10. Introduction to Part II

10.1. Overview

Features of the *Alaska Bridges and Structures Manual* (the Manual) include:

Application. The *Manual* is an application-oriented document.

Theory. The *Manual* is not a structural design theory resource or a research document but does provide background information for DOT&PF's bridge design criteria and application.

Example Problems. The *Manual* provides a few example problems or calculations demonstrating the proper procedure for selected bridge design applications. These design examples or calculations illustrate the specific structural design criteria, practices, and policies used by DOT&PF for the indicated applications. However, example problems do not absolve the bridge designer from the responsibility of understanding their applicability.

Details. Where beneficial, the *Manual* provides details for the various structural design elements.

Coordination with AASHTO *LRFD Bridge Design Specifications*. Part II of the *Manual* is a supplement to the AASHTO *LRFD Bridge Design Specifications* (*LRFD Specifications*), that:

- in general, does not duplicate information in the *LRFD Specifications*, unless necessary for clarity
- elaborates on specific articles of the *LRFD Specifications*
- presents interpretative information
- indicates DOT&PF's policy where the *LRFD Specifications* presents multiple options; and
- presents bridge design applications used in Alaska that are not included in the *LRFD Specifications*

In addition, the *Manual* discusses, for selected applications, the original development of the *LRFD Specifications* to assist the bridge engineer.

10.2. Manual Application

In general, the *Manual* applies to all bridge design projects under the responsibility of DOT&PF. These projects include DOT&PF projects, local agency projects using federal funds, state-funded projects, and possibly other projects that will use the *Alaska Standard Specifications*.

10.2.1. Audience

The primary audience for the *Manual* is the bridge engineer in the DOT&PF Bridge Section. In addition, the *Manual*'s audience includes:

- other DOT&PF personnel
- consultants retained by DOT&PF
- contractors retained by DOT&PF for design/build projects
- local agencies where the project is funded with federal and/or state money

10.2.2. Order of Precedence

The provisions cited in 23 CFR 625.4(b) are minimum standards that must be followed in all cases. If the *Alaska Bridge and Structures Manual* exceeds these standards, the *Manual* will govern. In the event of conflict between AASHTO publications, the more conservative requirements or interpretation will govern. The Chief Bridge Engineer will make any final determination in the case of unresolved conflicts.

10.2.3. Scope of Work Definitions

The appropriate application of the structural design criteria in this *Manual* will depend, in part, on the scope of the proposed structural work.

New Bridge: This scope of work is defined as a new bridge at a new location. With rare exceptions, the bridge engineer will meet the criteria presented in this *Manual* for all new bridge projects.

Bridge Replacement: This scope of work is where the existing bridge requires complete replacement of the superstructure, substructure, and foundation due to structural or functional deficiencies of the existing structure. The replaced bridge will generally maintain the horizontal and vertical alignment of the existing approaching roadway. With rare exceptions, the bridge engineer will meet the criteria presented in this *Manual* for the structural design of bridge replacement projects.

Bridge Widening: It may be necessary to widen an existing bridge for a variety of reasons where the existing superstructure and substructure are considered structurally sound. Types of bridge widenings include:

- widening an existing bridge without adding travel lanes
- adding travel lanes to a highway segment to increase the traffic-carrying capacity of the facility
- adding an auxiliary lane across the structure (e.g., adding a truck-climbing lane; and
- adding a bike path or pedestrian facility

See Chapter 23 for the application of the *Manual* to bridge widening projects.

Major Bridge Rehabilitation: Any number of deficiencies may indicate the need for major bridge rehabilitation:

- deterioration of structural elements
- insufficient load-carrying capacity
- inadequate seismic resistance
- traffic safety features (e.g., substandard bridge rail, substandard guardrail-to-bridge-rail transition); and/or
- geometric deficiencies (e.g., narrow bridge width, inadequate horizontal alignment)

Major bridge rehabilitation is warranted where it is more cost-effective than replacement. For DOT&PF practices on bridge rehabilitation, see Chapter 23.

Bridge Deck Rehabilitation/Replacement: If the bridge substructure and foundation are structurally sound, but the bridge deck is deficient, the deck may require rehabilitation or replacement. This decision will depend upon the level and type of rehabilitation required, cost-effective analysis, traffic volumes, and safety issues.

Bridge deck rehabilitation may also consist of one or more of the elements listed below under "Minor Bridge Rehabilitation." See Chapter 23 for DOT&PF practices on bridge deck rehabilitation.

Minor Bridge Rehabilitation: Minor bridge rehabilitation is generally limited to deficiencies with isolated bridge elements that exceed the limits of routine maintenance. Minor bridge rehabilitation work may include the following types of activities:

- expansion joint cleaning, repair, or replacement
- deck patching and/or sealing
- deck protection
- spot painting of structural steel; and/or
- drains and drainage systems

Seismic Retrofit: Highway bridges are vulnerable to partial or total collapse during earthquakes due to three main reasons:

- girders dropping from their supports
- seismic moments and shears exceeding the capacity of the columns, and
- ground failure associated with liquefaction and lateral spread

Seismic retrofit attempts to improve the performance of existing bridges that are vulnerable to these failure modes. Retrofits typically fall into one of two categories:

1. **Phase I**. The primary objective of Phase I retrofit strategies is to prevent girders from falling off their supports (abutment and pier caps) in a relatively cost-effective manner. The girders can be tied to their supports with restrainer cables to limit their displacement relative to the supports. Seismic retrofit can also limit girder movement by installing concrete shear keys. On some bridges, timber blocking can be installed between the ends of the girders and the abutment backwall to limit longitudinal girder movement. Another strategy involves increasing the support width, thus increasing the displacement capacity.
2. **Phase II**. All retrofit work beyond Phase I is Phase II retrofit strategies. Phase II strategies attempt to improve substructure ductility, and they are generally more expensive than Phase I strategies. They typically address column seismic deficiencies through retrofits such as column jacketing and foundation deficiencies through footing modifications. Seismic base isolation is generally categorized as a Phase II retrofit.

Bridge Maintenance: This scope of work consists of activities considered routine maintenance (e.g., repairing damaged bridge rail, cleaning out drainage inlets).

10.3. Design Variances

This section discusses DOT&PF procedures for identifying, justifying, and processing variances to the structural design criteria in the *Manual* and *LRFD Specifications*. For bridges in remote sites, see Chapter 20.

10.3.1. DOT&PF Intent

Meet all design criteria in this *Manual* and the *LRFD Specifications* including current interims. The effective application date of interim provisions is when the AASHTO Subcommittee on Bridges and Structures adopts them or as soon as practicable afterwards. Recognizing that strict adherence to design standards may not always be practical, DOT&PF has established a process to evaluate and approve variances to its structural design criteria.

10.3.2. Procedures

Formal, written approvals for variances are required where the criteria or policies in either this *Manual* or the *LRFD Specifications* are presented in one of the following contexts (or the like):

- "shall"
- "mandatory"
- "required" or
- if the statement is written in directive language to the bridge engineer (e.g., "use")

When proposing a design element that does not meet the requirements of the *Manual* or *LRFD Specifications* in the above context, follow the procedure outlined below.

Documentation

Prepare the justification for the variance at the earliest possible stage of the project. Address the following issues, as applicable:

- site constraints
- safety considerations
- construction costs
- construction logistics
- product availability
- environmental impacts, or
- right-of-way impacts

Document any proposed variances from the DOT&PF structural design criteria in the Bridge Type Selection Report (see Chapter 4). At a minimum, document any design variances in the design computations after the Bridge Type Selection Report is approved. Document significant changes in a memo and include it in the bridge file.

Approval

The Chief Bridge Engineer, in accordance with the current FHWA Stewardship and Oversight Agreement, must approve all proposed variances in writing. Figure 10-1 presents a typical memorandum used to seek design variance approval.

Forward a copy of the memorandum to the Engineering Manager for the Preconstruction Engineer's approval according to Chapter 11 of the *Alaska Highway Preconstruction Manual*.

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

MEMORANDUM

(date), 2

To: *(name)*, Chief Bridge Engineer

From: *(name)*, Bridge Engineer

Subject: Design Variance Request
Project No. *(project number)*

Attached for your review and approval for the subject project is a request for a design variance to Section *number and title* of the *Alaska Bridges and Structures Manual* and/or Article *number and title* of the AASHTO *LRFD Bridge Design Specifications*. The Attachment is pursuant to Section 10.3 "Design Variances" of the *Alaska Bridges and Structures Manual*.

Approved: *(name)*, Chief Bridge Engineer

Attachment

Figure 10-1
Design Variance Request

10.4. Structural Design Literature (National)

This section discusses the major national publications available in the structural design literature. It provides 1) a brief discussion on each publication, and 2) the status and application of the publication by DOT&PF. This list is not all inclusive; however, it does represent a hierarchy of importance. In all cases, bridge engineers must ensure that they are using the latest edition of the publication, including all interim revisions to date unless otherwise directed in this *Manual*.

10.4.1. LRFD Bridge Design Specifications

Description

The AASHTO *LRFD Bridge Design Specifications* serve as the national standard for use by bridge engineers or for the development of a transportation agency's own structural specifications. The *LRFD Specifications* establish minimum requirements, consistent with current nationwide practices that apply to common highway bridges and other structures such as retaining walls and culverts. Long-span structures may require design provisions in addition to those presented in the *LRFD Specifications*.

Interim revisions are issued annually. AASHTO currently intends to publish a completely updated edition every two years.

LRFD Methodology

The *LRFD Specifications* present a load-and-resistance-factor design (LRFD) methodology for the structural design of bridges, which replaces the load factor design (LFD) and service load design (SLD) methodologies of the previous AASHTO *Standard Specifications for Highway Bridges* (*Standard Specifications*).

The *LRFD Specifications* apply live-load factors that are lower than the traditional AASHTO load factors but balance this reduction with an increase in vehicular live load that more accurately models actual loads on our nation's highways. Basically, the LRFD methodology requires that bridge components be designed to satisfy four sets of limit states:

- Strength
- Service
- Fatigue-and-Fracture
- Extreme Event

Through the use of statistical analyses, the provisions of the *LRFD Specifications* reflect a uniform level of safety for all structural elements, components, and systems.

Superseded Publications

The information in the *LRFD Specifications* supersedes, partially or completely, several AASHTO structural design publications. As such, AASHTO no longer maintains these publications. However, some of these publications contain background information or other presentations that may be useful.

- *Standard Specifications for Alternate Load Factor Design Procedures for Steel Beam Bridges Using Braced Compact Sections*. This publication provides information on the inelastic design of compact steel members (resistance beyond first yield), historically known as autostress.

  An Appendix to the *LRFD Specifications* contains an updated inelastic design process for compact steel sections.

- *Guide Specifications for Strength Design of Truss Bridges*. This document provides provisions for the design of steel trusses using the Load Factor Design (LFD) methodology. Herein, the load combination for long-span bridges (i.e., the Strength IV load combination of the *LRFD Specifications*) first appeared.

- *Division 1A, Seismic Design of the Standard Specifications for Highway Bridges*. See Section 10.4.3.

- *Guide Specifications for Fracture Critical Non-Redundant Steel Bridge Members*. This publication provides recommended requirements for identifying, fabricating, welding, and testing fracture critical, non-redundant steel bridge members. It includes specifications on welding requirements that are in addition to those in the ANSI/AASHTO/AWS *Bridge Welding Code*.

  This document also discusses the need for proper identification of fracture critical members on plans, and it contains useful information addressing background, example problems, etc., that are not included in the *LRFD Specifications*.

- *Guide Specifications — Thermal Effects in Concrete Bridge Superstructures*. This publication provides guidance on the thermal effects in concrete superstructures with special

attention to the thermal gradient through the depth of the superstructure. These provisions have been incorporated into the *LRFD Specifications*.

- *Guide Specifications for Fatigue Design of Steel Bridges*. This publication provides an alternative procedure to that of the AASHTO *Standard Specifications for Highway Bridges* wherein the actual number of cycles are used for fatigue design. Such a procedure has now been adopted in the *LRFD Specifications*.

- *Guide Specifications for Design and Construction of Segmental Concrete Bridges*. This document provides details on the design and construction of segmental concrete bridges. The high points have subsequently been included in the *LRFD Bridge Design Specifications* and the *LRFD Bridge Construction Specifications*.

- *Guide Specifications for Structural Design of Sound Barriers*. This document provides criteria for the structural design of sound barriers to promote the uniform preparation of plans and specifications. The publication allows the design of masonry sound barriers in addition to concrete, wood, steel, synthetics, and composites and aluminum.

- *Guide Specifications for Horizontally Curved Highway Bridges*. The AASHTO *Guide Specifications for Horizontally Curved Highway Bridges* presents specifications and methodologies for the design of steel I-girder and steel box girder bridges that are on a horizontal curve. The design methodology is based on both the service load and load factor design methodologies and, therefore, is not compatible with the *LRFD Specifications*. DOT&PF only allows the use of this publication for the same applications as for the *Standard Specifications*.

DOT&PF Application

DOT&PF has adopted the use of the *LRFD Specifications* as augmented by this *Manual* as the mandatory document for the structural design of highway bridges and other structures. The *Manual* is based upon the current edition of the *LRFD Specifications* with current interim revisions. This policy does not apply to:

- existing elements for bridge widening and bridge rehabilitation projects (including seismic retrofits), originally designed to any edition of the *AASHTO Standard Specifications for Highway Bridges*, where strengthening is not involved. These modifications may be designed to the *AASHTO Standard Specifications for Highway Bridges*, 17th Edition, AASHTO, 2002.

- structural elements for which no LRFD specifications are available

Part II of the *Manual* presents DOT&PF's specific applications of the *LRFD Specifications* to structural design, which clarify, specify among options, or augment information from the *LRFD Specifications* for DOT&PF's application.

10.4.2. Guide Specifications for LRFD Seismic Bridge Design

These *Guide Specifications* are an alternative set of provisions for the seismic design of highway bridges. The major difference between these provisions and those in the *LRFD Specifications* is the methodology used for examining seismic demands. Because the methodology of the *Guide Specifications* focuses on displacements, it is often referred to as "displacement-based." By contrast, the seismic provisions in the *LRFD Specifications* are "force-based."

DOT&PF Application

Use the *Guide Specifications for LRFD Seismic Bridge Design* for the seismic design of new highway bridges, including temporary bridges.

10.4.3. Standard Specifications for Highway Bridges

The AASHTO *Standard Specifications for Highway Bridges* (*Standard Specifications*) was first published in the late 1920s with annual interim revisions and, until the adoption of the *LRFD Specifications*, served as the national standard for the design of highway bridges. The final version of the *Standard Specifications* is based on the Service Load Design (SLD) and Load Factor Design (LFD) methodologies. AASHTO maintained the AASHTO *Standard Specifications* through 2000, and published the final comprehensive 17th Edition in 2002.

DOT&PF Application

See Chapter 23 for the use of the *Standard Specifications* on bridge widening and rehabilitation projects. Where the *Standard Specifications* apply, HS20 is the minimum highway live load for strength considerations in the application of the *Standard Specifications*. Use HS25 live-load on all Interstate bridges, major hauling routes, routes accessing major

shipping points (including the Port of Anchorage), and access routes to identified resource areas. The HS25 live-load model is defined as 1.25 times the HS20 live loading as provided in the *Standard Specifications*.

*10.4.4. Seismic Retrofitting Manual for Highway Bridges, May 1995**

The FHWA *Retrofitting Manual* is based primarily on research conducted during the development of the 1983 FHWA guidelines by the Applied Technology Council, current Caltrans Seismic Design Criteria, and recent research conducted at the University of California, San Diego and elsewhere. The *Retrofitting Manual* offers procedures for evaluating and upgrading the seismic resistance of existing highway bridges. Specifically it contains:

- a preliminary screening process to identify and prioritize bridges that need to be evaluated for seismic retrofitting;
- a methodology for quantitatively evaluating the seismic capacity of an existing bridge and determining the overall effectiveness of alternative seismic retrofitting measures; and
- retrofit measures and design requirements for increasing the seismic resistance of existing bridges.

The *Retrofitting Manual* does not prescribe requirements dictating when and how bridges require a retrofit. The decision to retrofit a bridge depends on a number of factors, several of which the *Retrofitting Manual* does not address. These include, but are not limited to, the availability of funding and political, social, and economic considerations.

* ***Note:*** *This document was replaced by the FHWA Seismic Retrofitting Manual for Highway Structures: Part 1 - Bridges, December 2009; however, Alaska's program will continue to be based on the 1995 Retrofitting Manual.*

DOT&PF Application

Use the *Seismic Retrofitting Manual for Highway Bridges*, May 1995, for retrofitting of highway bridges.

10.4.5. Guide Specifications for Seismic Isolation Design

AASHTO published the *Guide Specifications for Seismic Isolation Design* as a supplement to the *Standard Specifications for Seismic Design of Highway Bridges*. The *Guide Specifications for Seismic Isolation Design* presents specifications for the design of bearings to seismically isolate the superstructure from the substructure of highway bridges.

DOT&PF Application

Use this guide, where applicable, in conjunction with the *Guide Specifications for LRFD Seismic Bridge Design*.

10.4.6. ANSI/AASHTO/AWS Bridge Welding Code D1.5M/D1.5

The *Bridge Welding Code* presents current criteria for the welding of structural steel in bridges. The *Bridge Welding Code* superseded the AASHTO *Standard Specifications for Welding of Structural Steel Highway Bridges* and supplements the *Structural Welding Code*, AWS D1.1.

The *Code* includes a commentary on selected sections.

DOT&PF Application

DOT&PF has adopted the mandatory use of the *Bridge Welding Code D1.5* for the design and construction of structural steel highway bridges. However, for items not specifically addressed in D1.5, such as welding on existing structures, welding tubular members, or welding on reinforcing steel, refer to the current edition of ANSI/AWS D1.1 and ANSI/AWS D1.4.

10.4.7. LRFD Guide Specifications for Design of Pedestrian Bridges

The AASHTO *LRFD Guide Specifications for Design of Pedestrian Bridges* apply to bridges intended to carry primarily pedestrian traffic, bicycle traffic, or both. This document is based upon the LRFD design methodology.

DOT&PF Application

Use this guide for the design of pedestrian bridges in conjunction with the *LRFD Specifications*.

10.4.8. Guide Specifications for Distribution of Loads for Highway Bridges

The AASHTO *Guide Specifications for Distribution of Loads for Highway Bridges* provides more refined live-load distribution factors than the traditional S-over factors of the *Standard Specifications*. Although the refined equations appear similar, they are not the same as those provided in the *LRFD Specifications* and shall not be used with the *LRFD Specifications*. The equations in the *Guide Specifications* include the multiple-presence factors of the *Standard Specifications*, while those of the *LRFD Specifications*

include the differing multiple-presence factors inherent to it.

DOT&PF Application

This publication only applies to non-LRFD applications. Therefore, this document is only used when reverting back to the *Standard Specifications* for design.

10.4.9. Guide Design Specifications for Bridge Temporary Works

The AASHTO *Guide Design Specifications for Bridge Temporary Works* is used in construction specifications for falsework, formwork, and related temporary construction used to build highway bridge structures.

DOT&PF Application

Reference this publication in construction contracts where applicable. Note that this publication is not the appropriate standard for temporary detour bridges.

10.4.10. LRFD Movable Highway Bridge Design Specifications

The AASHTO *LRFD Movable Highway Bridge Design Specifications* addresses the design of movable highway bridges (including ferry transfer bridges) using the *LRFD Bridge Design Specifications*. This document provides guidance for the structural design and machinery design of swing, bascule and vertical-lift spans.

DOT&PF Application

Use this publication for the design of any movable bridges.

10.4.11. LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals

The AASHTO *LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* present structural design criteria for the supports of various roadside appurtenances. The publication presents specific criteria and methodologies for evaluating dead load, live load, ice load, and wind load. This publication also includes criteria for several types of materials used for structural supports such as steel, aluminum, concrete, and wood.

DOT&PF Application

Use this publication when designing signs, luminaires, and signals.

10.4.12. Guide Specification and Commentary for Vessel Collision Design of Highway Bridges

The *AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges* is a comprehensive publication that includes information relative to designing bridges to resist vessel collision damage. As feasible, it is based on probabilistic principles. The *LRFD Specifications* contain only the load section of this document. The *Guide Specification and Commentary for Vessel Collision Design of Highway Bridges* contains more comprehensive information.

DOT&PF Application

Use this guide for the design of vulnerable highway bridges.

10.4.13. AISC Steel Construction Manual

The *Steel Construction Manual*, published by the American Institute of Steel Construction (AISC), provides dimensions, properties, and general design guidance for structural steel for various applications. The AISC *Manual* contains AISC allowable stress design and load-and-resistance factor design method criteria for steel buildings. However, the properties of the rolled structural shapes are sometimes useful for designing bridge structures.

DOT&PF Application

Use this AISC manual only where it addresses items not in the *LRFD Specifications* and with the approval of the Chief Bridge Engineer.

10.4.14. AREMA Manual for Railway Engineering

The AREMA *Manual for Railway Engineering*, published by the American Railway Engineering and Maintenance-of-Way Association (AREMA), provides detailed structural specifications for the design of railroad bridges. The AREMA specifications have approximately the same status for railroad bridges as the *LRFD Specifications* have for highway bridges; i.e., the structural design of railroad bridges must meet the AREMA requirements.

DOT&PF Application

Occasionally, DOT&PF is responsible for the structural design of railroad bridges. Use the specifications of the AREMA *Manual*, except as modified by the Alaska Railroad Corporation. In addition, the AREMA *Manual* contains requirements

for the geometric design of railroad tracks passing beneath a highway bridge. See Chapter 24.

10.4.15. Other Structural Design Publications

Many of the other available structural design publications may, on a case-by-case basis, be useful. The design engineer is responsible for verifying the adequacy of any member proportions, details or practices in these publications to ensure that they are consistent with the *LRFD Specifications*. The following briefly describes several of these structural design publications:

- *Prestressed/Precast Concrete Institute (PCI) Design Handbook*. This publication includes information on the analysis and design of precast and/or prestressed concrete products in addition to a discussion on handling, connections, and tolerances for prestressed products. It contains general design information, specifications, and standard practices.
- *Prestressed/Precast Concrete Institute (PCI) Bridge Design Manual*. This design manual includes both preliminary and final design information for standard girders and precast, prestressed concrete products and systems used for transportation structures. This document contains background, strategies for economy, fabrication techniques, evaluation of loads, load tables, design theory, and numerous complete design examples. This publication explains and amplifies the application of both the *Standard Specifications* and *LRFD Specifications*.
- *Post-Tensioning Institute (PTI) Post-Tensioning Manual*. This publication discusses the application of post-tensioning to many types of concrete structures, including concrete bridges. It also discusses types of post-tensioning systems, specifications, the analysis and design of post-tensioned structures, and their construction.
- *Concrete Reinforcing Steel Institute (CRSI) Handbook*. This publication meets the ACI Building Code Requirements for Reinforced Concrete.
- *National Steel Bridge Alliance (NSBA) Highway Structures Design Handbook*. This document addresses many aspects of structural steel materials, fabrication, economy, and design, and it includes LRFD examples; the general computational procedure is helpful to bridge engineers using the *LRFD Specifications*.
- *American Concrete Institute (ACI) — Analysis and Design of Reinforced Concrete Bridge Structures*. This publication contains information on various concrete bridge types, loads, load factors, service and ultimate load design, prestressed concrete, substructure and superstructure elements, precast concrete, and reinforcing details.
- *CRSI Manual of Standard Practice*. This publication explains generally accepted industry practices for estimating, detailing, fabricating, and placing reinforcing bars and bar supports.
- *PTI — Post-Tensioned Box Girder Bridges.* This publication contains information on economics, design parameters, analysis and detailing, installation, prestressing steel specifications, post-tensioning tendons, systems, and sources.
- *United States Department of Agriculture (USDA) Forest Service Timber Bridge Manual*. This *Manual* addresses all aspects of traditional timber bridge construction plus the latest developments in laminated deck systems using adhesives or prestressing forces.
- *Timber Construction Manual*. This document, published by the American Institute of Timber Construction (AITC), provides criteria for the design of timber structures, including bridges, for both sawn and laminated timber.
- *International Building Code*. This document, published by the International Conference of Building Officials (ICBO), provides criteria for the design of buildings.
- NCHRP 343 *Manuals for Design of Bridge Foundations*. This publication provides additional information on the application of the *LRFD Specifications* to foundations.
- *American Concrete Institute (ACI) 318-05 Building Code Requirements for Structural Concrete*. This document addresses the proper design and construction of structural concrete buildings. Although this document is intended for building design, bridge engineers find it useful because it provides more detail on aspects of concrete design that are less typical in highway bridges.

- PCA *Notes on ACI 318-02 Building Code Requirements for Structural Concrete with Design Applications*. The PCA Notes assist the engineer in the proper application of the ACI 318-02 design standard, which is the predecessor to ACI 318-05. Numerous design examples illustrate the application of the *Code* provisions.

10.5. *Alaska Highway Preconstruction Manual*

10.5.1. General

The *Manual* includes the following chapters:

- Chapter 2 "Organization"
- Chapter 4 "Project Development Process"
- Chapter 5 "Public Involvement and Agency Coordination"
- Chapter 10 "Highway Capacity"
- Chapter 11 "Highway Design"
- Chapter 12 "Non-Motorized Transportation"
- Chapter 14 "Traffic Safety in Work Zones"

Chapters 4 and 11 have the most application to the development of bridge plans by the Bridge Section.

10.5.2. Chapter 4 "Project Development Process"

Chapter 4 establishes procedures and guidance for developing federal-aid and state-funded highway capital improvement projects from project development authorization to construction contract award. The chapter addresses the following topics:

- preparing the environmental document
- preparing the Design Study Report (DSR)
- developing a set of project construction plans
- conducting field reviews
- advertising and award

10.5.3. Chapter 11 "Highway Design"

Chapter 11 of the *Alaska Highway Preconstruction Manual* is the preeminent design standard for the Department. This chapter interprets, amends, and augments AASHTO policies for application to DOT&PF projects. All designs should satisfy the minimum values in the *Manual* consistent with topographic, cultural, and economic conditions.

Several sections within Chapter 11 apply directly to bridges (e.g., vertical clearance, bridge rails). Review these sections when designing a bridge.

10.6. Bridge Identification

10.6.1. Structure Number Assignment

The Bridge Management Unit is responsible for assigning structure numbers to all structures. The four-digit structure numbers are assigned sequentially. 0001 to 2999 are reserved for highway bridges, 4001 to 4999 are used for highway culverts, 6001 to 6999 are DOT&PF-owned pedestrian minor structures, and 7001 to 7999 are DOT&PF-owned minor structures carrying highway traffic.

10.6.2. Bridge Type Names

Name bridge structures in accordance with the information provided below and in Figure 10-2. The following applies:

Bridges crossing rivers, creeks, streams, and other bodies of water.

The bridge is named for the body of water being crossed (e.g., Gastineau Channel Bridge). Adding the location (e.g., Tanana River Bridge at Tok) or the name of the road (e.g., Campbell Creek Bridge at C Street) can further modify this name.

Railroad grade separation structures

These are always either "overheads" or "underpasses." Standing on the railroad and describing the relative location of the street or highway identifies the proper name. These structures are further named by their location or the street or highway involved. For example, the Eklutna Overhead carries the Glenn Highway *over* the Alaska Railroad near Eklutna. The Parks Highway passes *under* the railroad tracks at the Parks Highway Underpass.

Local streets and roads crossing state highways at "overcrossings" or "undercrossings"

Standing on the highway and describing the relative location of the street or road identifies the proper name. These structures are further named by the street involved (e.g., the Muldoon Overcrossing carries Muldoon Road *over* the Glenn Highway).

Two state highways cross each other at a "separation"

Alaska has few separation structures.

Pedestrian pathways

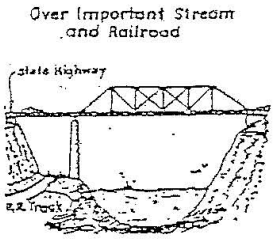
These use the same names as indicated above with the addition of the word "pedestrian." For example, Montana Creek Pedestrian Bridge. Pedestrian overcrossings (POCs) are frequently named for their location or vicinity. For example, the East High POC is located adjacent to East High School in Anchorage.

Crossing multiple features.

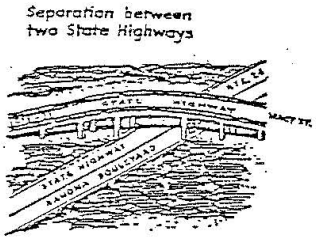
When a bridge crossing multiple features, the bridge is named according to the predominate feature in the following order of precedence:

- Bodies of water,
- State highways,
- Local roads,
- Railroads.

BRIDGE

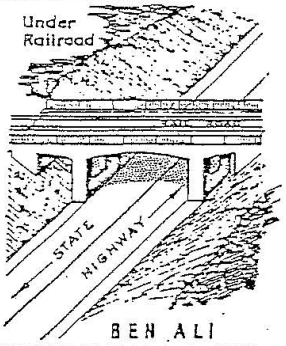


BRIDGE



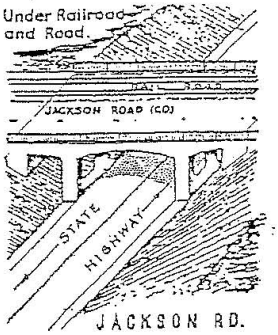
MACY-RAMONA
(OR RTE 2 – RTE 25)

SEPARATION



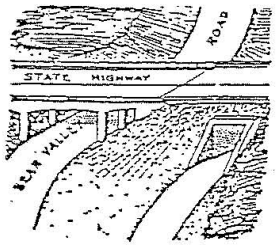
BEN ALI

UNDERPASS



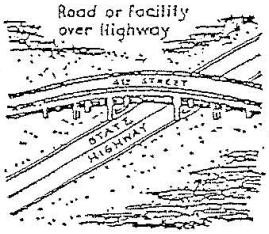
JACKSON RD.

UNDERPASS



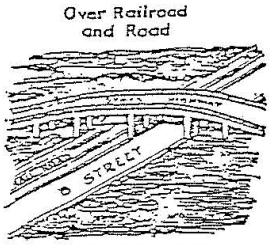
BEAR VALLEY RD &
BEAR VALLEY PEDESTRIAN

UNDERCROSSING



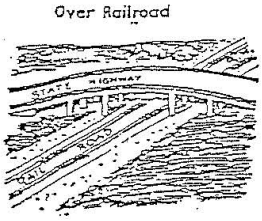
4TH STREET

OVERCROSSING



B STREET

OVERHEAD



BEN ALI

OVERHEAD

Figure 10-2
Bridge Type Names