency Medical Services
9. Local Media (newspapers, radio, television)
10. Railroads (where applicable)
11. U.S. Postal Service
12. Major Tour Operators

Provide local traffic enforcement and maintenance agencies 24 hour notice before shutting down a traffic signal system. Provide notice as required by utility companies before repairing or replacing a utility.

Provide the Alaska State Troopers, local police and fire department with the radio frequencies used on the project and the 24-hour telephone numbers of the Worksite Traffic Supervisor and the Project Superintendent. These telephone numbers are used to alert construction employees when emergency vehicles must pass through the project. When notified of emergencies make every necessary effort to expedite rapid passage.

Additional notices may be given through the Navigator or 511 System for selected projects. Check the special provisions for those requirements.

643-3.04 TRAFFIC CONTROL DEVICES. Before starting construction, erect permanent and temporary traffic control devices required by the approved TCPs. The Engineer will determine advisory speeds when necessary.

For lane closures on multilane roadways, use sequential arrow panels. During hours of darkness when required by the approved TCP use flashing warning lights to mark obstructions or hazards and steady-burn lights for channelization.

Use only one type of traffic control device in a continuous line of delineating devices, unless otherwise noted on an approved TCP. Use drums or Type II barricades for lane drop tapers.

During non-working hours and after completing a particular construction operation, remove all unnecessary traffic control devices. Store all unused traffic control devices in a designated storage area which does not present a nuisance or visual distraction to traffic. If sign panels are post mounted and cannot be readily removed, cover them entirely with either metal or plywood sheeting. Completely cover signal heads with durable material that that fully blocks the view of signal head and will not be damaged or removed by weather.

Keep signs, drums, barricades, and other devices clean at all times.

Use only traffic control devices that meet the requirements of the “Acceptable” category in ATSSA (American Traffic Safety Services Association) “Quality Guidelines for Temporary Traffic Control Devices” and meet crashworthiness requirements per Section 643-2.02.

Immediately replace any devices provided under this Section that are lost, stolen, destroyed, inoperable or deemed unacceptable while used on the project. Stock repair parts for each Temporary Crash Cushion used on the project. Repair damaged crash cushions within 24 hours.

Maintain pre-existing roadside safety hardware at an equivalent or better level than existed prior to project implementation until the progress of construction necessitates removing the hardware. All existing hazards that are currently protected with roadside safety hardware or new hazards which result from project improvements shall be protected or delineated as required in the plans, specifications, and approved TCPs until permanent roadside safety hardware is installed. All temporary roadside safety hardware shall meet crashworthiness requirements of 643-2.02.

All items paid under this Section remain the property of the Contractor, unless noted otherwise in the contract. Remove them after completing the project.

1. Embankments. Install portable concrete or steel barrier, plastic drums, barricades, tubular markers, plastic safety fence, and cones as specified on the Plans or TCPs to delineate open trenches, ditches, other excavations and hazardous areas when they exist along the roadway for more than one continuous work shift.

2. Adjacent Travel Lane Paving. When paving lifts are 2 inches or greater and you cannot finish paving adjacent travel lanes or paved shoulders to the same elevation before the end of the paving shift, install: W8-11 (Uneven Lanes), W8-9 (Low Shoulder), W8-17 (Shoulder Drop-Off), W14-3 (No Passing Zone), R4-1 (Do Not Pass), R4-2 (Pass with Care), and W8-1 (Bump) signs as appropriate. Place additional signs every 1500 feet if the section is longer than 1/2 mile.

3. Fixed Objects And Construction Vehicles And Equipment Working On Or Next To The Traveled Way. Do not park equipment in medians. Locate fixed objects at least 30 feet from the edge of traveled way. Fixed objects that exist prior to construction activity are not subject to this requirement unless the proposed temporary traffic routing moves the edge of traveled way closer to the pre-existing fixed object. Vehicles and other objects within parking lots in urban environments are considered preexisting fixed objects regardless of whether they are or are not present continuously throughout the day.

   When worksite restrictions, land features, right of way limitations, environmental restrictions, construction phasing, or other construction conditions allow no practicable location meeting the preceding requirements, the Engineer may approve alternate locations for fixed objects. Alternate locations shall be as far as practicable from the edge of traveled way. When the alternate location provides 15 feet or more separation from the edge of traveled way, the Engineer may verbally approve the alternate location. When the alternate location provides less than 15 feet separation, written approval is required.

   When the Engineer determines a fixed object or fixed objects present unacceptable hazard, use drums or Type II barricades with flashing warning lights, or use portable concrete or steel barriers, or temporary crash cushion to delineate or shield the hazard, as approved by the Engineer.

4. Flagging. Furnish trained and competent flaggers and all necessary equipment, including lighting of the flagging position during nighttime operations, to control traffic through the traffic control zone. The Engineer will approve each flagging operation before it begins and direct adjustments as conditions change.

   a. Flaggers must be certified as one of the following:

   b. Flagging Level I Certification by IMSA

   c. Flagger Certification by ATSSA

   d. Traffic Control Supervisor, ATSSA

   e. Work Zone Safety Specialist, IMSA

   f. ATSSA Flagging Instructor

Flaggers shall maintain current flagger certification. Flaggers must be able to show their flagger certification anytime they are on the project.

Flaggers must maintain their assigned flagging location at all times, unless another qualified flagger relieves them, or the approved traffic control plan terminates the flagging requirements. Remove, fully cover, or lay down flagger signs when no flagger is present. Keep the flaggers' area free of encumbrances. Keep the flagger's vehicle well off the roadway and away from the flagging location so the flagger can be easily seen.

Provide approved equipment for two-way radio communications between flaggers when flaggers are not in plain, unobstructed view of each other.

Obtain the Engineer's written approval before flagging signalized intersections. When flagging a signalized intersection, either turn off and cover the traffic signal or place it in the All-Red Flash mode. Coordinate changing traffic signal modes and turning off or turning on traffic signals with the agency responsible for signal maintenance and operation and the Engineer. Get their written approval in advance. Only uniformed police officers are permitted to direct traffic in an intersection with an operating traffic signal.

5. Pilot Cars. You may use pilot cars when part of an approved TCP, if the Engineer determines one-way traffic is necessary, or if the route through the traffic control zone is particularly hazardous, involved, or frequently altered to preclude adequate signing, Do not use pilot cars to avoid localized traffic control at several locations. Pilot car operators may not control Automated Flagger Assistance Devices while operating a pilot car.

   Organize construction operations so the total of all stoppages experienced by a vehicle traveling through a project does not exceed 20 minutes. However, this does not imply that you may allow 20 minutes in all cases. Coordinate multiple pilot-car operations within a project or adjoining projects to minimize inconvenience to the traveling public. Two or more pilot cars may be used to provide two-way traffic through the traffic control zone to reduce the waiting period. The flagger or pilot car operator must record each pilot car's departure time in a bound field book furnished by the Engineer. Whenever practical, the flagger should tell the motorist the reason for and approximate length of the delay. Make every reasonable effort to yield right-of-way to the public and prevent excessive delay.

   Use an automobile or pickup as the pilot car, with the company logo prominently displayed. Equip the pilot car with a two-way radio for contact with flaggers and other pilot cars. Mount a G20-4 sign (Pilot Car Follow Me) on the rear at least 5 feet above the driving surface. Use high intensity flashing strobe lights, oscillating beacons, or rotating beacons on all Pilot Cars. Vehicle hazard warning lights may supplement but are not permitted to be used instead of high intensity flashing strobe lights, oscillating beacons, or rotating beacons. Identify the last vehicle in the column.

   When pilot car operations are approved, establish all required pilot car traffic control devices before beginning work. Continue pilot car operations until no longer necessary and an approved TCP is in place for operations without pilot car, including all required traffic control devices.

6. Street Sweeping. Use a street sweeper that collects material to keep the project and affected areas free of loose material. Include paved portions of the roadway within project limits, haul routes open to the public, and sections of roadway outside of project limits where your operations have deposited loose material.

7. Watering. Furnish, haul, and place water for dust control and pavement flushing, as directed. Use water trucks that can provide a high-pressure water stream to flush the pavement and a light-water spray to control dust. If the flushing operations contaminate or fill adjacent catch basins, clean and restore them to their original condition. This requirement includes sections of roadway off the project where flushing is required. The Engineer will control water application.

Obtain an Alaska Department of Natural Resources permit for water removal before taking water from a lake, stream, or other natural water body. Comply with the Alaska Department of Fish and Game screening requirements for all water removal operations.

8. Portable Changeable Message Board Signs. Furnish Changeable Message Signs when approved on a TCP. Display only messages approved on the TCP. Follow application guidelines in the ATM.

9. Truck Mounted Attenuator (TMA.) TMAs are mounted on the rear of work vehicles. Impact attenuators shall meet crashworthiness requirements of 643-2.02. TMAs shall be mounted on a vehicle with a minimum weight of 15,000 pounds and a maximum weight in accordance with the manufacturer's recommendations. TMAs shall have an adjustable height so that it can be placed at the correct elevation during usage and to a safe height for transporting. Approach ends of TMAs shall have impact attenuator markings in accordance with the ATM. Do not use a damaged attenuator in the work. Replace any damaged TMA at your expense.

10. Traffic Control Vehicles. Use high intensity flashing strobe lights, oscillating beacons, or rotating beacons on the Work Zone Supervisor's vehicle and on vehicles being used to transport and set-up traffic control devices. Vehicle hazard warning lights may supplement but are not permitted to be used instead of high intensity flashing strobe lights, oscillating beacons, or rotating beacons.

643-3.05 AUTHORITY OF THE ENGINEER. The Engineer will provide written notice when conditions may adversely affect the traveling public's safety and/or convenience. The notice will state the defect(s), the corrective action(s) required, and the time required to complete the corrective action(s). If corrective action(s) are not completed within the specified time, the Engineer may immediately suspend work on the offending operations until the defect(s) are corrected. The Engineer may require outside forces to correct unsafe conditions. The cost of work by outside forces will be deducted from any monies due under the terms of this Contract.

643-3.06 TRAFFIC PRICE ADJUSTMENT. A Traffic Price Adjustment, under Item 643.0023.____, will be assessed for unauthorized lane closures or reductions. Unauthorized lane reductions will be assessed as one full lane closure, for each lane reduced without authorization

Authorized lane closures and/or lane reductions are those shown in the Contract, an approved TCP, or authorized in writing.

Unauthorized lane reductions include unacceptable roadway, pedestrian walkway or route, and bicycle route or pathway surfaces, such as severe bumps, ruts, washboarding, potholes, excessive dust or mud, and non-conforming or out of place traffic control devices. Failure to install temporary crash cushions or barriers, when required according to the Contract or TCP, is also considered an unauthorized lane reduction. The Engineer will make the sole determination whether unauthorized lane reductions or closures are present.

Adjustment Rates are listed in Table 643-3. These rates are liquidated damages which represent highway user costs, based on Average Daily Traffic (ADT). The Engineer will use the rate shown for the current ADT for this project, as published in the Regional Traffic Volume Report prepared by the Department's Planning Section. Adjustment rates for unauthorized reduction or closure of each lane of pedestrian walkways or route, and bicycle route or pathway, are the same as for one full roadway lane closure.

TABLE 643-3
ADJUSTMENT RATES

Published ADT	Dollars/Minute of Unauthorized Lane Reduction or Closure
Less than 1,000	$2
1,000-4,999	$10

5,000-9,999	$30
10,000+	$40

643-3.07 MAINTENANCE OF TRAFFIC DURING SUSPENSION OF WORK. Approximately one month before work is suspended for the season, schedule a preliminary meeting with the Engineer and Maintenance & Operations to outline the anticipated roadway condition and the work expected to be completed before shutdown. Schedule a field review with the Department for winter maintenance acceptance. At the field review the Engineer will prepare a punch list for implementation before acceptance.

To be relieved of winter maintenance responsibility, leave all roads with a smooth and even surface for public use at all times. Properly crown the roadbed surface for drainage and install adequate safety facilities. Make sure all illumination and signals, including vehicle detectors, are in good working order.

After the project is accepted for winter maintenance and until you are ordered to resume construction operations, the Department is responsible for maintaining the facility. The Department will accept maintenance responsibility only for portions of the work that are open to the public, as determined by the Engineer. The Department will not accept maintenance responsibility for incomplete work adjacent to accepted roads. You are responsible for maintaining all other portions of the work. The Engineer will issue a letter of “Acceptance for Winter Maintenance” that lists all portions of the work that the Department will maintain during a seasonal work suspension. You retain all contractually required maintenance responsibilities until receipt of this letter.

If you suspend work due to unfavorable weather (other than seasonal) or due to your failure to correct unsafe conditions, carry out Contract provisions, or carry out the Engineer’s orders, you must bear all costs for traffic maintenance during the suspended period.

When you resume work, replace or renew any work or materials lost or damaged during temporary use. If the Department caused damage during winter suspension, payment will be made for repairs by unit pay item or in accord with Subsection 109-1.05, Compensation for Extra Work. When the Engineer directs, remove any work or materials used in the temporary maintenance. Complete the project as though work has been continuous.

643-3.08 CONSTRUCTION SEQUENCING. The construction sequencing detailed in these provisions, the Special Provisions, and the Plans is suggested only. You may propose alternative construction sequencing.

Throughout the project, maintain the existing roadway, pedestrian walkway or route, and bicycle route or pathway configuration (such as the number of lanes and their respective widths) except for restrictions to traffic allowed in the Special Provisions or on the Plans, and addressed through approved TCPs. A restriction to traffic is any roadway surface condition, work operation, or traffic control setup that reduces the number of lanes or impedes traffic. Obtain an approved TCP before restricting traffic.

Do not restrict traffic or shut down signals during the times listed in the Special Provisions.

643-3.09 INTERIM PAVEMENT MARKINGS. Place permanent or interim pavement markings according to this Subsection, details shown on the Plans, approved TCPs, and Parts III and VI of the ATM before opening existing paved roadways, temporary paved roadways, detours, interim paving lifts, and roadways with seal coats and surface treatments for more than one continuous work shift. This work may include restriping the existing roadway before beginning construction, before seasonal suspension, and/or after seasonal suspension.

Remove conflicting pavement markings according to Subsection 670-3.04, Paint Removal. Pavement markings that are temporarily conflicting (markings that will be restored when construction

is complete) may be removed according to Subsection 670-3.04 or covered with black removable preformed marking tape.

Mark existing roadway sections that will be opened to traffic during the winter. Mark over the existing lines and markings, unless shown otherwise on the Plans or an approved TCP.

Maintain all interim pavement markings for their intended life including reapplication when necessary. There will be no compensation to upgrade interim pavement markings required for work operations lasting up to 2 weeks.

Use only temporary raised pavement markers or removable preformed retroreflective marking tape as interim pavement markings on final pavement surfaces. Completely remove and dispose of them when placing the final markings. Completely remove any residual adhesive that might misguide motorists. Place final pavement markings on finished pavement surfaces and interim pavement surfaces before suspending work for the winter.

Stage construction to avoid routing traffic over conflicting markings for more than one continuous workshift. If traffic is routed over conflicting markings during a work shift, delineate the roadway with a complement of warning signs, channelizing devices, and flaggers as required by the ATM.

Use only temporary raised pavement markers meeting Subsection 712-2.16 as interim markings on seal coat and surface treatment pavements. Install the markers according to the manufacturer's instructions before applying the asphalt surface material and cover coat. Remove the vinyl protective covers after applying the asphalt pavement.

On multicourse surface treatments, install the temporary raised pavement markers after applying the full width of the first layer of cover coat. Install the markers on each day's completed surface before removing the pilot car operations and allowing unescorted traffic on the surface treatment.

Do not place final pavement markings until traffic has traveled over the seal coat or surface treatment for at least 14 days. Apply final pavement markings within 10 days of completing the final sweeping or brooming of the mainline seal coat or surface treatment.

643-3.10 LIGHTING FOR NIGHT WORK. Illuminate the night work areas according to Table 643-4.

Table 643-4 does not provide a comprehensive list of operations that require lighting. Provide lighting for other operations when necessary.

Use balloon lighting as the main light sources. Do not use floodlights without prior approval by the Engineer. When approved, install floodlighting in a manner that minimizes glare for motorists, workers, and residents living along the roadway. Locate, aim, louver, and/or shield light sources to reduce glare.

The Engineer shall be the sole judge of when glare is unacceptable, either for traffic or for adjoining residences. When notified of unacceptable glare, modify the lighting system to reduce glare to an acceptable level.

TABLE 643-4
NIGHT WORK ILLUMINATION EQUIPMENT AND LOCATION REQUIREMENTS

Type of Work or Equipment	Lighting Configuration
Paving, Milling, Striping, Pavement Marking Removal, Rumble Strip Installation	At least one machine-mounted balloon light of at least 2000 watts. Provide additional lights or wattage if necessary to provide complete coverage.

Rolling, pavement sweeping	At least 4 sealed beam halogen lamps in the front and four in the back. Each should be at least 55 watts.
Flagging	One balloon light of at least 2000 watts, located within 30 feet of the flagger location. Locate so the flagger and the flagging location are illuminated. Provide additional lights or wattage if necessary to provide complete coverage of the flagging location.
Truck Crossings where haul vehicles cross or enter a road with more than 10,000 ADT, or where the haul vehicle crossing or entering location is controlled by portable traffic signals or flaggers	At least one balloon light of at least 2000 watts, located on the main road on the far right side of the intersection. Locate light within 30 feet of the edge of the side street. If there is a flagger at the crossing, locate the lights or lights so the lighting requirements for Flagging are also satisfied.

If the Contractor fails to provide required lighting equipment or provides lighting that creates unacceptable glare, the Contractor shall cease all construction activities that require illumination, including flagging operations, until the condition or conditions are corrected.

Use lighting equipment in good operating condition and that complies with applicable state and local adopted codes and standards, and OSHA, NEC, and NEMA requirements.

Provide suitable brackets and hardware to mount lighting fixtures and generators on machines and equipment. Design mountings so lights can be aimed and positioned as necessary to reduce glare. Locate mounting brackets and fixtures so they don't interfere with the equipment operator or overhead structures. Connect fixtures securely in a manner that minimizes vibration.

Ensure ground, trailer, and equipment-mounted light towers or poles are sturdy and freestanding without the aid of guy wires. Towers shall be capable of being moved as necessary to keep pace with the construction operation. Position ground and trailer-mounted towers and trailers to minimize the risk of being impacted by traffic on the roadway or by construction traffic or equipment.

Raise trailer or equipment mounted lights to maximum height, except do not exceed the clearance required for overhead objects such as overhead signals, overhead signs, trees, aerial utilities, or bridges. Aim and adjust lights to provide the required light levels. Provide uniform illumination on the hopper, auger, and screed areas of pavers. Illuminate the operator's controls on all machines uniformly.

Furnish each side of non-street legal equipment with a minimum of 75 square inches high intensity retroreflective sheeting in each corner, so at least 150 square inches of sheeting is visible from each direction. Provide red sheeting on the rear of the equipment and yellow sheeting elsewhere.

Existing street and highway lighting and conventional vehicle headlights may supplement but do not relieve the Contract requirement to provide lighting for night work, according to the requirements of Table 643-4.

Provide sufficient fuel, spare lamps, spare generators, and qualified personnel to ensure that all required lights operate continuously during nighttime operations. Ensure generators have fuel tanks of sufficient capacity to permit operation of the lighting system for a minimum of 12 hours. In the event of any failure of the lighting system, discontinue the operation that requires illumination until the required level and quality of illumination is restored.

Maintain a supply of at least twenty emergency flares for use in the event of emergency or unanticipated situations. Comply with local noise ordinances.

Install all post-mounted electroliers located within the clear zone, on NCHRP 350 or MASH compliant breakaway bases.

643-3.11 HIGH VISIBILITY GARMENTS. Ensure all workers within project limits wear outer garments that are highly visible and comply with the following requirements:

1. Standards. Use high visibility garments conforming to the requirements of ANSI/ISEA 107-2004, Class 2 for tops or Class E for bottoms, and Level 2 retroreflective material.

2. Labeling. Use garments labeled in conformance with Section 11.2 of ANSI/ISEA 107-2004 or ANSI/ISEA 107-2010.

3. Tops. Wear high visibility vests, jackets, or coverall tops at all times.

4. Bottoms. Wear high visibility pants or coverall bottoms during nighttime work (sunset to sunrise). Worksite traffic supervisors, employees assigned to traffic control duties, and flaggers wear high visibility pants or coverall bottom at all times.

5. Outer Raingear. Wear raingear tops and bottoms conforming to the requirements of this Subsection 643-3.11.

6. Exceptions. When workers are inside an enclosed compartment of a vehicle, they are not required to wear high visibility garments.

7. Condition. Furnish and maintain all vests, jackets, coveralls, rain gear, hard hats, and other apparel in a neat, clean, and presentable condition. Maintain retroreflective material to Level 2 standards.

Payment for high visibility garments for workers is subsidiary to other traffic contract items.

643-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows. Quantities will not be measured during winter suspension of work.

1. Traffic Maintenance. Calendar Day: Every day shown on the calendar, beginning and ending at midnight. Measurement begins on the day following receipt of the Notice to Proceed or on the first day of work at the project site, whichever is later, and ends on the date of project completion.

2. Traffic Control Device Items. By the number of units of each bid item shown on the bid schedule (or the Traffic Control Rate Schedule, if item 643.0025.____, Traffic Control, is included) that are installed, accepted, and operational. Incomplete or unsatisfactory devices will not be measured. Special Construction Signs are measured by the total area of legend-bearing sign panel, as determined under Subsection 615-4.01. Items measured by the day are for each item per 24-hour period.

3. Traffic Maintenance Setup Items. By each lane closure or one-lane road in place per hour. By each detour or road closure in place per 24-hour period.

4. Portable Concrete Barrier. By each nominal 12.5 foot section placed according to the approved TCPs, for the initial placement and for each subsequent relocation when moved more than 10 feet in any direction. Each transition piece (sloping end) will be measured as a single section.

5. Temporary Crash Cushion. By each acceptable installation.

6. Interim Pavement Marking. By the single-stripe station. A single stripe is a marking or a temporary raised pavement marker 4 inches wide. Wider striping is measured in multiples of 4 inches. Centerline gaps are not deducted from measurements.

7. Flagging and Pilot Car. By the number of approved hours, supported by certified payroll.

8. Street Sweeping. By the number of operated hours, supported by certified payroll and approved by the Engineer.

9. Watering. By the 1,000 gallons (M-Gallon) of water applied. The Engineer may specify measurement by weight or volume. If by weight, convert to gallons at 8.34 pounds per gallon. If by volume, convert to gallons at 7.48 gallons per cubic foot.

10. Traffic Price Adjustment. By each minute that any lane of traffic is not open to full use by the traveling public, measured to the nearest minute. The Engineer will determine whether the roadway is opened to full use.

11. Traffic Control. By the units specified in the Special Provisions.

12. Portable Changeable Message Board Sign. By the 24-hour period for each sign, as shown on an approved TCP and displaying an approved message.

13. Plastic Safety Fence. By the linear foot, as placed, to protect or channelize pedestrian traffic as shown on an approved TCP. Any adjustments in configuration of the fence at the same location that does not result in an increased amount of fence is not measured. Opening and closing the fence to gain access to and from the worksite is not measured.

14. Temporary Sidewalk Surfacing. By the square yard as shown on an approved TCP.

15. Temporary Guardrail. By the linear foot, including end treatments, as shown on an approved TCP.

16. Portable Steel Barrier. By the linear foot placed according to the manufacturer's recommendation and approved TCPs, for the initial placement, and for each subsequent relocation when moved more than 10 feet in any direction.

643-5.01 BASIS OF PAYMENT.

1. Traffic Maintenance. The contract price includes all resources required to provide the Worksite Traffic Supervisor, all required TCPs and public notices, the Construction Phasing Plan, and the maintenance of all roadways, approaches, crossings, intersections and pedestrian and bicycle facilities, as required. This item also includes any Traffic Control Devices required but not shown on the bid schedule.

   Items required by the Contract that are not listed on the bid schedule or not included in other items are subsidiary to Item 643.0001.____ or 643.0002.____ Traffic Maintenance, except the following:

   a. Traffic Price Adjustment

   b. Traffic Maintenance Setup

2. Traffic Control Device Items. The contract price includes all resources required to provide, install, maintain, move, and remove the specified devices. Warning lights, high-level warning devices, vertical panels, and sign supports required for traffic control devices are subsidiary.

3. Traffic Maintenance Setup Items. Each setup consists of all traffic control devices, flaggers, pilot cars, and subsidiary items necessary to implement the TCP shown on the Plans. Warning lights, high-level warning devices, vertical panels, and sign supports required for traffic control devices are subsidiary.

   Construction and obliteration of temporary roadways, when required on the Plans or approved TCP under a traffic maintenance setup item, is paid for under their respective roadway pay items.

When topsoil or seeding is required for detours, payment will be made under Sections 620 and/or 618.

4. Portable Concrete Barrier. The contract price includes all resources required to provide, install, maintain, and remove each barrier section.

5. Temporary Crash Cushion. The contract price includes all resources required to provide, install, maintain, repair, and remove each crash cushion.

6. Interim Pavement Marking. The contract price includes all resources required to provide, install, maintain, and remove the specified markings. Installation of word and symbol markings are subsidiary. The No-Passing Zone signing, described in Subsection 643-3.04, is subsidiary.

7. Flagging and Pilot Car. The contract price includes all required labor, vehicles, radios, flagger paddles and pilot car signs, and transportation to and from the worksite.

8. Street Sweeping. The contract price includes all resources required to keep the roadway free of loose material.

9. Watering. The contract price includes all resources required to provide watering, as directed.

10. Traffic Price Adjustment. If Item 643.0023.____, Traffic Price Adjustment, is shown on the bid schedule, the total value of this contract will be adjusted, for unauthorized lane reductions or closures, at the rates listed in Table 643-3.

11. Traffic Control. Payment for Item 643.0025.____, Traffic Control, will be made at the unit rate value contained in the Traffic Control Rate Schedule shown in the Special Provisions for the accepted units of traffic control devices.

12. Portable Changeable Message Board Sign. The contract price includes all resources required to furnish, move, and operate the sign.

13. Plastic Safety Fence. The contract price includes all resources required to install, maintain, and remove the fence.

14. Temporary Sidewalk Surfacing. The contract price includes all resources required to construct, maintain, and remove the surfacing.

15. Temporary Guardrail. The contract price includes all resources required to construct, maintain, and remove the guardrail.

16. Portable Steel Barrier. The contract price includes all resources required to provide, install, maintain, move and remove each barrier.

17. Lighting for Night Work. Payment for illuminating night work areas and any required adjustments to work zone illumination is subsidiary to other items.

Traffic control devices, barriers, and crash cushions required to delineate or shield fixed objects will not be measured or paid for separately, but will be subsidiary

Traffic control devices, barriers, and crash cushions required to delineate or shield guardrail posts or non-crashworthy ends will not be measured or paid for separately, but will be subsidiary, when required for failure to meet completion timelines in subsection 606-3.01.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**

643.0001.____	Traffic Maintenance	CDAY
643.0002.____	Traffic Maintenance	LS
643.0003.____	Permanent Construction Signs	LS
643.0004.____	Construction Sign	DAY
643.0005.____	Type II Barricade	DAY
643.0006.____	Type III Barricade	DAY
643.0007.____	Traffic Cone/Tubular Marker	DAY
643.0008.____	Plastic Safety Fence	LF
643.0009.____	Drum	DAY
643.0010.____	Sequential Arrow Panel, Type C	DAY
643.0011.____	Special Construction Signs	SF
643.0012.____	Portable Concrete Barrier	EACH
643.0013.____	Temporary Crash Cushion	EACH
643.0014.____	Interim Pavement Marking	STA
643.0015.____	Flagging	HR
643.0016.____	Pilot Car	HR
643.0017.____	Street Sweeping	HR
643.0018.____	Watering	MGAL
643.0019.____	Lane Closure	HR
643.0020.____	Detour	DAY
643.0021.____	Road Closure	DAY
643.0022.____	One Lane Road	HR
643.0023.____	Traffic Price Adjustment	CS
643.0024.____	Portable Changeable Message Board Sign	DAY
643.0025.____	Traffic Control	CS
643.0026.____	Temporary Sidewalk Surfacing	SY
643.0027.____	Temporary Guardrail	LF
643.0030.____	Portable Steel Barrier	LF
643.0031.____	Interim Pavement Marking	LS
643.0032.____	Flagging	CS
643.0033.____	Detour	LS

SECTION 644
SERVICES TO BE FURNISHED BY THE CONTRACTOR

644-1.01 DESCRIPTION. Furnish and maintain facilities and services specified in the Contract for the Department's project administrative personnel to use during the project. Services include heat, electrical power (NEC compliant), water and any others required to operate the facilities. All furnished facilities remain your property when you complete the work.

644-2.01 FIELD OFFICE. Furnish and maintain a suitable office for the Engineer to use during construction. If this office is part of your building, completely partition it from the rest of the structure and provide a separate outside door equipped with a lock. Provide a suitable stove or other heating device with fuel. Furnish adequate electrical lighting and 120-volt, 60-cycle power. Construct the office with at least 500 ft^2 of floor space and at least 60 ft^2 of window area, along with adequate ventilation. Provide at least 12 feet of shelf space. Equip the field office with sanitary facilities. Provide janitorial services at least weekly.

Furnish and install a high speed internet service and three telephones, with all necessary ancillary equipment.

Unless approved in advance by the Engineer, the internet system shall consist of Digital Subscriber Line service, or better, and shall have a send and receive capability supporting 10.0 Mbps download speed or higher and 2.0 Mbps upload speed at all times. The internet system shall have an unlimited monthly data usage, or 50 GB minimum, if approved by the Engineer. Include a wireless router and an appropriately sized battery backup for the internet system. The system shall be for the exclusive use of the Engineer.

The telephone system shall consist of commercially available telephones with the necessary equipment for each line. Provide one telephone that includes a built in digital answering machine.

Internet and telephone service shall be supplied and operational no more than two weeks after the field office has been set up on site. Service plans shall be provided and remain in effect for the duration of the use of the field office.

All long distance calls made by State personnel will be paid by the State. Installation and maintenance fees, local calls, connection fees and internet service provider fees, and all other fees shall be paid by the Contractor.

Provide at least one designated handicap parking space. Make the field office accessible according to the requirements of 2006 U. S. DOT ADA Standards for Transportation Facilities.

Make the field office available for occupancy 2 weeks before commencing work on the project through one week after project completion.

644-2.02 FIELD LABORATORY. Furnish and maintain a field laboratory for the Engineer to use exclusively throughout the contract. Provide a completely functional installation 2 weeks before commencing construction work through one week after Project Completion.

1. Grade and compact a site for the lab acceptable to the Engineer. Locate and level the structure on this site. If subsequent ground movement causes an unlevel or unstable condition, re-level or re-locate the facility as directed.

2. Provide a weatherproof structure suitable to field test construction materials, with the following minimum functional requirements:

    a. Floor space of 300 ft^2

    b. Two 10-ft^2 windows that open and lock

c. Lockable door(s)

d. Work bench(es), 2-1/2 X 16 feet total, 3 feet high

e. Shelf space, 1 X 16 feet

f. One 18-inch deep sink with attached faucet and approved drain

g. A gravity-fed 250-gallon tank or pressurized constant water supply of acceptable quality

h. Electrical service and facilities as follows:

(1) Electrical current, 120/240 VAC, 60-cycle on 24-hour basis.

(2) Wiring system to support a 40-amp user load demand with at least one 15-amp and one 20-amp circuit, both GFI protected

(3) Outlets, 6 conveniently spaced around the lab, consistent with local codes

(4) Lights, four 100-watt incandescent or eight 40-watt fluorescent, or equivalent LED fixtures

(5) Exhaust fan, 5 cfs

i. Heating equipment suitable to maintain a uniform room temperature of 70 F

j. Storage cabinet, 3 ft X 3 ft X 3 ft, lockable, securely fixed to an inside wall with a hinged door opening outward

k. Office desk and 2 chairs

3. If the lab is a mobile unit mounted on axles and wheels, block the structure under the frame so that the wheels do not touch the ground and the blocking rests firmly on the prepared site.

4. Provide a separate weatherproof shed within 20 feet of the main lab structure with the following minimum functional requirements:

a. Floor 8 ft X 12 ft, ceiling height 8 ft

b. Door 4 ft wide and window 5 ft^2 that opens, both lockable

c. Electrical service and facilities as in 2.h, except for the following:

(1) Lighting fixtures, 2 ea.

(2) Outlets, 3 conveniently spaced around the structure

(3) Wiring system with each circuit GFI protected to satisfy a 20-amp user load demand

d. Work table 3 ft X 1-1/2 ft X 3 ft high, capable of supporting 250 pounds and affixed to an inside wall as directed

e. Concrete-slab floor, 8 ft X 8 ft X 4 inches thick, cast-in-place or pre-cast. Install anchor bolts in the floor to accommodate the mounting pattern of the Gilson sieving machine at a location as directed.

(1) Comply with 1. above for slab foundation requirements.

(2) Found the slab directly on the prepared site.

5. For all types of installations, if the entryway is located higher than a single 7-inch rise, provide the following:

    a. Stairway, 3 feet wide X 11-inch tread X 7-inch rise

    b. Landing, 4 ft X 4 ft centered on the entryway

    c. Handrail(s) firmly affixed to the stairway

6. Provide the following lab equipment and services:

    a. Propane necessary for the lab operation, including two 100-lb tanks, regulators, hoses, fittings, and incidentals for a functional system

    b. Specialized sampling equipment such as belt templates or belt sampling devices as required

    c. Fuel and power necessary to continuously operate the facilities

644-2.03 CURING SHED. Furnish and maintain a suitable weather tight shed for curing concrete test cylinders, with a suitable tank(s) for curing concrete test cylinders.

Provide a tank(s) large enough to contain at least 6 each 4”X8” test cylinders from each pour that you propose to make during any 28-day period. Use a tank(s) at least 18 inches high, insulated, and constructed of heavy duty plastic or non-corrosive metal. Construct a lid to provide access to the tank(s).

Provide suitable heating to maintain the temperature in the tank between 70 and 77 °F at all times when curing the test cylinders. In addition, provide suitable thermometers in the shed and tank(s) to check the temperature.

Provide a supply of calcium hydroxide (high-calcium hydrated lime) sufficient to maintain a fully saturated water bath in the tank(s). Provide a source of potable water.

Provide electrical service and equipment for:

1. Heating/Cooling adequate to maintain temperatures between 70 F to 77 F

2. Two 100-watt incandescent or four 40-watt fluorescent, or equivalent LED fixtures.

3. One combination smoke alarm and carbon monoxide detector.

644-2.04 MEALS AND LODGING. When Items 644(4) and 644(5) appear in the bid schedule, furnish, and maintain suitable boarding facilities, at or near the project, for State employees. State employees include Department employees assigned to the project and other personnel authorized by the Engineer. The Special Provisions will list an estimated number of State employees.

Provide facilities meeting the Alaska Administrative Code 8 AAC 61.1010 and 8 AAC 61.1040 *Occupational Safety and Health Standards*, 18 AAC 31 *Alaska Food Code,* and U.S Code of Federal Regulations 29 CFR 1910.142 *Temporary Labor Camps*.

Boarding facilities may include a Contractor Camp or the use of roadhouses or lodges located near the project, providing the accommodations conform with Contract requirements and the applicable requirements of State employee labor union agreements.

Provide as a minimum, the following facilities:

1. Meals
    a. Three well balanced meals per day per person
    b. Food, drinks, and bottled water for employees to pack a mid-shift lunch
2. Kitchen and Dining Area
    a. Kitchen capable of preparing meals so that all portions are served at one time
    b. Separate dining area with 50 ft^2 per person based on full capacity
3. Lodging (Room and Bedding)
    a. Heated, well ventilated housing of 60 ft^2 of floor area for each person with twin size bed frame, box spring, mattress, mattress pad, sheets, pillow, and a heavy blanket or comforter
    b. A weekly change of sheets
    c. Lockable room door with keys
    d. Lockable storage space in the room of 35 ft^3 for each person
4. Common Area (reading/recreation area)
    a. A “common” area with furnishings at the rate of 10 ft^2 per person based on full capacity
    b. Satellite TV access or equal with a minimum number of 30 channels and a VCR
    c. Furnishings to include adequate couches, easy chairs, padded folding chairs, and a regulation size pool table or other recreational/entertainment activities
5. Sanitary Facilities and Services
    a. Toilets, showers, and sinks at the rate of 1 each per 10 persons
    b. Separate bathroom units for males and females at the rate specified above
    c. Clothes washers and dryers at the rate of 1 each per 30 persons
    d. Adequate hand soap, toilet paper, paper towels, bath towels, and wash cloths
    e. Clean bathrooms and empty garbage daily
    f. Vacuum rooms, launder towels and sheets, and do other cleaning as required
6. Safety Facilities
    a. First aid facilities
    b. Emergency response plan
    c. Emergency evacuation plan
    d. Fire alarms, smoke alarms, and fire extinguishers according to “Occupational Safety & Health Administration, U.S. Department of Labor”
7. Other facilities and services required by codes, regulations, and labor union agreements

Make boarding facilities available for use by State employees starting 2 weeks before commencing work on the project through one week after project completion.

Require State employees to sign a meal and/or lodging sheet to document receipt of each meal and each night's lodging.

644-2.05 VEHICLES. Furnish and maintain vehicles for exclusive use of the Department throughout the project. Provide vehicles from 2 weeks before commencing the work through 1 week after the final inspection. During seasonal shut-down, provide vehicles 1 week before commencing work through 1 week after the shut-down.

Provide full-size four-wheel drive pickups or all-terrain vehicles (ATV) or utility task vehicles (UTV). Provide vehicles less than 3 model years old, in good condition and with less than 36,000 miles on the odometer. Furnish all fuels, maintenance, and insurance. The Special Provisions will state the required number and type of vehicles.

You are responsible for normal wear and tear, and any other incidental damage including broken windshields, occurring during the Department's operation and use. The Department is responsible for damage to any vehicle caused by its own negligent operation. The Department will provide non-owned auto liability insurance providing third party liability coverage for any accident during the Department's operation and use.

644-2.06 NUCLEAR TESTING EQUIPMENT STORAGE SHED. Design, furnish and maintain a weatherproof, heated, and ventilated nuclear densometer/testing equipment storage shed for the Engineer to use exclusively throughout the contract. Install the building at least 15-feet from an occupied area at a location approved by the Engineer. Install the shed before commencement of construction activities and maintain it until one week after project completion. Provide sufficient floor area for the nuclear testing equipment and a portable electric heater to maintain a minimum room temperature of 50 °F in freezing weather. Design the building with enough floor area to provide sufficient clearance between the equipment, heater, and combustibles. Provide a commercial grade metal-clad exterior entrance door of 3'-0" min width by 6'-8" height with dead-bolt lockset. Hang the door so that hinge pins are not accessible from the exterior. Provide the Engineer with 2 keys to control access. Provide a 5/16" x 10 foot long welded steel security chain securely attached inside the structure with tamperproof hardware for the Engineer to secure the testing equipment. Provide 120-volt, 60-cycle power, an interior light, and a wall receptacle for the heater. Secure the structure to the ground with tamperproof anchors to resist wind loads and prevent unauthorized movement of the building. The nuclear testing equipment storage shed remains the property of the Contractor. Remove the shed from the site following project completion.

644-2.07 STORAGE CONTAINER. Furnish, transport and maintain a weathertight, lockable, steel enclosed 20 foot long X 8 foot wide X 8 foot high wooden floored container for the storage of the Department's materials, supplies and testing equipment (but not nuclear equipment). Provide twenty equally spaced fastening points on the interior walls that are capable of securing the Department's contents. Door opening dimensions of the storage container shall be greater than 60 square feet. Supply necessary equipment to lift and move container with minimal disturbance to the Department's contents. The container shall not be moved by skidding or hook lift. The Contractor shall be listed as the shipper on all documents listing and acknowledging receipt of the Department's goods for shipment.

Deliver an empty and clean container to the Regional Materials Laboratory, or location acceptable to the Engineer, three weeks prior to transporting to the project site. Allow 7 days for the Department to load the container. Transport the loaded container to the project site. Set up container at a location approved by the Engineer prior to commencing construction work.

Provide electrical service and other facilities as follows:

1. Electrical current, 120V (ac), 60 cycle on a 24 hour a day basis;

2. Wiring system to support a 20 amp user load demand;

3. Two GFI protected outlets conveniently spaced on the interior walls;

4. Four 100 watt incandescent or eight 40 watt fluorescent lights, or equivalent LED fixtures, located for maximum illumination; and

5. Provide a stairway with railing, built to meet the International Building Code, if there is more than 12-inch difference in floor entry and existing ground elevation.

Return the container to the Regional Materials Laboratory, or location acceptable to the Engineer, upon project completion. Allow 7 days for the Department to unload the container. The storage container remains your property after you complete the work.

644-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Meal. By each meal served to authorized personnel, based on signed meal sheets.

Lodging. By each night's lodging received by authorized personnel based on signed lodging sheets.

Vehicle. By the 24-hour day for each vehicle.

Nuclear Testing Equipment Storage Shed. By the number of storage sheds specified, to include all components, installed and accepted as completed units and ready for equipment storage.

Storage Container. By the number of storage containers specified, to include all components, installed and accepted as completed units and ready for materials and equipment storage.

644-5.01 BASIS OF PAYMENT.

Meal. Includes all resources required to provide meals to all authorized personnel assigned to, or associated with, the project.

Lodging. Includes all resources required to provide lodging for all authorized personnel assigned to, or associated with, the project.

Vehicle(s). Includes all resources, including fuel, oil, maintenance, and insurance to furnish the specified number of fully operational vehicles for the duration specified in the contract.

Lump Sum Items. Payment for lump sum items will be made as follows:

1. A percentage of the lump sum amount, to be determined by the Engineer, will be paid as full compensation for furnishing the facility at the site.

2. The balance of the lump sum amount will be prorated over the anticipated active construction period with a portion included as part of each interim payment, for maintenance, repairs, providing all utilities, and for removing it from the site. If anticipated construction period changes, the final increment will be held until final payment.

Nuclear Testing Equipment Storage Shed. At the contract unit price to include all labor, materials, tools, equipment and supplies required to furnish and install the shed before commencement of construction, to maintain it for the duration of the project and to remove the shed and electrical service after project completion. Electrical service and utility costs are subsidiary to this item.

Storage Container. At the contract unit price to include all labor, materials, tools, equipment and supplies required to deliver the storage shed to the regional office for loading, to deliver it to the project office, to install it before commencement of construction, to maintain it for the duration of the project, to remove the shed and electrical service after project completion, to deliver it to the regional office for unloading, and to remove the storage shed. Electrical service and utility costs are subsidiary to this item.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
644.0001.____	Field Office	LS
644.0002.____	Field Laboratory	LS
644.0003.____	Curing Shed	LS
644.0004.____	Meal	EACH
644.0005.____	Lodging	EACH
644.0006.____	Vehicle	LS
644.0007.____	Vehicle	DAY
644.0008.____	Vehicle (ATV)	EACH
644.0009.____	Vehicle (UTV)	EACH
644.0015.____	Nuclear Testing Equipment Storage Shed	EACH
644.0016.____	Storage Container	EACH

SECTION 646
CPM SCHEDULING

646-1.01 DESCRIPTION. Provide and maintain a Critical Path Method (CPM) progress schedule for the project. Use the schedule in coordinating and monitoring of all work under the Contract including activity of subcontractors, manufacturers, suppliers, and utility companies, and reviews by the Department. Update CPM, as required.

Provide work plans.

646-2.01 SUBMITTAL OF SCHEDULE.

Submit a detailed initial CPM schedule at least 5 working days prior to the preconstruction conference, for the Engineer's approval. Meet the requirements set forth below.

The construction schedule, for the entire project, may not exceed the specified contract time.

Following the Engineer's review, if revisions to the proposed CPM schedule are required, do so promptly. The CPM schedule must be finalized and accepted before beginning construction work.

646-3.01 REQUIREMENTS AND USE OF SCHEDULE.

1. Schedule Requirements. Prepare the CPM schedule as a Precedence Diagram Network developed in the activity-on-node format which includes:

   a. Activity description

   b. Activity duration

   c. Resources required for each of the project activities, including:

      (1) Labor (showing work days per week, holidays, shifts per day, and hours per shift)

      (2) Equipment (including the number of units of each type of equipment)

      (3) Materials

   Show on the activity-on-node diagram the sequence and interdependence of all activities required for complete performance of all items of work under this Contract, including shop drawing submittals and reviews and fabrication and delivery activities.

   No activity duration may be longer than 15 work days without the Engineer's approval.

   The Engineer reserves the right to limit the number of activities on the schedule.

   Consider that schedule float time is shared equally with the Department.

   The contract completion time will be adjusted only for causes specified in this Contract.

2. Schedule Updates. Hold job site progress meetings on a frequency satisfactory to the Engineer for the purpose of updating the CPM schedule. Review progress and verify finish dates of completed activities, remaining duration of uncompleted activities, and any proposed logic and/or time estimate revisions. Submit a revised CPM schedule, within 5 working days after this meeting, showing the finish dates of completed activities and updated times for the remaining work, including any addition, deletion, or revision of activities required by Contract modification.

3. Work Plans. In addition to the CPM schedule, submit a work plan every two weeks during construction detailing your proposed operations for the forthcoming two weeks. Include:

a. work activities

b. manpower involved by trade

c. work hours

d. equipment involved

e. location of the work to be performed

646-4.01 METHOD OF MEASUREMENT. See Section 109.

1. Upon approval of CPM and work plan, 15 percent of the amount bid on the pay item.

2. Starting in the month after approval of CPM through estimated month of project completion, equal monthly payments that total 75 percent of the amount bid on the pay item.

3. Upon project completion, the remaining 10 percent of the amount bid on the pay item.

646-5.01 BASIS OF PAYMENT.

Non-compliance with CPM Schedule update requirements is considered unsatisfactory performance and may result in withholding progress payments according to subsection 109-1.06.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
646.0001.____	CPM Scheduling	LS

SECTION 649
GOVERNOR'S WORKFORCE DEVELOPMENT (RESERVED)

SECTION 651
WORK BY OTHERS (RESERVED)

SECTION 652
INTERIM COMPLETION DATES (RESERVED)

SECTION 660
SIGNALS AND LIGHTING

660-1.01 DESCRIPTION. Furnish and install, modify, remove, or salvage one or more traffic signal systems, flashing beacon systems, highway lighting systems, sign illumination systems, traffic count systems, electrical equipment on structures, falsework lighting, partial installations for future systems, or combinations thereof, as specified.

Where an existing system is to be modified, reuse the existing material in the revised system as shown on the Plans or specified in the Special Provisions, and salvage or dispose of all other materials.

When required by the Special Provisions, provide an on-site manufacturer's representative to:

1. Energize and adjust the electrical system.

2. Provide acceptable instruction for the operation and maintenance of the electrical system.

660-1.02 DEFINITIONS. Use the definitions in NEMA TS 1-1989, *Traffic Control Systems*, Section 1, Definitions, along with the following:

1. Electrolier. The complete assembly of pole, mast arm, luminaire, ballast, and lamp.

2. Luminaire. The assembly which houses the light source and controls the light emitted from the light source. Luminaires consist of hood (including socket), reflector, ballast or driver, and glass globe or refractor.

3. Lighting Standard. The pole and mast arm which supports the luminaire.

4. Vehicle. Any motor vehicle licensed for highway use by the State of Alaska.

660-2.01 MATERIALS. Use materials that conform to Section 740, the Materials Certification List, the Plans, specifications, and the following:

Concrete	Section 501 (Class A)
Grout	Subsection 701-2.03
Reinforcing Steel	Section 503
Paint	Subsection 708-2.01
Steel Pipe Pile	Section 715
Anchor Plate	ASTM A709
Galvanizing	Subsection 716-2.07

1. Equipment List(s) and Drawings. Within 30 days after the Contract award, submit 8 collated copies of a portfolio of equipment and materials proposed for installation to the Department for review and approval. Include a table of contents in the portfolio(s) that includes each item's intended use(s) and the following:

   a. Materials on the *Qualified Products List*: A description that includes product name, manufacturer, model or part number, and the conditions listed for approval.

   b. Materials Not on the *Qualified Products Lis*t: Catalog cuts that include the manufacturer's name, type of product, size, model number, conformance specifications, and other data as may be required, including manufacturer's maintenance and operations manuals, or sample articles.

   c. Pole Package. A complete set of design, fabrication, and installation proposals for each signal and lighting pole. Include stamped engineering calculations, shop drawings, welding plans, equipment lists, and pole installation plans.

d. Materials Not Requiring Certification: Incidental materials incorporated into the work (such as nuts, ties, bolts, washers, etc.) must meet all applicable Specifications and be installed per all manufacturer's recommendations. Certification is not needed unless required by the Special Provisions or requested by the Engineer.

2. As-Built Plans. Prepare 3 complete sets of red lined as-built plans and keep them current with the construction. Detail in the as-built plans all construction changes made to the Plans. Include the following information on the appropriate sheets:

   a. Location and depth of conduit runs

   b. Station and offset of all junction boxes

   c. Heights of signal faces and overhead signs

   d. A list of equipment, including manufacturer, brand, and model number installed in each controller cabinet

   Furnish copies of the as-built plans at least twice a month during construction so that they may be reviewed for accuracy and completeness. Furnish any additional information required to clarify the as-built plans and correct all discrepancies. The Department will not make progress payments for the signal and illumination work completed until reviewing accurate as-built plans reflecting the construction progress. Correct any deficiencies before payment.

   Before final inspection of the work, submit 3 complete sets of as-built plans to the Engineer. You may substitute 2 colored copies of the as-built plans in lieu of keeping the 3 separate original copies. If you elect to do this, a sample of the method of copying must be approved before starting any work on the signal and lighting items.

3. Warranties, Guarantees, and Instruction Sheets. Deliver to the Engineer all manufacturers' warranties, guaranties, instruction sheets, and parts furnished with materials used in the work before the Department assumes maintenance responsibilities.

CONSTRUCTION REQUIREMENTS

660-3.01 GENERAL.

1. Scheduling of Work. Complete each new traffic signal system, highway lighting system, and sign illumination system and ensure it is ready for operation before opening to traffic the corresponding section of new alignment.

   Do not place traffic signal systems in operation until the street lighting is energized at controlled intersections.

   Install detector loops and underground conduit before applying new pavement.

   Do not pull conductors into conduit until the junction boxes are set to grade, crushed rock sumps are installed, grout is placed around the conduit, and metallic conduit is bonded.

   In vehicular undercrossings, place soffit lights in operation as soon as practicable after removing falsework from the structure. Place lighting for pedestrian structures in operation before opening the structure to pedestrian traffic.

2. Safety Precautions. Before starting work on existing street lighting circuits, de-energize the system by opening disconnect switches, and/or opening bypass switch plugs, and tagging each opened device as detailed in Part 4, Section 44, Article 440 of NESC. Where said

circuits are under the control of an electric utility, obtain written assurance daily from the utility that the circuit being worked on has been de-energized.

Post suitable signs at load centers when any of the circuits from that load center are being worked on.

3. Excavating and Backfilling. Excavate as required for the installation of junction boxes, conduits, foundations, and other appurtenances. Avoid unnecessary damage to streets, sidewalks, landscaping, and other improvements.

   Do not excavate wider than necessary for the proper installation of conduits, junction boxes, and foundations. Do not perform excavation until immediately before installing conduit and other appurtenances.

   Excavate trenches for installing rigid metal conduit to a depth 6 inches below the bottom of the rigid metal conduit. Embed conduit between two 6-inch lifts of material that are free of rocks exceeding a 1-inch maximum dimension.

   Place the material from the excavation where it will not cause damage or obstruction to vehicular and pedestrian traffic or interfere with surface drainage. Dispose of all surplus excavated material according to Subsection 203-3.01.

   Backfill excavations according to Section 204.

   Keep excavations after backfilling well-filled and maintained in a smooth and well-drained condition until permanent repairs are made.

4. Welding. Conform to Subsection 504-3.01.7, and the requirements of the individual items.

5. Removing and Replacing Improvements. Replace or reconstruct improvements damaged by your operations such as sidewalks, curbs, gutters, pavement, base material, lawns and plants, and other improvements that are removed or broken with the same kind of material as found on the work, or with materials of equal or better quality. Leave the new work in satisfactory and serviceable condition.

   Whenever a part of a square or slab of existing sidewalk, curb and gutter, or driveway is broken or damaged, remove the entire square, section, or slab and reconstruct the concrete as above specified.

   Before removing the sidewalk, driveways, or pavement material, cut the outline of all areas to be removed in concrete sidewalks, driveways, and in pavements through completely with a saw. Make cuts neat and true and prevent shatter outside the removal area.

6. Salvaging or Reusing Electrical Equipment. Salvage and deliver existing electrical equipment, including controller assemblies, signal equipment, luminaires, lighting standards, signal poles and mast arms, service equipment, and junction box lids to a location indicated on the Plans, the Special Provisions, or by the Engineer.

   Jointly inventory, with the Engineer, all equipment and materials to be salvaged or reused. Perform the inventory within 15 days following the Notice to Proceed. Note on the inventory the location and condition of all materials to be salvaged or reused.

   When a controller assembly is to be salvaged, the salvaged material includes the controller unit, timing modules, switches, detector control units, conflict monitor unit, and all other equipment contained in the controller cabinet before Contract award.

When existing electrical equipment is to be reused, furnish and install all necessary materials and equipment, including signal mounting brackets, new tap wires, fused disconnect kits, anchor bolts, nuts, washers, and concrete as required to complete the new installation. Clean, relamp, and recondition all traffic signal, flashing beacon, and lighting fixtures to be reinstalled according to Subsection 660-3.01.8.b. You may elect to use new equipment if you determine that it will be more cost effective than reusing the old equipment called for in the Plans and/or Special Provisions. If using new equipment, notify the Engineer when submitting the equipment list(s) and drawings per Subsection 660-2.01.1. Include the submittals for the items proposed for use in lieu of the reused equipment with this submittal.

Replace salvaged materials required to be reused and found to be unsatisfactory by the Engineer with new material. Replacement will be paid for as extra work under Subsection 109-1.05.

Remove and salvage electrical equipment without damage. Replace at your expense any of the above-mentioned electrical equipment that has been damaged or destroyed by your operations.

Underground conduit, conductors, foundations, junction boxes, and detectors not reused become your property and must be removed from the highway right-of-way. If said materials, except conductors and cables, do not interfere with other construction they may, with approval, be abandoned in place with a credit taken by the Department. To limit future operation and maintenance concerns, remove all cables and conductors from any conduits that will be abandoned in place. Meet Subsection 660-3.02 for foundations abandoned in place.

Repair holes left in the shafts of existing metal poles, due to removal of equipment or mast arms, by welding in a suitable disk, grinding smooth, and painting as provided for repair of damaged coatings in AASHTO M 36.

As directed, repair or replace damaged existing metal poles that are to be relocated or reused in place. The Engineer will determine the extent of repairs or replacements. The Department will pay for the repairs or replacements ordered as extra work according to Subsection 109-1.05. Refinish poles according to Subsection 660-3.01.8.

Fill holes formed by removing junction boxes and foundations with material equivalent to the surrounding material and compact to the same density.

7. Field Tests. Before acceptance of the work, perform the following tests on all electrical systems under this Section, in the presence of the Engineer. Furnish the necessary equipment needed to perform these tests. The Department reserves the right to retest, and the test results will govern the acceptance or rejection of the installation. Replace or repair at your expense, and in an approved manner, any faults in material or any part of the installation revealed by these tests. Repeat the same test until no fault appears.

   a. Continuity. Test each circuit for continuity.

      Test each loop detector circuit for continuity at two locations:

      (1) Loop detector at the junction box before splicing with the loop detector lead-in cable must have a value less than 0.5 ohms.

      (2) Loop detector and lead-in cable system at the traffic signal controller cabinet or detector cabinet after splicing in the junction box must have a value less than 5 ohms for single pair lead-in cable and 10 ohms for multi-pair lead-in cable. The continuity test ohm reading at the traffic signal controller cabinet or detector cabinet must be greater than the ohm reading measured at the loop detector at the junction box.

b. Grounds. Test for grounds in each circuit by physically examining the installation to ensure that all required grounding bushings, bonding jumpers, and ground rods have been installed and are mechanically firm.

c. Insulation Resistance Test. Perform a megohm test on each circuit, between circuits, and between the circuit and a ground. Measure each detector loop and lead-in cable system at the traffic signal controller cabinet or at the detector cabinet between one loop detector lead-in conductor and the cabinet ground rod. Ensure the insulation resistance is not less than 100 megohms or the minimum specified by the manufacturer, measured at 500 volts DC. Disconnect all lamps and magnetometer sensing probes prior to the insulation resistance test. Document these tests in writing, for each circuit, and submit to the Engineer prior to acceptance of the system.

d. Inductance Test. Measure each detector loop and lead-in cable system at the traffic signal controller cabinet or detector cabinet. The inductance must be in the range of 50 to 500 microhenries.

e. Circuit. Energize every signal indication circuit with lamps installed before installing the load switches.

f. Functional. Perform the following tests on each signal and lighting system after all of the component circuits have satisfactorily passed the tests for continuity, grounding, insulation integrity and circuitry.

(1) Perform the functional test for each new traffic signal system by running at least 24 hours of flashing operation, followed by not less than 5 days of continuous, satisfactory operation. You may omit the flashing portion of the test for a modified signal system or if there was an existing signal maintained at this location during the construction activity.

The Engineer and the final owner of the signal system will determine if the flashing operation will be required. If the system performs unsatisfactorily, correct the condition and repeat the test until the system runs for 5 days with continuous satisfactory operation.

Do not start signal functional tests on a Friday, Saturday, Sunday, a legal holiday, or the day before the legal holiday.

Initially turn on the system between 9:00 a.m. and 2:00 p.m. Before turning it on, ensure all equipment is installed and operable. This includes, but is not limited to, pedestrian signals and push buttons; signal face backplates and visors; vehicle detectors; highway lighting; and all regulatory, warning, and guide signs. Aim all signal faces as required by Subsection 660-3.08.

(2) Perform the functional test for each highway lighting system and sign illumination system until the systems burn continuously 5 days without the photocell, followed by a 5-day operational test using the photocell.

(3) Perform the functional test for each flashing beacon system for not less than 5 days of continuous, satisfactory operation.

(4) Perform a continuous 5-day burning test on each pedestrian overcrossing and undercrossing lighting system before final acceptance.

A shut down of the electrical system due to a power interruption does not constitute discontinuity of the functional test if the system is functional when the power is returned.

8. Repairing Damaged Finishes. Examine all exterior surfaces for damage in the field, including new, reused, and State-furnished equipment. Repair damaged finishes as follows:

   a. Galvanized. Repair damage to galvanized coatings in conformance with AASHTO M 36.

   b. Painted.

      (1) Wash the equipment with a stiff bristle brush using a solution of water containing 2 tablespoons of heavy-duty detergent powder per gallon. After rinsing, wire brush all surfaces to remove all poorly bonded paint, rust, scale, corrosion, grease, or dirt. Remove any dust or residue remaining after wire brushing before priming.

      (2) You may use factory or shop cleaning methods for metals if equal to the methods specified herein.

      (3) Immediately after cleaning, coat all bare metal with pre-treatment, vinyl wash primer, followed by 2 prime coats of zinc chromate primer for metal.

      (4) Give signal equipment, excluding standards, a spot-finishing coat on newly primed areas, followed by 1 finishing coat over the entire surface.

      (5) Give ungalvanized standards 2 spot-finish coats on newly primed areas.

      You may apply all paint coats either by hand brushing or by approved spraying machines. Perform the work in a neat and workmanlike manner. The Engineer reserves the right to require the use of brushes for the application of paint, should the work done by the paint spraying machine prove unacceptable.

660-3.02 FOUNDATIONS.

1. Cast-in-Place and Precast Foundations. Use cast-in-place or precast, including cast-in-CMP, foundations for posts and poles in drilled or excavated holes. Use either precast or cast-in-place foundations for cabinets.

   a. Form the entire controller foundation and the top 12 inches of pole or post foundations and give the top a smooth steel trowel finish. If foundation is precast, place the centerline of foundation at the station, offset, and elevation shown on the plans, and orient subsurface conduit stub for connection.

   b. Place conduits in the center of the pole-post foundations with clearance allowed for bushings. If subsurface conditions prevent completing a drilled hole, and when approved, use a corrugated metal pipe (CMP) form as a substitute for the drilled hole. Consider the savings in concrete to offset the cost of supplying and installing the CMP form. No additional payment will be made for the CMP formed foundation.

   c. When a CMP is used, over-excavate the area around the form enough to allow for proper compaction around the form. Backfill and compact according to Section 205, and Subsections 203-3.04 and 660-3.01. Use Select Material Type A or sand slurry as backfill material. Do not use water for drilling operations or for any other purpose where it may enter the hole.

   d. Use controller cabinet anchor bolts as recommended by cabinet manufacturer and set with a template.

   e. Place Class A concrete meeting Section 501. Place reinforcing steel meeting Section 503. If required, use corrugated steel pipe that is at least 14 gage, meeting Subsection 707-2.01.

f. Drill holes or use forms that are vertical and true to the locations shown in the Plans. When foundation excavation is complete, but before placing the concrete, remove all loose material to ensure that the foundation rests on firm, undisturbed ground.

g. If a reinforcing steel cage is required, place and secure it symmetrically about the vertical axis and securely block it to clear the sides of the foundation. Use a template to securely support all anchor bolt assemblies and conduit ends so they do not move during concrete placement. Protect anchor threads from contact with concrete during pour.

h. Do not permit surface water to enter the hole. Before placing concrete, remove all water that may have infiltrated in the hole. Thoroughly moisten both the forms and the ground before placing concrete. Pour each foundation in one continuous pour.

i. Do not erect or place posts, poles, and pedestals on the foundation until 7 days after placing the concrete. Plumb the assembly according to Subsection 660-3.08 by adjusting the nuts on the anchor bolts.

j. Replace, with no additional compensation, all finished concrete pile caps with anchor bolts that do not match the base plate of the pole or are out of plumb. Do not modify the anchor bolts or base plate to get the base plate set on the leveling nuts.

k. Install the bottoms of the bottom leveling nuts in a level plane within one inch of the top of concrete pile cap. Generously lubricate the bearing surface and internal threads of all top nuts with beeswax and tighten the top nuts according to the following:

(1) Luminaire poles on frangible couplings: frangible coupling manufacturer's instructions

(2) Signal poles and luminaire poles without frangible couplings: Table 660-1.

TABLE 660-1.
TOP NUT ROTATION FOR TURN-OF-NUT
PRETENSIONING OF DOUBLE-NUT MOMENT CONNECTIONS

Anchor Bolt	Nut Rotation beyond Snug Tight [a,b,c]	
Diameter, in.	F1554 Grade 36	F1554 Grades 55 and 105, A449, A615, and A706 Grade 60
≤1 ½	1/6 turn	1/3 turn
>1 ½	1/12 turn	1/6 turn

a. Nut rotation is relative to anchor bolt. The tolerance is plus 20 degrees (1/18 turn)
b. Applicable only to double-nut moment connections.
c. Use a beveled washer if the nut is not in firm contact with the base plate or if the outer face of the base plate is sloped more than 1:40.

(3) High-tower lighting structures: Use direct-tension-indicating (DTI) washers to achieve anchor bolt preload as shown on the plans.

2. Pile Foundations.

a. Install pipe piles according to Section 505.

b. Install pipe piles open-ended and to a minimum depth of 15 feet (less top projection).

c. Use CJP groove welds for all circumferential welds.

d. Inspect 100 percent of CJP welds using UT or RT.

e. Backfill and compact the work hole around upper portion of each pile in 8-inch lifts with a soil-cement mixture. (minimum of 3 sacks of cement per cubic yard of soil).

f. Certify steel pipe piles by matching the stencils on the pipe piles (by 300 foot lots) to the physical and chemical tests for the applicable lot.

3. All Foundations.

a. When shown on the plans, install frangible couplings according to the manufacturers written installation instructions. Use shims furnished by the coupling manufacturer.

b. Provide new foundations and anchor bolts of the proper type and size for standards that are to be relocated. Install the anchor bolts on a bolt circle that matches the base plate.

c. Install a raised Type III junction box on the door side of the controller cabinet, and butt it against the cabinet's foundation unless installing a one-piece cabinet/junction box foundation. Extend the top of the controller cabinet foundation 18 inches above the junction box and provide it with a 1-inch diameter drain. The drain connected to the cabinet interior must empty to the rear and above the ground. Place all conduits in the door side half of the foundation to provide adequate terminal block clearance. For one-piece cabinet/junction foundations, place the junction box opening at the elevation and orientation shown on the plans. For cabinets with two doors, place conduits in each half-cabinet to provide adequate terminal block clearance.

d. Existing foundations may be abandoned-in-place. However, remove the tops of the foundations, reinforcing steel, anchor bolts, and conduits to at least 12 inches below the roadway subgrade, sidewalk, or unimproved ground. Backfill the resulting hole with material equivalent to and compacted to the density of the surrounding ground.

660-3.03 CONDUIT. Install electrical conductors in conduit, except for overhead wiring, wiring inside poles, and when otherwise specified. Use galvanized conduit and fittings that are rigid metal type and manufactured of mild steel or wrought iron.

1. If called for in the Plans, use rigid non-metallic type conduit. Where nonmetallic conduit is to be installed, use a rigid metal type conduit to run between a load-center and the nearest junction box. Use conduit routing as noted or detailed on the Plans; when it is not shown, use the routing as directed.

2. If conduit and fittings to be installed will be exposed to sunlight on the surfaces of poles or in structures and foundations, use rigid metal type.

3. Thread and ream the ends of all conduits, whether shop or field cut, to remove burrs and rough edges. Make cuts square and true so that the ends butt together for the full circumference. Do not use slip joint or running threads for coupling conduit. When a standard coupling cannot be used for coupling metal type conduit, use an approved threaded union coupling. Where the coating on ferrous metal conduit has been damaged, paint such damaged places with rust preventative paint.

4. Until wiring is started, cap all conduit ends with standard pipe caps or approved plug and coupling combinations. When caps are removed, provide the threaded ends with approved conduit grounding bushings.

5. Bury conduit at least 30 inches below the finished grade. However, under paved areas behind a curb, bury the conduit at least 18 inches below the top back of curb or abutting pavement, whichever is lower. See Subsection 660-3.01.3 for backfill requirements.

6. Install rigid metal conduit under existing pavements which are 30 feet wide or less by jacking. Unless trenching is called for in the Plans, install conduits under existing pavements greater than 30 feet wide by boring or drilling methods.

7. When encountering obstructions during jacking or drilling operations, obtain approval and cut small test holes in the pavement to clear the obstruction. Locate the bottom inside face of the borepit no closer than the catch point of a 1-1/4:1 slope from the edge of pavement. Do not leave these pits unattended until the means of protection has been approved.

8. Keep the bottom of trenches for non-metallic conduit relatively free of sharp irregularities that would cause pinching and excessive bending of the conduit.

9. Ensure that the first 6 inches of backfill is free of rocks exceeding 1 inch maximum dimension.

10. Terminate the conduit entering the bottom of concrete junction boxes with a 90-degree sweep inside the box wall. Terminate conduit openings not less than 5 inches above the bottom of all boxes, a minimum of 6 inches below the top of the Type IA boxes, and 12 inches below the top of Type II and Type III boxes. Extend conduits entering through the junction box wall a minimum of 2 inches beyond the inside box wall, and ensure it is a minimum of 6 inches above the bottom of the box.

11. Furnish foundations with conduits as shown on the Plans. Extend the conduits a maximum of 2 inches vertically above the foundation and slope towards the handhole opening.

12. At low points in all conduit runs, install a drain and sump containing approximately 2 ft^3 of coarse concrete aggregate material. Compact aggregate used for sump as directed to prevent settlement of foundations, junction boxes, or adjacent improvements. Place additional drains adjacent to all junction boxes and structures, regardless of the method of conduit placement used. The drains must be a 3/8-inch hole drilled in the bottom of the lower straight section of the sweep elbow. Prevent scraping of conductors by deburring drilled drain holes in conduit. Wrap the exterior of the hole with approved filter cloth material and secure it as directed or approved by the Engineer.

13. Provide conduits for future use with grounding bushings, bonded to ground, and capped with an approved plastic insert type plug. Install a polypropylene pull rope with 200 pound minimum tensile strength in all conduits that are to receive future conductors. Double back at least 2 feet of pull rope into the conduits at each end.

14. Mark all underground conduit with a continuous strip of polyethylene marker tape that is 4 mils thick and 6 inches wide. Mark the tape with a black legend on a red background and bury it 9 inches (±3 inches) below the finished grade. Lay two strips of marker tape side-by-side under all road crossings.

15. Where new junction boxes are placed in existing rigid metal conduit runs, fit the conduit with threaded bushings and bond them.

16. Seal the conduit leading to soffit, wall, or other lights or fixtures below the grade of the junction box by using an approved sealing fitting and sealing compound.

17. Clean existing underground conduit to be reused in the new system before pulling in the new cables, as follows:

    a. Conduits with reused conductors. Wherever the Plans show reusing existing conduits that contain in service cables, clean them using compressed air. Existing cables that will be reused may be left in the conduits while you clean them.

b. Conduits with no reused conductors. Ream with a mandrel or cylindrical wire brush and blow out with compressed air.

c. Use a heavy-duty air compressor that delivers at least 125 cubic feet per minute of air at 110 psi.

18. Use conduit of larger size than shown on the Plans, when desired. If used, it must be for the entire length of the run from junction box to junction box. Reducing couplings are not allowed. Increase the size of the junction boxes and perform any additional work at the foundations due to the use of larger size conduit, without extra compensation.

19. Conduits may require routing under or over existing culverts or storm drain systems and other underground utilities with additional drains and aggregate sumps at the low spots.

20. When extending existing conduits or installing junction boxes in existing conduit runs, extend the conduit into the proposed junction box or foundation using drains, elbows, and bonding as required for new installations. When adjusting junction boxes, shorten or lengthen existing conduits to meet clearance requirements. Complete extensions and modifications to existing conduits using the same size and types of materials.

21. Cut off abandoned conduits flush with the inside wall or bottom of junction boxes.

22. Install expansion fittings, as detailed on the structure plans, where the conduit crosses an expansion joint in the structure. Provide each expansion fitting with a bonding jumper equivalent to a stranded, No. 6 AWG, copper wire, or equivalent copper braid. Use expansion-deflection fittings that are waterproof and permit a 3/4 inch expansion and contraction and a 3/4 inch deflection without deformation.

660-3.04 JUNCTION BOXES. Furnish pre-cast reinforced concrete junction boxes of the sizes and details shown on the Plans. Use cast iron lids.

Emboss the word TRAFFIC on the lids of all junction boxes that contain any traffic signal conductors. Emboss the word LIGHTING on the lids of all other junction boxes.

Install junction boxes at the approximate locations shown on the Plans or when a location is not specific, locate the junction boxes as directed. You may, at your expense, install additional junction boxes to facilitate the work. Locate junction boxes so they are not in the roadway, sidewalk, or pathway surfaces. Where practical, place junction boxes shown in the vicinity of curbs adjacent to the back of curb with their long dimension parallel to the curb. Do not locate junction boxes in drainage collection areas.

Effectively ground the covers of all junction boxes with metal covers. Use a 3-foot tinned copper braid for Type IA Junction Boxes and a 6-foot tinned copper braid for Type II and Type III Junction Boxes.

Bed the entire bottom of all junction boxes on coarse concrete aggregate material of a minimum depth of 18 inches.

Place the top of junction boxes flush with the sidewalk grade or top of adjacent curb. When located in an unpaved section adjacent to a paved shoulder, locate the junction box 1 inch below the finished grade. Install flush with the surface in paved areas. Adjust as directed the junction boxes located in areas requiring grading. Adjust junction boxes located in seeded areas to 2 inches below the surface.

Locate junction boxes immediately adjacent to the pole or fixture they serve with the following limitations:

1. 300 feet maximum for any single cable conduit run or any conduit run that exclusively contains 2 or fewer 2/C No. 12 AWG loop lead-in cables.

2. 190 feet maximum for any other conduit runs.

3. If the limitations require additional junction boxes, locate them on equal spacing subject to the above limitations.

660-3.05 WIRING. Install power conductors serving the cabinet sized such that their ampacity rating is greater than the cabinet total connected load. Make wiring neat in cabinets by cabling wires together with self-clinching nylon ties. Terminate all spare conductors on terminal blocks. Attach all conductors, including spares, to terminal blocks with “spade” type terminal lugs. Furnish additional terminal blocks if enough locations are unavailable in existing terminal blocks. Do not splice conductors within cabinets, poles, signal heads, and luminaires.

Pull conductors into conduit only after junction boxes are set to grade, crushed rock sumps are installed, grout is placed around the conduit, and grounding bushings have been installed on all conduits.

1. Pull conductors by hand or by approved commercially built cable-pulling equipment that is specially designed for that purpose. Do not pull cable by any other means. Equip the cable pulling device with a force limiting circuit and force gauge.

2. Use wire-pulling lubricant when placing the cables and conductors in conduit. Do not allow the tension of the wire or cable to exceed the manufacturer’s recommend allowable tension for the conductor or cable.

3. When adding new conductors to a conduit with existing conductors, remove all conductors and clean the conduit with a mandrel or brush. Pull both old and new conductors through as a unit. In a new installation, pull all conductors through the conduit as a unit.

4. Leave at least 1 foot of slack in the bottom of each signal or combination signal and lighting pole of each signal conductor or cable. Neatly leave at least 3 feet of slack illumination and signal conductor or cable curled up in the bottom of each junction box or splice location.

5. Separate the neutral for pedestrian push button circuits from the signal light circuit neutral.

6. Run all signal and feeder conductors continuously without splices from a terminal block located in a cabinet, compartment, or signal head, to a similarly located terminal block. When modifying an existing signal system, splice existing conductors (cables) to new conductors (cables) as required to complete the signal, opticom, and interconnect systems. Make these splices only in pole bases, signal terminal compartments, or the controller cabinet.

7. Route highway illumination cable through each lighting pole designated for connection to that cable’s circuit. Do not splice illumination cable between a load center and a pole or between poles. Join the individual conductors by using non-insulated, overlap type pressure connectors. Insulate with mastic-lined heat shrink tubing or 2 layers of one-half lapped UL listed electrical tape. Do not use wire binding screws, studs, or nuts. Stagger splices to minimize the overall diameter.

8. Install all loops in 1-inch rigid schedule 80 PVC conduit in the roadway and to the nearest junction box. Run loop lead-in cable continuously without splices from the controller cabinet to the curbside detection junction box nearest the loop being spliced to the lead-in cable. Splice the loop(s) to the lead-in cable by soldering at the junction box and encapsulating in a waterproof splice kit.

Multiple loop configurations must have the individual lead-ins, multiple pair, or single pair brought to the controller cabinet for termination. Make series connection of loop lead-ins in the controller cabinet only. Wind all loops in the same direction with the starting lead marked with an “S.” Connect the black conductor of the pair shown in Table 660-2 to the “S” designated conductor of the loop. Connect multiple loop detectors in the same lane so that the adjacent loops are in alternating directions clock wise (CW), counter clock wise (CCW), etc.

9. When splicing loop detectors to multi-pair loop lead-in cables, complete the work according to the following.

   a. See the Plans for the identifying number assigned to each loop detector and the loops assigned to each loop lead-in cable. Using this information, splice the loop detector tails to the paired conductors found in each lead-in cable, using the color code in Table 660-2.

TABLE 660-2
MULTIPLE PAIR LOOP LEAD-IN COLOR CONNECTION SCHEDULE

Loop Detector Number	Colored Pair
The lowest numbered loop detector	Red and Black
The second lowest numbered loop detector	Blue and Black
The third lowest numbered loop detector	White and Black
The fourth lowest numbered loop detector	Green and Black
The fifth lowest numbered loop detector	Brown and Black
Usually a spare pair	Yellow and Black

   b. Remove a short section of cable jacket and only cut the shielded pairs dedicated to loop detectors being spliced. Run these pairs, without splices, to the controller cabinet.

   c. Strip the insulation from the ends of the conductors. With the loop and lead-in conductors parallel to one another, twist the bare ends together and then solder them together.

   d. Insulate and seal each soldered connection with a mastic lined heat shrink tubing; crimp the ends of the heat shrink tubing with a pair of needle nose pliers.

   e. First, crimp and then solder spade terminals to the ends of the shielded pairs in the controller cabinet.

10. Maintain the electrical isolation between shields and do not allow the drain wires to come in contact at any point other than the ground bus in the cabinet. Tie all drain wires to the ground bus at the controller cabinet.

11. Encapsulate illumination cable conductor splices in a rigid, 2-piece, transparent, snap together, plastic mold specifically designed for each splice type.

    Encapsulate all loop lead-in cable splices in rigid, transparent, PVC molds filled with re-enterable polyurethane electrical insulating and sealing compound. Furnish splice kits rated for 1000 volts AC operation and direct burial.

    Provide re-useable four piece molds that are held together with stainless steel hose clamps. Two pieces form a cylinder and two flexible end caps seal the ends and allow the conductor entry. Use molds with dimensions suitable for the splice made, encase the cable jackets, and have fill and vent funnels.

    Insert a loose woven polyester web that allows a full 1/4 inch of insulating compound to flow between the splice and the inside of the mold. Fill the PVC molds with re-enterable

polyurethane electrical insulating and sealing compound that cures transparent, is nontoxic, is non-corrosive to copper, and does not support fungi or mold growth.

12. Use molds with dimensions suitable for the splice, to encase the cable jackets, to be rated for 600 volts, and have fill and vent funnels for epoxy resin. Fill the splice mold bodies with epoxy resin that is resistant to weather, aromatic and straight chain solvents, and that will not sustain combustion. When filling the mold bodies of loop lead-in and telemetry cable splices, use a compound that provides re-entry capabilities.

13. Permanently identify all cables and single wire conductors by labeling all pole bases and cabinets, at each detector loop tail/lead-in cable and illumination cable splices, and in junction boxes adjacent to lighting and signal poles. When modifying an existing system, label all new and existing lighting cables/conductors with circuit numbers at locations noted above. If the existing circuits are not identified, the Engineer will provide the required circuit numbers.

14. Label the cables used in the signal and illumination systems with the following legends:

    a. Use the legends included in Table 740-2, for the cables listed.

    b. Use the loop number shown on the Plans to label each tail of all loop detectors and the paired loop lead-in conductors in the controller cabinet.

    c. For interconnect cables, use the first letter of the direction the cable follows to the adjacent intersection on each cable. Add a number suffix if more than one cable is routed to the adjacent intersection.

15. Furnish the two types of identification tags listed below that feature hand written legends. Write the legends specified neatly and legibly, using a black marking pen recommended by the tag manufacturer. Replace at no expense to the State all identification tags the Engineer deems illegible.

    a. Use identification cable ties for labeling loop detector tails and the paired conductors included in each loop lead-in cable in the controller cabinet. Furnish identification cable ties made of nylon that feature a nonmagnetic stainless steel locking device embedded in the head and a tag attached "flag style" to the head. Use cable ties consisting of a single strap with a minimum size tag of 3/4 inch by 3/8 inch.

    b. To label all other cables, use cable tags made of nylon reinforced vinyl impervious to the elements and which will not tear. Provide tags with a 4 inch by 1-3/4 inch minimum size that attach flag style at one corner to a single strap. Furnish yellow tags for labeling all signal and interconnect cables and red tags for labeling lighting and feeder cables.

16. Terminate the control and power cables as shown in Table 740-2.

17. Connect telemetry cable to a Type No. 66B3-50 terminal block. Start the wiring at the top with Pair No. 1. Connect the incoming cable from the computer to the left side of the terminal block, and connect the outgoing cable to the next intersection to the right side.

18. Wire luminaires using No. 10 AWG illumination tap conductors that run from the fused disconnect kit in the pole base.

    Install a fused splice connector between the line and luminaire ballast tap conductors in the base of every pole equipped with a luminaire.

    Attach the conductors to the connector halves with setscrew type pressure connectors. Provide the plug and socket assembly so that the fuse remains in the load side plug without

exposing live metal parts when the connector separates and the coil springs are not included in the current carrying circuit.

Make the fused connectors readily accessible from the handhole. Install tap conductors to prevent slack when their ends touch the top of the foundation.

660-3.06 BONDING AND GROUNDING. Make the following mechanically and electrically secure: metallic cable sheaths, metal conduit, non-metallic conduit grounding wire, ballast and transformer cases, service equipment, sign switches, pedestrian push buttons, metal poles, and pedestals. Normally non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, must be electrically connected to earth ground, and must be connected together and to the electrical supply source in a manner that establishes an effective ground-fault current path. All installations must comply with the grounding and bonding requirements of NEC Article 250.

Install main or system bonding jumper as applicable at the service as required by NEC Article 250. Install copper grounding electrode conductors (GEC), sized per NEC Table 250.66, or #6 AWG, whichever is larger. Install copper equipment grounding conductors (EGC) for each circuit or raceway, sized per NEC Table 250.122, or #12 AWG, whichever is greater. Where conduits are installed for future conductors, the EGC may be omitted.

Furnish threaded-type grounding bushings made of malleable iron or steel with a zinc or galvanized finish. Use bushings with an insulated throat, a tin-plated copper saddle for attaching the grounding conductors, and stainless steel set screws.

Retrofit all existing spare conduits that will contain new cables exclusively with new grounding bushings. Whenever you reuse an existing conduit that contains no EGC, install a bare or insulated size 8 AWG copper wire as the EGC. Where conduits are installed for future conductors, the above mentioned copper wire may be omitted.

Install a bare or insulated copper conductor in all conduit as the EGC. Attach grounding conductors to each end of the metal conduit using insulated throat grounding bushings. Leave 12 inches of slack between each grounding bushing. Allow clearance for bushings when installing conduits in foundations.

Bond breakaway type standards and pedestals by using 2 conductors from the conduit, one attached with a ground rod clamp to an anchor bolt and the other connected to the lower portion of the shaft. Bond standards with frangible coupling type bases by attaching one conductor from the conduit to the lower portion of the shaft. Use conductor from the conduit to the shaft that is 48 inches long.

Solidly ground one side of the secondary circuit of a transformer.

660-3.07 TRAFFIC CONTROLLER ASSEMBLIES. Prepare each solid-state, traffic controller assembly to operate various traffic signal devices as shown on the Plans. The controller must provide right-of-way, clearance, and other indications using duration and sequence as determined by preset programming.

Details of operation for the complete controller assembly must be according to the traffic phases; preferential phase sequence and concurrence; signal indications; signal indication sequence; detection requirements; and other details shown on the Plans or as specified herein.

At the time the controller cabinet and equipment are delivered for testing, or if ordered prior to purchase, submit the following for each controller assembly called for in the Plans:

a. Two blackline sets of controller cabinet schematic wiring diagrams

b. Two copies of the manufacturer's maintenance and operations manuals for the equipment in the cabinet

The schematic wiring diagrams must show all circuits and parts in detail. Clearly identify all parts by name or number. Submit the final wiring diagrams for each controller assembly in an AutoCad Drawing Interchange File format (DXF, DWG, etc.). Use only the default font style and line type distributed with a basic AutoCad package.

1. Shop Tests. Deliver the controller units, auxiliary equipment, and fully wired cabinet (including wiring diagrams and manuals) to a designated test location. All items must arrive together. Partial shipments will not be accepted and will be returned to the vendor.

   Allow 6 weeks for shop testing.

   All equipment must meet the operational and functional requirements of the Plans and Specifications when tested according to NEMA Standard TS 1-1989, *Traffic Control Systems*.

   If a partial failure occurs at any step in the test (physical, environmental, or operational), you may make on-site repairs within 10 days after notification of the malfunction. The test will then be restarted at the beginning of the category in which malfunction occurred. Failing to make repairs within 10 days after notification will result in rejection.

   If equipment malfunctions twice in the same category, the equipment will be rejected.

   When equipment is rejected, return the entire package (including the cabinet) freight collect to the vendor. Submit the new equipment, with a different serial number, for testing. Do not use rejected equipment on signal projects within the State of Alaska.

   Testing after equipment rejection for failure to comply with specification requirements will be at your expense. The Department will make deductions to cover the costs of such testing from any moneys due or which may become due to you under this Contract.

   A failure is any occurrence that results in other than normal equipment operation. The equipment is considered to have failed if any of the following occur:

   a. The controller unit malfunctions

   b. The load switch produces incorrect signal indications

   c. The signal conflict monitor fails to satisfy the contract requirements

   After the shop test is satisfactorily completed, you will be notified to pick up the tested and marked equipment at the test site. Pick up the successfully tested equipment within 2 weeks of notification and deliver to the work site. Successful test completion does not relieve you of equipment warranty obligations as specified in Subsection 660-2.01.3 or field testing as specified in Subsection 660-3.01.7.

   Copies of shop test results will be sent to you, the vendor, and the State Materials Engineer.

2. Controller Cabinet Installation.

   a. Where the cabinet is mounted on a concrete pedestal foundation, place a 1-inch drain hole or pipe with screen in the foundation, connecting to the cabinet and emptying above the ground line.

   b. Place a 3/8-inch fillet of silicone caulking between each controller cabinet and the concrete slab foundation to prevent dust and dirt from entering the cabinet.

c. When called for in the Plans or Special Provisions, add 2 inches of approved foam insulation within the bottom of the cabinet between the control equipment and the concrete base. Design all wiring, terminals, and other items to allow sufficient room for the insulation.

d. On Precast Controller Foundations. When called for in the Plans or Special Provisions, place a 3/8-inch thick, 2-piece exterior grade plywood board on the bottom of the cabinet and under the foam insulation. Place the plywood within the controller cabinet, and do not extend under it. Make holes to allow for the conduits entering the cabinet. Place a pliable sealant composed of a silicon caulking compound between the plywood board and the cabinet and between the plywood board and all the conduits.

e. Place a ground rod in the Type III junction box next to the cabinet or in the foundation of the cabinet if it is precast foundation.

f. See Subsection 660-3.05 and Section 740 for wiring requirements.

3. Controller Operation. Provide the following operations.

a. Wire the controller cabinet to flash the yellow signals on the main street or highway, and the red signals on the cross streets and left turn lanes.

b. Make the flashing circuit independent of the controller unit. They must remain in operation upon shutdown of the controller or removal of the controller from the cabinet.

c. Wire the controller cabinet so that removal of the conflict monitor causes the intersection to go into flashing operation.

d. Accomplish transfer to flashing operation by relays between the normal load switching device and the field terminals.

e. Do not operate pedestrian pushbuttons at more than 24 volts.

f. Controller Priorities. Prioritize the drives, controls and equipment so that each device, control, or item of equipment overrides the operation of those items listed below it:

(1) Power failure

(2) Power restart

(3) Flashing

(4) Railroad preemptor

(5) Emergency vehicle preemptor

(6) Phase selector

(7) Interconnect

(8) Time switch

(9) Normal controller unit operation

4. Preemption. Provide the following preemption operations when called for on the Plans or as specified in the Special Provisions.

a. General. Preemption units must use the controller unit functional inputs and timings to the largest extent possible. Signal load switching control must remain with the controller unit.

b. Railroad Preemption. The Railroad Preemption Routine must consist of 4 functional intervals in the order listed below:

(1) Enter Preemption Interval.

(a) Energize a 120 VAC alarm circuit which may be used for a sign, bell, or beacon.

(b) Immediately advance to the pedestrian clearance interval of any walk that is being displayed. On any phase other than the track clearance phase(s), abbreviate the pedestrian clearance interval by a timer with a minimum range of 0-30 seconds.

(c) Following the pedestrian clearance period, the controller must advance into and time normally the vehicle clearance intervals.

(d) If the preemption is received while in the track clearance phase(s), skip step (b) and (c) above.

(2) Track Clearance Interval.

(a) Provide a timing period to allow sufficient green clearance time for any vehicles that may be stopped on or immediately behind the railroad tracks. The timing must be adjustable over a range of 0 to 30 seconds.

(b) Following the track clearance period, the controller must advance into and time normally the vehicle clearance interval(s).

(3) During Preemption Interval. Allow the controller to operate normally with the exception of not serving those phases that conflict with the railroad crossing. Keep this interval in effect until the preemption call is removed.

(4) Leaving Preemption Interval.

(a) De-energize alarm circuit.

(b) Immediately advance to the active phase normal pedestrian and/or vehicle clearance interval(s).

(c) The controller must advance to those phases that were omitted under preemption control when complete control is returned to the controller unit.

c. Emergency Equipment Preemption. The Emergency Equipment Preemption Routine must consist of 3 functional intervals in the order listed below:

(1) Enter Preemption Interval.

(a) Energize a 120 VAC alarm circuit which may be used for a sign, bell, or beacon.

(b) Immediately advance to the pedestrian clearance interval of any walk that is being displayed. On any phase other than the track clearance phase(s), abbreviate the pedestrian clearance interval by a timer with a minimum range of 0-30 seconds.

(c) Following the pedestrian clearance period, the controller must advance into and time normally the vehicle clearance intervals.

(d) If the preemption call is received while in the preempt phase(s), skip step (b) and (c) above.

(2) Preempt Phase Interval. Hold the controller in the preempt phase(s) until the call is removed.

(3) Leaving Preemption Interval. When the preemption call is removed, the controller unit must immediately revert to normal operation.

660-3.08 SIGNAL AND LIGHTING STRUCTURES. Install signal and lighting equipment according to the details shown on the Plans and the following:

Remove all burrs and sharp edges from inside and outside of all holes before passing conductors through the walls of posts, poles, mast arms, signal heads, and other equipment.

Install photoelectric control units to face the north sky. When installed on the top of steel poles, install the bracket in the center of the rain cap. Secure it with a locknut and make watertight with a fillet of silicone caulking compound. When installed on wood poles or Type 1 or 1A Load Centers, couple the bracket to the end of a rigid metal conduit.

1. Electrolier Installation. Before installation, check the socket position in the luminaire to verify that it corresponds to the setting indicated in the instructions for the light distribution type shown on the Plans. Set the pole with a slight rake, by plumbing the side of the tapered pole away from the road.

   After the pole has been plumbed, level the luminaire as recommended by the manufacturer.

2. Wood Pole Installation. Place the poles in the ground to at least 6 feet deep.

   After setting each wood pole in the ground, backfill the space around the pole with selected earth or sand, free of rocks 4 inches or larger, or deleterious material. Place in layers approximately 4 inches thick and thoroughly compact with mechanical tampers.

   Provide overhead equipment a minimum vertical clearance of 18 feet from bottom of equipment to the pavement.

3. Signal Pole Installation. Install signal poles so the side opposite the mastarm, or combination of mastarms, is vertical in its final deflected position. Provide a 1-inch drain hole in the grouted base. Run this drain from below the top of the conduits to outside of the grouted area.

4. Signal Head Mounting. Support bracket mounted signal heads, as shown on the Plans, by mounting brackets consisting of watertight assemblies of 1-1/2 inch nominal diameter standard steel pipe and malleable iron or brass pipe fittings. All members must be either plumb or level, symmetrically arranged, and securely assembled. Construct these so that all conductors are concealed within the assembly.

   Attach vehicle and pedestrian signal head mounting hardware to the side of pole that faces away from traffic.

   Aim through-phase vehicle signal faces at a point located a distance from the face as shown in Table 660-3. If 2 through-signal faces are not visible from this point at a height of 42 inches above finished grade, consult the Engineer for corrective measures.

Direct pedestrian signal heads at the center of the crosswalk on the opposite side of the street.

TABLE 660-3
THROUGH-SIGNAL AIMING POINT

85th Percentile Speed (mph)	Minimum Visibility Distance (feet)
20	175
25	215
30	270
35	325
40	390
45	460
50	540
55	625
60	715

The horizontal dimension between the center of a terminal compartment or axis of a signal face and the axis of an immediately adjacent signal face must be a minimum of 22 inches in side mounted frames and 11 inches in post top installations.

At each signal location, construct a terminal compartment into the mounting brackets. Fit each compartment with a terminal block containing 12 poles, each with 2 screw-type terminals. Each terminal must accommodate at least 3 No. 14 AWG conductors. Provide a rain-tight cover, giving ready access to the terminal block. Provide a bronze terminal compartment of sufficient strength to remain intact in event the pole is knocked down. Provide cast-iron slip-fitters, where used without integral terminal compartment.

For post-top mounting of bracket mounted signals, cast the terminal compartment with an integral slip-fitter. For post-top mounting of a 1 way signal head, you may use a slip-fitter without a terminal compartment. The slip-fitter must fit over a 4-inch standard pipe or 4-1/2 inch outside diameter end of tapered standard. Provide each slip-fitter with 2 rows of cadmium plated steel set screws, with 3 screws in each row to secure the assembly in plumb position.

Where signal heads are side mounted on poles, the terminal compartment must be designed for and securely bolted to the pole. Mount pole side mounted pedestrian and traffic signal heads on the back side of pole unless noted or detailed otherwise on the Plans. Mount the pole/post mounted traffic signal heads so that no portion of the backplates are hidden by the pole/post.

Equip the signal heads with positive brass lock rings and fittings designed to prevent heads from turning due to external forces. Lock ring and connecting fittings must have serrated contacts.

Equip signal head assembly for suspension from mast arm with a ferrous or bronze plumbizer.

Do not mount signal heads within 12 inches either side of a mast arm extension splice.

Do not install signal heads at any intersection until all other signal equipment, including the controller, is in place and ready for operation at that intersection, unless the faces are not directed toward traffic or unless the faces are adequately covered.

Side-mount pedestrian signals using a 2-piece, hinge connected, cast aluminum bracket that mounts directly between the pole and the side of the signal head housing. Limit clearance

between the head and pole to 3 inches. The bracket must properly fit round poles 4 inches or greater in diameter and allow a minimum rotation of 30 degrees when mounted on a 4-inch pole. Include a rain-tight 12-position terminal block within the mounting bracket.

5. Pedestrian Push Button Installation. Install the push button and sign on the crosswalk side of the pole. Install indicator lights when specified.

   Pedestrian push button signs must conform to the details in the ASDS. Install push button signs and The Meaning of Pedestrian Signals stickers, R9-4, above each push button. Use R10-4B (R or L) push button signs with the arrow pointing in the direction of the appropriate crosswalk. Install the sticker immediately above the push button and below the sign. When channel is used for mounting push button signs, tap the top and bottom sign bolts into the pole.

6. High Tower Lighting System Installation. Install the high tower poles as recommended by the manufacturer. Provide the erection plan to the Engineer prior to installing poles.

   Attach the luminaire to the bracket arm by means of a bracket entry and lamp support assembly.

   Install the lowering system including head frame, luminaire support ring, winch(s), hoisting assembly, and electric motor.

   Adjust the luminaire reflectors until all are oriented in the same direction and they provide the asymmetrical light distribution pattern shown on the illumination sheets.

7. Underpass Lighting System Installation. Mount the fixture as detailed on the drawings so that the axis of the lamp is perpendicular to the axis of the underpass.

8. Flashing Beacon Installation. When installing flashing beacons adjacent to or in conjunction with a traffic signal system, install the flasher control in the controller cabinet.

660-3.09 MAINTAINING TEMPORARY AND EXISTING ELECTRICAL SYSTEMS. Keep in effective operation during the progress of the work all existing electrical systems (traffic signal, highway and street lighting, flashing beacon, and sign illumination), and approved temporary replacements except when shutdown is permitted to allow for alterations or final removal of the systems. Temporary replacement equipment must be compatible with existing equipment used in the Region. Limit traffic signal shutdowns to the period Sunday through Thursday between the hours of 9:00 p.m. to 6:00 a.m., unless otherwise specified in Subsection 643-3.08. Do not allow lighting system shutdowns to interfere with the regular lighting schedule. Obtain written approval before performing any work on existing systems.

Notify the local traffic enforcement and maintenance agencies at least 24 hours before the operational shutdown of a traffic signal system. Provide necessary traffic control under Section 643.

Where an existing system is being modified, the Department will pay for work not shown on the Plans or Special Provisions that is considered necessary to keep all or part of the existing system in effective operation as extra work as provided in Subsection 109-1.05.

Once commencing work on the project, provide all maintenance for temporary and existing electrical facilities. The State will pay for the electrical power for the above mentioned electrical systems. The above maintenance does not include previous damage such as burned out lamps, non-operative detection, or other malfunctioning equipment. Present written documentation of all non-functioning and malfunctioning electrical equipment before commencing work on the project. You and the Engineer will inspect this equipment jointly. If work begins on the Project and the

Engineer does not receive written notice, this is considered evidence that all equipment is functional and operational.

Give the Engineer the name and 24-hour phone number of the person maintaining the existing and temporary electrical facilities. Commence repair work within 1 hour of notification for traffic signal systems.

Ascertain the exact location of existing conduit runs, direct burial cable, junction boxes, and all underground utilities before using equipment that may damage such facilities or interfere with any system.

Where roadways are to remain open to traffic and existing lighting systems are to be modified, complete work each day so the lighting system will be in operation by sunset.

When you work on a traffic signal system, keep a record of all work performed in a diary located in the controller cabinet. Furnish a diary for each temporary system. Make sure each entry is printed legibly and includes:

1. The dates and times you began and completed your work, and the names of the crewmembers completing the work.

2. The characteristics of the equipment failure or faulty operation evident before repair.

3. The changes made or corrective actions taken.

4. The printed name and signature of the person responsible for making the repairs or changes.

Keep temporary electrical installations in effective operation until they are no longer required. Salvage all original and Department-provided equipment according to the provisions in Subsection 660-3.01.6 and remove all other materials from the project.

660-3.10 FALSEWORK LIGHTING. When required by the Special Provisions, install falsework lighting where vehicular traffic with or without pedestrian traffic crosses through or under structure falsework.

Provide illumination of the portal faces of falsework during the hours from dusk to dawn. Provide illumination of the pavement and pedestrian openings through or under falsework 24 hours a day.

Submit a plan for the proposed lighting installations and do not commence falsework construction until the Engineer has reviewed such plans. The Engineer will make a subsequent review after you place falsework lights in operation.

Falsework lighting equipment remains your property and must be removed from the site of the work upon completion of the project or when directed.

660-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

Item 660.0009.____, Bored Casing. By the linear foot along the slope of the bored or jacked casing for the actual length bored or jacked, in place.

Item 660.0011.____, Traffic Loop. By each loop unit, complete and in place, including all conduit, conductors, and other equipment to the nearest junction box.

Item 660.0013.____, Relocate Electrolier. By each complete unit, removed, relocated, reinstalled, and functional.

660-5.01 BASIS OF PAYMENT. Sign removal and reinstallation required to install foundations, conduits, and junction boxes is subsidiary. Minor conduit routing changes as directed are

subsidiary to existing contract pay items. All concrete required to complete the foundations is subsidiary. If no item for Bored Casing is included in the bid schedule, boring is subsidiary to other items of work.

If the Engineer orders soffit lights or lighting for pedestrian structures placed in operation before permanent power service is available, the Department will pay the cost of installing and removing temporary power service as extra work under Subsection 109-1.05.

Furnishing, installing, maintaining (including power), and removing falsework lighting is subsidiary to the items of work involved in the structure that requires the falsework lighting.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
660.0001.____	Traffic Signal System Complete,	LS
660.0002.____	Flashing Beacon System Complete,	LS
660.0003.____	Highway Lighting System Complete,	LS
660.0004.____	Sign Illumination System Complete	LS
660.0005.____	Structure Illumination System Complete	LS
660.0006.____	Traffic Count System Complete	LS
660.0007.____	Temporary Signal System Complete,	LS
660.0008.____	Temporary Illumination System Complete	LS
660.0009.____	Bored Casing, ___ Inch Minimum Diameter	LF
660.0010.____	High Tower Lighting System Complete	LS
660.0011.____	Traffic Loop	EACH
660.0012.____	Underpass Lighting System Complete	LS
660.0013.____	Relocate Electrolier	EACH

SECTION 661
ELECTRICAL LOAD CENTERS

661-1.01 DESCRIPTION. Furnish and install load center assemblies at the locations indicated in the Plans. Modify existing load centers when indicated.

Use load centers of the following types as shown on the load center detail sheets:

Type 1:	Pad mounted with underground service (large)
Type 1A:	Pad mounted with underground service (small)
Type 2:	Post mounted with underground service
Type 3:	Pole mounted with overhead service

661-2.01 MATERIALS. Use materials that conform to Section 740, the Materials Certification List, the Plans, specifications, and the following.

Concrete	Section 550, Class B
Grout	Subsection 701-2.03
Reinforcing Steel	Section 503

Wood Posts. Construction grade, 6 x 6 inch nominal dimension S4S Douglas Fir, Hem-Fir, Western Larch, Western Hemlock, Mountain Hemlock or Southern Pine meeting *Standard Grading and Dressing Rules*, West Coast Lumber Inspection Bureau. Treat the posts according to Section 714.

Load Center. NEMA 3R enclosure constructed of zinc-coated A60 finish sheet steel per ASTM A653 and ASTM A924, with no external screws, bolts, or nuts.

Shop coat cabinet components with a 2-part urethane paint undercoat and 2-part urethane finish coats. Finish coats must be standard white for removable panels and non-gloss silver-gray, closely matching FSS No. 5950 Color No. 36622, for the enclosure.

The load center must be labeled as a unit by a State of Alaska-approved independent electrical testing laboratory (such as UL, ETL, CSA, etc.) defined by ANSI Standard Z34.1 *Third-Party Certification Programs for Products Processes and Services* and conform to applicable published standards noted herein, the Plans, and Special Provisions. The load center must be marked with the maximum available fault current and the date the fault current calculation was performed. The marking must be sufficiently durable to withstand the environment. The load center must be labeled as service entrance equipment.

Panelboards. Load panels in load centers must conform to FSS W-P-115C, Type 1 - Circuit Breaker Panelboards; UL 67 - *Panelboards*; and NEMA PB1 - *Panelboards with Molded Case Circuit Breakers*. The rated voltage of the panels must be as noted on the load center summary in the Plans, 120/240 volts or 240/480 volt single phase or 120/208 volt or 277/480 volt three-phase. The ampacity rating of panels must not be less than the ampacity noted on the load center summary, 100 amps minimum, at rated voltage. Provide separate copper neutral and ground buses.

A label must be applied to the exterior of the panelboard indicating the potential arc flash hazard at the enclosure. The label must comply with NEC 110.16(A) and must include the information required by NFPA 70E, including the estimated arc flash incident energy as calculated per IEEE 1584.

Circuit Breakers. Use bolt-on type circuit breakers with a copper bus. The series rated interrupting capacity of the circuit breakers in the panels must not be less than shown on the load center summary, or 10,000 AIC minimum, at rated voltage. Ensure that the circuit breakers installed are rated to be operated in the ambient temperatures to which they will be exposed.

Use circuit breakers that are molded-case thermal-magnetic types with single-trip indicating switch handle. They must have an enclosed toggle type operating mechanism with quick-make/quick-break action and have a trip-free disconnect from the switch handle that will prevent the contacts from being held in the closed position. The circuit breakers must have the frame size, interrupting capacities, and trip rating clearly marked on the breaker. Multi-pole circuit breakers must have a common trip mechanism. Contacts must be silver alloy enclosed in an arc quenching chamber. Overload trip ratings must be self-compensating for ambient temperatures from 14 °F to 140 °F. Circuit breakers must be 240 or 277 volt maximum rated for 120/240/277 volt circuits, whichever is applicable, and have an interrupting capacity (RMS - symmetrical) of not less than 10,000 amperes. They must have not less than 480 volt rated for circuits above 277 volts and have an interrupting capacity (R.M.S.- symmetrical) of not less than 14,000 amperes.

Contactor. Electrically-held type consisting of an operating coil, a laminated armature, contacts, and terminals. Contacts must be fine silver, silver alloy, or superior alternative material rated to switch the specified load, 30 ampere minimum at rated voltage, and be normally open, unless otherwise noted. Contactor coils must be rated for operation at 240 VAC.

Meters. Equip all meter sockets mounted in Type-1 and Type-1A load centers with internal mounted meters with manual circuit closing devices. The devices may be either the link or lever type. Do not use the horn and sliding types. Equip all load centers with internal mounted meters with safety sockets (that is, provisions for de-energizing the meter jaws). The test section cover must be sealable with a 0.047-inch stainless steel bail.

Transformers. Transformers in load centers containing load panels of different nominal voltages must be isolated winding type with primary and secondary voltages and kVA ratings as noted on the Plans. Transformers must carry rated volt-amperes continuously without exceeding a 240 °F temperature rise above a 100 °F ambient temperature.

Where installed outside of the load center enclosure, use a non-ventilated transformer enclosure fabricated from aluminum, stainless steel, or galvanized steel and filled with high-melting point, thermal setting, or epoxy insulating compounds to prevent moisture from entering the winding enclosure. Coat enclosures fabricated from sheet metal with moisture-resistant paint. Insulate transformer leads with non-hygroscopic material and extend them 9 inches beyond the winding chamber seal.

Conductors. Stranded copper with either type XHHW-2 or RHW insulation.

Conduit. Galvanized rigid conduit made of mild steel meeting UL standard UL-6.

Terminals. Size all terminals according to the amperage ratings of the conductor used. They must be suitable for termination of copper and aluminum conductors.

Photoelectric Controls. Use photoelectric controls rated for operation at 240 VAC.

Galvanizing. Galvanize steel materials according to Subsection 716-2.07. Repair damage to galvanized coatings per AASHTO M 36.

Welding. Perform welding according to Subsection 504-3.01, and the requirements of the individual items.

Equipment List(s) and Drawings. Within 30 days after the Contract award, submit 8 collated copies of a portfolio of equipment and materials proposed for installation to the Department for review and approval. Include a table of contents in the portfolio(s) that includes each item's intended use(s) and the following:

1. Materials on the *Qualified Products List:* A description that includes product name, manufacturer, model or part number, and the conditions listed for approval.

2. Materials Not on the *Qualified Products List*: Catalog cuts that include the manufacturer's name, type of product, size, model number, conformance specifications, and other data as may be required, including manufacturer's maintenance and operations manuals, or sample articles.

3. Materials Not Requiring Certification: Incidental materials incorporated into the work (such as nuts, ties, bolts, washers, etc.) must meet all applicable Specifications and be installed per all manufacturer's recommendations. Certification is not needed unless required by the Special Provisions or requested by the Engineer.

661-3.01 CONSTRUCTION REQUIREMENTS. Install load centers at the location and position shown on the Plans. Any deviation from the plan location must be coordinated with and approved by the serving utility and the Engineer.

Furnish conduit, conductors, contactors, breakers, transformers, and all other necessary materials at all new and modified load centers to complete the installation.

Install a rigid metal conduit of the size shown in the Plans at a 30-inch depth from the load center and extend it to a location 2 feet from the power source. Install a pull rope in the conduit, cap the end, and mark the terminus with a 2- x 4-inch stake or 1-inch rebar, 3 feet long. Extend the end of the stake or bar 1 inch above the ground. When the servicing utility requires the complete conduit and weather head to be in place on the designated service pole, furnish and install all materials required by the utility. The additional work and materials are subsidiary to the load center bid item.

Where the service is to be installed on a utility-owned pole, coordinate the positioning of the riser and service equipment with the service utility.

House circuit breakers, switches, and contactors in a NEMA 3R type enclosure listed by an approved independent electrical testing laboratory as service equipment with a hinged and locking front cover. Indelibly label panel covers with the circuit number. Legend plates, labels, and signs must be engraved plastic or metal fastened with screws, non-cold-susceptible adhesive, or component mounting hardware.

Size and wire load center cabinets to serve the combination of highway lighting, traffic signal, and thaw wire circuits shown in the Plans. Each cabinet must be a single box subdivided to form compartments as required. Include hinged lockable door(s) or panel cover(s) with provision for a padlock with a 5/16 inch diameter shackle for each compartment. Circuit breaker ratings must be as shown in the load center summary for each location.

Wire and equip load centers with commonly metered thaw wire and lighting circuits with separate contactors, selector switches, and terminal blocks for lighting and thaw wire circuits. Control the thaw wires as described in Section 616.

Where a meter is required, furnish and install a meter socket that is acceptable to the serving utility, complete with sealing rings. Do not mount the meter socket on doors or removable panels.

Load centers containing contactors must have contactor control switches mounted in the load distribution section. Control switches for systems having automatic controls (for example, photo cell, thermostats, or time controls) must be 3-position types with the positions labeled "On", "Off" and "Auto". Control switches for manual control only must be a 2-position type with positions labeled "On" and "Off". Label each switch to identify function being controlled.

Mount transformer fuses in dead-front fuse holders with lighted blown fuse indicators, where required. Label them to indicate function and fuse amp rating.

Install a 3/4-inch x 10-foot copper clad ground rod inside the base readily accessible through the removable cover, or adjacent supporting post. Connect ground rod to neutral bus with a soft-drawn copper grounding electrode conductor sized per NEC, No. 6 AWG minimum. Bond all non-current carrying metal parts of the load center to the ground bus.

Locate the photo cell for lighting control on the nearest light standard or top of the load center as shown on the load center summary. Orient it to the unobstructed northern sky. Submit for approval the method of attachment of the conduit to the load center. Use either a 3/C or a 5/C No. 14 AWG cable to connect the photo cell to the load center. When the photo cell is on a lighting standard with a breakaway base, use an approved break-away disconnect in the base of the light standard. Restrain the cable in a similar manner as the lumination cable in the pole base.

Provide a typed circuit directory for each load panel inside of the load center door, protected with a plastic cover, describing each circuit, with even and odd numbered circuit breaker positions shown on separate parts of the directory. Provide a power and control one-line diagram protected by a laminated plastic cover inside the load center. Include the following information on the directory and one-line diagram: Load center identification (A, B, etc.), Project Name, Project number (Federal/State) and Service Voltage.

661-4.01 METHOD OF MEASUREMENT. By the actual number of load centers, modified load centers, and transformers completed and accepted shown on the Plans or as directed.

661-5.01 BASIS OF PAYMENT. Load circuits, consisting of conduits and conductors attached to the load centers and photoelectric controls, and terminations of field wiring, are subsidiary to other items of work.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
661.0001.____	Load Center, Type 1	EACH
661.0002.____	Load Center, Type 1A	EACH
661.0003.____	Load Center, Type 2	EACH
661.0004.____	Load Center, Type 3	EACH
661.0005.____	Modify Load Center	EACH
661.0006.____	Transformer,	EACH
661.0007.____	Modify Load Center	LS

SECTION 670
TRAFFIC MARKINGS

670-1.01 DESCRIPTION. Furnish and place traffic markings of the type, color, dimensions, and at the locations shown on the Plans. Meet these specifications and the applicable portions of the Alaska Traffic Manual.

670-2.01 MATERIALS. Use materials that conform to the following:

Traffic Paint	Subsection 708-2.03
Glass Beads	Subsection 712-2.08
Preformed Pavement Markings	Subsection 712-2.14
Raised and Recessed Pavement Markers	Subsection 712-2.15
Methyl Methacrylate Markings	Subsection 712-2.17
Glass Beads for Methyl Methacrylate Markings	Subsection 712-2.18

Construct the iron casting for the raised pavement markers of modular iron meeting ASTM A536.

Submit a manufacturer certification for both the Methyl Methacrylate material and glass beads to certify that the materials furnished conform to these Specifications.

670-3.01 CONSTRUCTION REQUIREMENTS. Install interim pavement markings meeting Section 643 if permanent markings are not installed prior to opening the roadway to traffic.

1. Paint.

   a. Apply paint only to pavements that are clean, dry, and warmer than 40 °F.

   b. Remove all dirt, oil, grease, and other foreign matter from the surfaces to be painted in a satisfactory manner.

   c. Apply the paint at the rate of 80 ft^2/gal (approximately 20 mils wet film thickness). This rate is effectively 22 gallons of paint per mile of solid 4-inch stripe. A tolerance not to exceed 10 percent is allowed for film thickness or yield.

   d. Apply glass beads over the wet painted stripes in a uniform pattern at the rate of 6 pounds (± 0.1 pound) of beads per gallon of paint. Pressure-apply the beads using a mechanical dispenser mounted not more than 12 inches behind the paint dispenser.

   e. Use approved equipment for highway lane striping that is specifically designed and manufactured for that purpose by a company experienced in the design and manufacture of such equipment. Minimum requirements include the capability of striping two 4-inch yellow centerlines and one 4-inch white edge line simultaneously. Apply markings with clear-cut edges, true and smooth alignment, and uniform film thickness.

2. Preformed Marking Tapes (PMT). Apply the PMT material as directed by the manufacturer by either the inlay or overlay method. Use the inlay method whenever new asphalt concrete is placed. Use the overlay method to apply markings to existing pavement.

   Store all PMT materials between 60 °F and 85 °F for at least 24 hours prior to installation. During installation, maintain field stockpiles at the required storage temperature.

   For the inlay method, embed the pavement markings in the asphalt concrete surface with a conventional steel wheeled roller. Apply when the surface temperature of the mat is the warmest possible without deforming the marking. The minimum allowable surface temperature, taken within 3/8 inch of the top of the mat, is 140 °F.

If the application of the PMT materials falls behind the paving operation to the extent that the markings are not being applied at the minimum acceptable temperature, slow the paving operation to match the rate of the marking laydown. Resume full paving operations after demonstrating that you have sufficiently skilled personnel to install the markings within the required temperature limits.

When applying pavement markings by the overlay method, ensure the surface is clean and dry and is at least 60 °F and rising. Broom the surface clean. Remove any dust using compressed air. Apply a coat of primer/adhesive activator according to the manufacturer's recommendations. Install and roll the markings with a minimum 200-pound pneumatic roller.

3. Raised and Recessed Pavement Markers. Install raised and recessed pavement markers per the manufacturer's instructions.

   Cut or dado the finished pavement surface with a concrete saw to produce a slot with dimensions as shown on the Plans or recommended by the manufacturer. Clean and dry the slots using compressed air. Install a reflective marker of the color indicated with an epoxy adhesive recommended by the marker manufacturer.

4. Methyl Methacrylate Pavement Markings.

   a. General. Provide installation instructions for the methyl methacrylate markings a minimum of 15 days prior to application. Retain a copy of the instructions for use on the project.

      Ensure the on-site presence of a manufacturer's representative on the first day of striping and any additional days as required.

   b. Preparation. Prepare the roadway areas to receive methyl methacrylate pavement markings according to the manufacturer's recommendations. Clean and dry roadway surface. Remove contaminants such as curing agents, surface oils, or existing road marking materials prior to applying pavement marking material. Do not apply marking to new asphalt until the asphalt has cured for at least 15 days.

   c. Application. Apply methyl methacrylate marking material according to the manufacturer's installation instructions and the recommendations of the manufacturer's representative. Use equipment designed and capable of properly mixing at the point and time of application.

      (1) Longitudinal Markings. Apply markings for lane lines, edge lines, and centerlines at a thickness of 60 ± 5 mils. Apply glass beads at the drop rate specified in Subsection 712-2.18 by double bead gun, one gun directly in front of the spray unit and another directly behind.

      (2) Transverse Markings. Apply markings for crosswalks, stop bars, symbols, transverse markings between gore and channelization striping, and legend markings at a thickness of 120 ± 5 mils. Apply Sinker beads as specified in Subsection 712-2.18 at a minimum drop rate of 1 lb/yd2.

   d. Sampling. Collect a representative sample of spray material by placing a flat sheet of aluminum in the path of the striping guns. Collect the sample without glass beads. Measure the thickness of the sample without glass beads utilizing a wet film thickness gage.

670-3.04 PAVEMENT MARKING REMOVAL. Remove all existing traffic markings that are in conflict with the striping details shown on the Plans, an approved TCP, or any temporary striping as directed. Do not paint over existing markings. Do not use open flame on the final paving lift.

Remove pavement markings to the fullest extent possible without materially damaging the pavement surface, color, or texture. As the work progresses, remove sand or other material deposited on the pavement as a result of removing markings. Remove accumulations of sand or other material that might interfere with drainage or constitute a hazard to traffic.

Before making any change in the traffic pattern, remove or obliterate pavement markings that may create confusion to motorists.

Where using blast cleaning to remove pavement markings or objectionable material within 10 feet of a lane occupied by public traffic, immediately remove the residue (including dust) after contact between the sand and the surface being treated. For such removal, use a vacuum attachment operating concurrently with the blast cleaning operation or by other approved methods.

Repair any damaged pavement or surfacing caused by the pavement marking removal operation.

670-3.05 PRELIMINARY SPOTTING. Provide the necessary control points at intervals including all changes of direction and changes in the basic configuration of striping, such as at the beginning and ending of no-passing zones on a 2-way, 2-lane roadway. Use these points in preliminary spotting of lines before striping is commenced. Perform preliminary spotting of the lines to be painted and obtain approval for all spotting before striping begins. Preliminary spotting is required for all longitudinal striping, with spacing of spots not to exceed 50 feet.

Reference the lines and markings to be replaced at their existing locations prior to performing any work that may disturb them.

670-3.06 TOLERANCES FOR LANE STRIPING.

1. Length of Stripe. ±6 inches in 40 feet

2. Width of Stripe. ±1/4 inch

3. Lane Width. ±4 inches from the widths shown on the Plans (measured from the edge of pavement or edge of traveled way to center of lane line or between the centers of adjacent lane lines)

4. Stripes on Tangent. Do not vary more than 1 inch laterally within a distance of 100 feet when using the edge of the stripe as a reference.

5. Stripes on Curves. Uniform in alignment with no apparent deviations from the true curvature

6. All Stripes. Keep the center of the stripe within 4 inches from the planned alignment.

Traffic markings not within the above tolerances are unacceptable under Subsection 105-1.11.

670-4.01 METHOD OF MEASUREMENT. See Section 109 and the following:

1. Mile Basis. By the horizontal distance along centerline from beginning to end of each stripe pattern, excluding gaps for intersections or other openings. Skip stripes will be measured as 1/4 of this distance.

    a. Single Stripe: A longitudinal marking less than 6 inches wide, such as, but not limited to, a single center line or edge stripe.

    b. Double or Wide Stripe: A longitudinal marking greater than 6 inches wide, such as, but not limited to, double center lines, and auxiliary lane lines.

2. Square Foot Basis. Transverse pavement marking lines 6 inches or more wide will be measured by nominal width times actual length.

3. Each. All other transverse markings will be measured on a unit basis with each separate word or symbol constituting a unit.

   Raised or recessed pavement markers will be measured per each unit installed complete.

4. Linear Foot. A single lineal measurement for every measured foot of stripe from beginning to end of each stripe pattern, excluding gaps for intersections or other openings. Skip stripes will be measured as 1/4 of this distance.

   a. Single Stripe: A longitudinal marking less than 6 inches wide, such as, but not limited to, a single center line or edge stripe.

   b. Double or Wide Stripe: A longitudinal marking greater than 6 inches wide, such as, but not limited to, double center lines, and auxiliary lane lines.

670-5.01 BASIS OF PAYMENT. At the contract price per unit of measurement for those items listed below that appear on the bid schedule.

Accept payment as full compensation for cleaning of pavement, painting traffic markings, application of preformed pavement markings, glass beads, installing raised or recessed pavement markers, furnishing paint, glass beads, preformed marking tape and all other materials necessary to complete the work prescribed in this Section.

When Items 670.0009.__, 670.0014.__, or 670.0015.__, and 670.0016.__ are not shown on the bid schedule, removal of pavement markings is subsidiary to other items of work.

For traffic markings which do not conform to the requirements of this Section but which are allowed to remain in place, payment will be adjusted as follows:

1. Lump Sum. When payment is on a lump sum basis the price reduction will be the product of the lump sum price times the length of non-conforming markings divided by the total length of markings. For the purpose of this calculation, stripe lengths will be considered as continuous with no deduction for skips or breaks, for each 4-inch width stripe being applied, except that a double centerline stripe (No Pass) will be considered as one stripe.

2. Unit Prices. When payment is on a unit price basis, no payment will be made for those units which are not in conformance.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
670.0001.____	Painted Traffic Markings	LS
670.0002.____	Single Stripe	MILE
670.0003.____	Double or Wide Stripe	MILE
670.0004.____	Transverse Pavement Marking Lines	SF
670.0005.____	Transverse Markings, Words and Symbols	EACH
670.0006.____	Preformed Pavement Markings	LS
670.0007.____	Raised Pavement Marker	EACH
670.0008.____	Recessed Pavement Marker	EACH
670.0009.____	Removal of Pavement Markings	MILE
670.0010.____	Methyl Methacrylate Pavement Markings	LS
670.0011.____	Methyl Methacrylate Transverse Pavement Marking Lines	SF

PAY ITEM		
Item Number	**Item Description**	**Unit**
670.0012.____	Methyl Methacrylate Transverse Markings, Words and Symbols	EACH
670.0013.____	Painted Traffic Markings	LF
670.0014.____	Removal of Pavement Markings	LS
670.0015.____	Removal of Pavement Markings	SF
670.0016.____	Removal of Pavement Marking Symbols	EACH

SECTION 681
FUEL TANK (RESERVED)

DIVISION 700–MATERIALS

SECTION 701
HYDRAULIC CEMENT AND SUPPLEMENTARY CEMENTITIOUS MATERIALS

701-1.01 GENERAL. Meet the following general requirements for all cementitious materials furnished:

Before using, retest Portland cement stored longer than 3 months in bags or 6 months in bulk for compressive strength, time of setting, and loss on ignition according to AASHTO M 85. Store separately different types or brands of cementitious materials, or cementitious materials from different mills.

Protect cementitious materials from dampness during shipment and storage. Do not use partially set cement or cement which contains caked lumps. Do not use cement salvaged from discarded or used bags.

701-2.01 PORTLAND CEMENT. Meet AASHTO M 85, Type I, II, or III including the low-alkali cement requirement shown in Table 2—Optional Chemical Requirements.

701-2.02 BLENDED HYDRAULIC CEMENT. Meet AASHTO M 240, Type IP, or Type IS. Report the weight of pozzolan and ground granulated blast furnace slag as percent of weight of the total cementitious material. Do not vary the pozzolan and ground granulated blast furnace slag constituent content from the certified value more than ±5 percent by weight of the total cementitious material. Limit pozzolan in Type IP to fly ash. Meet the replacement limits in Table 701-1

TABLE 701-1
BLENDED HYDRAULIC CEMENT LIMITS

Cement Type	Constituent	Percent of Total Cementitious Material by Weight Maximum
Type IP	Fly Ash	35%
Type IS	Slag cement	40%

701-2.03 GROUT. Non-shrink, non-corrosive, non-metallic, cement-based grout meeting ASTM C1107, except develop a 28-day compressive strength of at least 9,000 psi when tested according to AASHTO T 106 or ASTM C109.

701-2.04 FLY ASH. Meet AASHTO M 295, Class C or Class F, including optional chemical requirements as set forth in Table 2—Supplementary Optional Chemical Requirement.

701-2.05 GROUND GRANULATED BLAST-FURNACE SLAG. Meet AASHTO M 302, Grade 100 or Grade 120.

701-2.06 SILICA FUME. Meet AASHTO M 307.

701-2.07 DS GROUT. Use drilled shaft (DS) grout conforming to the following requirements:

1. Portland Cement Type I or Type II cement meeting the requirements of Subsection 701-2.01.

2. Fine Aggregate: Use fine aggregate meeting Subsection 703-2.01, except 100 percent passing the No. 4 sieve.

3. Potable Water: Use water meeting the requirements of Subsection 712-2.01.

4. Proportioning: Mix grout in proportions using at least 564 lbs/yd^3 of Portland cement, fine aggregate, and with enough water to produce a flowable mixture. Do not exceed 67 gal/yd^3 of water.

Thoroughly mix DS grout to a uniform consistency before injecting into soil surrounding drilled shaft casing and filling CSL tubes.

701-2.08 POST-TENSIONED GROUT. (RESERVED)

701-2.09 CERTIFICATION. Furnish a Certified Test Report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

1. the project name and number;

2. the manufacturer's name;

3. the name of the product or assembly;

4. a complete description of the material;

5. country of origin;

6. the lot, heat, or batch number that identifies the material;

7. all required test results for the specified material from the same lot, heat, or batch defined in Subsection 701-2.09.6;

8. a statement, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

Tag, stencil, stamp, or otherwise mark all materials or assemblies furnished under certification to the project with the lot number, heat number, batch number, or other appropriate identification, which can be readily recognized and legible, and is identical to the accompanying Certified Test Report.

SECTION 702
ASPHALT MATERIALS

702-2.01 ASPHALT BINDER. Meet AASHTO M 320 for the specified Performance Grade.

Re-refined engine oil bottoms (REOB) / vacuum tower asphalt extenders (VTAE) shall not be used as a modifier of Asphalt Binder. REOB/VTAE are materials as defined in Asphalt Institute document IS-235. Furnish a certificate of compliance according to Subsection 106-1.05.1 certifying that REOB/VTAE were not used as a modifier of Asphalt Binder.

702-2.02 CUT-BACK ASPHALT. Meet AASHTO M 81 and M 82.

702-2.03 EMULSIFIED ASPHALT. Meet AASHTO M 140 and the following:

1. Cationic Emulsified Asphalt. Meet AASHTO M 208.

2. Special Tack Emulsion, STE-1. Meet the following, when tested using AASHTO T 59:

TESTS ON EMULSION

Viscosity @ 77 °F, SSF	30, max.
Storage Stability, I day, %	1, max.
Demulsibility, 35 mL 0.8% SDS, %	25, min.
Particle Charge	Positive*
Sieve Test, % Retained	0.10, max.
Distillation Oil by Vol. of Emulsion, %	5, max.
Distillation Residue by Wt. of Emulsion, %	45, min.

TESTS ON RESIDUE

Penetration @ 77 °F	100-250
Ductility @ 77 °F, 5 cm/min., cm	40, min.
Solubility in TCE, %	97.5, min.

** If Particle Charge test is inconclusive, material having a max. pH value of 6.7 is acceptable.*

702-2.04 STORAGE AND APPLICATION TEMPERATURES. Store, mix, and apply asphalt materials within the following temperature ranges:

TABLE 702-1
STORAGE AND APPLICATION TEMPERATURES

Type and Grade of Material	Spray °F	Mix °F	Storage °F
MC-30	85+		140, max.
MC-250	165+	165-220	240, max.
RC-800	200+		200, max.
CRS-2	125-175		100-175
CRS-2P	125-175		100-175
CMS-2	125-175	120-160*	100-175
CSS-1	90-120	90-160*	50-125
STE-1	70-140	70-150	50-125

* Temperature of the emulsified asphalt in the pugmill mixture.

Store, mix, and apply asphalt binder within the temperature ranges recommended by the manufacturer or shown on the approved Job Mix Design.

702-2.05 JOINT ADHESIVE. Meet the requirements of Table 702-2.

TABLE 702-2
ASPHALT JOINT ADHESIVE

PROPERTY	SPECIFICATION	TEST METHOD
Brookfield Viscosity, 400°F	4,000-11,000 cP	ATSM D2669
Cone Penetration, 77°F Flow, 140°F Resilience, 77°F Tensile Adhesion, 77°F Asphalt Compatibility	60-100 0.2-inch, max. 30%, min. 500%, min. Pass	ASTM D5329
Ductility, 77°F Ductility, 39.2°F	1-foot, min. 1-foot, min.	ASTM D113
Softening Point	170°F, min.	AASHTO T 53

702-2.06 JOINT SEALANT. Special Tack Emulsion (STE-1), undiluted CSS-1 meeting Subsection 702-2.03, or approved joint sealant listed on the Qualified Products List.

702-2.07 WARM MIX ASPHALT (WMA). WMA additives, processes and technologies shown in Table 702-3 are preapproved for use on Department projects. Satisfy asphalt binder and mix specification requirements after incorporating additives in the asphalt binder and/or mix.

TABLE 702-3
WMA TECHNOLOGIES

WMA Technology	Process Type	WMA Supplier
Advera WMA	Foaming (Synthetic Zeolite)	PQ Corporation
Aspha-min	Foaming (Synthetic Zeolite)	Aspha-min
Double Barrel Green / Green Pac	Foaming	Astec Industries, Inc.
Eco-Foam II	Foaming	AESCO/Madsen Inc.
Evotherm	Chemical Additive	Ingevity
Rediset	Chemical Additive	Nouryon
Chemoran (CWM)	Chemical Additive	Colas
ZycoTherm	Chemical Additive	Zydex Industries
Sasobit	Organic Additive	Sasol WaxAmericas, Inc.
Ultrafoam GX System	Foaming	Gencor Industries Inc.

702-2.08 ASPHALT RELEASE AGENT. Use a release agent listed on the AASHTO-NTPEP website.

SECTION 703
AGGREGATES

703-2.01 FINE AGGREGATE FOR CONCRETE. Meet AASHTO M 6, Class A, except as follows:

Delete paragraph 8.2 of AASHTO M 6.

Delete the following methods of sampling and testing:

AASHTO T 11	Amount of Material Finer than No. 200 Sieve
AASHTO T 27	Sieve Analysis
AASHTO T 103	Soundness (freezing and thawing)

And substitute the following:

ATM 304 (Method A)	Sieve Analysis of Fine and Coarse Aggregates and Material Finer Than No. 200 Sieve in Mineral Aggregates by Washing

Add the following: Meet AASHTO T 104 using sodium sulfate solution.

In AASHTO M 6, Section 7.1, table entitled "Deleterious Substances Limits", change the maximum percent of material by mass finer than No. 200 Sieve in a. (concrete subject to surface abrasion), from 2.0 to 3.0.

703-2.02 COARSE AGGREGATE FOR CONCRETE. AASHTO M 80, Class B, except as follows:

Delete the following methods of sampling and testing:

AASHTO T 11	Amount of Material Finer than No. 200 Sieve
AASHTO T 27	Sieve Analysis

And substitute the following:

ATM 304 (Method A)	Sieve Analysis of Fine and Coarse Aggregates and Material Finer Than No. 200 Sieve in Mineral Aggregates by Washing

Add the following: Meet AASHTO T 104 using sodium sulfate solution.

703-2.03 AGGREGATE FOR BASE AND SURFACE COURSE. Crushed stone or crushed gravel, consisting of sound, tough, durable pebbles or rock fragments of uniform quality. Free from clay balls, vegetable matter, or other deleterious matters. Meet Table 703-1:

TABLE 703-1
AGGREGATE QUALITY PROPERTIES FOR BASE AND SURFACE COURSE

PROPERTY	BASE COURSE	SURFACE COURSE	TEST METHOD
L.A. Wear,%	50, max.	45, max.	AASHTO T 96
Degradation Value	45, min.	45, min.	ATM 313
Fracture,%	70, min.	70, min., 1 Face	ATM 305
Liquid Limit	---	35, max.	ATM 204
Plastic Index	6, max.	10, max.	ATM 205
Sodium Sulfate Loss,%	9, max. (5 cycles)	9, max. (5 cycles)	AASHTO T 104

Meet Table 703-2 aggregate gradation requirements, as determined by ATM 304:

TABLE 703-2
AGGREGATE GRADATION FOR BASE AND SURFACE COURSE
Percent Passing by Weight

SIEVE	GRADATION			
	BASE COURSE		SURFACE COURSE	
	C-1	D-1	E-1	F-1
1-1/2 in.	100			
1 in.	70-100	100	100	100
3/4 in.	60-90	70-100	70-100	85-100
3/8 in.	45-75	50-80	50-85	60-100
No. 4	30-60	35-65	35-65	50-85
No. 8	22-52	20-50	20-50	40-70
No. 50	6-30	6-30	15-30	25-45
No. 200	0-6	0-6	8-15	8-20

703-2.04 AGGREGATE FOR HOT MIX ASPHALT. Process and crush aggregate that is free from clay balls, organic matter, other deleterious material, and not coated with dirt or other finely divided mineral matter. Aggregate used must consist of sound, tough, durable rock of uniform quality.

Remove all natural fines passing a No. 4 sieve before crushing aggregates for Type IV mixes.

Coarse Aggregate**.** Aggregate retained on the No. 4 Sieve.

Meet Table 703-3 requirements:

TABLE 703-3
COARSE AGGREGATE QUALITY FOR HMA

Description	Specification	Type II, Class A	Type I, Type II Class B, Type III	Type IV	Type V	Type SP
LA Wear, % max.	AASHTO T 96	45	45	45	45	45
Degradation Value, min.	ATM 313	30	30	30	30	30
Sodium Sulfate Loss % max. (5 cycles)	AASHTO T 104	9	9	9	9	9
Fracture, % min.	ATM 305	90, 2 face	80, 1 face	90, 2 face	98, 2 face	90, 2 face
Flat-Elongated Pieces, % max. 1:5	ATM 306	8	8	8	8	8
Absorption, % max.	ATM 308	2.0	2.0	2.0	2.0	2.0
Nordic Abrasion, % max.	ATM 312	-	-	-	8.0	8.0

Fine Aggregate. Aggregate passing the No. 4 sieve. Fine aggregate shall meet the quality requirements of AASHTO M 29, including S1.1, Sulfate Soundness.

Fine aggregate for Type II, Class A mix shall not contain more than 20 percent natural fines (blend sand and mineral filler) added to the crushed aggregate, and shall not exhibit rut depth larger than 6.0 mm, as determined by ATM 419.

Fine aggregate for Type IV mixes:

1. do not blend back natural sand
2. shall be non-plastic as determined by ATM 205
3. shall have a minimum uncompacted void content (Fine Aggregate Angularity) determined by AASHTO T 304, Method A, of 45 percent

TABLE 703-4
BROAD BAND GRADATIONS FOR HOT MIX ASPHALT AGGREGATE
Percent Passing by Weight

		Gradation				
Sieve	**Type I**	**Type II**	**Type III**	**Type IV**	**Type V**	**Type SP**
1 inch	100	-	-	-	-	-
3/4 inch	80-90	100	-	-	100	100
1/2 inch	60-84	75-90	100	100	65-90	90-100
3/8 inch	48-78	60-84	80-90	80-95	55-80	74-90
No. 4	28-63	33-70	44-81	55-70	40-60	42-54
No. 8	14-55	19-56	26-70	35-50	≤ 45	25-35
No. 16	9-44	10-44	16-59	20-40	≤ 35	-
No. 30	6-34	7-34	9-49	15-30	≤ 25	-
No. 50	5-24	5-24	6-36	10-24	≤ 20	-
No. 100	4-16	4-16	4-22	5-15	≤ 12	-
No. 200	4-7	4-7	4-7	4-7	4-7	2-10

703-2.05 AGGREGATE FOR COVER COAT AND SURFACE TREATMENT. Crushed stone or crushed gravel, consisting of sound, tough, durable pebbles or rock fragments of uniform quality. Free from clay balls, vegetable matter, or other deleterious matters, and with no adherent films or coatings of dirt, clay, dust or other deleterious matter that could impede adherence of the bituminous material. Wash the aggregate if necessary. Meet Table 703-5.

TABLE 703-5
QUALITY PROPERTIES FOR COVER COAT AND SURFACE TREATMENT

L.A. Wear,%	AASHTO T 96	45, max.
Degradation Value	ATM 313	50, min.
Sodium Sulfate loss,%	AASHTO T 104	9, max. (5 cycles)
Fracture,%	ATM 305	90, min. (single face)

Cover Coat Material. Meet the gradation requirements of Table 703-6, as determined by ATM 304.

TABLE 703-6
AGGREGATE GRADATION FOR COVER COAT MATERIAL
Percent Passing By Weight

	TYPE 2 COVER	TYPE 3 COVER AGGREGATE		
SIEVE	**AGGREGATE**	Grading A	Grading B	Grading C
1/2 in.	--	--	--	100
3/8 in.	100	100	100	90-100
No. 4	85-100	85-100	60-100	10-30
No. 8	--	0-25	0-10	0-8
No. 50	0-20	--	--	--
No. 200	0-1	0-1	0-1	0-1

Surface Treatment Material. Meet the gradation requirements of Table 703-7, as determined by ATM 304.

TABLE 703-7
AGGREGATE GRADATION FOR ASPHALT SURFACE TREATMENT

	GRADING Percent Passing by Weight						
SIEVE	A	B	C	D	E	F	G
1-1/2 in.	100	--	--	--	--	--	--
1 in.	90-100	100	--	--	--	--	--
3/4 in.	--	90-100	100	--	--	--	--
1/2 in.	0-15	20-55	90-100	100	100	--	--
3/8 in.	--	0-15	40-75	90-100	90-100	100	100
No. 4	--	--	0-15	0-10	10-30	75-100	85-100
No. 8	--	--	0-5	0-5	0-8	0-10	60-100
No. 200	0-1	0-1	0-1	0-1	0-1	0-1	0-10

703-2.06 MINERAL FILLER. Meet AASHTO M 17. Determine material grading using AASHTO T 37.

703-2.07 SELECTED MATERIAL. Meet the following requirements for the type specified. Obtain the Engineer's approval for the intended purpose, prior to use on the project.

1. Type A. Aggregate containing no muck, frozen material, roots, sod or other deleterious matter and with a plasticity index not greater than 6 as tested by ATM 204 and ATM 205. Meet the following gradation as tested by ATM 304:

Sieve	Percent Passing by Weight
No. 4	20-60%
No. 200	0-6%, determined on the minus 3-inch portion of the sample

2. Type B. Aggregate containing no muck, frozen material, roots, sod or other deleterious matter and with a plasticity index not greater than 6 as tested by ATM 204 and ATM 205. Meet the following gradation as tested by ATM 304:

Sieve	Percent Passing by Weight
No. 200	0-10% determined on the minus 3-inch portion of the sample

3. Type C. Earth, sand, gravel, rock, or combinations thereof containing no muck, peat, frozen material, roots, sod, or other deleterious matter and is compactable under the provisions of Subsections 203-3.04 or 203-3.05.

703-2.08 FILTER BLANKET. Meet AASHTO M 80, Class A. Meet the following gradation: AASHTO M 43, size No. 467.

703-2.09 SUBBASE. Hard, durable particles or fragments of stone or gravel. Do not use materials that break up when alternately frozen and thawed or wetted and dried. Do not include muck, frozen material, roots, sod, or other deleterious matter. Meet Table 703-8.

TABLE 703-8
QUALITY PROPERTIES FOR SUBBASE

L.A. Wear,%	AASHTO T 96	50, max.
Liquid Limit	ATM 204	25, max.
Plasticity Index	ATM 205	6, max.
Degradation Value	ATM 313	40, min.

Meet the grading requirements of Table 703-9 as determined by ATM 304.

Grading C and Grading D: Crushed aggregate with at least 50 percent by weight of the particles retained on the No. 4 sieve having at least one fractured face as tested by ATM 305.

TABLE 703-9
AGGREGATE GRADATION FOR SUBBASE
Percent Passing by Weight

SIEVE	GRADING				
	A	B	C	D	E
4 in.	100	--	--	--	--
2 in.	85-100	100	--	--	--
1 in.	--	--	100	--	--
3/4 in.	--	--	--	100	--
No. 4	15-60	15-60	40-75	45-80	--
No. 16	--	--	20-43	23-50	--
No. 200 *	10 Max.	0-6	4-10	4-12	0-6

** Gradation shall be determined on that portion passing the 3-inch screen.*

703-2.10 POROUS BACKFILL MATERIAL. Gravel consisting of crushed or naturally occurring granular material containing not more than 1 percent clay lumps or other readily decomposed material (AASHTO T 112). Meet the grading requirements of Table 703-10 as determined by ATM 304.

TABLE 703-10
AGGREGATE GRADATION FOR POROUS BACKFILL MATERIAL

SIEVE	PERCENT PASSING BY WEIGHT	
	GRADATION A	GRADATION B
3 in.	100	--
2 in.	--	100
1.5 in.	--	95-100
1 in.	0-10	--
3/4 in.	--	0-20
3/8 in.	--	0-5
No. 200	0-5	0-2

703-2.11 GABION BACKFILL. Stone and gravel, uniformly graded from 4 to 12 inches in least dimension and having no more than 60 percent wear (AASHTO T 96).

703-2.12 SAND BLANKET. Sand containing no muck, frozen material, roots, sod or other deleterious matter and with a plasticity index not greater than 6 as determined by ATM 204 and ATM 205. Meet the grading requirements of Table 703-11 as determined by ATM 304.

TABLE 703-11
SAND BLANKET MATERIAL GRADATION

SIEVE	PERCENT PASSING BY WEIGHT
3/8 in.	100
No. 4	95-100
No. 200	0-6

703-2.13 STRUCTURAL FILL. Aggregate containing no muck, frozen material, roots, sod or other deleterious matter and with a plasticity index not greater than 6 as determined by ATM 204 and ATM 205. Meet the grading requirements of Table 703-12 as determined by ATM 304.

TABLE 703-12
AGGREGATE GRADATION FOR STRUCTURAL FILL

SIEVE	PERCENT PASSING BY WEIGHT
3 in.	100
3/4 in.	75-100
No. 4	15-60
No. 16	10-30
No. 200	0-6

703-2.14 AGGREGATE FOR ABRASIVE FINISH. Crushed silica sand, oven dried, and stored in moisture-proof bags. Free from clay balls, vegetative matter, or other deleterious matter (AASHTO T 112). Not coated with dirt or other finely divided mineral matter. Meet the grading requirements of Table 703-13 as determined by ATM 304.

TABLE 703-13
GRADATION FOR SAND FOR ABRASIVE FINISH

SIEVE	PERCENT PASSING BY WEIGHT
No. 12	100
No. 40	0-5

703-2.15 CRUSHED GLASS. Up to 10 percent by weight crushed glass (cullet) smaller than 3/8-inch may be uniformly blended with natural soil-aggregate material prior to project delivery and placement. Glass cullet must be free of soil, paper, plastic, metals, organic material and other deleterious and hazardous substances. No more than 2.0 percent debris should be present as determined by Section X3 of AASHTO M318.

Eligible glass products from which glass cullet might be produced include: food and beverage container glass; plain ceramic or china dinnerware; or building window glass.

Prohibited glass products include: automobile windshields or other glass from automobiles; light bulbs of any type; porcelain products; laboratory glass; television, computer or other cathode ray monitor tubes.

Provide documentation identifying the origin of the glass products and certifying the glass cullet:

1. Does not contain prohibited materials,

2. Meets debris content requirement.

Uniformly blend glass cullet and natural soil-aggregate and meet the gradation requirements of Table 703-14.

TABLE 703-14
COMBINED AGGREGATE/GLASS CULLET GRADATION

Type (Section)	Section/Table
Selected Material (203-3.03)	Section 703-2.07
Aggregate Base Course (301)	Table 703-2
Subbase	Table 703-8

For the natural soil-aggregate used in the blend, meet quality requirements as shown in Table 703-1, Section 703-2.07, or Section 703-2.09 for the type specified.

703-2.16 RECYCLED ASPHALT PAVEMENT (RAP). RAP shall be free of contamination and deleterious materials. RAP maximum particle size shall not exceed 1.5-in.

For HMA, the combined gradation of all aggregates, virgin and recycled, shall meet the requirements of Table 703-4 for the specified HMA Type.

SECTION 704
MASONRY UNITS

704-2.01 CLAY OR SHALE BRICK. Meet one of the following specifications:

Sewer Brick	ASTM C32, Grade SM or SS
Building Brick	ASTM C62, Grade MW

704-2.02 CONCRETE BRICK. Meet ASTM C1634.

704-2.03 CONCRETE MASONRY BLOCK. Meet ASTM C90. Use rectangular or segmented block, When shown on the Plans, shape ends to provide interlock at vertical joints. Meet the dimensions and tolerances shown on the Plans.

SECTION 705
JOINT MATERIALS

705-2.01 JOINT FILLERS. Meet AASHTO M 213.

705-2.02 JOINT SEALANT.

Silicone Joint Sealant	ASTM D 5893
Hot Pour Joint Sealant (Asphalt, Concrete)	ASTM D6690, Type IV

705-2.03 BRIDGE SEALS.

1. Preformed Strip Seals and Compression Seals. Use preformed seals constructed with only virgin natural polyisoprene (natural rubber) as the raw polymer in the elastomeric compound. Do not use polychloroprene (neoprene). Use steel extrusions meeting ASTM A709 Grade 36. Galvanize steel extrusions in accordance with Subsection 716-2.07. Use preformed material meeting the following requirements of ASTM D2000:

$$M4AA\ 514\ A_{13}B_{13}C_{12}F_{17}$$

Use a lubricant-adhesive for installing preformed strip seals and compression seals meeting ASTM D4070.

a. Certification. Furnish a Certified Test Report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

(1) the project name and number;

(2) the manufacturer's name;

(3) the name of the product or assembly;

(4) a complete description of the material;

(5) country of origin;

(6) the lot, heat, or batch number that identifies the material;

(7) all required test results for the specified material from the same lot, heat, or batch defined in Subsection 705-2.03.1.a.(6);

(8) a statement, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

Tag, stencil, stamp, or otherwise mark all materials or assemblies furnished under certification to the project with the lot number, heat number, batch number, or other appropriate identification, which can be readily recognized and legible, and is identical to the accompanying Certified Test Report.

2. Silicone Expansion Joint Seals. Use materials that conform to the following:

a. Silicone Joint Sealants.

(1) Horizontal Joints. Use formed-in-place sealant composed of 100 percent silicone that is self-leveling, cold applied, and two-part formulation meeting the requirements in Table 705-1.

(2) Vertical Joints. Use formed-in-place sealant composed of 100 percent silicone meeting the requirements of ASTM D5893, Type NS (Non-Sag). Do not use acid cure sealants. Ensure the silicone sealant is compatible with the surface to which it is applied.

b. Bond Breaking Backing Material. Use closed-cell expanded polyethylene foam backer rod meeting the requirements of ASTM D5249.

TABLE 705-1
SELF-LEVELING SEALANT REQUIREMENTS

Property	Requirements	Test Method
Extrusion Rate	Min, 50 mL/minute	ASTM C1183
Specific Gravity	Min. 1.25 Max. 1.35	ASTM D792
Joint Elongation	Min. 600%	ASTM D5329 (modified)*
Joint Modulus (at 100% elongation)	Min. 3 psi Max. 12 psi	ASTM D5329 (modified)*

* Modify the ASTM D5329 test by using a pull rate of 2 inches per minute and a joint size of 1/2 inch x 1/2 inch x 2 inch.

705-2.04 JOINT MORTAR. Use a mixture of one part portland cement and two parts approved sand with water as necessary to obtain the required consistency. Use mortar within 30 minutes after its preparation.

705-2.05 FLEXIBLE WATERTIGHT GASKETS. Ring gaskets (seals):

1. Joining rigid concrete (cast-in-place and precast) pipes, manholes, box sections and other structures:

   a. ASTM C443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

   b. ASTM C990 Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed flexible Joint Sealants (Butyl Rubber Sealant)

   c. ASTM C1628 Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets

   d. ASTM C1619 Specification for Elastomeric Seals for Joining Concrete Structures Class B (oil resistant performance)

2. Joining flexible metal pipe (steel and aluminum):

   a. ASTM C443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

   b. ASTM C1619 Specification for Elastomeric Seals for Joining Concrete Structures Class B (oil resistant performance)

   c. ASTM D1056 Specification for Flexible Cellular Materials-Sponge or Expanded Rubber

      (1) Type 2-Closed cell rubber

(2) Class B-Oil resistance with low mass change

(3) Grade 3-Compression-deflection range from 9 to 13 psi

Use continuous flat gaskets with thickness 1/2-inch greater than the nominal depth of the corrugation for bands with projections or flat bands and 3/8-inch for corrugated bands.

3. Joining plastic pipe:

a. ASTM D3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

b. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
Not less than 50% by volume oil resistant polymer

705-2.06 EXPANDED POLYETHYLENE. Use closed-cell expanded polyethylene with a density of at least 2.1 lb/ft^3 as determined by ASTM D3575 and with a minimum compressive stress of 9 psi at 25 percent deflection as determined by ASTM D3575.

SECTION 706
CONCRETE AND PLASTIC PIPE

706-2.01 NON-REINFORCED CONCRETE PIPE. Meet AASHTO M 86.

706-2.02 REINFORCED CONCRETE PIPE. Meet the following:

Round Pipe	AASHTO M 170, “Wall B”
Elliptical Pipe	AASHTO M 207

706-2.03 PERFORATED CONCRETE PIPE. Meet AASHTO M 175.

706-2.04 DRAIN TILE. Meet AASHTO M 178. When specified, provide integral spacer lugs in the pipe spigot to provide for an annular opening and self-centering feature.

706-2.05 PVC PIPE FOR WATER AND SANITARY SEWER SYSTEMS. Use Polyvinyl Choloride (PVC) pipe systems manufactured from a compound that meets ASTM D1784 with a cell classification of 12454B. Ensure the entire pipe system is made of materials with a 150 psi rated working pressure. Use pipe with push on type joints and an exterior size compatible with ductile iron fittings. Meet the following:

PVC Pipe	ANSI/AWWA	C 900 or C905
PVC Fittings	ANSI/AWWA	C 907
Rubber Gasket	ASTM	F477
Joints	ASTM	D3139

706-2.06 PLASTIC PIPE. Non-perforated, semi-rigid, smooth-wall pipe meeting the following:

Polypropylene (PP)	
Storm and Drainage	AASHTO M330, Type S or Type D,
Sanitary	ASTM F2764
Polyethylene (PE)	AASHTO M 294, Type S or Type D
Polyvinyl Chloride (PVC)	ASTM D2680
Acrylonitrile-Butadiene-Styrene (ABS)	ASTM D2680

706-2.07 CORRUGATED POLYETHYLENE PIPE. Meet the following for perforated or unperforated:

Culverts	AASHTO M 294, Type S or Type D
Underdrains	AASHTO M 252

706-2.08 HDPE PIPE FOR WATER AND SANITARY SEWER SYSTEMS. Use high density polyethylene (HDPE) pipe and fittings manufactured from a PE 3408 resin that meets ASTM D3350 with a cell classification of 345464C. Ensure the entire system is made of materials with a 150 psi rated working pressure, except material two inch or less in diameter shall have a 200 psi rated working pressure. Join all pipe and fittings by either butt fusion or flanges as per manufacturers recommendation. No mechanical joints are allowed. Meet the following:

HDPE Pipe 2” or less	ASTM	D2737
HDPE Pipe over 2”	ASTM	F714
Butt Fusion Fittings	ASTM	D3261
Flanged joints	ASTM	D3261

When HDPE pipe is used in arctic applications:

1. Protect by using a thaw wire, control system, and power supply designed by an Electrical Engineer, and meeting the requirements of Section 616; except use heating cable consisting of 10 AWG nickel-plated copper bus wires in a self-regulated polymeric core, with a continuous exposure capability of 150°F;

2. Surround with a minimum of three inch thick polyurethane insulation; and

3. Provide an outer surfacing of 24 gauge galvanized steel or 16 gauge aluminum.

706-2.09 POLYPROPYLENE PIPE. Meet the following:

Storm	AASHTO M330, Type S or Type D, or ASTM F3219
Culvert	AASHTO M330, Type S or Type D, or ASTM F3219
Sanitary	ASTM F2764

SECTION 707
METAL PIPE

707-2.01 CORRUGATED STEEL PIPE, PIPE ARCHES, AND UNDERDRAINS. Meet AASHTO M 36 for conduits and coupling bands including special sections such as elbows and flared end sections. Meet the specified sectional dimensions and gages. Furnish shop-formed elliptical pipe where specified. Fabricate pipe using one of the following:

1. Zinc-coated steel meeting AASHTO M 218

2. Aluminum-coated steel meeting AASHTO M 274

3. Aluminum-zinc alloy coated steel meeting AASHTO M 289

707-2.02 BITUMINOUS COATED CORRUGATED STEEL PIPE, PIPE ARCHES, AND UNDERDRAINS. Meet AASHTO M 190 for conduits and coupling bands. Meet the specified sectional dimensions, gages, and type of bituminous coating. Fully coat coupling bands with bituminous material. Furnish shop-formed elliptical pipe where specified.

Use the same gage of steel for special sections, such as elbows and flared end sections, as the conduit to which they are joined. Meet the requirements of AASHTO M 190. Use the type of coating and invert paving specified.

Meet the specified minimum size of perforations after coating.

707-2.03 CORRUGATED ALUMINUM ALLOY CULVERT PIPE AND UNDERDRAINS. Meet AASHTO M 196.

707-2.04 STRUCTURAL PLATE CULVERTS. Meet the following:

Steel or iron plates	AASHTO M 167
Aluminum alloy	AASHTO M 219

707-2.05 DUCTILE IRON PIPE FOR WATER AND SANITARY SEWER. Use ductile iron pipe and fittings that are bituminous coated, cement mortar lined, have push on type joints, and a 150 psi working pressure. Meet the following:

Cement mortar lining	ANSI/AWWA	C104
Loose Polyethylene Encasement	ANSI/AWWA	C105 (8 mil when required)
Ductile Iron Fittings	ANSI/AWWA	C110 or C153, and C104
SBR Rubber Gaskets	ANSI/AWWA	C111 (Push on or mech. joint)
Threaded Flange Joints	ANSI/AWWA	C115
Ductile Iron Pipe	ANSI/AWWA	C150 and C151 and C104

707-2.06 SERVICE PIPE. Meet the following:

1. Copper Pipe. Cold drawn, seamless, annealed Type “K” with flare fittings meeting ASTM B88.

2. Steel Pipe. Standard weight, Grade B, galvanized, welded or seamless pipe meeting ASTM A53.

707-2.07 GALVANIZED STEEL WATER CONDUIT. Meet the following:

Galvanized Pipe	ASTM A53
Galvanized Fittings	ASTM A197 galvanized per AASHTO M 232

SECTION 708
PAINTS

708-1.01 GENERAL REQUIREMENTS. Ship paint in strong, substantial containers, plainly marked with the name, weight, and volume of the paint content, together with the color formula, batch number, and the name and address of the manufacturer.

Store materials in a closed weather proof, dry shelter at all times.

Have the paint manufacturer furnish samples of the actual batches of paint supplied for the project for independent laboratory testing of chemical composition.

Use reduction and clean up thinners approved by the coating manufacturer. Measure and document all thinner reduction with records provided to the Engineer. Ship all thinners in their manufacturer's original containers.

708-2.01 PAINT FOR STEEL STRUCTURES.

1. Prime Coat. A single component, moisture cure, polyurethane (SC-MC-U) using zinc dust pigment, meeting the following:

zinc powder	78% by weight, min.
volume of solids	60% min.
zinc in dry film	83% minimum, by weight (ASTM D521)
weight per gallon	23 pounds, min.
VOCs	3.75 pounds per gallon, max.

2. Intermediate Coat. A single component, moisture cure, polyurethane (SC-MC-U). Pigment color must contrast with the prime coat and the top coat. Meet the following:

micaceous iron oxide (MIO)	3.3 pounds per gallon, min. (ASTM D5532, Type I)
volume of solids	60% min.
weight per gallon	12.5 pounds min.
VOCs	3.75 pounds per gallon, max.

3. Top Coat. A single component, moisture cure, aliphatic polyurethane (SC-MC-ALIP-U). Pigment color FSS FED-STD-595B, color number 26492. Evaluate the color match as a general match under a daylight source using ASTM D1729. Meet the following:

micaceous iron oxide (MIO)	3.3 pounds per gallon, min. (ASTM D5532, Type I)
Volume of solids	60% min.
Weight per gallon	12 pounds min.
VOCs	3.75 pounds per gallon, max.

All coatings must pass the following tests:

Corrosion Resistance, ASTM B117, Salt Spray Test. Minimum of 5000 hours with less than 1/16 inch creep from scribe. Use 1/8 inch minimum thickness ASTM A36 steel panels, having SSPC-SP 10 Near White Blast with 1 to 2 mils angular profile.

Accelerated Weathering, ASTM G154. Minimum 400 hours QUV B bulb with no chalking, cracking, or gloss loss greater than 20%.

Forward Impact, ASTM D2794. Minimum 150 in-lb impact.

Abrasion Resistance, ASTM D4060. Less than 90 mg loss on CS-17 wheel, 1 kg/load, 1000 cycles.

Moisture Resistance, ASTM D4585. Minimum 1000 hours at 100 °F with no change in appearance.

Flexibility, ASTM D522, Cylindrical Mandrel Bend Test. Bend around 1/2 inch diameter mandrel with no cracking.

Adhesion, ASTM D4541. Minimum 500 psi on a certified pull test.

Cyclic Weathering, ASTM D5894. Minimum 5000 hours, 15 cycles with less than 1/16 inch creep from scribe. Use 1/8 inch minimum thickness ASTM A36 steel panels, having SSPC-SP 10 Near White Blast with 1 to 2 mils angular profile.

708-2.02 PAINT FOR TIMBER. Meet Master Painter's Institute Detailed Performance Standard MPI #119 Latex, Exterior, Gloss (MPI Gloss Level 6).

708-2.03 PAINT FOR TRAFFIC MARKINGS. Use one of the following:

1. Solvent Base Traffic Marking Paint. Paint must meet the requirements of Federal Specification A-A-2886B, TYPE II – Fast Dry-10 minutes no pick up; lead-free yellow (or all colors); or

2. Waterborne Traffic Marking Paint. Paint must meet the requirements of Federal Specification TT-P1952 F, TYPE II, or TYPE III; or

3. The current State of Alaska DOT&PF maintenance specification for pavement marking paint.

708-2.04 PAINT FOR CONCRETE. Meet Master Painter's Institute Detailed Performance Standard MPI #119 Latex, Exterior, Gloss (MPI Gloss Level 6).

SECTION 709
REINFORCING STEEL AND WIRE ROPE

709-2.01 REINFORCING STEEL.

1. Reinforcing Steel Bars. Furnish deformed reinforcing steel bars of the type, grade, and size as specified. For steel reinforcing bars used in bridge structures, use bars meeting ASTM A706, Grade 60. For all other structures, use bars meeting AASHTO M 31, Grade 60.

2. Headed Reinforcing Steel Bars. Furnish headed reinforcing steel bars meeting the requirements of ASTM A970, Class HA. Use reinforcing steel meeting Section 709-2.01.1 unless otherwise noted.

3. Epoxy-Coated Reinforcing Steel Bars. Furnish epoxy-coated steel bars meeting the requirements of ASTM A775. Coat epoxy-coated reinforcing steel in an epoxy coating applicator plant certified in accordance with the Concrete Reinforcing Steel Institute (CRSI) Voluntary Certification Program. Use reinforcing steel meeting Section 709-2.01.1 unless otherwise noted.

4. Steel Wire. Furnish plain steel wire of the size specified that meets the requirements of AASHTO M 32.

5. Steel Bar Mats. Furnish deformed steel bar mats of the type, grade, size, and spacing as specified. Unless otherwise noted, furnish steel bar mats meeting the requirements of AASHTO M 54, Grade 60.

6. Steel Welded Wire Fabric. Furnish plain steel welded wire fabric of the size and spacing specified that meets the requirements of AASHTO M 55.

7. Epoxy-Coating Patch Material. Furnish epoxy-coating patch material meeting the requirements of ASTM D3963.

8. Certification. Furnish a Certified Test Report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

   a. the project name and number;

   b. the manufacturer's name;

   c. the name of the product or assembly;

   d. a complete description of the material;

   e. country of origin;

   f. the lot, heat, or batch number that identifies the material;

   g. all required test results for the specified material from the same lot, heat, or batch defined in Subsection 709-2.01.8.f; and,

   h. a statement, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

Tag, stencil, stamp, or otherwise mark all materials or assemblies furnished under certification to the project with the lot number, heat number, batch number, or other appropriate identification, which can be readily recognized and legible, and is identical to the accompanying Certified Test Report.

709-2.02 WIRE ROPE OR WIRE CABLE. Meeting AASHTO M 30, 3/4 inch Type 1, Class A.

709-2.03 BAR SUPPORTS.

1. Precast Mortar Blocks. Provide mortar blocks meeting the following:

   a. Ensure the mortar blocks have compressive strength at least equal to the strength of the concrete in which the mortar blocks are embedded. Sample and test the mortar for compressive strength according to AASHTO T 106. Each test will be considered to represent no more than 2,500 mortar blocks made of the same mortar and cured under the same conditions.

   b. Ensure the bearing area of the mortar block is less than 2 inches in each dimension.

   c. Secure to the reinforcing steel with either a grooved top that will hold the bar in place or a protruding embedded wire that is tied to the reinforcing steel.

2. Metal Supports. Provide metal supports meeting at least one of the following:

   a. Galvanized after fabrication according to AASHTO M 232 Class D,

   b. Stainless steel meeting the requirements of ASTM A493, Type 302, or

   c. Plastic coated using coatings that do not react chemically with the concrete, have a minimum thickness of 3/32 inch where the support touches the form, do not crack at or above -5°F, and do not deform enough to expose the metal at or below 200°F.

3. Plastic Supports. Provide plastic supports meeting the following:

   a. Non-porous.

   b. Chemically inert in concrete.

   c. Have rounded seats.

   d. Do not deform under load during normal temperatures.

   e. Do not shatter or crack under impact loading in cold weather.

   f. Have at least 25 percent of their gross area perforated.

   Do not use plastic supports that prevent complete concrete consolidation in and around the support or require supports less than 1 foot apart along the length of the bar.

SECTION 710
FENCE AND GUARDRAIL

710-2.01 BARBED WIRE. Meet AASHTO M 280, 12.5 gage wire, with 4-point round 14-gage barbs, spaced at 5 inches, Class 1 coating.

710-2.02 WOVEN WIRE. Meet AASHTO M 279, Grade 60, Class 1 coating.

710-2.03 CHAIN LINK FABRIC. Meet AASHTO M 181, Type I (Class C or D coating), Type II, or Type III, including fittings and hardware. Use 9-gage fabric wire, 2-inch mesh.

710-2.04 METAL BEAM RAIL.

1. W-Beam and Thrie Beam Guardrail. Meet AASHTO M 180, Class A, Type II.

2. Box-Beam Guardrail. Meet:

   a. ASTM A500 Grade B, or

   b. ASTM A501.

Galvanize the rail per AASHTO M 111 after fabrication.

710-2.05 FENCE POSTS. Meet AASHTO M 181, Grade 1 or Grade 2, including rails and braces.

710-2.06 GUARDRAIL POSTS AND BLOCKOUTS. Furnish posts and blockouts, as specified, meeting the following requirements.

1. Wood Posts and Blockouts. Use timber with a stress grade of 1200 psi or more. Testing must meet the standards of the West Coast Lumber Inspection Bureau. Use timber for posts and blockouts that is either rough sawn (unplaned) or S4S with nominal dimensions indicated. Allowable size tolerance of rough sawn blockouts in the direction of the bolt holes is ±1/4 inch. Only one combination of post and blockout finish may be used for any one continuous length of guardrail. Treat all timber to meet Section 714.

2. Steel Posts and Blockouts. Meet the section and length specified or shown on the Plans. Use copper bearing steel when so specified. Use steel meeting the requirements of ASTM A36 and galvanized per ASTM A123/A.

3. Synthetic Blockouts. Products made from alternate materials may be used if accepted by the FHWA for use on the National Highway System.

710-2.07 GUARDRAIL HARDWARE. Meet AASHTO M 180. Galvanize after fabrication fittings, bolts, washers, and accessories meeting AASHTO M 111 or AASHTO M 232, whichever applies. Guardrail cable anchor assembly must conform to TF13 Guide to Standardized Roadside Hardware, designator FCA01, with the cable meeting AASHTO M 30, Type II, Class A.

710-2.08 WIRE MESH. Galvanized 2-inch mesh (poultry netting), 20 gage wire.

710-2.09 ANCHOR WIRE. Galvanized 9 gage steel wire.

710-2.10 PIPE COUPLINGS. Galvanized nonrecessed, taper tapped, extra heavy couplings.

710-2.11 GUARDRAIL TERMINALS. W-beam shall meet requirements of AASHTO M 180, Class A, Type II. Galvanize after fabrication.

Components made from rolled pressed and forged shapes, castings, plates, bars, and strips shall meet the coating requirements of AASHTO M 111. Galvanize after fabrication.

All hardware or fasteners supplied shall meet the coating requirements of AASHTO M 232.

Provide one of the following terminal types, as shown on the plans, for single-rail W-beam guardrail. Design requirements: 31-inch top of rail height, 8-inch blockouts, W6 x 8.5 steel posts, 12ft-6in w-beam panels, and mid-span splice connection to run of rail.

1. Parallel Terminals:

    a. Provide terminals meeting the following:

        (1) Crashworthiness: MASH-compliant Test Level 3 terminals

        (2) Length: 50 feet nominal effective length

        (3) End Offset: 0 to 2 feet (25:1 or flatter straight taper) Offset end as shown on the plans.

2. Buried in Backslope Terminal: Provide MASH-compliant Test Level 3 terminals.

SECTION 711
CONCRETE CURING MATERIALS AND ADMIXTURES

711-2.01 CURING MATERIALS.

Burlap Cloth made from Jute or Kenaf	AASHTO M 182, Class 4
Sheet Materials for Curing Concrete	ASTM C171
Liquid Membrane-Forming Compounds for Curing Concrete	ASTM C309, Type 1-D Class B, except do not use compounds containing linseed oil.

711-2.02 CHEMICAL ADMIXTURES.

Air-Entraining Admixtures	AASHTO M 154
Water-Reducing Admixtures	AASHTO M 194, Type A
Set-Retarding Admixtures	AASHTO M 194, Type B
Set-Accelerating Admixtures	AASHTO M 194, Type C
Water-Reducing and Set-Retarding Admixtures	AASHTO M 194, Type D
Water-Reducing and Set-Accelerating Admixtures	AASHTO M 194, Type E
Water-Reducing Admixtures	AASHTO M 194, Type F
High Range Water-Reducing and Set-Retarding Admixtures	AASHTO M 194, Type G
Specific Performance Admixtures	ASTM C494, Type S

SECTION 712
MISCELLANEOUS

712-2.01 WATER. Use water for mixing and curing concrete meeting ASTM C1602 including the optional chemical limits. Water from 'Community' or 'Non-Transient Non-Community' sources regulated by the Alaska Department of Environmental Conservation Division of Environmental Health Drinking Water Program, or equivalent in other states, do not require testing under ASTM C1602. For all other water sources, consider the water to be 'combined' as employed in ASTM C1602.

Use water for irrigating trees, plants, and seeded areas that is free of elements harmful to plant growth.

712-2.02 CALCIUM CHLORIDE. AASHTO M 144.

712-2.03 LIMESTONE. Use limestone containing not less than 85 percent of calcium and magnesium carbonates. Meet the standards of the Association of Official Agricultural Chemists. Meet the following gradation for agricultural ground limestone suitable for application by a fertilizer spreader:

Sieve	Percent Passing, by Weight, Min.
No. 10	100
No. 20	90
No. 100	50

Use soluble or ground limestone in a hydraulic sprayer. Ground limestone must permit complete suspension of insoluble particles in water.

712-2.04 PRECAST CONCRETE CURBING. Portland cement concrete curb units conforming to the lengths, shapes, and other details of the Plans. Use steel reinforcement, where shown on the Plans, meeting Subsection 709-2.01.

Furnish a depressed or modified section of curb, when shown on the Plans, for driveways, crossing, closures, or for other reasons.

712-2.05 PRECAST CONCRETE MANHOLE SECTIONS. Meet AASHTO M 199, except that the absorption test will not be required. Reject units with cracks and honeycombed or patched areas in excess of 30 square inches.

712-2.06 FRAMES, GRATES, AND COVERS. Conform to the plan dimensions and to the following materials requirements.

Gray iron castings	AASHTO M 306 and AASHTO M 105, Class 35B.
Carbon-steel castings	AASHTO M 103. Grade is optional.
Structural steel	ASTM A709
Galvanizing	AASHTO M 111
Malleable iron castings	ASTM A47. Grade is optional.

Manhole frames and cover bearing surfaces are machine finished and all covers interchangeable.

712-2.07 CORRUGATED METAL UNITS. Meet AASHTO M 36. When bituminous coating is specified, meet AASHTO M 190, Type A.

712-2.08 GLASS BEADS. Submit certifications of compliance as specified in Section 106-1.05 for each lot of glass beads used on the contract. Glass beads shall contain no more than 200 ppm of lead or 200 ppm of arsenic when tested in accordance with EPA testing methods 3062, 6010B, or 6010C. Glass Beads shall meet AASHTO M 247, Type 1, with a moisture resistant coating when tested in accordance with AASHTO T346.

712-2.09 CORPORATION STOPS AND CURB STOPS. Use threaded corporation stops meeting AWWA C800. Use tapped couplings and service saddles as detailed on the Plans and per the manufacturer's recommendations.

712-2.10 GATE VALVES. All valves must open counter-clockwise, and have ends corresponding to the type of conduit being used.

Valves Larger than 3-inch. Iron body, fully bronze mounted, double disc, parallel seat valves, as manufactured to meet AWWA Specifications C500.

Valves 3-inch and Smaller. Meet ASTM B62. Solid bronze, wedge disc, non-rising stem, Class 125, with threaded ends.

712-2.11 VALVE SERVICE BOXES. Furnish the specific style box, stem, and cover shown on the Plans. Inscribe cover with “water” or “W”. Furnish service box of sufficient length to be adjusted an equal amount above and below the final ground surface. Dip boxes in coal tar pitch.

Furnish special wrenches, keys, or other tools needed to operate valve and to open valve box lid. Furnish a minimum of one of each type for each style and size of box and lid.

Boxes for Valves Larger than 3-inch. Cast iron, not less than 5-1/4 inch shaft, with extension stem adjustable for elevation.

Boxes for Valves, 3-inch and Smaller. Cast iron, not less than 4-1/4 inch shaft, with screw type extension stem.

712-2.12 HYDRANTS. Meet AWWA Specifications C-502, “Dry-Barrel Fire Hydrants”. Equip hydrants with 5-inch main valve openings and 6-inch standard mechanical joint hub ends for connection to the auxiliary gate valve. Equip hydrants with an auxiliary gate valve and valve box as shown on the standard details. Use mechanical joints for all connections. Furnish the following types of hose connections, as indicated on the drawings and bid schedule:

Single Pumper Hydrants. Two 2-1/2 inch hose connections and one 4-1/2 inch pumper connection.

Double Pumper Hydrants. One 2-1/2 inch hose connection and two 4-1/2 inch pumper connections.

Furnish hydrants in lengths indicated on the drawings. Furnish hydrants with working parts made of bronze or non-corrodible metal. Paint and coat to meet the cited AWWA Specifications.

712-2.13 GABIONS.

Wire Mesh: Use 11 gage minimum wire, except that the selvedge may be heavier. Meet or exceed ASTM A641 medium hardness and tensile strength; Class 3 coating. Furnish at least one sample of each component of the mesh for testing.

Use mesh with 4-inch openings in the longest dimension.

Use wire mesh that is designed to be nonraveling. It must resist pulling apart at any of the connections forming the mesh when a single wire strand in a section of mesh is cut.

Tie and Connecting Wire: Conform to the same specifications as wire used in the mesh except that it may be not more than 2 gauges smaller. Supply sufficient quantity for securing and fastening all edges of the gabion baskets and diaphragms, for fastening adjacent gabion baskets together, and to provide cross connecting wires in each gabion cell as specified below.

Gabion Baskets. Supply baskets, as specified, in various lengths and heights. Make the lengths multiples (2, 3, or more) of the horizontal width. Furnish all gabion baskets in uniform width of not less than 24 inches or more than 48 inches.

Fabricate the sides, ends, lid, and diaphragms for field assembly into a rectangular basket of the required size. Construct gabions as a unit. The base, ends and sides are either to be woven into a single unit or one edge of these members connected to the base so that strength and flexibility at the point of connection is at least equal to that of the mesh.

Diaphragms. Where the length of the gabion exceeds its horizontal width, divide the gabion equally with diaphragms of the same mesh and gage as the gabion basket and make compartments of a length approximately equal to horizontal width. Furnish the gabion with the necessary diaphragms secured in proper position on the base section so that no additional tying at this juncture is necessary.

Securely selvedge or bind all perimeter edges so that the joints formed by tying the selvedges have approximately the same strength as the body of the mesh.

712-2.14 PREFORMED PAVEMENT MARKING TAPE.

1. General Requirements:

   a. Reflectorized plastic pavement markings and legends. Furnish a pliant polymer or homogenous preformed ribbon, 60 mils thick and of specified width, containing glass spheres uniformly distributed throughout the entire cross section. Furnish type that is designed to be inlayed on hot asphalt pavement or attached to existing bituminous pavement with a precoated pressure adhesive or liquid contact cement as herein specified.

   b. Use legends and symbols meeting the applicable shapes and sizes in the Alaska Traffic Manual and the Plans.

   c. Ensure that the plastic marker will mold itself to pavement contours, breaks, faults, etc. at normal pavement temperatures and fuse with itself and with previously applied markings of the same composition under normal conditions of use.

2. Composition Requirements: Furnish marker with the following materials uniformly distributed throughout its cross-sectional area, and with a reflective layer of beads bonded to the top surface:

Material	(Composition by Weight, min.)
Resins & Plasticizers	20%
Pigments	30%
Graded Glass Beads	25%

3. Physical Requirements:

   a. Tensile Strength. Minimum tensile strength of 100 psi when tested according to ASTM D638.

   b. Plastic Pull Test. A test specimen made by cutting two 1-inch by 3-inch pieces of the plastic and attaching a 1-inch by 1-inch area at the end of each piece to the other, must support a dead weight of 4 pounds for not less than 5 minutes at a temperature between 70 °F and 80 °F.

   c. Pigmentation. Select and blend the pigments to provide a marking film which includes titanium dioxide for white markers and medium chrome yellow for yellow markers meeting standard highway colors through the expected life of the film.

d. Glass Beads. Colorless glass with a minimum index of refraction of 1.50 when tested using the liquid oil immersion method. Use beads of size and quality to meet the performance requirements for the plastic.

e. Skid Resistance. Meet a minimum skid resistance value of 40 BPN for the surface of the plastic using ASTM E303.

f. Reflectance. Meet the following initial minimum reflectance values for white and yellow films at 0.2° and 0.5° observation angles and 86.0° entrance angle using FSS FED-STD-370. Use a test distance of 50 feet and a 2-foot x 2.5-foot rectangular sample. Express specific luminance (SL) as millicandelas per ft^2 per foot candle.

(1) Use an angular aperture of both the photoreceptor and light projector of 6 minutes of arc. Use the geometric center of the sample as the reference center and the reference axis perpendicular to the test sample.

	White		Yellow	
Observation Angle	0.2°	0.5°	0.2°	0.5°
Specific Luminance	550	380	410	250

g. Reflectivity Retention Tests. Meet the following test requirements:

(1) Taber Abraser Simulation Test. Using a taber abraser with an H-18 wheel and a 125-gram load, inspect the sample at 50, 100 and 200 cycles, under a microscope, to observe the extent and type of bead failure.

No more than 10 percent of the beads may be lost due to popout and the predominant mode of failure must be “wear down” of the beads.

(2) Qualitative Test. Judge bead bond strengths under a microscope with a magnification of 5X. The beads when removed must show a portion of the polymer bead bond retained with the beads.

h. Certification. In lieu of running the tests required by this Subsection, provide a certification from the manufacturer stating the product conforms to these requirements.

i. Effective Performance Life. Provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface remains stable.

The plastic must be weather resistant and through normal traffic wear, show no appreciable fading, lifting or shrinkage and show no significant tearing, roll back, or other signs of poor adhesion.

4. Application. Use a vendor-furnished mechanical applicator for the installation of a 4-inch wide pressure sensitive adhesive coated material. Provide the mechanical applicator on location for the duration of the installation period. Ensure that a manufacturer's representative is present during the time of the installation to provide technical assistance.

712-2.15 RAISED AND RECESSED PAVEMENT MARKERS. Use reflectors for both raised and recessed pavement markers consisting of an acrylic plastic shell filled with tightly adherent potting compound. Use shells containing one or two glass-covered prismatic reflective faces as called for on the Plans to reflect incidental light from a single or opposite directions.

1. Shell. Molded Methyl Methacrylate meeting ASTM D788, Gr. 8.

2. Overall Dimensions. 4 x 2 x 3/8 inches.

3. Reflective Surface. Each reflective surface must have a minimum area of 3-1/4 in^2 and be located on a 30-degree angle from a horizontal plane.

4. Optical Requirements. Meet the following minimum optical requirements of the reflective faces for an observation angle of 0.2 degrees, with the incident light parallel to the base of the reflector:

Horizontal Entrance Angle	Specific Intensity*		
	White	Yellow	Red
0 degrees	3	1.8	0.75
20 degrees	1.2	0.72	0.30

**Candelas per footcandle of illumination at the reflector on a plane perpendicular to the incident light.*

5. Adhesive. Install pavement markers with an epoxy adhesive recommended by the marker manufacturer and approved by the Engineer.

6. Color. Match the color of the raised pavement markers to the color of the marking for which they supplement, substitute, or serve as a positioning guide.

7. Filler. Use a potting compound filler selected for strength, resilience, and adhesion.

Bond thin, smooth, untempered glass to the prismatic reflective faces to provide an extremely hard and durable abrasion resistant surface.

712-2.16 TEMPORARY RAISED PAVEMENT MARKERS FOR SHORT-TERM OPERATIONS, SEAL COATS, AND SURFACE TREATMENTS.

1. Marker. L-shaped polyurethane body with retroreflective tape on the top vertical section, with a self-adhesive base. Reflectorize both faces of the yellow marker and one face of the white marker. Make the marker body of 60 mil minimum thickness polyurethane meeting Table 712-1 with vertical leg approximately 2 inches high by 4 inches wide and base approximately 1-1/4 inch wide.

TABLE 712-1
REQUIREMENTS FOR TEMPORARY RAISED PAVEMENT MARKERS

PROPERTY	RESULT	ASTM TEST METHOD
Specific Gravity (min.)	1.19	D792
Hardness	80A	D2240
Tensile Strength (psi, min.)	4600	D412
Ultimate Elongation (%, min.)	330	D412
Modulus @ 300% (psi, min.)	1000	D412
Stiffness @ -20 °F (psi, min.) @ 72 °F (psi, min.)	1700 900	D1053 D1053
Compression Set 22 hrs @ 160 °F max. %	65	D395
Taber Abrasion CS17 wheel wt loss mg/1000 cycles	3	----

2. Reflective Tape. Metalized polycarbonate microprism retroreflective material with acrylic backing or equal, a minimum 1/4-inch wide by 4 inches long. Provide the minimum optical performance shown in Table 712-2, for an observation angle of 0.2 degrees.

TABLE 712-2
OPTICAL PERFORMANCE FOR REFLECTIVE TAPE

Horizontal	Specific Intensity *

Entrance Angle	White	Yellow
0 degrees	3.5	3.0
30 degrees	2.7	1.7

*Candelas per footcandle of illumination at the reflector on a plane perpendicular to the incident light.

3. Protective Cover. Where chip seals, slurry seals or tack coats are to be utilized after placement of the temporary raised pavement markers, furnish markers with a protective cover made of clear flexible polyvinyl chloride.

4. Adhesive. Pressure-sensitive material, a minimum of 1/8 inch thick and 3/4 inch wide, factory-applied to the marker base with release paper.

712-2.17 METHYL METHACRYLATE PAVEMENT MARKINGS.

1. Quality Requirements: Use a marking material formulated for spray application without reflective beads or anti-skid aggregate. Use glass beads and aggregate designed to be applied to freshly applied material to meet the specified retroreflectance and anti-skid properties.

2. Use a marking material manufactured from new materials and free from dirt and other foreign material. Use a methyl methacrylate-based resin system for Part "A". Use benzoyl peroxide liquid plasticizer for Part "B".

3. Submit a manufacturer certification for both the methyl methacrylate material and glass beads to ensure that the materials furnished conform to these Specifications.

4. Performance Properties:

   a. No Track Time: Material must be track free after 15 minutes when applied at 40 mils (ASTM D711).

   b. Hardness: Shore Durometer, A-1, 80 minimum after 24 hours.

   c. Tensile Strength: At break, minimum 125 psi (ASTM D638).

   d. Percent Elongation: Minimum 20% (ASTM D638).

   e. Water Absorption: Maximum 0.5% (ASTM D570).

   f. Chemical Resistance: The material must show no effect after 7-day immersion in anti-freeze, motor oil, diesel fuel, gasoline, calcium chloride, sodium chloride or transmission fluid.

   g. Ultra-violet Light: Ultra-violet light must have no effect.

   h. Skid Resistance: Minimum 45 units, British pendulum (ASTM E303).

   i. Reflectivity: 200 millicandelas, minimum initial

   j. Viscosity: Spray Material: 5 - 12 Pa•s (ASTM D2196 Method B, LV Model, Spindle #4 at 60 RPM).

5. Composition: The composition is at the discretion of the manufacturer, but must be essentially comprised of resins, reactive monomers, pigments, plasticizer, benzoyl peroxide, aggregate and glass beads. When mixed in the stated ratio, the material must cure to 99 percent minimum by weight and volume solids.

712-2.18 GLASS BEADS FOR METHYL METHACRYLATE PAVEMENT MARKINGS. Meet the following requirements:

Beadgun Position►	**Front** ▼	**Rear** ▼
Glass Type►	1.5 RI*, Sinker	1.5 RI*, Floater
Coating►	Adhesion (ACO2)	Fluorocarbon
Sieve Size ▼	Percent Passing by Weight ▼	Percent Passing by Weight ▼
No. 16	100	100
No. 20	90-100	100
No. 30		75-95
No. 40	10-35	
No. 50	0-10	15-35
No. 80	0-5	
No. 100		0-5
Drop Rate, lb/ft^3►	65	40

** Refractive Index*

712-2.19 LOW-VISCOSITY RESIN. Meet AASHTO M 235, Type IV, Grade 1, with the following revisions:

Amend AASHTO M 235 Table 1 as follows:

Replace "2.0[20]" with "0.105[1.05]" in the row labeled "Grade 1, max".

712-2.20 CONCRETE ANCHORS.

1. Anchor Bolts. Use hot-dip galvanized anchor bolts meeting ASTM F1554, Grade 36, unless noted otherwise.

2. Coil Anchor Inserts. Use 1-inch diameter galvanized inserts with a minimum safe working load of 7,500 pounds. Hot-dip galvanize anchors according to AASHTO M 111 or AASHTO M 232.

3. Threaded Anchor Inserts. Use 1-inch diameter galvanized ferrule inserts with a minimum safe working load of 6,500 pounds. Hot-dip galvanize anchors according to AASHTO M 111 or AASHTO M 232.

712-2.21 EPOXY FOR BONDING DOWELS. Use an epoxy cartridge system appropriate for the service temperature and ambient concrete temperature at the time of installation.

Use epoxy cartridge systems that meet the requirements of the “Acceptance Criteria for Adhesive Anchors in Masonry Elements,” AC58, by the International Code Council Evaluation Service (ICC-ES) including the suitability requirements for creep, in-service temperature, dampness, freezing and thawing, and seismic tests.

712-2.22 CONTROLLED LOW-STRENGTH MATERIAL. Provide controlled low-strength material (CLSM) that is a self-compacting, cementitious, flowable material requiring no subsequent vibration or tamping to achieve consolidation and meeting the following:

1. Cementitious Materials. Meet Section 701.

2. Water. Meet Subsection 712-2.01

3. Chemical Admixtures. Meet Subsection 711-2.02

4. Aggregate. Crushed stone or naturally occurring gravel, containing no deleterious matter, and with 100 percent of the aggregate passing a 3-inch sieve.

5. Strength. 100 psi minimum to 300 psi maximum 28-day compressive strength as determined by ASTM D4832.

SECTION 713
STRUCTURAL TIMBER, LUMBER, AND PILING

713-2.01 MATERIAL REQUIREMENTS. Meet AASHTO M 168. Use the grade and species shown on the Plans, or if not shown on the Plans, use Douglas Fir No. 1 or equal for timber, lumber and piling.

SECTION 714
PRESERVATIVES FOR TIMBER

714-2.01 PRESERVATIVES. Pressure treat all timber that is exposed to weather, water, or soil to AASHTO M 133 or the AWPA Standards, using preservatives registered by the US Environmental Protection Agency.

1. Timber. Use the preservatives and treatment processes of AASHTO M133, and if in aquatic enviroments, and *Best Management Practices for the Use of Treated Wood in Aquatic Environments* (BMPs), published by the Western Wood Preservers Institute, 12503 SE Mill Plain Blvd., #205, Vancouver, WA 98684 (Phone: 360-693-9958). Treat products according to AWPA Standard U1, Commodity Specification A: Sawn Products for soil and freshwater applications meeting Use Category 4B.

2. Glued-Laminated Timber. Treat products according to AWPA Standard U1, Commodity Specification F: Wood Composites. Use preservatives for soil and freshwater applications meeting Use Category 4B.

3. Timber Piling. Treat products according to AWPA Standard U1, Commodity Specification E: Round Timber Piling. Use Category 4B for soil and freshwater contact. Marine piling products shall be treated according to AWPA Standard U1, Commodity Specification G: Marine (Salt Water) Applications. Use Category 5A for salt water application.

4. Lumber. Pressure treat all lumber in accordance with AWPA Standards or according to AASHTO M 133.

SECTION 715
STEEL FOR PILES

715-2.01 SCOPE. Steel used for Structural Steel Piling and Sheet Piling.

715-2.02 GENERAL REQUIREMENTS. Furnish steel piles of the dimensions, weights, cross-sections, and grades specified. Satisfy the impact test requirements of Subsection 716-2.02. Meet the following:

1. Structural Steel HP Piling. Furnish HP shape piles meeting ASTM A709, Grade 50T3.

2. Structural Steel Pipe Piling. Furnish pipe piles meeting one of the following:

   a. American Petroleum Institute (API) 5L X52 PSL2 with one longitudinal seam.

   b. ASTM A709, Grade 50T3 with one longitudinal seam fabricated and monogrammed according to API 2B.

   c. ASTM A709, Grade 50T3 fabricated according to the following:

      (1) General. Fabricate single seam helical weld pipe piling from coiled skelp. Use skelp material that does not contain repair welds. Use skelp having a width not less than 0.8 times the outside diameter of the pipe and not greater than 3.0 times the outside diameter of the pipe. Form pipe when the steel temperature is below 400°F. Locate junctions of skelp end welds and the helical seam welds at distances greater than 1.0 times the outside diameter of the pipe from the pipe ends and at distances greater than 5.0 times the outside diameter of the pipe from other junctions of skelp end welds and helical seam welds.

      (2) Welding. Use complete joint penetration welds produced by the automatic submerged–arc welding process, the automatic gas metal-arc welding process, or a combination of both processes. Perform welding according to Section 504.

      (3) Welding Inspection. Perform welding inspection according to AWS D1.1. Provide 100% visual inspection of welds on the inside and outside surfaces of the pipe.

      (4) Non-Destructive Examination. Randomly examine 10% of the total length of helical seam welds and skelp end welds. Examine welds by performing one of the following tests:

         (a) Radiographic testing according to the requirements of AWS D1.1 Section 6, Part E with Subsection 6.12.3 of AWS D1.1.

         (b) Ultrasonic testing according to the requirements of AWS D1.1 Section 6, Part F with Subsection 6.13.3.1 of AWS D1.1.

         If more than 10% of the weld lengths examined are defective, examine a second random sample of 25% of the total length of welds. If more than 10% of the weld length examined in the second sample are defective, examine 100% of the total length of welds.

         Repair all weld defects in accordance with AWS D1.1.

      (5) Destructive Examination. Perform destructive examination on specimens from finished pipe of each specified outside diameter, wall thickness, steel type, heat, and grade. Examine specimens at a frequency of at least one set of tests for each lot representing 2000 linear feet of finished pipe or once per week during each

production run, whichever occurs first. Do not use specimens containing repaired welds.

(a) Tensile Tests. Meet the specified tensile requirements for yield strength, tensile strength, and elongation. Perform tension tests according to ASTM A370 using one base metal specimen and two weld specimens taken at 90° to the length of the weld with the weld across the center of the sample. For base metal specimen, determine and report yield point, yield strength, tensile strength, and elongation. For weld test specimens, determine and report tensile strength.

Each lot of pipe will be considered to meet the tensile requirements if the base metal test results meet the specified yield strength, tensile strength, and elongation and the weld test results meet the specified tensile strength result.

(b) Bend Tests. Perform transverse side bend tests according to ASTM E190. Each lot of pipe will be considered to meet the bend test requirements if no cracks occur in the specimen.

(6) Tolerances. Meet the following tolerances:

(a) Roundness. Limit the difference between the major and minor outside diameter to 1% of the specified outside diameter of the pipe or 1/4 inch, whichever is less.

(b) Circumference. Limit the outside circumference to 1% of the nominal outside circumference of the pipe or 1/2 inch, whichever is less.

(c) Straightness. Do not deviate from a straight line parallel to centerline of the pile more than 1/8 inch per 10 feet of length, but not to exceed 3/8 inch in any 40-foot length.

(d) Length. ±1-1/2 inch per 10 feet of length.

(7) Defects. The Engineer may reject piles containing surface defects. The depth of the surface defect will be measured as the gap between the lowest point of the defect and a prolongation of the original contour of the pipe. Use of piles containing surface defects may be authorized according to the following requirements based on the depth of the surface defect:

(a) If the surface defect is not greater than 5% of the wall thickness in depth, the defect need not be repaired.

(b) If the surface defect is deeper than 5%, but not greater than 7%, of the specified wall thickness, grind smooth the surface defect. Remove abrupt changes in contour, but do not reduce the thickness in the ground area more than 7% of the specified wall thickness.

(c) If the surface defect is deeper than 7%, but not greater than 20%, of the specified wall thickness, repair the defect by welding according to Section 504.

(d) If the surface defect is deeper than 20% of the specified wall thickness, repairs will not be permitted and the pile will be rejected.

3. Pile Tip Reinforcing. Use pile tip reinforcement conforming to the requirements of ASTM A27 Grade 65-35 or ASTM A148 Grade 90-60. Make each pile tip in one piece of cast steel. Weld tip reinforcing to the piles in conformance with the manufacturer's written directions.

4. Structural Steel Sheet Piling. Furnish sheet piles meeting AASHTO M 202. Provide piling and connectors of the same ASTM designation and grade shown on the Plans. Do not mix piling of different grades.

715-2.03 CERTIFICATION. Furnish a certified test report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

1. the project name and number;

2. the manufacturer's name;

3. the name of the product or assembly;

4. a complete description of the material;

5. country of origin;

6. the lot, heat, or batch number that identifies the material;

7. all required test results for the specified material from the same lot, heat, or batch defined in Subsection 715-2.03.6; and,

8. a statement, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

For pipe manufactured to API 5L, submit an inspection certificate with test results according to API 5L 10.1.3.

715-2.04 MARKING. Mark all pipe and sheet piling using dot peen, die stamp or other low stress engraving process that is legible after coating or galvanizing. Mark the exterior and interior faces of one end of the piling with the lot number, heat number, batch number, or other appropriate identification that matches the accompanying certified test report.

Also mark helical welded pipe piles with the fabricator’s name, measured major diameter, measured minor diameter, and nominal wall thickness on the exterior face at both ends.

SECTION 716
STRUCTURAL STEEL

716-2.01 SCOPE. Structural steel for highway bridges and other structural purposes.

716-2.02 GENERAL REQUIREMENTS. Meet the following:

1.	General requirements for delivery of rolled steel plates, shapes, and bars for structural	ASTM A6
2.	Structural Steel	ASTM A709
3.	Filler Metal for Applicable Arc-Welding Electrodes	AWS Specifications
4.	Stud Shear Connectors	ASTM A108 Gr. 1015, or 1020

5. Raised Pattern Plate. Where raised pattern plate is shown on the Plans, use plates with a raised pattern surface meeting the following requirements:

   a. Use diagonal type pattern, with the intersecting diagonals at right angles to one another. Use the same material for the raised portions of the pattern as the base metal of the plate. The raised pattern must be an inherent part of the plate. The pattern must be continuous throughout the surface of the plate and the projections along any diagonal must be spaced alternately with the projections along the normal diagonals.

   b. Use plate with projections that are self-draining and self-cleaning and provide a skid-resistant surface from all angles of approach. The projections must have flat tops and be designed not to chip, crack, split, or buckle at their intersection with the base metal.

6. Impact Test Requirements. Use structural steel and filler metal for applicable arc-welding electrodes meeting the following requirements:

   a. For structural steel, meet the impact testing requirements and marking requirements of ASTM A709 for the specified grade, type of component, and impact testing temperature zone. If the grade is not specified, use Grade 36 steel. If the type of component is not specified, use steel grades marked with suffix T. If the impact testing temperature zone is not specified, use steel marked for Zone 3.

   b. For filler metal for applicable arc-welding electrodes, meet the minimum average energy values of the base metals to be joined when tested at or below the temperature corresponding to the specified impact testing temperature zone of the base metal. Perform impact tests according to ASTM A370.

716-2.03 FASTENERS. Meet the following:

1.	High Strength Bolts	ASTM F3125, Grade A325
2.	Nuts	ASTM A563
3.	Hardened Steel Washers	ASTM F436
4.	Zinc Coated Load Indicating Washers	ASTM F959 Type 325

716-2.04 STEEL GRID FLOORS. Meet ASTM A709, Grade 36. If the material is not galvanized, ensure the steel has a copper content of 0.2 percent minimum.

Unless painting of floors is specified in the Special Provisions, open type floors must be galvanized.

716-2.05 MACHINE BOLTS. Meet ASTM A307.

716-2.06 STEEL PIPE. Meet ASTM A53 Grade B.

716-2.07 GALVANIZING. Hot-dip galvanize structural steel shapes, plates, bars and their products according to AASHTO M 111. Galvanize tubes and piles on inside and outside surfaces.

Hot-dip galvanize steel poles, mast arms, pedestals, and posts, according to AASHTO M 111. Submerge each component in the galvanizing kettle in one dip. Use only the dry kettle method of fluxing for high tower poles.

Hot-dip galvanize all anchor bolts, nuts, washers, tie-rods, clamps, and other miscellaneous ferrous parts in conformance with AASHTO M 232. After galvanizing, ensure that the bolt threads accept galvanized standard nuts without requiring tools or causing removal of protective coatings.

Galvanize rigid metal conduit in conformance with AASHTO M 232.

For steel bridge members, apply 10 mils zinc galvanizing by spray-metalizing process according to Steel Structures Painting Council's coating system guide SSPC-CS 23.00. Prepare surfaces before galvanizing according to Steel Structures Painting Council's surface preparation guide SSPC-SP 5, White Metal Blast Cleaning.

Repair damaged coatings according to ASTM A780 Annex A1 or Annex A3, except as described herein. Clean the damaged area according to SSPC-SP 3, Power Tool Cleaning for repairs meeting Annex A1 and SSPC-SP 5/NACE No. 1, White Metal Blast Cleaning for repairs meeting Annex A3.. Extend the cleaned area 1/2 inch to 3/4 inch into the undamaged section of the coating. Keep the cleaned area dry and free of rust and soiling. Within 24 hours of cleaning, coat the cleaned section with zinc to a thickness of not less than 10 mils when using the method in Annex A3 and not less than 3 mils when using the method in Annex A1. Taper the thickness of the repair coating to match the original coating thickness at the edges of the cleaned section. Where zinc coating is to be metallized in accordance with Annex A3, use zinc wire containing not less than 99.98 percent zinc.

716-2.08 CERTIFICATION. Furnish a Certified Test Report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

1. the project name and number
2. the manufacturer's name
3. the name of the product or assembly
4. a complete description of the material
5. country of origin
6. the lot, heat, or batch number that identifies the material
7. all required test results for the specified material from the same lot, heat, or batch defined in Subsection 716-2.08.6
8. an affidavit, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

Tag, stencil, stamp, or otherwise mark all materials or assemblies furnished under certification to the project with the lot number, heat number, batch number, or other appropriate identification, which can be readily recognized and legible, and is identical to the accompanying Certified Test Report.

SECTION 718
STEEL FORGINGS

718-2.01 SCOPE. Steel forgings from which pins, rollers, trunnions or other forged parts are to be fabricated.

718-2.02 GENERAL REQUIREMENTS. Meet the dimensions shown on the Plans and the following specifications.

1. Alloy Steel Forgings (general industrial use): AASHTO M 102, Class G.

2. Carbon Steel Forgings (general industrial use): AASHTO M 102, Class C.

3. Pins and Rollers

   a. More than 7 inches in Diameter: Annealed carbon-steel forgings meeting AASHTO M 102, Class C.

   b. 7 inches or Less in Diameter: Either annealed carbon-steel forgings meeting AASHTO M 102, Class C or cold finished carbon-steel shafting meeting AASHTO M 169, Grade 1016 to 1030, inclusive, with a minimum Rockwell Scale B hardness of 80. Material not meeting the specifications for hardness may be accepted provided it develops a minimum tensile strength of 66,000 psi and a minimum yield point of 33,000 psi.

4. Threads for Pins: ANSI B 1.1, Class 2A coarse thread series. Thread pin ends, having a diameter of 1-3/8 inch or more, 6 threads to the inch.

718-2.03 CERTIFICATION. Submit 5 copies of a certified mill test report covering chemical and physical tests for the material in each shipment.

SECTION 719
STEEL, GRAY-IRON AND MALLEABLE-IRON CASTINGS

719-2.01 SCOPE. Steel, gray-iron and malleable-iron castings intended for various uses as shown on the Plans.

719-2.02 GENERAL REQUIREMENTS. Meet the size and dimensions shown on the Plans, be true to pattern in form, and conform to the following specifications.

Carbon Steel Castings	AASHTO M 103, Grade 65-35
Chromium Alloy Steel Castings	AASHTO M 163, Grade CA-15
Gray-Iron Castings	AASHTO M 306 and AASHTO M 105, Class 35B
Malleable-Iron Castings	ASTM A47, Grade 32510

SECTION 720
BEARINGS

720-2.01 ELASTOMERIC BEARING PADS. Elastomeric bearing pads include plain pads, consisting of elastomer only, and laminated pads with steel laminates.

1. General. Meet AASHTO M 251, with the following revisions:

4.1 Properties of the Elastomer

Delete the first sentence and replace with the following: Use elastomeric compound in the construction of the bearings containing only virgin natural polyisoprene (natural rubber) as the raw polymer. Do not use neoprene. Properties and requirements elsewhere in AASHTO M 251 pertaining solely to polychloroprene (neoprene) do not apply.

Add the following:

Use elastomer compound classified as low temperature Grade 5 and meeting the requirements of paragraph 8.9.1.

5. FABRICATION

Add the following paragraph:

5.5. Fabricate pads over 3/4 inch thick with alternating laminations of elastomer and metal or fabric reinforcements. The outside laminations must be metal or fabric with a minimum elastomer cover as shown on the Plans.

Table 2 – Tolerances.

Delete Item 6 and replace with the following:

6. Top, bottom, and edge cover of embedded laminates or connection members -0, +1/8 inch.

2. Certification. Furnish a Certified Test Report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

   a. the project name and number;

   b. the manufacturer's name;

   c. the name of the product or assembly;

   d. a complete description of the material;

   e. country of origin;

   f. the lot, heat, or batch number that identifies the material;

   g. all required test results for the specified material from the same lot, heat, or batch defined in Subsection 720-2.01.2.f; and

   h. a statement, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

Tag, stencil, stamp, or otherwise mark all materials or assemblies furnished under certification to the project with the lot number, heat number, batch number, or other appropriate identification, which can be readily recognized and legible, and is identical to the accompanying Certified Test Report.

720-2.02 EPOXY ADHESIVE FOR ELASTOMERIC BEARING PADS. Meet AASHTO M 235, Type IV, Grade 3.

720-2.03 POLYTETRAFLUOROETHYLENE (PTFE) BEARINGS. PTFE bearing assemblies consist of elastomeric bearing pads, polytetrafluoroethylene surfacing, and stainless steel and steel plates.

1. Materials.

Elastomeric Bearing Pads	Subsection 720-2.01
Stainless Steel Plates	ASTM A 240, Type 304
Steel Plates	ASTM A 709, Grade 36

Use PTFE from virgin material (not reprocessed) meeting the requirements of ASTM D 4894 or D 4895, and Table 720-1.

2. Fabrication. Fabricate the PTFE sliding surface with lubricant dimples having a maximum diameter of 0.32 inch, a minimum depth of 0.08 inch and a maximum depth of one half of the PTFE sheet thickness. Distribute the dimples uniformly within the area ¼ inch from the edges of the PTFE sheet and occupying between 20 percent and 30 percent of the PTFE sheet area.

For welding of structural steel, conform to the requirements of Section 504.

TABLE 720-1
POLYTETRAFLUOROETHYLENE (PTFE)

Test	Requirements	ASTM Method
Specific Gravity	2.13 - 2.19	D792
Peak Melting Temperature	623°F (±2°F)	D4894, D4895, or D5977
Tensile strength (Minimum)	2800 psi	D638 or D2256
Elongation (Minimum)	200%	D638 or D2256

Bond the PTFE to steel substrate under controlled conditions according to the written instructions of the manufacturer of the adhesive system. Use adhesive material meeting the requirements of the PTFE manufacturer.

Uniformly roughen the contact surfaces of PTFE sheet and steel plate to be bonded to a minimum roughness height value of 250 microinches.

Factory treat the side of the PTFE sheet to be bonded by the sodium naphthalene or sodium ammonia process, after the contact surface is roughened.

Fully bond the PTFE sheet in the recess. Ensure the PTFE surface is smooth and free from bubbles after completion of the bonding operation. PTFE sheets that are delaminated will be rejected.

Perimeter seal weld the stainless steel plate to the steel sole plate. Use stainless steel electrodes in accordance with the requirements of the electrode manufacturer. After the completion of the weld operation, ensure the stainless steel plate is smooth and free from waves.

Control the flatness of the bearing elements such that upon completion of the bearing assembly the PTFE/stainless steel sliding interface is in full bearing.

Provide a mating surface of the stainless steel plate with the PTFE surfacing with a surface finish of less than 8 microinches root-mean-square (rms), determined according to ASME B46.1. Do not exceed a first movement static coefficient of friction of 0.05 for the sliding element of the production bearings, when tested without the coating of silicone grease.

Fully vulcanize elastomeric bearing pads to the steel plates under factory controlled conditions. Provide a bond with a peel-strength of at least 30 pounds per inch as determined by AASHTO M 251, Appendix X2.

Prepare and paint metal surfaces, except stainless steel surfaces, of bearings exposed to the atmosphere in the completed work. Prepare and paint the surfaces according to Section 504.

After installation of the bottom portion of the bearing assembly, apply a 1/16 inch thick coating of silicone grease to the entire PTFE surface and reassemble the bearing without damage to the mating sliding surfaces. Use silicone grease conforming to SAE AS8660.

At your expense and without contract extension time return damaged bearings and bearings with scratched mating surfaces to the factory for replacement or resurfacing.

Prior to proof testing, permanent die stamp all individual components on 2 of 4 sides with markings consisting of bearing number and contract number. Provide each bearing with a unique bearing number and match marks on plate edges to insure correct assembly at the job site.

3. Testing. Proof test and evaluate full sized PTFE bearings for compression and coefficient of friction in the presence of the Engineer, unless otherwise directed. Perform proof tests on samples randomly selected by the Engineer from the production bearings to be used in the work. Perform proof tests at an approved independent laboratory. If proof tests are not performed at the specified load, perform additional physical tests in the presence of the Engineer, unless otherwise directed, to demonstrate that the requirements for proof testing at the specified load are satisfied. Give the Engineer at least 7 working days notice before beginning proof testing.

   Proof test one bearing per lot of production PTFE bearings. A lot is defined as 25 PTFE bearings or fraction thereof of the number of PTFE bearings shown on the Project Plans.

   Clean the bearing surfaces prior to testing.

   Proof test bearings after conditioning specimen for 12 hours at 75o ±5oF.

   Perform the tests with the dead load as specified in the Contract for the bearing with the test load applied for 12 hours prior to friction measurement and the following:

   Arrange the tests to allow measurement of the static coefficient of friction on the first movement of the bearing.

   Measure the first movement static and dynamic coefficients of friction at a sliding speed not exceeding one inch per minute and do not exceed the specified coefficient of initial static friction.

   Subject the test bearings to a minimum of 100 movements of at least one inch of relative movement at a sliding speed not exceeding 12 inches per minute. After cycling, measure again the first movement static and dynamic coefficients of friction at a sliding speed not exceeding one inch per minute and do not exceed the specified coefficient of initial static friction.

The proof tested bearings are to show no visible sign of: (1) bond failure of bearing surfaces, (2) separation or lift-off of plates from each other or from PTFE surfaces, (3) other defects. When a proof tested bearing fails to comply with the Contract Documents, test each bearing in that lot for acceptance.

Proof test results are to be certified correct and signed by the testing laboratory personnel who conducted the test and interpreted the test results. Include the bearing numbers of the bearings tested on the proof test results.

Test a minimum of one pad per lot for bond strength per AASHTO M 251. Test specimens are to show no indication of deterioration of elastomer or loss of bond between the elastomer and steel laminates.

Protect all PTFE and stainless steel surfaces from contamination and weather damage.

4. Certification. Furnish a Certified Test Report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

   a. the project name and number;

   b. the manufacturer's name;

   c. the name of the product or assembly;

   d. a complete description of the material;

   e. country of origin;

   f. the lot, heat, or batch number that identifies the material;

   g. all required test results for the specified material from the same lot, heat, or batch defined in Subsection 720-2.03.4.f; and,

   h. a statement, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

   Tag, stencil, stamp, or otherwise mark all materials or assemblies furnished under certification to the project with the lot number, heat number, batch number, or other appropriate identification, which can be readily recognized and legible, and is identical to the accompanying Certified Test Report.

SECTION 721
PRESTRESSING STEEL AND FITTINGS

721-2.01 SCOPE. Prestressing steel and fittings used in pre-tensioned and post-tensioned concrete construction.

721-2.02 PRESTRESSING STEEL. Meet the following:

Steel Strand	AASHTO M 203
Uncoated Stress-Relieved Steel Wire	AASHTO M 204. Do not use oil-tempered wires.
High Strength Steel Bars	AASHTO M 275

721-2.03 POST-TENSIONING SYSTEM. Use only post-tensioning systems that utilize tendons fully encapsulated in anchorages and ducts. Systems that transfer prestress force by bonding the prestress steel directly to concrete are not allowed. Use only post-tensioning systems that are approved by the Engineer and meet the following requirements:

1. Anchorage and Distribution. Secure prestressing steel at the ends by means of approved permanent type anchoring assemblies.

   Use anchorage devices for post-tensioning that hold the prestressing steel at a load producing a stress of not less than 95 percent of the guaranteed ultimate tensile strength (GUTS) of the prestressing steel, when tested in an unbonded state, without exceeding the anticipated set.

   Distribute the load from the anchoring assemblies to the concrete by means of approved devices or bearing plates that will effectively distribute the load to the concrete. Construct the bearing plate and wedge plate from ferrous metal. For bending stresses in the bearing plates or assemblies induced by the pull of the prestressing steel, do not exceed the yield point of the material or cause visible distortion in the bearing plate when 95 percent of the GUTS of the tendons is applied as determined by the Engineer. Do not exceed 3500 psi directly underneath the bearing plate or assembly for the final unit compressive stress on the concrete.

   Galvanize the body of the anchorage assembly in accordance with AASHTO M 111. Other components of the anchorage assembly including wedges, wedge plate and local zone reinforcement need not be galvanized.

   Construct anchorage assemblies with grout vents suitable for post-grouting inspection access as approved by the Engineer. Equip all anchorages with a grout cap that is vented and bolted to the anchorage.

   Recess the anchoring assemblies so that the ends of the prestressing steel and all parts of the anchoring assemblies will be at least 3 inches inside of the end surface of the members, unless shown otherwise on the plans. After post-tensioning all tendons, fill the recesses with concrete conforming to the provisions for the structure and then finished flush with the abutment end diaphragm.

2. Strand Couplers. Do not use strand couplers.

3. Enclosures for Post-tensioning. Use rigid ferrous metal duct enclosures for prestressing steel that are galvanized, mortar tight, and capable of withstanding concrete pressures without deforming. Use rigid ducts with smooth inner walls that can be curved to the proper configuration without crimping or flattening and have sufficient strength to maintain their correct alignment during placing of concrete. Do not use semi-rigid ducts. Fabricate ducts with either welded or interlocked seams.

Connect sections of rigid ducts using galvanized ferrous metal couplings that are mortar tight and do not result in angle changes at the joints. Do not use split metal couplings. Use waterproof tape to seal all connections to the duct. Connect ducts to anchoring assemblies using transition couplings that are galvanized ferrous metal or polyethylene, mortar tight, and of sufficient strength to prevent displacement of the ducts during concrete placement.

Use ducts for multi-strand tendons with a minimum diameter that provides an inside area at least 2.5 times the net area of the prestressing steel in the tendon.

Do not use ducts with diameters that exceed 0.4 times the least gross concrete thickness at the duct location.

Use duct enclosures with vents for the injection of grout after post-tensioning.

4. Grout Vents. Use vents with positive means for allowing the escapement of air, water, grout, and bleed water out of the vents, injecting grout through the vents, and sealing to prevent grout leakage from the vents. Use 3/4 inch minimum diameter standard pipe or suitable plastic pipe vents with positive shut-off designed to withstand the grouting pressure. Do not crimp or bend the vent pipe. Use metallic or plastic structural fasteners to connect the vent with the duct. Do not use plastic components that react with the concrete or enhance corrosion of the prestressing steel, or contain water-soluble chlorides. Make all vents mortar tight, taped as necessary. Make vents with sufficient length out of the concrete member to allow proper closing of the vents. Remove ends of vents at least 1 inch below the roadway surface after grouting has been completed.

   Place vents at the following locations:

   a. At anchorages.

   b. At the high points of the duct, when the vertical distance between the highest and lowest point is more than 20 inches.

   c. At a location down flow from all high point vents where the duct is approximately one-half duct diameter lower than the crest, but not to exceed 3 feet downstream.

   d. At the lowest point of the duct.

   e. At major changes in the cross-section of the duct.

   f. At other locations designated by the Engineer.

5. Grout Caps. Use grout caps that completely cover and seal all exposed ends of prestressing steel at the anchorage. Seal the cap with neoprene “O” ring seals and place a grout vent on the top of the cap. Use caps rated for a minimum pressure of 150 psi.

721-2.04 CERTIFICATION.

1. Prestressing Steel. Furnish a Certified Test Report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

   a. the project name and number;

   b. the manufacturer's name;

   c. the name of the product or assembly;

d. a complete description of the material;

e. country of origin;

f. the lot, heat, or batch number that identifies the material;

g. all required test results for the specified material from the same lot, heat, or batch defined in Subsection 721-2.04.1.f; and,

h. a statement, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

Tag, stencil, stamp, or otherwise mark all materials or assemblies furnished under certification to the project with the lot number, heat number, batch number, or other appropriate identification, which can be readily recognized and legible, and is identical to the accompanying Certified Test Report.

2. Post-Tensioning Systems. Submit certified test reports to the Engineer that shows the post-tensioning system meets all the requirements specified herein. Submit the certified test reports with the shop drawing submittal. If any component of the post-tensioning system is modified or replaced, the entire system must be retested and resubmitted to the Engineer for approval.

Ensure that all components of a system are stamped with the supplier’s name, trademark model number and size corresponding to catalog designation.

Submit certification stating the manufacturer's minimum guaranteed ultimate tensile strength of all prestressing steel used for this project.

Assign an individual lot number for each manufactured reel of prestressing steel to be shipped to the site. Tag each reel in such a manner that each lot can be accurately identified at the site. All unidentified prestressing steel received at the site will be rejected.

Assign and tag each lot of anchorage assemblies to be installed at the site. Tag each anchorage assembly in such a manner it can be accurately identified at the site. All unidentified anchorage assemblies received at the site will be rejected.

SECTION 722
BRIDGE RAILING

722-2.01 BRIDGE RAILING.

Steel tube rail elements	ASTM A500, Grade B
Steel Thrie Beam elements	AASHTO M 180, Class B, Type II
Posts	ASTM A709, Grade 36
Machine bolts, cap screws, nuts and washers	ASTM A307
High strength bolts, nuts and washers	Subsection 716-2.03
Anchor bolts	ASTM F3125, Grade A325 or ASTM A449, Type 1
Welded studs	AASHTO M 169, Grade 1015 or 1020
Bent anchor rods	ASTM A709, Grade 36
Shims, plates, angles and sleeves	ASTM A709, Grade 36
Plate Washers and Tapered Plate Washers	ASTM F436
Galvanize steel portions of railing after fabrication.	AASHTO M 111 or M 232 and Subsection 716-2.07

722-2.02 CERTIFICATION. Furnish a certified test report from the manufacturer or an independent testing laboratory containing a list of dimensional, chemical, metallurgical, electrical, physical, and other required test results of the specified material certifying that the product or assembly has passed all specified tests. Include the following:

1. the project name and number
2. the manufacturer's name
3. the name of the product or assembly
4. a complete description of the material
5. country of origin
6. the lot, heat, or batch number that identifies the material
7. all required test results for the specified material from the same lot, heat, or batch defined in Subsection 722-2.02.6
8. a statement, signed by a person having legal authority to act for the manufacturer or the independent testing laboratory, that the test results show that the product or assembly to be incorporated into the project has been sampled and tested and the samples have passed all specified tests.

Tag, stencil, stamp, or otherwise mark all materials or assemblies furnished under certification to the project with the lot number, heat number, batch number, or other appropriate identification, which can be readily recognized and legible, and is identical to the accompanying certified test report.

SECTION 723
WATERSTOPS

723-2.01 MATERIALS.

1. Strip Tape. Use a waterproofing joint sealing system that complies with the requirements of Table 723-1.

TABLE 723-1
WATERPROOFING STRIP TAPE REQUIREMENTS

Property	Test method	Requirement
Tensile strength	ASTM D412	1,500 psi. min
Ultimate elongation	ASTM D412	500% min.
Tear strength (maintained to -40 °F)	ASTM D624, Die C	50 lb./in min.
Peel Strength (7 days)	ASTM D903	No loss of adhesion

2. Adhesive. Use a high-modulus, high-strength, structural, epoxy paste adhesive that meets the waterstop sealant system manufacturer's recommendations.

3. Embedded Waterstop. For polyvinylchloride embedded waterproofing waterstop, meet the requirements of Table 723-2.

TABLE 723-2
POLYVINYLCHLORIDE WATERSTOP REQUIREMENTS

Property	Test Method	Requirement
Water Absorption	ASTM D570	0.15% max.
Tear Resistance	ASTM D624	225 lb./in. min.
Ultimate elongation	ASTM D638	300% min.
Tensile strength	ASTM D638	2000 psi min.
Low temperature brittleness	ASTM D746	No Failure @ -35 °F
Stiffness in flexure	ASTM D747	700 psi min.
Specific gravity	ASTM D792	1.40 max.
Hardness Shore A15	ASTM D2240	79 +/- 3
Accelerated extraction Tensile strength Elongation	Corp. of Engineers CRD-C-572	 1600 psi min. 300% min.
Effect of Alkali Weight change Hardness change	Corp. of Engineers CRD-C-572	 Between +0.25% / -0.10% +/- 5 points

For natural rubber embedded waterproofing waterstop, meet the requirements of Table 723-3.

TABLE 723-3
NATURAL RUBBER WATERSTOP REQUIREMENTS

Property	Test Method	Requirement
Water Absorption 2 days at 70°C (% change)	ASTM D471	5% max.
Hardness Shore A	ASTM D2240	65
Tensile strength	ASTM D412	3500 psi min.

Tensile strength at 300% Modulus	ASTM D412	1450 psi min.
Ultimate elongation	ASTM D412	500% min.
Low Temperature Brittleness	ASTM D746 Procedure B	Grade 5 - Pass @ -70.6 °F
Compression set 22 hours at 70°C % original deflection	ASTM D395	30% max.
Accelerated aging 96 hours at 70°C % of tensile strength before aging	ASTM D573	80% min.
Accelerated aging 96 hours at 70°C % of elongation before aging	ASTM D573	80% min.
Ozone resistance 7 days at 50 PPHM at 70°C, 20% elongation	ASTM D1149	No Crack

4. Obtain the Engineer's approval to use waterstops of materials other than those specified.

SECTION 724
SEED

724-2.01 DESCRIPTION. Grass seed to provide a living vegetative cover.

724-2.02 MATERIALS. Provide seed mix as specified in the Special Provisions. Provide seed collected or harvested within 2 years of the targeted seeding date. Provide all seed in pure live seed (PLS) unless otherwise directed.

Furnish seed true of genus and species. Meet applicable requirements of the State of Alaska *Seed Regulations*, 11 AAC 34, Article 1 and Article 4, and the Federal Seed Act, 7 CFR Part 201.

The Engineer will review requests for species or cultivar substitution(s); genus substitution is not allowed. Substitution requests need to be submitted a minimum of 60 calendar days in advance of purchase.

1. Prohibited and Restricted Noxious Weeds and Quarantined Pests. Furnish seed and appliances certified to be free of prohibited noxious weeds or quarantined pests, and certified to contain no more than the maximum allowable tolerances for restricted noxious weeds, according to Alaska Administrative Code, Title 11, Chapter 34 (11 AAC 34).

   a. Seed or appliances found to contain prohibited noxious weeds or quarantined pests will be rejected, according to 11 AAC 34.020(a) and 11 AAC 105-180, respectively.

   b. Seed or appliances found to contain restricted noxious weed seed in excess of the maximum allowable tolerance per pound will be rejected, according to 11 AAC 34.020(b).

   Prohibited and restricted noxious weeds are listed in 11 AAC 34.020, and can be viewed at the following URL: http://plants.alaska.gov/invasives/noxious-weeds.htm.

2. Labeling. Ensure each bag or container of individual seed species is labeled to meet requirements of 11 AAC 34.010. Do not remove labels from bags or containers.

3. Certification. Certify seed is free of prohibited noxious weeds and restricted noxious weeds are within allowable tolerances. Furnish to the Engineer a statement signed by the vendor identifying the lot number or lot numbers, certifying each lot of seed has been tested within the preceding nine months, by a recognized seed testing laboratory, a member of the Association of Official Seed Certifying Agency (AOSCA), or the Alaska Plant Materials Center.

   Seed will be rejected if:

   a. Contains prohibited noxious weeds;

   b. Contains restricted noxious weeds above maximum allowable tolerances;

   c. Not certified as tested within the preceding nine months;

   d. Wet, moldy, or otherwise damaged in transit or storage; or

   e. Containers do not have labels or the labels have been removed.

   Seed may be rejected for:

   f. Discrepancies in the lot numbers listed on the statement to the lot numbers indicated on the labels of the seed containers.

The Contractor shall immediately remove rejected seed from the project premises. If seed is rejected for containing prohibited noxious weeds or for exceeding maximum allowable tolerances of restricted noxious weeds, dispose of rejected seed according to 11 AAC 34.075(g).

SECTION 725
FERTILIZER

725-2.01 DESCRIPTION. Standard commercial fertilizer supplied separately or in mixtures, and furnished in moisture proof containers. Mark each container with the weight and with the manufacturer's guaranteed analysis of the contents showing the percentage for each ingredient contained therein.

725-2.02 MATERIALS. Furnish a mixture of chemical ingredients providing the total available nitrogen, phosphoric acid, and potassium required by the soil analysis or as specified in the Special Provisions. Tolerances of the chemical ingredients are plus or minus 2 percent.

No Cyanamid compounds or hydrated lime are permitted in mixed fertilizers.

SECTION 726
TOPSOIL

726-2.01 TOPSOIL. Furnish a natural friable surface soil without admixtures of undesirable subsoil, refuse, or foreign materials. Meet the following:

1. Reasonably free of litter and free from roots, clods, hard clay, prohibited noxious weeds, tall grass, brush, sticks, stubble, and be free-draining and non-toxic. Prohibited and Restricted Noxious Weeds are listed in 11AAC 34.020 is located at the following URL: http://plants.alaska.gov/invasives/noxious-weeds.htm.

2. Contain between 3 percent and 20 percent organic matter as determined by loss-on-ignition of oven dried samples according to ATM 203.

3. Grading requirements:

Sieve	Percent Passing
2 in.	100
No. 4	75-100
No. 10	60-100
No. 200	10-70

Notify the Engineer of the source of topsoil at least 30 days prior to delivery of topsoil to the project from that location. The Engineer will inspect and test the topsoil and its source before approval will be granted for its use.

Unsuitable topsoil sources may be used if, prior to delivery to the project, sufficient organic matter in the form of pulverized peat moss or rich organic soil from other sources is thoroughly mixed with the topsoil to provide a product meeting the above requirements.

Use the application rates, determined by the Engineer, of fertilizer and limestone per acre of ground area of topsoil, based on soil analysis tests so that the total natural and applied chemical constituents are as follows:

Nitrogen	45 - 65 pounds per acre
Phosphoric Acid	45 - 90 pounds per acre
Potassium	45 - 90 pounds per acre

TABLE 726-1
LIMESTONE REQUIREMENTS

Soil pH	Limestone, tons/acre
Above 6.0	0
5.0-6.0	1.5
Below 5.0	3.0

SECTION 727
SOIL STABILIZATION MATERIAL

727-2.01 MULCH. Use one of the following:

1. Wood Cellulose Fiber or Natural Wood Fiber. Processed wood fiber with the following characteristics:

   a. Contains no germination- or growth-inhibiting factors.

   b. Will remain in uniform suspension in water under agitation and will blend with grass seed, fertilizer and other additives to form a homogeneous slurry.

   c. Will form a blotter-like ground cover on application, having moisture absorption and percolation properties and the ability to cover and hold grass seed in contact with soil.

   d. Dyed a suitable color to facilitate inspection of its placement.

2. Ship the mulch material in packages of uniform weight (plus or minus 5 percent) and bearing the name of the manufacturer and the air-dry weight content.

3. Use a commercial tackifier on all slopes steeper than 2:1. Use the amount recommended by the manufacturer.

4. Dried Peat Moss. Partially decomposed fibrous or cellular stems and leaves of any of several species of Sphagnum mosses with the following characteristics:

   a. Chopped or shredded to allow distribution through normal hydraulic type seeding equipment and capable of being suspended in water to form part of a homogeneous slurry.

   b. Free from woody substances and mineral matter such as sulfur or iron and with a pH value of between 4.0 and 6.5.

   c. Furnished in an air dry condition and contain less than 35 percent moisture by weight. Have a water holding capacity of not less than 800 percent by weight on an oven dry basis.

   d. Non-toxic.

727-2.02 MATTING. Use one of the following:

1. Burlap. Standard weave with a weight of 3.5 to 10 oz/ yd^2.

2. Jute Mesh Fabric. Cloth of a uniform, open, plain weave of undyed and unbleached single jute yarn. Use yarn that is loosely twisted and not varying in thickness more than one-half its normal diameter. Furnish jute mesh in rolled strips meeting the following requirements:

   a. Width: 45 to 48 inches, ± 1 inch

   b. 78 warp-ends per width of cloth (minimum)

   c. 41 weft-ends per yard (minimum)

   d. Weight: 20 ounces per linear yard, ± 5%

3. Woven Paper or Sisal Mesh Netting. Woven from twisted yarns available in rolls 45 to 48 inches wide. Mesh may vary from closed to open weave, ranging from 1/8 to 1/4 inch openings. Shrinkage after wetting may not exceed 20 percent of the surface area.

4. Knitted Straw Mat. Commercially manufactured erosion control blanket. Use photodegradable netting and biodegradable thread. Use straw and straw products from oats, wheat, rye, or other approved grain crops that are certified weed free of prohibited and restricted noxious weed seed and quarantined pests, according to Alaska Administrative Code, Title 11, Chapter 34 (11 AAC 34), and free of mold, or other objectionable material. When straw or straw products certified according to 11 AAC 34 are not available, use non-certified products manufactured within Alaska before products manufactured in another state, country or territory. Grass, legumes, or any other herbaceous plants produced as hay, shall not be substituted for straw or straw products. May contain coconut or fiber to reinforce the straw. Follow the manufacturer's published recommendations.

5. Woven/Curled Wood Blanket. Machine produced mat of curled wood shavings with a minimum of 80 percent 6-inch or longer fibers, with consistent thickness and the fibers evenly distributed over the entire area of the blanket. Smolder resistant without the use of chemical additives. Cover the top side of the blanket with biodegradable extruded plastic mesh.

727-2.03 STAPLES. U-shaped staples for anchoring matting, approximately 6 inches long and 1 inch wide. Machine-made: No. 11 gage or heavier steel wire. Hand-made: 12-inch lengths of No. 9 gage or heavier steel wire.

SECTION 729 GEOSYNTHETICS

729-2.01 GEOTEXTILE FOR SUBSURFACE DRAINAGE, SEPARATION, STABILIZATION, EROSION CONTROL AND EMBANKMENT REINFORCEMENT.

1. Subsurface Drainage. Meet AASHTO M 288 for Subsurface Drainage, except provide a minimum permittivity of 0.50 sec^{-1}, and meet Class 2 Strength Property Requirements.

2. Separation. Meet AASHTO M 288 for Separation, except provide a minimum permittivity of 0.50 sec^{-1}, and meet Class 3 Strength Property Requirements.

3. Stabilization. Meet AASHTO M 288 for Stabilization, except provides a minimum permittivity of 0.50 sec^{-1}, and meet Class 1 Strength Property Requirements.

4. Erosion Control. Meet AASHTO M 288 for Permanent Erosion Control and meet Class 1 Strength Property Requirements.

5. Reinforcement. Meet the requirements in Table 729-1 for Type 1 or Type 2.

Package, label, handle and store geotextile materials according to ASTM D 4873.

TABLE 729-1
GEOTEXTILE REINFORCEMENT PROPERTIES

Property	Test Method	Units	Requirement[a]	
			Type 1	Type 2
Grab Tensile	ASTM D4632	lb.	200/200	400/400
Grab Elongation	ASTM D4632	% (MD)	10	10
Wide Width Tensile	ASTM D4595	lb/in. (ultimate)	200/200	400/400
Wide Width Tensile	ASTM D4595	lb/in. (@ 5% strain)	100/100	200/200
Seam Breaking Strength	ASTM D4632	lb./in.	180	360
Puncture	ASTM D6241	lb.	500	1500
Trapezoidal Tear	ASTM D4533	lb.	100	150
AOS	ASTM D4751	U.S. sieve size	#30[b]	#30[b]
Permittivity	ASTM D4491	sec^{-1}	0.20	0.20
Flow Rate	ASTM D4491	gal./min./ft^2	10	10

[a] Minimum Average Roll Values (MARV) in machine direction (MD) / cross-machine direction (XD) unless otherwise specified

[b] Maximum average roll value

729-2.02 SILT FENCE. Meet AASHTO M 288 for Temporary Silt Fence.

729-2.03 PAVING FABRIC. Meet AASHTO M 288 for Paving Fabric.

729-2.04 GEOGRID FOR EMBANKMENT AND ROADWAY STABILIZATION AND REINFORCEMENT. Provide geogrid consisting of a regular network of connected polymer tensile elements with aperture geometry sufficient to provide significant mechanical interlock with the surrounding material. Provide dimensionally stable geogrid that is able to retain its geometry during construction. Provide geogrid structure that resists ultraviolet degradation and all forms of chemical and biological degradation encountered in the material in which it is buried.

Package, label, handle, and store geogrid material according to ASTM D 4873.

1. Stabilization. Provide geogrid that meets the survivability requirements in Table 729-2 and meets the physical requirements in Table 729-3.
2. Reinforcement. Provide geogrid that meets the survivability requirements in Table 729-2 and as shown on the Plans.

TABLE 729-2
GEOGRID SURVIVABILITY REQUIREMENTS

Property	Test Method	Units	Requirement	
			CLASS 1	CLASS 2
Ultimate Multi-Rib Tensile Strength[a]	ASTM D6637	lb./ft.	1230	820
Junction Strength[a]	ASTM D7737	lb.	25	25
Ultraviolet Stability (Retained Strength)	ASTM D4355	%	50% after 500 hours of exposure	

[a] Minimum Average Roll Value (MARV) in any rib direction.

TABLE 729-3
GEOGRID PHYSICAL REQUIREMENTS

Property	Test Method	Units	Requirement	
			CLASS 1	CLASS 2
2% Tensile Strength[a]	ASTM D6637	lb./ft.	≥ 400	≥ 260
5% Tensile Strength[a]	ASTM D6637	lb./ft.	≥ 800	≥ 540
Percent Open Area	COE, CW-02215	%	50 – 80	50 – 80
Aperture Size[b]	Direct measure	in.	0.5 – 3.0	0.5 – 3.0

[a] Minimum Average Roll Value (MARV) in machine and cross-machine directions.
[b] measured as the spacing between parallel ribs.

SECTION 730
SIGN MATERIALS

730-2.01 SHEET ALUMINUM. Use alloy 6061-T6, 5052-H36, 5052-H38, or recycled aluminum meeting alloy 3105, as specified in ASTM B209. Verify alloy and temper designations by mill certification.

Treat the aluminum base metal sheets with a rinsed non-hexavalent chromium conversion coating for aluminum and aluminum alloys that meets ASTM B921, class one. Handle the cleaned and coated base metal only by a mechanical device or by operators wearing clean cotton or rubber gloves. After cleaning and coating operations, protect the panels at all times from contact or exposure to greases, oils, dust or other contaminants.

Make each sign panel a continuous sheet for all lengths 72 inches or less in the horizontal direction. Use no more than one vertical splice for signs up to 144 inches in length and 48 inches or less in height.

Meet the panel dimensions specified with a tolerance of 1/16 inch. Furnish metal panels that are cut to size and shape and free of buckles, warp, dents, cockles, burrs and any other defects resulting from fabrication. Complete all possible fabrication, including shearing, cutting and punching of holes prior to the base metal preparation.

730-2.02 HIGH DENSITY OVERLAID PLYWOOD. Construct plywood sign panels, for Construction and Maintenance Signs, of high density plywood, exterior type Grade B-C or better. Meet the requirements in PS 1-66 *Products Standard for Softwood Plywood, Construction and Industrial* published by the Products Standards Section of the U.S. Department of Commerce.

Use high density type overlay, with the following properties:

1. Minimum weight of 60 pounds per thousand square feet of surface

2. Minimum thickness of 0.012 inch before pressing

3. Contain a minimum resin content of 45 percent based on the dry weight of the impregnated fiber

4. Contain sufficient resin content to bond itself to the plywood

Single Panel Signs	Thickness, inches, Minimum
Up to and including 18 inches wide	3/8
Over 18 inches wide	1/2
Plywood shields on destinations signs	3/8
Multiple Panel Signs	5/8

Prime the sign back with one coat of white exterior enamel undercoat and finish with one coat of white exterior enamel. Use primer recommended by the supplier of the finish coat which is completely compatible.

Before applying reflective sheeting:

5. Clean the surface thoroughly with lacquer thinner, heptane, benzene, or solvent recommended by sheeting manufacturer.

6. Sand the surface with light sandpaper or steel wool and wipe dry and clean with clean cloth.

730-2.03 RETROREFLECTIVE SHEETING. Meet ASTM D4956 for the type specified.

730-2.04 SIGN POSTS. Use the type and size of posts designated on the Plans.

1. Metal Pipe Posts.

   a. Fabricate from steel pipe to meet ASTM A53 Standard Weight (Schedule 40), Type E or S, Grade B. Furnish square posts with 7/16 inch diameter holes drilled or punched as necessary to permit mounting of the sign.

   b. Hot dip galvanize to meet AASHTO M 111 after fabrication. When cutting metal posts after hot dip galvanizing, minimize damage to the zinc coating and protect all exposed surfaces by treating the exposed area.

   c. Repair galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating to meet the applicable provisions of AASHTO M 36.

2. Perforated Steel Posts.

   a. Fabricate posts from 0.105-inch (12 gauge) thick cold-rolled carbon steel sheets, commercial quality, to meet ASTM A653 and ASTM A924. Zinc coat, both sides, to meet coating designation G90. Form posts into a steel tube, roll to size, and weld in the corner.

   b. Perforate all members for their entire length with 7/16 inch diameter holes on 1 inch centers.

   c. Furnish members that are straight and with a smooth, uniform finish, with no splices.

   d. Ensure that all perforations and cut off ends are free from burrs.

   e. Ensure that consecutive sizes will telescope freely with a minimum of play.

3. Finished Wooden Posts.

   a. Meet AASHTO M 168, except limit the sweep (circular deviation from a straight line) to 0.08 foot in 10 feet.

   b. Pressure treat wooden posts with a preservative registered with the US Environmental Protection Agency, conforming to the requirements of AASHTO M 133 or AWPA Standard U1 Commodity Specification A (Sawn Products) for soil and freshwater applications meeting Use Category 4B.

      Use the methods specified in Section 714. Meet the minimum retention of preservative specified according to AWPA Standard U1, Commodity Specification A: Sawn Products.

   c. Treat all field cuts and holes in wooden posts by thoroughly swabbing, spraying or brushing with two coats of a preservative conforming to AWPA Standard M4.

4. Wide Flange Posts.

   a. Steel. Meet ASTM A36.

   b. Hot dip galvanize to meet AASHTO M 111 after fabrication. When cutting galvanized metal posts, minimize damage to the zinc coating and treat the exposed area as follows.

   c. Repair galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating to meet the applicable provisions of AASHTO M 36.

5. Flanged Channel Posts. Use either of the following:

a. Aluminum meeting ASTM B221, alloy 6061-T6.

b. Steel meeting ASTM A36. Galvanize steel posts per AASHTO M 111.

6. Square Non-Perforated Steel Tubes.

a. Fabricate from 3/16 inch thick cold-rolled carbon steel sheets, commercial quality, to meet ASTM A500, Grade B. Form posts into a steel tube, roll to size, and weld in the corner. Furnish with 7/16-inch diameter holes drilled or punched as necessary to permit mounting of the sign.

b. Hot dip galvanize to meet AASHTO M 111 after fabrication. When cutting metal posts after hot dip galvanizing, minimize damage to the zinc coating and protect all exposed surfaces by treating the exposed area.

c. Repair galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating to meet the applicable provisions of AASHTO M 36.

730-2.05 FLEXIBLE DELINEATOR POSTS. Durable fiberglass composite or plastic material meeting the dimensions and colors shown on the Plans. Resistant to ultraviolet light, ozone and hydrocarbon damage and remain flexible at a temperature of minus 40 °F. Provide posts with reflectors that are capable of self-erecting and remaining serviceable after 5 head-on impacts at 55 mph and 10 impacts at 35 mph with an automobile at an air temperature of plus 40 °F.

730-2.06 ACRYLIC PRISMATIC REFLECTORS. Meet AASHTO M 290 and the dimensions and colors shown on the Plans.

730-2.07 SIGN SUPPORT FASTENERS. Meet the following:

FASTENER SPECIFICATION TABLE		
FASTENERS	**STEEL**	**STAINLESS STEEL**
Bolts	ASTM A307	ASTM F593
Nuts	ASTM A563	ASTM F594
Washers	ASTM F844	ASTM A480

SECTION 731
WATERPROOFING MEMBRANE

731-2.01 SPRAY-APPLIED WATERPROOFING MEMBRANE. Meet the requirements in Table 731-1.

TABLE 731-1
SPRAY-APPLIED WATERPROOFING MEMBRANE

Test	Requirements	Test Method
Adhesion to Concrete	100 psi min., with failure in concrete	ASTM D4541
Tensile Strength at Break	1500 psi min.	ASTM D638
Elongation at Break	130% min.	ASTM D638
Crack Bridging	Pass at 10 cycles of 1/8 inch when tested at -15°F	ASTM C1305
Interlayer Shear Strength	40 psi min.	AASHTO TP-114

731-2.02 SHEET WATERPROOFING MEMBRANE. Meet the requirements in Table 731-2.

TABLE 731-2
SHEET WATERPROOFING MEMBRANE

Test	Requirements	Test Method
Tensile Strength at Break	50 lbs/inch min.	ASTM D882
Elongation of Membrane at Break	300% min.	ASTM D882
Puncture Resistance	200 lbs min.	ASTM E154
Permeability	0.05 perms max.	ASTM E96
Flexibility	Pass	ASTM D146

SECTION 740
SIGNALS AND LIGHTING MATERIALS

740-2.01 GENERAL. Use electrical materials, devices, fittings, and hardware that conform to applicable NEMA and ANSI standards.

Use electrical products that are Third Party Labeled or Listed (by a State of Alaska-approved independent electrical testing laboratory such as UL, ETL, CSA, etc.), unless otherwise indicated on the Materials Certification List (MCL).

Ensure that all material and workmanship, as determined by the Department, conform to the standards of the NEC, the NESC, and local safety codes as adopted and amended by the authority having jurisdiction.

740-2.02 SIGNAL AND LIGHTING STRUCTURES.

1. Design. Design structures for highway lighting and traffic signals to conform to the 2013 AASHTO Standard Specifications for Structural Supports of Highway Signs, Luminaires, and Traffic Signals, including September 2013 errata and 2015 Interim Revisions.

   All working drawings and calculations must be stamped with the seal of, dated by, and signed by a Professional Engineer registered in the State of Alaska. Submit the working drawings and calculations for each pole to the Engineer for approval. Design for all stresses on the completed structure with all hardware in place. Show the design wind loads, projected areas, wind drag coefficients, material properties, and other design information on the working drawings. Include a summary of the loads used in each pole's design.

   Design each electrolier to include a traffic sign, 48 inches by 48 inches, located with its centroid 14 feet above the base of the pole.

   Determine the shaft lengths and mast arm connector plate locations of all poles to meet the plan mounting heights of luminaires and traffic heads.

   Design signal mast arms so that no signal heads or signs will be mounted within 12 inches either side of a mast arm extension splice. Design all poles and mast arms with a round or 16-sided cross section, except high tower poles may also be 12-sided cross section.

2. Fabrication. Fabricate all posts, poles, and mast arms from tapered steel tubes. Fabricate tubes with walls up to ½-inch thick from the pre-qualified base metals listed in AWS D1.1 and which feature maximum yield strengths of 70,000-psi. Fabricate all elements greater than ½-inch thick from steel that conforms to ASTM A709 and meets the Fracture Critical Impact Test requirements for zone 3.

   Fabricate 10 feet long signal posts from sheet steel that features a minimum thickness of 11 US Standard Gage. Fabricate each post with a minimum inside diameter of five inches at the base plate. Use a three and one-half inch long piece of 4-inch schedule 40 pipe that conforms to ASTM A53 Grade B as a post-top adapter.

   Fabricate poles from full length sheets or shorter sections. Fabricate each section from not more than 2 pieces of sheet steel. When using 2 pieces, place the longitudinal welded seams directly opposite one another. Place the welded seams on adjacent sections to form continuous straight seams from the base to the top of the pole. The Department will not accept poles and mast arms made with laminated steel elements.

   Steel selection shall be according to ASTM A385 for silicon content.

   Hot dip galvanize all pole segments and attachments to meet AASHTO M 111 and these specifications. Completely submerge pole segments in one dip in a kettle of concentrated zinc ammonium chloride flux solution heated to 130°F, then completely submerge in one dip in a separate

kettle of prime western grade zinc heated to approximately 825°F. Galvanize all bolts and fasteners to meet AASHTO M 232.

Poles must be straight, with sweep not exceeding 3/4 inch throughout the length of the pole.

Do not put holes in the pole segments unless shown on the design drawings and provided for in the engineering calculations.

Fabricate pile cap adapters from grade X42 steel line pipe that conforms to API 5L and from steel plate that conforms to ASTM A709 Grade 50. Attach the anchor plate to the pile section with a complete joint penetration (CJP) weld. Fabricate the anchor plate to match the base plate of the lighting standard.

3. Mill Certification. Submit the mill certification for all steel items (piles, plates, bolts, and all other related items) to the Engineer for approval.

4. Welding. Perform all welding to conform to Subsection 504-3.01, Item 7. Welding and the following:

   a. Make all welds continuous. Grind all exposed welds flush with the base metal, except fillet welds and seam welds on top of mast arms. Grinding the seam welds on 16- sided poles is not required.

   b. Use complete Joint Penetration (CJP) groove welds for all circumferential welds. Only one-time repair of circumferential welds is allowed without written permission of the Engineer.

   c. Use CJP groove welds on longitudinal seams within 6 inches of CJP circumferential welds. Use partial joint penetration (PJP) longitudinal seam welds in all other seam weld locations. PJP welds must provide at least 60 percent penetration.

   d. Welded support to base plate connections must be either (1) CJP groove welds or (2) socket-type joints with two fillet welds. When CJP groove welds are used, additional fillet welds may be used when deemed necessary by the designer.

   e. Inspect 100 percent of CJP welds by either radiography (RT) or ultrasound (UT). Inspect a random 25 percent of all fillet and PJP welds by magnetic particle (MT). If a defect is found, inspect 100 percent of all fillet and PJP welds made to fill the order. Show NDE symbols on the plans.

5. Miscellaneous. Neatly round all exposed corners of the plates that make up the base assembly to a 1/8-inch radius and finish smooth all exposed edges. Provide shafts with slip-fitter shaft caps. Orient hand holes to face down-stream of the traffic flow.

   Furnish anchor bolts and nuts required for relocating existing poles.

   Identify critical information for all poles and arms with visible permanent aluminum tags that contain the information shown in Table 740-1. The measurements shown are for illustration purposes only. The tags must be 1-1/2 inches by 3 inches for a 1-line message and 1-1/2 x 4 inches for a 2-line message. The letter size must be 1/4 inch high and the spacing between the edge of the tag and text and between text must be 3/8 inch. Secure the tags with two 1/8-inch blind rivets at the base of poles and the underneath side of mast arms. If a signal mast arm extension is required, mark it with a tag with the same message as the signal mast arm.

TABLE 740-1
POLE MARKINGS

	MEASUREMENTS	TAG MARKINGS
Signal Poles		

a) Signal mast arm length	40.7 ft./*30.5 ft.*	SMA 407/*SMA 305*
b) Luminaire mast arm length	15.1 ft./*15.1 ft.*	LMA 151/*LMA 151*
c) Pole height	37.4 ft.	PH 374
d) Intersection number (if more than one) - pole number		1 - P 4
e) Sum of signal mast arm moments about centerline of signal pole		SM 4000/*SM 3200*
f) Design wind speed	100 mph	DWS 100
Light Poles		
a) Luminaire mast arm length	15.1 ft./*15.1 ft.*	LMA 151/*LMA 151*
b) Pole height	37.4 ft.	PH 374
Signal Mast Arm		
a) Mast arm length	40.7 ft.	SMA 407
b) Intersection number (if more than one) - pole number		1 - P 4
c) Sum of signal mast arm moments about centerline of signal pole		SM 3740
d) Design wind speed	100 mph	DWS 100
Luminaire Mast Arm		
a) Mast arm length	18.0 ft.	LMA 180
b) Pole number (if unique arm design)		P 4
***Note**: Italic type indicates additional Tag Markings if poles have 2 luminaire or 2 signal mast arms.*		

740-2.03 WOOD POLES. Use wood poles for service or temporary installations of the class shown on the Plans or as specified in the Special Provisions.

Use 35-foot poles, except for service poles use 25-foot poles.

Use mastarms and tie rods for wood pole installations that conform to Subsection 740-2.02, and to the details shown on the Plans. Provide each mastarm with an insulated wire inlet and wood pole-mounting bracket for mastarm and tie rod crossarm.

Use structural timber meeting Section 713. Do not use poles that have more than 180 degrees twist in grain over the full length. Ensure that the sweep is no more than 4 inches. Pressure-treat wood poles, that are not to be painted, after fabrication. Meet Section 714.

740-2.04 HIGH TOWER POLES.

1. Design high tower poles in conformance with Subsection 740-2.02 and the following:

   a. Design for the basic wind speed shown in Standard Specifications for Structural Supports or for 100 miles per hour, whichever is greater.

   b. Design all poles for a 50-year design life.

   c. Use a gust effect factor of 1.14.

   d. Design all poles using fatigue category I importance factors.

   e. Design all poles that taper less than 0.0117 ft/ft for vortex shedding.

   f. Design all poles to support a load that consists of the lowering device and ten luminaires equipped with light shields. Use the following values for these components.

Component	Effective Projected Area	Weight
One lowering device	8.6 ft^2	309 lbs

Ten luminaires	21.5 ft^2	617 lbs
Ten light shields	30.0 ft^2	22 lbs

g. Use tapered tube sections that telescope into each other. Provide the pole segment lengths on the plans. Design all poles for no more than four sections. Provide for a telescoping slip joint with a minimum overlap length of 24 inches or 1.5 times the diameter of the female section, whichever is larger.

h. Provide a reinforced rectangular hand hole that provides an opening large enough to install the winch assembly.

i. Provide a detachable door over the hand hole frame including hinges, nuts to fasten the door to the frame, and a neoprene gasket to provide a watertight seal around the frame. Provide for a locking mechanism for the hand hole door.

j. Use anchor bolts that conform to ASTM F1554, Grade 55 with Supplemental Impact Test Requirements of Section S4. The distance from bottom of the leveling nut to the top of the concrete of the anchor bolts may not exceed 1 inch.

k. Provide connection details for the installation of the light lowering device and associated hardware.

l. Furnish poles that allow the luminaire-lowering device to come within five feet of the base plate.

2. Fabricate the high tower poles as follows:

a. Mark all sections of the shaft to facilitate field assembly.

b. Fabricate poles segments so that no field welding is required.

c. Fabricate each tapered section from one piece of steel.

d. Provide CJP longitudinal seam welds in the ends of those sections that form a joint. Make the CJP longitudinal seam weld at least 12 inches longer than the length of the telescoping slip joint.

e. Fabricate the base flange from steel that meets the requirements of ASTM A709.

740-2.05 CONDUCTORS. Use conductor sizes based on the American Wire Gage (AWG). Use sizes that conform to the Plans or, when not shown, to this subsection.

Use insulated conductors made of uncoated, stranded copper that conforms to the specifications of ASTM B8. Use grounding conductors that are bare or insulated copper of the gage required by the NEC. They may be stranded, solid, or braided.

Provide the following markings on the outer coverings of conductors and cables on intervals of 2 feet or less: manufacturer, the number of conductors or pairs in cables, conductor size, 600V, the conductor or cable type and environmental conditions for which the conductor or cables are listed, and the symbol of an approved independent testing laboratory.

Use conductors meeting the referenced specifications for the following purposes:

1. Power Conductors. For individual conductors, install general-purpose building wire manufactured according to UL Standard 44, and NEMA No. WC7. Furnish conductors insulated with cross-linked polyethylene listed as type XHHW-2 and rated for 600 volts AC operation.

TABLE 740-2
CONDUCTOR TERMINATION TABLE

CONDUCTORS PER CABLE	CIRCUIT	WIRE COLOR	AWG. NO.	BAND LEGEND
5	Vehicle Red Vehicle Yellow Vehicle Green Common Neutral Spare	Red Orange Green White Black	14	Head No.
7	Vehicle Red Arrow Vehicle Yellow Arrow Vehicle Green Arrow Common Neutral Spare Spare Spare	Red Orange Green White White/Black Black Blue	14	Head No.
7	Vehicle Red Vehicle Yellow Vehicle Green Common Neutral Spare Vehicle Yellow Arrow Vehicle Green Arrow	Red Orange Green White White/Black Black Blue	14	Head No. (s)
5	Pedestrian Don't Walk Pedestrian Walk Common Neutral Spare Spare	Red Green White Orange Black	14	Head No.
5	Photo Electric Control Load to Contactor Neutral Spare Spare	Black Red White Orange Green	14	PEC
2	Pedestrian Pushbutton Neutral	Black White	14	Head No. Located Under
2	Flashing Beacon Neutral	Black White	14	Head No.
2	Preemption Neutral	Black White	14	"PRE"
3	Highway Luminaire Highway Luminaire Highway Luminaire Spare	Black Red White	8 or 6	Circuit No. Circuit No.
3	Service to Controller Neutral Spare	Black White Red	6	"SIG" No Band No Band
3	Sign Luminaire Sign Luminaire Sign Spare	Black Red White	8	SIGN SIGN

Use size 10 AWG wire for illumination tap conductors. In an electrolier, the illumination tap conductors run from the fused disconnect kit to the ballast in the luminaire. Furnish conductors with black, red, or white colored insulation as required to identify the two phase and neutral conductors, respectively.

If conductors in controller cabinets carry the full signal load circuit, use size 10 AWG or larger conductors. Use orange colored conductors from the flash transfer relay to program emergency flashing operation.

2. Illumination Cables. For cables that consist of three size 6 or 8 AWG conductors, furnish power cables that feature three conductors, each insulated with cross-linked polyethylene, and a black, low density, high molecular weight polyethylene jacket. Use insulated conductors listed as type XHHW-2. Furnish these cables with one black, one white, and one red colored conductor and no grounding conductor. Use cables rated for 600 volts AC operation.

   Use insulated conductors meeting UL Standard 44. The jacket must also meet ANSI/NEMA WC 70.

3. Power Cables. For cables that consist of three size 4 AWG or larger conductors, furnish tray cables that feature three conductors, each insulated with cross-linked polyethylene that meets the requirements of XHHW-2, and a PVC jacket. Furnish these cables without an integral grounding conductor. Use cables manufactured according to UL Standard 1277, ICEA S-95-658, and ANSI/NEMA WC 70. Provide cables listed for direct burial and resistance to sunlight and rated for 600 volts AC operation.

   Furnish these cables with black conductor insulation with one printed number (1, 2, or 3) identifying each conductor.

4. Control Cables. Wire with signal cable meeting IMSA 20-1 all vehicular signal heads, pedestrian signal heads, pedestrian push button detectors, flashing beacons, hardwired local coordination and preemption devices, and photoelectric controls.

5. Detector Loops. Use No. 12 AWG conductors for detector inductive loops that meet IMSA Specification 51-3, Type RHW/USE, or IMSA Specification 51-5, when called for on the Plans or specified in the Special Provisions.

6. Loop Lead-In Cables. Unless otherwise specified, use a tray cable that conforms to the following specifications to connect the loop detectors to the terminal blocks in the controller cabinet. Furnish this cable, also known as Snyder Cable; manufactured according to UL Standard 1277. Supply these cables third party certified as Type TC and certified for use in underground conduit or as an aerial cable supported by a messenger, and rated for 600 volts AC operation.

   Use size 18 AWG, 16 strand, tinned copper conductors per ASTM B33 insulated with wet-rated, cross-linked polyethylene similar to XHHW. Furnish conductors with insulation colors that match Table 660-1 twisted into pairs.

   Provide each twisted pair with an overall aluminum foil coated mylar shield that provides 100 percent coverage and a 20 AWG tinned copper drain wire that is in constant contact with the foil side of the shield. Apply a tight fitting polyvinyl chloride jacket over the conductor assembly.

   Only use the following loop lead-in cable, also known as shielded data cable, to rewire existing traffic signals when specified. Use cables that consist of 6 twisted pairs that consist of stranded, size 18 AWG tinned copper wire and polyethylene or polypropylene insulation. Furnish each pair covered with an aluminum foil shield, stranded copper drain wire, and an overall PVC or PE jacket. Use cable rated for 300 volts and whose colored pairs match those specified in Table 660-1.

7. Telemetry Cable. Use interconnect cable that consists of solid copper conductors of the number of pairs called for in the Plans meeting the requirements of Rural Utilities Service [formerly the Rural Electrification Administration (REA)] specification PE-39 for filled telephone cables. The shield may be either copper or aluminum.

TABLE 740-3
INTERCONNECT TERMINATION TABLE

TELEMETRY CABLE: Type PE-39, No. 19 or No. 22 AWG, Solid Copper, as noted on the Plans or in the Special Provisions.					
PAIR No.	**COLOR**	**PAIR No.**	**COLOR**	**PAIR No.**	**COLOR**
1	Blue White	9	Brown Red	17	Orange Yellow
2	Orange White	10	Gray Red	18	Green Yellow
3	Green White	11	Blue Black	19	Brown Yellow
4	Brown White	12	Orange Black	20	Gray Yellow
5	Gray White	13	Green Black	21	Blue Violet
6	Blue Red	14	Brown Black	22	Orange Violet
7	Orange Red	15	Gray Black	23	Green Violet
8	Green Red	16	Blue Yellow	24	Brown Gray
				25	Gray Violet

HARDWIRE CABLES: IMSA Type 20-1, (2) 7 conductor No. 14 AWG			
Cable No. 1		Cable No. 2	
Circuit	**Color**	**Circuit**	**Color**
Cycle 2	Green	Offset 1	Green
Cycle 3	Orange	Offset 2	Orange
Cycle 4	Red	Offset 3	Red
Free	Blue	Split 2	Blue
Common	White	Common	White
Spare	Black	Spare	Black
Spare	White/Black	Spare	White/Black

740-2.06 ELECTRICAL CONDUIT.

1. Rigid Metallic Conduit.

t. Use UL Standard UL-6 galvanized conduit and fittings that are rigid metal type and manufactured of mild steel or wrought iron.

2. Rigid Nonmetallic Conduit. Use UL Standard UL-651 Schedule 40 and 80 rigid polyvinyl chloride (PVC) conduit. Use PVC fittings meeting NEMA TC 3.

740-2.07 FUSED SPLICE CONNECTORS. Use fused, quick disconnect, splice connector that is weather tight and has two halves: a single-unit line side socket and a load-side plug. Use fuses that are 10 ampere, midget (13/32” x 1-1/2“) ferrule type with a fast acting current limiting (KTK type) design.

740-2.08 SIGN SWITCHES. Provide a NEMA 3R non-fused disconnect switch as shown on the Plans for each sign illumination installation.

740-2.09 CONTROLLER ASSEMBLIES. Use solid-state, traffic controller assembly meeting the requirements of NEMA Standard. TS 1, *Traffic Control Systems*, and designated sections of NEMA Standard TS 2, *Traffic Controller Assemblies*.

Use non-incandescent indicators for all electronic devices covered under Subsections 740-2.10 through 740-2.13.

740-2.10 CONTROLLER UNIT.

1. Actuated Controller Units. Actuated Controller Units must conform to the NEMA Standard TS 1, *Traffic Control Systems*, Section 13 Interface Standards for Advance Two-Phase through 8-Phase Solid-State Traffic Controller Units and Section 14, Definitions and Physical and Functional Standards for Advance Two-Phase through 8-Phase Solid-State Traffic Signal Controller Units of the Vehicle-Actuated Type, and the following modifications:

   a. Use single ring 4 phase or dual ring 8 phase controller units as shown on the Plans.

   b. Make dual ring controller units user-programmable for dual entry and single-entry operation.

   c. TS 1-1989, *Traffic Control Systems*, 14.3.7.2 Overlap Programming. In item 1, insert "providing the function is field programmable without the use of external tools or devices" after the word "manufacturer".

740-2.11 CONTROLLER CABINET. Use a controller cabinet that meets the requirements of NEMA Standard TS 2-1992, *Traffic Controller Assemblies*, Section 7, Cabinets and NEMA Standard TS 1-1989, *Traffic Control Systems*, Section 10, Terminals and Facilities.

Apply 2 factory finishing coats of aluminum paint to the outside of the controller cabinets. Paint the interior surfaces of the controller cabinet with 2 factory finish coats of a suitable white exterior grade paint.

1. Standard Features. Supply the following standard features:

   a. Cabinet Lock. Use a cabinet that has a main door equipped with a construction core lock. The lock must accept a Best CX series core that will be installed by the State after the contract is complete.

   b. Cabinet Ventilation.

      (1) Furnish the fan and cabinet vent with internally mounted metal covers that are fabricated to close off the flow of air during winter operation.

      (2) Equip the cabinet with a selectable, 750/1500-watt cabinet heating device. The heating device must have a remote air-sensing thermostat. The contacts must be rated 20 amps, 120 volts.

      Construct the thermostat so that contacts close on descending temperature and are adjustable between 0 and 30 °F ±5 °F. The contacts must open on rising temperatures of 15 °F above the closing temperature. The adjustment must have an indicating pointer.

      Connect the thermostat in series with an electrical resistance heater and blower fan. The blower fan must be rated for continuous duty. The heater and fan must be connected in parallel and rated 120 volts, 60 Hertz. Mount the unit in the horizontal position at a location beneath the lowest shelf.

      Do not block the air intake or outlet. Provide the unit with a SPST manual override switch that bypasses the thermostat to enable the fan and heater to operate at warmer temperatures.

   c. Cabinet Wiring.

      (1) Neatly arrange the wiring within controller cabinets to conform to the requirements of Subsections 660-3.05 and 740-2.05.

      Wire and equip all controller cabinets to handle the full capacity of the controller and cabinet configuration (see NEMA TS 1, *Traffic Control Systems*, Section 10, Table 10-2 Wired Sockets) specified on the Plans or Special Provisions. Use configuration 4 for a 4-phase controller, and configuration 8 for an 8-phase controller.

Equip the cabinet with all required control and auxiliary equipment connecting cables to operate the phases and detection indicated on the Plans, including future use.

Size all wiring, switches, surge protectors, flash relays, flashers, etc., to handle the necessary amperage required under full cabinet use. Use orange colored wires to run from the flash transfer relay used for emergency flash programming.

(2) Intersection flash operation must be programmable by rearranging interconnecting jumpers between the load switches, flash transfer relays, and field signal wire terminal blocks. Make these changes by moving the jumpers at the terminal blocks.

(3) Field Terminal Blocks.

(a) Provide 2 or more insulated terminal blocks to terminate field conductors. Provide each block with 12 poles with 10-32 screw type terminals. Use a terminal block that is a barrier type with removable shorting bars in each of the 12 positions and with integral-type marking strips. Terminate all conductors to a terminal block.

(b) Terminate conductors from the controller unit in ring-type terminal lugs or solder them to a through panel solder lug on the rear side of the terminal. Terminate all other conductors in spade-type terminal lugs.

(c) Do not bring more than 3 conductors to any one terminal. Two flat metal jumpers, straight or U shaped, may also be placed under a terminal screw. Fully engage at least 2 full threads of all terminal screws when the screw is tightened. Do not extend live parts beyond the barrier.

(d) Terminate all interconnect cable conductors on individual terminals.

(e) Include a 16-position neutral terminal bus bar on each side of the cabinet.

d. Cabinet Accessories. See NEMA Standard TS 2, Section 5 Terminals and Facilities, Figure 5.4.2-1 Cabinet Power Distribution Schematic for items (1) through (5).

(1) Disconnecting Means.

(a) Main circuit breaker must be a single pole, 50 ampere, 10,000 amperes interrupting capacity (or higher rating, if specified on the drawings) for 8 phase cabinets or a single pole, 30 ampere, 10,000 amperes interrupting capacity (or higher rating, if specified on the drawings) for 4 phase cabinets.

(b) Auxiliary circuit breaker(s) must be single pole, 20 ampere, 10,000 amperes interrupting capacity (or higher rating, if specified on the drawings) to protect fan, heater, light and convenience outlet(s).

The rating of the main disconnect means with overcurrent protection must be not less than 125 percent of the maximum anticipated continuous load. When using disconnecting means, use the “trip-indicating trip-free” type.

(2) Signal Bus. Connect the signal bus to the incoming AC line through a signal bus mercury contactor and an overcurrent protection device. Energize the signal bus mercury contactor to provide power to the signal bus. The current rating of the signal bus mercury contactor must be at least the current rating of the main overcurrent protection device.

(3) AC Service Transient Suppression. Connect the transient suppression device for the primary feed of the cabinet on the load side of the cabinet overcurrent protection device. The transient voltage suppression device connected to the controller power circuit must provide

protection against voltage abnormalities of 1 cycle or less duration. The suppressor must be solid state high energy circuit containing no spark gap, gas tube, or crow bar component. The current rating of the device must be 15 amps minimum. The device must provide transient protection between neutral and ground, line and ground, as well as line and neutral. If the protection circuits fail, they must fail to an open circuit condition. The device must meet all requirements of UL standard 1449. The suppressed voltage rating must be 600 volts or less when subject to an impulse of 6,000 volt, 3,000 amp source impedance, 8.0/20 microsecond waveform as described in UL 1449. In addition, the device must withstand, without failure or permanent damage, one full cycle at 264 volts RMS. The device must contain circuitry to prevent self-induced regenerative ringing. There must be a failure warning indicator light which must illuminate when the device has failed and is no longer operable. The transient suppression device must withstand a 20,000 ampere surge current with a 8x20 microsecond (time to crest x time to second halfcrest) waveform 20 times at 3-minute intervals between surges without damage or degradation to the suppressor. Output voltage must not exceed 500 volts at any time during the test. Use a device that is a solid state, high-energy circuit with no spark gap, gas tube, or bar component.

(4) Radio Interference Suppression. Equip each traffic cabinet, flasher, and other current interrupting device with a suitable radio interference suppressor installed at the input power point. Install the radio interference suppressor after the AC service transient suppression unit described in Subsection 740-2.11.1.d.(3). It must provide a minimum attenuation of 50 decibels over a frequency range from 200 kilohertz to 75 megahertz, when used with normal installations.

The interference suppressor must be hermetically sealed in a substantial metal case filled with suitable insulating compound. Terminals must be nickel-plated, 10-24 brass studs of sufficient external length to provide space for connecting two No. 8 conductors and must be so mounted that the terminals cannot be turned in the case. Ungrounded terminals must be properly insulated from each other and must maintain a surface leakage distance of not less than 1/4 inch between any exposed current conductor and any other metallic part, with an insulation factor of 100 to 200 megohms dependent on external circuit conditions.

The radio interference suppressor must have a current rating equal to, as a minimum, the rating of the main disconnect means as specified in Subsection 740-2.11.1.d.(1). It must be designed for operation on 120 volts, 60 hertz, single phase circuits and be UL and EIA compliant.

Connect the ground connection of the radio interference suppressor only to AC neutral. Do not connect to Earth Ground directly.

(5) Light Fixture. Mount a fluorescent lighting fixture on the inside of the cabinet near the front edge. Use a fixture rated to accommodate a F15T8 lamp operated from a high power factor ballast. The lamp must be included. The lighting fixture “ON-OFF” switch must be a toggle switch mounted on an inside control panel. Include in the circuit a door-actuated switch that turns the light ON when the door is open and OFF when the door is closed.

(6) Communications Transient Suppression. Provide a transient suppressor for the system interface communications lines when used. This suppressor must withstand a 100 ampere 10 x 700 microsecond waveform 20 times at 30 second intervals between surges without damage or degradation to the suppressor. Apply the transient surge both line to line and line to ground. Output voltage must not exceed 8 volts line to line and line to ground. Output voltage must not exceed 8 volts line to line or 250 volts line to ground at any time during the test.

(7) Control Panel. Provide and label a control panel assembly that is readily accessible from the front of the cabinet. The control panel assembly must consist of:

(a) “controller power” switch to energize the controller while the signal lights are off or are being operated by the flasher. Label and rate the switch for load current.

(b) convenience outlet with independent ground fault circuit protection. Use a duplex, 3-prong, NEMA Type 5-20R grounding type outlet.

(c) “auto/flash” switch which when placed in the “flash” position provides flashing operation without interrupting the controller unit power. When the switch is placed in the “auto” position the controller unit must provide normal operation.

(d) “stop time/off/on” switch which when placed in the “stop time” position causes the controller unit to stop time. In the “off” position the controller unit must be active regardless of external commands. In the “on” position the timing must be normal but subject to external command interruptions.

(e) “heater by-pass” switch to by-pass the remote heater thermostat.

(f) momentary contact test switches to place calls on each vehicle and pedestrian phase. Switches must provide tactile feedback and be rated at 1 ampere, minimum, for a resistive load at 120 volts AC and at 28 volts DC. Contacts must be coin silver or gold plated and be enclosed and labeled as to their function.

e. Police Panel Assembly. Provide a labeled police panel assembly located behind the auxiliary door, consisting of:

(1) “flash/automatic” switch which when placed in the “flash” position causes the intersection displays to go into the flashing mode. When placed in the “automatic” position, the signal system must resume normal operation.

(2) “signals /off” switch which when placed in the “off” position removes power from the signal bus. Do not allow power on the bus when either “automatic” or “flash” operation is selected by any means.

(3) removable, rigid metal cover on the back of the police panel to cover the live switch terminals.

f. Warning Sign. The cabinet must contain a conspicuous warning sign against operation without the conflict monitoring device being installed.

2. Special Features. Provide special features if called for on the Plans or as specified in the Special Provisions.

a. Intersection Display Panel. Connect the display panel to the field wiring terminals, and include the following features:

(1) LED indicators for 8 vehicle phase displays (R-Y-G)

(2) LED indicators for 4 pedestrian phase displays (W-DW)

(3) A door activated switch that turns off the display panel when the cabinet door is closed

(4) Momentary detector tests switches to enter 8 vehicle phase calls and 4 pedestrian phase calls

(5) A display panel that is plug connected to the cabinet and is completely removable without disconnecting individual wires

(6) Approaches labeled with the street names and the northerly direction indicated

b. Manual Phase Selector Controls. Provide the traffic signal system with manual phase selector control that permits the system to advance to any phase, including pedestrian indications, with all clearance periods timed by the controller units.

Phases must be selected by a momentary contact switch, which plugs into a standard 1/4 inch 2-circuit telephone jack located in the police panel. Changes from “automatic” to “manual” phase selector control mode must be controlled by a toggle switch. Mount the toggle switch for the manual phase selector control in the police panel and clearly label it “Automatic/Manual.”

c. Coordination “Remote/Time of Day/Free” Switch. When the switch is in the “Remote” position, all supervisory functions performed on the controller unit from a master coordinator or central computer must operate normally.

When the switch is in the “Time of Day” position, the local controller must use the local coordinators time of day plan. When the switch is in the “Free” position it must be possible to remove any or all coordination devices and maintain normal, non-coordinated controller operation without wire jumpers, jumper plugs or other special devices. Provide this switch if a local coordination or system modem/interface unit is shown on the Plans.

740-2.12 STANDARD AUXILIARY EQUIPMENT.

1. Solid State Flasher. Use a NEMA Type III flasher unit that conforms to NEMA Standard TS 2, *Traffic Controller Assemblies*, Section 6.3 Solid State Flashers.

2. Three-Circuit Solid State Load Switches. Use load switches that conform to NEMA Standard TS 2, *Traffic Controller Assemblies*, Section 6.2 Three Circuit Solid State Load Switches and as a minimum be supplied with Light Emitting Diode indicators on the DC input circuitry. The load switch must have 3 independent switching circuits, each being an individually replaceable solid state module.

3. Conflict Monitors.

   a. Use conflict monitors that are NEMA Type 12 with 12 fully programmable input channels.

   b. Use a low impedance device external to the unit between the input and AC (Common) if the circuit connected to the sensing input of the unit exhibits high impedance characteristics caused by dimmers or burned-out lamps.

   c. Use a unit that verifies each yellow change interval for a minimum display period of at least 2.7 ±0.1 seconds. The yellow change interval is the time which the yellow field terminal input is active. When the minimum yellow change interval is not satisfied, the conflict monitor must transfer the output relay contacts to the fault condition.

4. Flash Transfer Relay. Use flash transfer relays that meet the requirements of NEMA Standard TS 2, *Traffic Controller Assemblies*, Section 6.4 Flash Transfer Relays.

740-2.13 SPECIAL AUXILIARY EQUIPMENT. Use the following special auxiliary equipment when called for on the Plans and/or Special Provisions:

1. Inductive Loop Detectors. Provide inductive loop detectors that conform to the requirements of NEMA Standard TS 1, *Traffic Control Systems*, Section 15, Inductive Loop Detectors.

2. Local Coordination Units. Provide local coordination units that are solid-state, utilizing digital timing. The units must be compatible with existing master systems.

   a. Controls. Each coordination unit must provide the following minimum supervisory control of the local controller unit:

(1) 3 cycles

(2) 3 offsets for each cycle

(3) Free Call results in independent operation of the local controller unit

(4) 3 permissive periods

(5) 3 split selections

(6) Short direction offset seeking

(7) Call to non-actuation during coordinated operation

b. Cycle. Adjustable over a minimum range of 40 to 150 seconds in a maximum of 5 second increments.

c. Offsets. Selectable as a percentage of the cycle length in 1 percent increments from 0 percent to 99 percent, or in 1 second increments.

d. Free Call. By suitable connections at the local controller, the effect of “Free Call” may be omitted. In this case, when the System Master calls for free operation, the local coordinating unit must operate to provide the shortest cycle and the associated average offset.

e. Permissive Periods.

(1) First Vehicle Permissive. During this period, the coordinator must yield the controller to the selected, non-actuated phase(s). The end of this period must be capable of being set at any 1 percent or 1 second interval.

(2) First Pedestrian Permissive. This period may be of fixed duration and must start concurrently with the First Vehicle Permissive. It must terminate no more than 7 percent later. During this period, the coordinator must yield the controller to the selected, non-actuated vehicle plus pedestrian phase(s). When the coordinator yields to a vehicle during this period, the associated phase must be inhibited until the following cycle.

(3) Second Vehicle Permissive. Both the start and end of this cycle must be capable of being set at 1 percent or 1 second increment of the cycle. During this period, the controller must respond to pedestrian and vehicle calls, for the pre-selected phases.

f. Force Offs.

(1) Equip the coordinator with 2 independent, ring-related, force off functions.

(2) The force off function must cause the local controller to terminate the right-of-way of the appropriate phase.

(3) Force off points must be selectable to any 1 percent or 1 second increments of the cycle.

g. Offset Seeking. The coordination unit must seek any new offset in the shortest direction at a rate not to exceed 20 percentage points per cycle.

h. Call to Non-Actuation. The coordinator must provide an output that may be used to energize the call to non-actuation and inhibit the maximum termination inputs to the local controller.

i. Connectors. Provide a front panel mounted, MS-type connector for all input/output circuit connections.

3. System Modem/Interface Unit. Supply a system modem/interface unit assembly that is compatible with the existing computerized traffic control system.

4. Preemption Units. Provide preemption units that are solid-state with digital timing. Equipment must be shelf-mounted, with a front panel MS-type connector. Design preemption equipment to use the controller functions and timing capabilities to the maximum extent. Installing the preemption equipment must not alter the internal wiring of the controller unit. The preemption units may be an integral part of the controller unit.

5. Special Logic.

   a. Use special logic circuits that are solid-state with digital timing.

   b. Build solid-state logic or timing circuits (external to the controller unit) on edge-connected, plug-in, printed circuit boards. Build up logic circuits by plugging logic circuit boards into wired connectors.

      When using 5 or less plug-in logic circuit boards, install the circuit board connectors in a chassis or rack mounted on a cabinet wall. Provide MS-type connectors to permit removal of the chassis or rack without unsoldering connections or removing wires or cables from the cabinet.

      When using more than 5 plug-in logic circuit boards, install the circuit board connectors on a chassis designed for shelf mounting. Provide this chassis with a Type MS connector. It must be shelf-mounted.

   c. Obtain approval when using special logic circuits before the controller cabinet and equipment are fabricated by the supplier.

740-2.14 VEHICULAR SIGNAL HEADS. Provide Light Emitting Diode, (LED) Signal Heads that conform to the following publications:

Circular Indications: *Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Circular Signal Supplement*, 6/27/05 (ITE Publication ST-052). This is hereafter referred to as “VTCSH-Circular-05”.

Arrow Indications: *Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement*, 7/1/07 (ITE Publication ST-054). This is hereafter referred to as “VTCSH-Arrow-07”.

“The applicable ITE Specification”, as used in this specification, means VTCSH-Circular-05 for circular LED indications and VTCSH-Arrow-07 for arrow LED indications.

1. Signal Heads.

   Use signal heads that: are the adjustable, vertical type with the number and type of lights specified; provide a light indication in one direction only; are adjustable through 360 degrees about a vertical axis; and are mounted at the location and in the manner shown on the Plans. Ensure that all vehicular signal heads at any one intersection, except for programmed visibility signal heads, are of the same make and type.

   Provide a removable aluminum tunnel visor with an open slot at the bottom for each optical unit.

   Furnish housing, backplates and visors factory finished with a single coat of environmentally safe, ultraviolet-resistant, polyester powder coating that is applied electrostatically at 90kV and baked for 20 minutes at 400 degrees Fahrenheit per ASTM D3359, ASTM D3363 and ASTM D522. Coating to be a Dull Black finish meeting Federal Standard 595b-37038.

   a. LED Optical Units. Use LED optical units and lenses meeting the requirement of the applicable ITE specification for all indications. Also meet the following requirements:

(1) Gaskets. Use one-piece EPDM (ethylene propylene rubber) gaskets to seal LED modules.

(2) Markings. Provide LED Signal module with manufacturer applied markings listed in Section 3.6, Module Identification, of the applicable ITE Specification. For circular indications marking shall include: "Manufactured in conformance with the ITE Vehicle Traffic Control Signal Heads: LED Vehicle Circular Traffic Signal Supplement (June 27, 2005)." For arrow indications, marking shall include: "Manufactured in conformance with the ITE Vehicle Traffic Control Signal Heads: LED Vehicle Arrow Traffic Signal Supplement (July 1, 2007)."

(3) Compatibility. Use LED signal modules that are operationally compatible with currently used controller assemblies (solid state load switches, flashers, and conflict monitors).

(4) Testing Requirements.

(a) All LEDs Functional. LED modules with any non-functioning individual LEDs at the final inspection will be rejected.

(b) Burn-in. Manufacturer shall energize each new LED module for a minimum of 24 hours at operating voltage before shipment to ensure electronic component reliability.

(c) Production Testing and Inspection. Submit manufacturer's certification that all tests in Section 6.3 of the applicable ITE Specification have been successfully completed on each LED module to be used on the project.

Show results of each individual test on the certification.

(d) Design Qualification and Quality Assurance Testing by an Independent Lab. Have ETL/Intertek or other approved OSHA "Nationally Recognized Testing Laboratory" do the following:

Perform an initial assessment of the manufacturer's factory, engineering and manufacturing systems, and procedures to confirm compliance with ISO 9000.

Perform initial Design Qualification Testing as specified in Section 6.4 of the applicable ITE specification.

Every 6 months, conduct a factory inspection and perform Quality Assurance Tests on two samples of each certified LED module in accordance with the following sections of the applicable ITE specification:

Conditioning
6.4.4.1 - 6.4.4.4 Luminous Intensity
6.4.4.6 Chromaticity
6.4.6.1 Current Consumption
6.4.6.6 Power Factor
6.4.6.7 Total Harmonic Distortion

Provide a certification label on each certified LED traffic signal module verifying the manufacturer's factory and modules passed the tests listed in a. through c. above.

(e) Warranty. Provide written warranty by the signal module manufacturer that covers defects in materials, workmanship, and compliance with the applicable ITE specification for a period of 60 months after the manufacture date. No new LED module will be accepted if its manufacture date is more than 12 months before the date of installation. Begin warranty period for modules that replace failed modules on the date of installation.

The warranty shall require the manufacturer to replace LED modules that fail within the warranty period with new LED modules at no cost to the Department, and to cover the cost of shipping failed modules. The warranty does not include the cost of removing failed modules or reinstalling new modules. Warranty shall require the manufacturer to send the Department prepaid authorization to return the failed module and provide a toll free telephone number for notifying them when it becomes necessary to return failed LED modules.

The warranty shall require the manufacturer to deliver replacement LED modules within 5 working days of receiving failed modules to the location specified by the Department.

2. Housing.

   a. Use die cast aluminum, meeting ASTM B85, for all parts of the housing, including the doors and end plates. Ensure all parts are clean, smooth, and free from flaws, cracks, blow holes, or other imperfections.

   b. Use a one-piece housing with integral top, bottom, sides, and with square doors, for each signal section.

   c. Use stainless steel for all exposed bolts, screws, hinges, pins, and door-locking devices. Use stainless steel or approved non-ferrous, corrosion-resistant material for all interior screws and fittings .

   d. Provide an opening in the top and bottom of each housing to accommodate standard 1-1/2 inch pipe fittings and brackets.

   e. Provide the top and bottom openings of each housing with integral serrated bosses that will provide positive positioning of the signal head in 5-degree increments to eliminate undesirable rotation or misalignment of the signal head as well as between sections. Provide a total of 72 teeth in the serrated boss. Ensure teeth are clean and sharp to provide positive positioning with the grooves of the mating section or framework.

   f. Fasten individual signal sections together with a cadmium-plated tri-stud connector, lockwashers, and nuts with access holes for the passage of electrical conductors from one section to another.

   g. Provide 2 integral hinge lugs on the left side of each signal housing for mounting the door.

   h. Provide 2 latches with stainless steel wing nut assemblies on the right side of each signal housing to engage the door latches.

   i. Provide each signal housing door opening with a one-piece EPDM gasket around the periphery to provide a weather tight seal in a NEMA Type 3R enclosure.

   j. Provide a round opening designed to accommodate any standard traffic signal lens in each signal housing door.

3. Backplates. Furnish and attach backplates to all vehicle signal heads except post-mounted flashers.

   Construct backplates of 0.1-inch minimum thickness aluminum alloy sheet meeting ASTM B209, alloy 3003-H14. Use 8 inch wide backplate extensions for 12-inch displays and 5-1/2 inch wide backplate extensions for 8-inch displays. When there are 2 or more backplate sections, fasten them together with aluminum rivets or bolts and peen after assembly to prevent loosening.

   Use 5 or 5-1/2 inch wide backplate extensions (borders) for all post mounted and pole side mounted vehicle signal heads. Provide nominal 5-inch wide backplate extensions on all 5 section overhead

cluster mounted signals. Provide backplates with nominal borders of 8 inches for the 8-inch sections and 5 inches for 12-inch sections on all combination 8-inch/12-inch vertical mounted signal heads.

Factory finish the back and front faces of backplates with a single coat of environmentally safe, ultraviolet-resistant, polyester powder coating that is applied electrostatically at 90kV and baked for 20 minutes at 400 degrees Fahrenheit per ASTM D3359, ASTM D3363 and ASTM D522. Coating to be a Dull Black finish meeting Federal Standard 595b-37038.

740-2.15 PEDESTRIAN SIGNALS. Use LED Pedestrian Countdown modules that use the international "HAND/WALKING PERSON" symbols. Except for the countdown indication and as otherwise noted in this specification, use modules that conform to “Pedestrian Traffic Control Signal Indications - Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules” Institute of Transportation Engineers, 3/19/2004, (hereafter referred to in this document as “PTCSI-04”) and to the applicable Sections of the current Alaska Traffic Manual.

1. Pedestrian Signal Modules: Provide Portland Orange “HAND” and “COUNTDOWN DIGITS” and lunar white “WALKING PERSON.” Locate COUNTDOWN DIGITS adjacent to the associated UPRAISED HAND. Make “HAND” and “WALKING PERSON” symbols a minimum of 11 inches high and 7 inches wide and COUNTDOWN DIGITS a minimum of 9 inches high and 7 inches wide. Provide incandescent looking WALKING PERSON, HAND and COUNTDOWN DIGITS. Ensure the WALKING PERSON, UPRAISED HAND and COUNTDOWN DIGITS are not readily visible when not illuminated. Provide “AlInGaP” Portland Orange LEDs or equivalent, rated for 100,000 hours or more at 77ºF and 20 mA. Provide “InGaN” White LEDs.

   Make all exposed components of modules suitable for prolonged exposure to the environment, without appreciable degradation that would interfere with function or appearance.

   Provide modules with an installed gasket to seal the junction with the signal housing.

   a. Lens. Use modules with internal masks to prevent the icons and digits from being visible when not in operation. No external silk-screen is permitted. Provide a smooth or textured lens of transparent polycarbonate material, frosted to prevent sun phantom. Use lenses that will not crack, craze or yellow due to solar UV exposure typical for a south-facing Arizona desert installation, after a minimum of 60 months in service.

   b. Retrofit. When a module will replace an existing module in an existing signal housing, furnish signal modules designed as retrofit replacements for existing neon type pedestrian signals (ICC 4090 and/or 4094). Provide modules that do not require special tools for installation. Provide modules that fit securely into existing pedestrian signal housings without any modification to the housing, connect directly to existing electrical wiring, and form a weather-tight seal. Provide modules and components constructed so each retrofit of existing pedestrian signals only requires the removal of the existing neon message module, gasket, and power supply and installation of the new LED pedestrian countdown module. Provide all necessary components to complete conversion including a one piece gasket.

   c. Photometric Requirements. Meet the following requirements:

      (1) Minimum Luminance. Maintain the following minimum luminance values for at least 60 months, under the operating conditions defined in Sections 3.3.1 and 5.2.1 of PTCSI-04 (when measured normal to the plane of the icon surface):

         (a) WALKING PERSON 2,200 cd/m2,

         (b) UPRAISED HAND 1,400 cd/m2,

         (c) DIGITS 1,400 cd/m2 (when “88” is displayed).

(2) Maximum Luminance. Provide modules for which the actual luminance of a module does not exceed three times the minimum maintained luminance, as defined in Section 4.1.1 of PTCSI-04, when operated within the temperature range -40°F to +165°F

(3) Uniformity: Provide modules for which the uniformity of the signal output across the emitting section of the module lens (i.e. icons or digits) does not exceed a ratio of 5 to 1 between the maximum and minimum luminance values as measured in 0.5 in. diameter spots.

(4) Markings. Permanently mark the back of each LED signal module with:

(a) Manufacturer's name, trademark, and other necessary identification

(b) Warranty information

(c) Rated voltage and power consumption in volt-amperes

(d) An up arrow or the word "UP" or "TOP" for orientation within a signal housing.

d. Electrical. Provide LED pedestrian countdown signal modules that:

(1) are operationally compatible with currently used controller assemblies (solid state load switches, flashers, and conflict monitors).

(2) have a maximum of 4 each secured, color coded, 36 inches long, 600V, 18 AWG minimum, jacketed wires, conforming to the National Electrical Code, rated for service at +221ºF for electrical connection.

(3) operate from a 60 ±3 Hz AC line over a voltage range of 80 VAC to 135 VAC. Test voltage for all photometric performance measurements shall be 120 ±3 volts rms.

(4) use LED circuitry that prevents perceptible flicker over the voltage range specified above.

(5) include voltage surge protection against high-repetition noise transients and low-repetition noise transients as stated in Section 2.1.8, NEMA Standard TS-2, 2003. Module must meet the following test requirements: Section 8.2 IEC 1000-4-5 & Section 6.1.2 ANSI/IEEE C62.41.2, 3kV, 2 ohm and Section 8.0 IEC 1000-4-12 & Section 6.1.1 ANSI/IEEE C62.41.2, 6kV, 30 ohm.

(6) have a current draw sufficient to ensure compatibility and proper triggering and operation of load current switches and conflict monitors in signal controller units. When the module is switched from the On state to the Off state the terminal voltage shall decay to a value less than 10VAC RMS in less than 100 milliseconds when driven by a maximum allowed load switch leakage current of 10 milliamps peak (7.1 milliamps AC).

(7) have a maximum power consumption at 77°F of: Hand 11.0 watts, Walking Person 8.0 watts, Digits 10.0 watts (when display shows "88")

(8) have waterproof strain relief and anti-capillary wires, or have electrical wires that do not penetrate the LED module housing. This is intended to prevent water seepage between the back cover and the electrical wires, or between the copper and insulation of the wires (Connection may be made by use of an over molded connector).

(9) will default to the hand symbol for abnormal conditions when nominal voltage is applied to the unit across the two phase wires (rather than being applied to the phase wire and the neutral wire).

(10) have three separate power supplies: one each for the Walking Person, the Upraised Hand and the countdown digits. Use separate circuitry to power the LED Walking Person icon and the LED Upraised Hand icon, in order to virtually eliminate the risk of displaying the wrong icon.

e. Testing Requirements.

(1) All LEDs Functional. LED modules with any non-functioning individual LEDs at the final inspection will be rejected.

(2) Burn-in. Manufacturer shall energize each new LED module for a minimum of 24 hours at operating voltage before shipment to ensure electronic component reliability.

(3) Production Testing and Inspection by Manufacturer. Submit manufacturer's certification that all tests in Section 6.3 of PTCSI-04 have been successfully completed on each LED module to be used on the project. Show result of each individual test on the certification.

(4) Design Qualification and Quality Assurance Testing by an Independent Lab. Have ETL/Intertek or other approved OSHA "Nationally Recognized Testing Laboratory" do the following:

(a) Perform an initial assessment of the manufacturer's factory, engineering and manufacturing systems, and procedures to confirm compliance with ISO 9000.

(b) Perform initial Design Qualification Testing as specified in Section 6.4 of the PTCSI-04.

(c) Every 6 months, conduct a factory inspection and perform Quality Assurance Tests on two samples of each certified LED module in accordance with the following sections of PTCSI-04:

6.4.2 Conditioning
6.4.4.1 - 6.4.4.4 Luminous Intensity
6.4.4.6 Chromaticity
6.4.6.1 Current Consumption
6.4.6.6 Power Factor
6.4.6.7 Total Harmonic Distortion

(d) Provide a certification label on each certified LED traffic signal module verifying the manufacturer's factory and modules passed the tests listed in a. through c. above.

f. Warranty. Provide a manufacturer's written warranty that covers defects in materials, workmanship, and compliance with PTCSI-04 for a period of 60 months after the manufacture date. No new LED module will be accepted on a project if its manufacture date is more than 12 months before the date of installation. Begin warranty period for modules that replace failed modules on the date of installation.

The warranty shall require the manufacturer to replace LED modules that fail within the warranty period with new LED modules at no cost to the Department, and to cover the cost of shipping failed modules. The warranty does not include the cost of removing failed modules or reinstalling new modules. Warranty shall require the manufacturer to send the Department prepaid authorization to return the failed module and provide a toll free telephone number for notifying them when it becomes necessary to return failed LED modules.

The warranty shall require the manufacturer to deliver replacement LED modules within 5 working days of receiving failed modules to the location specified by the Department.

g. Countdown Module Functions.

(1) General. Begin the countdown at the beginning of the FLASHING HAND indication. End the countdown at “0” at the end of the FLASHING HAND indication. Make the countdown display dark from the end of one FLASHING HAND indication until the beginning of the next. Display steady, not flashing, countdown digits. Do not provide user accessible switches, controls, or options that would allow modification of cycle time, icons, digits or that would allow the countdown to operate while the WALKING PERSON or STEADY HAND is displayed.

(2) Learning Cycle. At power on, make the countdown display dark for one learning cycle in which it will determine the duration of the FLASHING HAND indication.

(3) Normal Operation. Display the countdown/FLASHING HAND for the duration measured in the learning cycle for every cycle until the module measures a different FLASHING HAND duration.

(4) Countdown Duration Modification. When a different duration is measured, make the countdown dark for the next cycle, and enter a Learning Cycle as previously described. Resume Normal Operation with the new FLASHING HAND duration if the measured FLASHING HAND duration for the next cycle is the same as for the first cycle when a change was detected. Continue Learning Cycles, if the duration is different, until the measured FLASHING HAND duration is the same for two cycles. Resume Normal Operation with the new duration when that happens.

(5) Countdown Truncation. Make the digits dark if the controller output displays a STEADY HAND or if both the HAND and WALKING PERSON go dark, regardless of whether the countdown to zero has been completed.

(6) Preemption. Handle preemption events as described under Countdown Duration Modification and, if necessary, Countdown Truncation.

(7) Recycling. Allow for consecutive cycles without display of the STEADY HAND .

(8) Power Outage. Maintain an uninterrupted countdown during short power failures (<1.5 seconds). Make the digits dark after a loss of power of more than 1.5 seconds and enter a Learning Cycle when the power is restored.

2. Housing:

a. Provide signal housings that have maximum overall dimensions of 18-1/2 inches wide, 18-3/4 inches high, and 9 inches deep, including Z-crate-type visor and hinges.

b. Provide a dustproof and weatherproof housing that allows easy access to and replacement of all components.

c. Provide a one-piece, corrosion-resistant, aluminum-alloy die-cast case complete with integrally cast top, bottom, sides and back. Provide 4 integrally cast hinge lug pairs, 2 at the top and 2 at the bottom of each case, for operation of a swing-down door.

d. Provide 1 of the following 3 versions of the case, according to project specifications:

(1) Clamshell mount, with hardware, for “pole left of message” installation. These need not include upper and lower openings, but when provided the openings must be plugged to be weather-tight.

(2) Clamshell mount, with hardware, for “pole right of message” installation. These need not include upper and lower openings, but when provided the openings must be plugged to be weather-tight.

(3) Make suitable for either post top or bracket mounting with upper and lower openings to accommodate standard 1-1/2 inch pipe brackets. Plug unused openings to be weathertight. Integrally cast a shurlock boss into the bottom opening of the signal case. Make the dimensions of the shurlock boss as follows: outside diameter, 2-5/8 inch; inside diameter, 1-31/32 inch; number of radial teeth, 72; and depth of teeth, 5/64 inch. Use clean and sharp teeth that provide full engagement to eliminate rotation or misalignment of the signal.

e. Make the door frame a one-piece, corrosion-resistant, aluminum-alloy die-casting, complete with 2 hinge lugs cast at the bottom and 2 latch slots cast at the top of each door. Attach the door to the case by means of two Type 304 stainless steel spring pins. Attach 2 stainless steel hinged bolts with captive stainless steel wing nuts and washers to the case with the use of stainless steel spring pins. Provide a door that will latch and unlatch without the use of tools.

3. Conductors: Meet IMSA specifications 20-1 with No. 14 AWG or larger.

4. Load Switches: Place all load switches for operation of pedestrian signals in the controller cabinet.

5. Fasteners. Use machine screws, studs, and washers that are stainless steel.

6. Gaskets: Use gaskets that conform to ASTM D1056, Grade 2C2.

7. Terminal Blocks: Mount a terminal block in the unit for field wiring, as specified in Subsection 740-2.14.

8. Finish. Factory finish the outside of pedestrian signal head housings and visors and signal visor interiors with a single coat of environmentally safe, ultraviolet-resistant, polyester powder coating that is applied electrostatically at 90kV and baked for 20 minutes at 400 degrees Fahrenheit per ASTM D3359, ASTM D3363 and ASTM D522. Coating to be a Dull Black finish meeting Federal Standard 595b-37038.

740-2.16 PEDESTRIAN PUSH BUTTONS. Tamper-proof with a 2-inch minimum diameter concave or convex chrome or stainless steel telescoping-type plunger.

Construct a weatherproof assembly designed to prevent an electrical shock under any weather condition and grounded per the NEC.

Push button switch. Provide a phenolic-enclosed precision snap-acting type, switching unit, single-pole, double-throw, with screw type terminals, rated 15 amperes at 125 volts, AC. Must have the following characteristics:

1. Switching unit with a stainless steel plunger actuator and a U-frame to permit recessed mounting in push button housing.

2. Switch operating force of 9 to 13 ounces and a minimum release force of 4 ounces.

Where a pedestrian push button is to be attached to a pole, shape the housing to fit the curvature of the pole to provide a rigid installation. Provide saddles to make a neat fit.

Where a pedestrian push button is to be mounted on top of a 2-1/2 inch diameter post, provide the housing with a slip-fitter with screws for securing to the post.

Factory finish pedestrian push button housings, mountings, brackets and fittings with 2 coats of dark olive green enamel. Painting is not required where the color is an integral part of the component material.

740-2.17 FLASHING BEACONS. Each beacon consists of a single section traffic signal head, meeting the provisions in Subsection 740-2.14 with yellow or red lens as shown on the Plans.

Each flashing beacon control unit consists of a circuit breaker, flasher, and terminal block housed in a single enclosure. Provide a NEMA Type 3R enclosure with top-hinged cover, hasp for sealing cover, and provisions for locking.

Furnish and install a radio interference and transient suppressor in the enclosure, meeting the requirements of Subsection 740-2.11.1.d.(3) and (4).

Mount 20 amp, single-pole, 120 volt AC switches at the top and center of the dead front panel.

Use a solid state NEMA Type 3 flasher meeting the requirements of NEMA Standard TS 1-1989, *Traffic Control Systems*.

Use 20 amp, 600 volt barrier-type terminal blocks, molded from phenolic material, with plated brass screw-type terminals and integral-type marking strips.

740-2.18 LUMINAIRES.

1. Mast Arm Mounted Luminaires.

   Furnish luminaires that:

   a. Have high pressure sodium lamps with a rated life of 24,000 hours based on 10 hours per start, or LED lighting fixtures with minimum 100,000 hour design life

   b. Include a terminal block for terminating the illumination tap conductors

   c. Feature an easily removed hinged door or tray used exclusively for mounting the ballast or driver

   d. Provide the illumination levels and uniformity specified (or better) in the arrangements listed on the Plans when calculated according to the American National Standard Practice for Roadway Lighting, A.N.S.I./I.E.S RP-8, dated 1983

   e. Include a lamp-starting aid that plugs into a socket for easy replacement

   f. Feature a wire way meeting NEC requirements for installing three size 10 AWG conductors with type XHHW-2 insulation between the pole and a terminal block located in the luminaire

   g. Have reflectors free of substances (such as paint) that affect photometric performance

   Furnish the Engineer with manufacturer's current electronic photometric data in Illuminating Engineering Society (I.E.S.) format to verify illumination levels and uniformity ratios.

   Provide mast arm mounted luminaires with slip-fitters designed for mounting on 2-inch nominal diameter standard pipe.

   Use refractor-type lenses made of borosilicate glass, unless polycarbonate resin refractors are called for in the Plans or Special Provisions.

   When polycarbonate resin lenses are called for, mold the lens in a single piece from polycarbonate resin when approved for use by the manufacturer. Do not use reworked compound whose properties have been impaired by previous molding operations. Use lenses free from cracks, blisters, burns, and flow lines, and furnished with the natural molded surface. Lenses must be of uniform density throughout and be free from air, gas, or moisture pockets, and uncured areas, as consistent with good manufacturing practice. Lenses must be transparent with a clear bluish tint, produced from resin which has been suitably ultraviolet stabilized to reduce the effects of ultraviolet radiation on their color properties.

Use resins which meet the requirements for the self-extinguishing classification of ASTM D635. Resin must have a minimum impact strength, Izod notched of 12 foot-pounds per inch when tested according to ASTM D256, Method A, using a 1/8 inch x 1/2 inch bar molded according to ASTM recommended practice.

Furnish a certificate of compliance from the lens fabricator that all requirements contained in the paragraph above have been met.

Mount the refractor in a door frame assembly which is hinged to the luminaire at the house side and fastened at the street side with an automatic type latch.

Force the refractor and door frame assembly upward at the street side by spring pressure, against the gasket seat, when in the closed and latched position.

Gasket material must be capable of withstanding the temperatures involved and be securely held in place.

Manufacture all parts of the luminaire from corrosion-resistant materials.

When cut off fixtures are specified, the optical assembly must provide 90-degree cutoff and shielding; consist of a die cast aluminum lens holder with a aluminum alglas finish, hydroformed gasketed reflector, and a heat impact resistant mogul multiple screw shell socket with lamp grips. Provide an adjustable socket holder with 2 vertical positions. Furnish an activated charcoal filter in the optical assembly to prevent particulate and gaseous contamination. Use a reflector that is specifically designed to produce an ANSI, IES (MC-III, S-C-II) light distribution when used with 200 through 400 Watt High Pressure Sodium lamps. Use a flat plate glass lens on the fixture. No part of the lens may project below the metal housing of the luminaire.

Submit the manufacturer's luminaire specifications and photometric data for approval, per Subsection 660-2.01.

2. High Tower Luminaires. Use luminaires with 480-volt, 1,000-watt, high pressure sodium lamps. Lamps must provide 140,000 minimum initial lumens with a rated life of 24,000 hours. Provide luminaires with double fused ballasts. Furnish fuses of the size recommended by the luminaire manufacturer. Use a filtered design fixture with borosilicate glass refractor. Use a reflector with a smooth, non-porous inner surface, encased within a spun and sealed aluminum cover. Firmly attach the reflector with aluminum cover to a cast ring.

   The ring must be designed so that the reflector/refractor assembly may be readily attached to, or detached from, the luminaire bracket entry and lamp support assembly without completely removing the support bolts. Enclose the luminaire ballast within a die-cast aluminum housing that integrally attaches to the luminaire bracket entry and lamp support assembly. It must be readily removable without removing the luminaire from the bracket arm.

   Furnish the assembly with a side entry slipfitter designed for 2-inch nominal diameter pipe with provision for ±3 degree adjustment for leveling the luminaire. Prevent the lamp from backing out by means of a stainless steel lamp clamp attached to the assembly but separate from the socket. Include an enclosed terminal block which protects all electrical connections from exposure to weather. Attach an aluminum rolled rain shield to the outside of this assembly. Furnish the luminaire distribution type shown on the Plans or specified in the Special Provisions. Submit manufacturer's luminaire specifications and photometric data for the fixture for approval prior to ordering.

740-2.19 SIGN LIGHTING FIXTURES.

1. Incandescent Down Light. Provide the type of sign lighting fixture, with incandescent lamp, shown on the Plans or as specified in the Special Provisions.

a. Hood. Cadmium plated, finished with aluminum paint, and side outlet tapped for conduit.

b. Reflector. Symmetrical 8-inch steel. Porcelain enameled green finish on the outside and white on the inside.

c. Lamp. Provide 2,900 lumen.

2. Mercury Vapor. Fully enclosed, rain-tight, dust-tight, and corrosion-resistant. Design each fixture for mounting at the bottom of the sign on an overhead sign structure as shown on the Plans. Painting of fixture is not required.

a. Housing. Cast aluminum alloy or other non-corrosive material conforming to the Plans. Finish all housings in a workmanlike manner with no exposed burrs or sharp edges.

b. Refractor. Glass having inner prisms with a smooth exposed face. Mount the refractor in a door frame assembly which is hinged to the body of the fixture and fastened with an automatic type latch.

c. Gaskets. Made of a material capable of withstanding the temperatures involved, and securely held in place.

d. Light Distribution. Light distribution over the sign face must conform to the isolux distribution patterns shown in the Plans. Accomplish light distribution entirely by refraction through the lens with no additional refractors or reflectors.

e. Miscellaneous. All ballasts, lampholders, lamps, terminal blocks, and necessary fuses must conform to applicable requirements of Subsection 740-2.21 or to the Plans.

f. Lamps. Color-improved to provide good color rendition of signs.

740-2.20 ILLUMINATION CONTROL. Use photoelectric controls capable of directly switching multiple lighting systems. Furnish photoelectric units designed for pole top mounting which include a slip-fitter, terminal block, and cable supports or clamps to support pole wires.

1. Photoelectric Unit. A light sensitive element connected directly to a normally closed, single-pole throw control relay without intermediate amplifications. Plug the unit into a phenolic resin twist lock receptacle set in a cast aluminum mounting bracket with a threaded base. Screen photoelectric units to prevent artificial light from causing cycling.

Use either horizontal sensing or zenith sensing type units meeting the following:

a. A supply voltage rating of 60 Hz, 105-277 volts

b. A maximum rated load at a minimum of 1,800 volt-amperes

c. An operating temperature range from -40 °F to +150 °F

d. A power consumption of less than 10 watts

e. A unit base with a 3-prong, EEI-NEMA standard, twist-lock plug mounting

Furnish units for highway lighting that have a “turn-on” between 10.8 and 54 lux and a “turn-off” at between 1.5 and 5 times “turn-on.”

Furnish units for illuminated signs that have a “turn-on” level of between 215 and 270 lux. (“Turn-on” level specified above corresponds to a switching level of approximately 430 to 540 lux measured in the horizontal plane.) "Turn-off" level must not exceed 3 times “turn-on” level.

Measurements must meet the procedures in EEI-NEMA *Standards for Physical and Electrical Interchangeability of Light-Sensitive Control Devices Used in the Control of Roadway Lighting*.

2. Temperature Switch. When mercury vapor sign lighting fixtures are used, provide a temperature switch in each photoelectric control circuit for lighting systems which will:

   a. bypass the photoelectric unit when the ambient temperature drops to -13 °F, and energize the mercury vapor light circuits;

   b. return switching functions to the photoelectric unit upon a temperature rise of 5 to 10 °F above the turn-on temperature; and

   c. have a minimum range of (-40 °F to +40 °F), and be setable in increments no greater than 5 °F.

740-2.21 BALLASTS. Include ballasts for high intensity discharge lamps as an integral part of each luminaire and design for the voltages and lamp types specified in the Plans or Special Provisions. Ensure that the current needed to start the lamps is less than the operating current.

Furnish regulator-type ballasts with copper windings electrically isolated from each other, which will start and operate the lamps in temperatures down to -40 °F. The allowable line voltage variation is plus and minus 10 percent.

Equip high-pressure sodium luminaires, except those with 1000 watt lamps, with magnetic regulator ballasts with the following additional operating characteristics:

1. The lamp wattage regulation spread at any time over the life of the lamp must not exceed 18 percent of nominal lamp watts at plus and minus 10 percent line voltage variations.

2. With nominal line and lamp voltages, the ballast must regulate the lamp output to within 5 percent of the ballast design center, and sustain lamp operation with a minimum 60 percent voltage drop lasting 4 seconds or less.

Equip luminaires with 1000 watt high pressure sodium lamps with auto-regulator ballasts that provide a maximum 30 percent lamp regulation spread, a minimum 35 percent voltage dip tolerance, and with nominal line and lamp voltages regulate lamp output to within 5 percent of the ballast design center.

Furnish ballasts, for soffit luminaires, with mounting brackets attached and equip with terminal blocks for primary connections and lamp socket preconnected to the secondary for flush mounted luminaires and with terminal blocks for both primary and secondary connections for use with suspended luminaires.

Submit the ballast manufacturer's specification sheets for review and approval.

740-2.22 HIGH TOWER LUMINAIRE LOWERING SYSTEM. Furnish an integral luminaire lowering device that is compatible with the high tower design and consists of a head frame assembly, luminaire ring assembly, and winch assembly complete with electric motor.

Provide a manufacturer's on-site installation technician to oversee the assembly and final adjustment of all lowering system components. A State of Alaska-designated representative must be given the option to witness the final assembly and adjustment of the lowering system, as well as the initial lifting of the luminaires prior to placing the system in service.

Furnish a complete service manual with instructions on installation, operation, and maintenence for each lowering device, winch assembly, and power drive system furnished on the project.

Install one of the following high mast lowering devices wired for a single circuit, rated 480 VAC single-phase, on each high tower pole shown on the Plans. Furnish all power cords with four #8 AWG conductors.

Manufacturer	Model No.	Options to be furnished
Eagle High Mast Lighting Co.	ELC-XX-GV	Hot dip galvanized masthead assembly and transition plate, and integral motor
Holophane Corporation	LD25	Stainless steel hoist and winch cables
Millerbernd Manufacturing	SSLD-2	Integral winch and motor assembly

The Plans will indicate the number of luminaires on each pole, each pole's height, and whether FAA approved obstruction lights are required.

740-2.23 UNDERPASS LIGHTING SYSTEM. Use underpass luminaires that have vandal-resistant surface-mounted fixtures installed in a galvanized welded steel enclosure as detailed on the Plans. The lamp must be a mogul based 150-watt, clear, ANSI/NEMA C78.42, horizontal mount, high pressure sodium type. The lamp must provide a minimum of 15,000 initial lumens with a rated life of 24,000+ hours based on a minimum burn period of 3 hours.

Mount the ballast within the body of the fixture with a constant wattage autoregulator CWA type meeting ANSI/NEMA C78.1355 operating characteristics. See Plans for input voltage.

Provide a square lens that is semi-recessed, extra thick, injection molded polycarbonate prismatic type, with internal specular aluminum reflector. The lens must provide the uniformity specified in the Plans or Specifications with a minimum spacing to mounting height ratio (S/MH) of 3.5:1, in the plane defined by the axis of the lamp, and a minimum S/MH ratio of 1:1 in the plane passing vertically through the length of the lamp axis.

Provide a lens frame and side housing made of ASTM B209, alloy 6061-T6 tempered aluminum a minimum of 0.177 inch thick, or equivalent stainless steel, secured with tamper proof screws requiring a special manufacturer's tool to remove.

Provide fixtures that are Third Party listed for wet, damp, and dry locations. Fasten the fixture into the mounting enclosure with stainless steel screws accessible only from within the fixture housing.

Fabricate the mounting enclosure from 0.138 inch thick mild steel with continuous welded seams and hot-dipped galvanized, as detailed on the Plans. Use wiring within the enclosure that might come in contact with the ballast rated at 390 °F [type SR-2]. Provide a grounding screw or lug within the enclosure for a maximum No. 8 AWG ground conductor.

Submit the manufacture's fixture specifications, photometric data, and a computer-generated lighting layout for approval prior to ordering. Calculate, by the point-to-point method, the light level on the walkway surface through the underpass with no wall, ceiling, or walkway reflectances. The calculated light level on the walking surface and the calculated average-to-minimum uniformity ratio may not be worse than the light level and uniformity ratio noted on the drawings. Center the calculation area on the light fixtures and base it on the width of the walkway less 12 inches, and the length of the walkway equal to the distance between the first and last fixtures plus a distance equal to 50 percent of the spacing between the fixtures added to each end of the walkway. You may substitute fixtures having similar construction, electrical, and light distribution characteristics, if approved. In the case of a substitution, construct the enclosure shown on the drawing to match the mounting requirements of the submitted fixture. Submit shop drawings for the enclosure for approval along with the fixture shop drawings.