

## 11. Sampling and Testing the Contractor's Work

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### 11.1. Materials' Acceptance

The project engineer is responsible for determining the acceptability of all material incorporated into the project. The contract and the project's Materials Testing Guide List show the tests or certifications required to determine a material's acceptability. Materials, with few exceptions, must meet the contracts' quality requirements before they can be accepted and paid for; one notable exception is pay items that specify reductions in payment for material that fails to meet quality standards.

There are three general categories of materials that are incorporated into projects: (1) materials manufactured or fabricated off-site, which are accepted based on manufacturer's certifications and/or off-site testing and inspections; (2) materials produced off-site or on-site that the project materials staff test for acceptability at the point of incorporation into the project; (3) materials incorporated directly into the project without any processing, which the project materials staff test for acceptance at the point of incorporation.

The first category includes items such as steel girders, timbers, concrete beams, and electrical items.

Acceptance of these items is based on the review and approval of materials submittals (Section 8.3). The second category is typified by processed aggregates and aggregate-based products, while the third category includes unprocessed materials such as soils, sands, or aggregates. On-site testing is the basis of acceptance of the last two categories of pay items.

### 11.2. Materials Testing Summary

During the course of the project, the project engineer uses the project's Materials Testing Summary to determine the frequency of tests to perform on each pay item. As the project engineer completes each type

of test on a pay item, he/she should summarize the results of all those tests on the final Materials Testing Summary (Section 5.4). The project engineer should keep the summary current as the project progresses. At project completion, the regional quality assurance/materials unit and the project engineer will review the completed summary prior to co-signing the Project Materials Certification.

### 11.3. Mix Designs

On projects containing **asphalt paving**, the contract specifies whether the contractor or the Department is responsible for designing the hot asphalt mix. If the contractor has the responsibility, a private laboratory must prepare the contractor's mix design and an Alaska-licensed professional engineer must seal it (12 AAC 36.190). Prior to the start of paving, the contractor must submit the proposed mix design, along with laboratory test results from the design, to the project engineer at the time specified in the contract. The project engineer will provide copies of the mix design to the group chief/PM and the regional quality assurance/materials unit. All mix designs, including transfers, require the approval of the regional quality assurance or materials engineer.

If the Department is responsible for the design, the contractor must submit the required samples of aggregate, asphalt, and anti-stripping agent, along with a final mix of gradation, to the project engineer at the time specified in the contract before the start of paving. The project engineer usually relies on the regional quality assurance/materials unit for preparation of the mix design and provides them with the contractor's samples.

On projects containing **structural concrete**, the contract either specifies the mix requirements or specifies that the Department will design the mix using materials provided by the contractor. The contractor must submit samples of the cement, the coarse and fine aggregates, and the air-entraining agent to the project engineer for the design, well in advance of the placement date. The project engineer will rely on the regional quality assurance/materials unit for preparation of this mix design. All mix designs, including transfers, require the approval of the regional quality assurance or materials engineer. Additives will not be approved in the field.

If additional mix designs are necessary for any reason once paving has begun, they are handled in the same manner as the original design. The contract requires that mix designs be approved prior to their use.

#### **11.4. Sampling, Testing and Transmitting Materials**

The Materials Testing Frequency Guide provides the project engineer with a complete list of material tests and testing frequencies for all materials included under each pay item contained in the original contract. Applying the frequencies in the airport or highway Material Sampling & Testing Frequency tables with the material quantities in the contract make up the guide. The contractor receives the guide at the preconstruction meeting. Update the Materials Testing Frequency Guide after items are added by change documents. The project engineer uses the guide as a baseline for scheduling project staff and material tests for acceptance.

On FAA projects, modifications of the Materials Sampling & Testing Frequency Table in the Specifications and the ACM require the FAA's approval. See sections 18.10 and 18.11 for Material Sampling & Testing Frequency tables for airport projects.

For non-NHS highway projects, the project engineer may request a modification to the testing frequency based on local conditions. **The regional materials engineer/quality assurance engineer must approve any modification.**

The five broad categories of tests performed on project materials:

- Quality
- Information
- Quality control (by contractor)
- Acceptance
- Independent assurance

The contractor is responsible for quality control throughout the project life. Sample the materials for quality at the source. Independent assurance tests are sampled on the project site with half transported to the regional lab for testing.

Perform *quality tests* on material sources prior to use on a project to determine usable materials. Material is

tested to determine soundness, wear, deleterious substances, and physical and chemical properties. The Department runs quality tests for a new materials source developed or used during the project. The project materials staff is responsible for taking the samples and shipping them to the regional lab for testing.

The project engineer has the discretion to take *information tests*. Informational testing should be limited. Information tests are not needed if the contractor performs QC. These tests may be used to:

- Evaluate materials during the production process
- Check on the contractor's quality control program
- Evaluate the condition of materials placed in a stockpile prior to making stockpile payment
- Provide helpful information in reviewing changes in materials sources

Prior to the preconstruction meeting, the contractor performs **quality control (QC) tests** after submitting a quality control program for review and approval by the project engineer. QC testing involves skillful inspection, sampling and testing of materials, data analysis, and specific action to maintain the specified overall quality of a product or service. It requires the expertise to make timely corrective adjustments to achieve and maintain acceptable levels of quality or service. QC means that the contractor or supplier maintains control of the manufacturing processes. QC work performed by the manufacturers or service provider encompasses inspection and frequent testing to ensure that manufactured items meet the contract requirements. QC elements include:

- Methods for producing and controlling the materials
- Regularly sampling and testing the materials by qualified personnel
- Materials engineering — evaluating test results
- Adjusting the control process when needed, to produce materials within specifications
- Monitoring trends — making refinements when needed
- Inspection (plant, materials, and construction techniques)

**Acceptance testing** is the Department’s responsibility. Acceptance tests determine the acceptability of a particular lot of material incorporated into the project. Do not use acceptance tests to control the contractor’s work. The contract spells out the particular tests. Cross-reference failing tests to a subsequent passing retest in an adjacent area, or to corrective actions taken by the contractor if pass/fail sampling and testing are used. Perform all acceptance tests with WAQTC qualified technicians and in WAQTC qualified laboratories. On airport projects, WAQTC qualified technicians are allowed in place of National Institute for Certification in Engineering Technologies (NICET) qualified technicians for acceptance testing in asphalt.

The two categories of acceptance tests for pay items are:

- Quality level analysis (QLA) sampling and testing, used when specifications require price adjustments
- Pass/fail sampling and testing, used when price adjustment is not a factor

The project engineer and the materials technicians shall use the specifications and the sampling and testing procedures according to the contract.

The project engineer or the inspector select the time and place of pass/fail sampling and testing. Failing test results require corrective action by the contractor, followed by resampling and retesting. The number of passing tests must meet minimum frequency requirements.

A random sampling program determines sampling points for QLA testing. Statistically analyze the test results to determine the overall quality level of the material incorporated into the project. Adjust the amount paid to the contractor under the pay item to account for the quality level using a specified table or formula. Note that FHWA and FAA have different tables and formulas to follow for the QLA. There must be no resampling or retesting of either failing or passing samples in order to maintain integrity of the statistical randomness of the program. The contractor may request a retest, if allowed by the contract.

The Department’s policy does not allow the use of contractor quality control tests for acceptance.

Perform **independent assurance tests** to check the reliability of the project’s acceptance sampling and

testing. The project engineer notifies the roving materials inspector to take an independent assurance test. A WAQTC qualified project staff member not involved in the acceptance test process may take the samples if the roving materials inspector is not available. Split the samples with half of the sample being tested in the field lab and the other half of the sample being tested by the regional lab. The regional lab will report the results of both tests on the same form and will compare the results. The regional lab then reports the comparison back to the project engineer and the materials rover, who are responsible for resolving any out-of-tolerance variances in the test results.

Use the following table when comparing independent assurance and acceptance test results. Both independent assurance and acceptance test results must be entered on the same reporting form. **The regional materials engineer/quality assurance engineer or designee must sign the form signifying that a comparative analysis has been made.**

| <b>Guidelines for Comparing Independent Assurance and Acceptance Test Results</b> |                           |
|---|---------------------------|
| <b>Type of Test</b>   | <b>Maximum Difference</b> |
| <b>All Gradations:</b>  |                           |
| Greater than +1”  | 8%                        |
| 1” to +1/2”   | 6%                        |
| ½” to No. 4   | 4%                        |
| No. 4 to + No. 100  | 3%                        |
| No. 100 to + No. 200  | 2%                        |
| No. 200   | 2%                        |
| <b>Atterberg Limits</b>   |                           |
|   | 1%                        |
| <b>Asphalt Concrete Pavement</b>  |                           |
| Asphalt Content:  |                           |
| Ignition oven   | 0.2%                      |
| Nuclear Content Gauge   | 0.2 %                     |

|   |         |
|---|---------|
| MSG Variance  | 0.02    |
|   |         |
| <b>Asphalt Core Densities</b>                       | 2%      |
|   |         |
| <b>Densities:</b> Soils, gravels, sand combinations | 4 pcf   |
| Standard Densities                                  | 4 pcf   |
|   |         |
| <b>Flat and Elongated</b>                           | 2%      |
|   |         |
| <b>Fracture</b>                                     | 10%     |
|   |         |
| <b>Moistures:</b> Soils and aggregates              | 1.0%    |
|   |         |
| <b>Portland Concrete Cement:</b>                    |         |
| Air Content   | 1.5%    |
| Flexural & Compressive Strength                     | 85-115% |
| Slump:  |         |
| Less than 3"  | ½ inch  |
| 3" to 5"  | ¾ inch  |
| Greater than 5"                                     | 1 inch  |
| Unit Weight   | 2 pcf   |
|   |         |
| <b>Sand Equivalent</b>                              | 8       |

The project engineer or inspector notifies the roving materials inspector in advance of any need for sampling or testing. Either the materials lab staff or, on smaller projects, the inspector qualified in the WAQTC Sampling Module will perform the materials tests. The person performing the test and the person who checks the results sign the test results.

For information on rounding procedures and significant decimals used in calculating materials test results, see Section 4.6.

The materials lab staff shall provide the project engineer, the inspector, and the contractor with timely test results.

When the regional laboratory is accredited to run the acceptance tests, the independent assurance tests may be waived or will be run in another regional laboratory or on separate equipment and by technicians not running the acceptance tests. The project engineer shall provide copies of all tests performed in the field laboratory to the contractor, the group chief/PM, and the quality assurance/materials unit with each project construction report.

Samples sent to an off-site laboratory must have a submittal sheet identifying the sample. Retain a copy of the submittal sheet for the field lab records. The submittal sheet shall have the following information to help the receiving lab positively identify the sample (see Table VII in the Appendix):

- Department, project name, and number
- Type of sample and sample number
- Tests desired
- Source the material came from
- Location where the sample was taken
- Specification pay item and quantity represented by the sample
- Description of the sample
- Date of the sample and the name of the sampler

### 11.5. Dispute Resolution

At the first level of dispute between test results, WAQTC-qualified laboratories will have precedence over non-WAQTC-qualified laboratories. AASHTO-accredited laboratories will have precedence over WAQTC-qualified laboratories.

### 11.6. Structural Welding

Structural welding is a critical item of work that requires close coordination between the project engineer, group chief/PM, the contractor, the design engineer of record (DER), the technical welding advisor (TWA), the state quality assurance consultant (when used) and the state materials engineer (SME). Close coordination is required prior to and during construction. The administrative requirements for structural welding are complex and may often involve

all of the aforementioned project team members. This section describes areas of responsibility and procedures specific to structural welding, unless otherwise stated in the contract.

### **General**

The contractor is responsible for quality control (QC) inspection and testing. The Department has the prerogative to conduct quality assurance (QA) and acceptance inspection and testing.

The chief bridge engineer will designate a member of his staff as a technical welding advisor (TWA). The primary responsibilities of the TWA are:

1. Assist the DER in developing the scope of QC inspection required for the plans and specifications
2. Develop the scope of services for contracting the quality assurance welding inspection and nondestructive examination (NDE) when required
3. Review the contractor's welding plan and inspection reports when QA consultants are not utilized

The Statewide Materials Section maintains a consultant term contract for QA welding inspection and NDE conducted on materials fabricated outside of Alaska.

The project engineer shall contact the TWA during the initial review of the project plans and specifications, if his or her project involves structural welding. The TWA will review specifications, plans, NDE requirements, and in conjunction with the DER and project engineer, determine if a QA consultant is required to inspect the welding and/or fabrication. If a QA consultant is required, the project engineer must follow the Term Contracts and Job Order Procedures in Section 11.7.

### **Shop Welds**

The fabricator (that is, the contractor) is responsible for the QC inspection.

All shop welding is subject to QA inspection at the Department's discretion. When QA is required, the project engineer will forward the fabricator's welding plan to the QA consultant. The QA consultant will review the required Welding Procedure Specifications (WPSs), the Procedure Qualification Records (PQRs),

Welder Performance Qualification Records (WPQRs), qualifications of the fabricator's QC inspector, fabricator's NDE technician qualifications, and the fabrication quality control (QC) program. Once the contractor's welding plan satisfies contract requirements, the QA consultant forwards the documents to the project engineer. The QA consultant will monitor fabrication and/or welding and conduct/supervise NDE testing as required by the contract. The QA consultant will forward post-fabrication/NDE reports to the project engineer. The QA consultant will advise the project engineer as to whether or not the project satisfies contract requirements.

When the QA consultant is not used, the project engineer will submit the fabricator's welding plan to the TWA. The TWA will review the contractor's welding plan and advise the project engineer on whether or not the welding plan satisfies contract requirements. The TWA's points of contact would be the project engineer and the DER for all welding matters concerning the structure.

### **Field Welds**

The contractor is responsible for QC inspection.

All field welding is subject to QA inspection at the Department's discretion. When QA is required, the project engineer forwards the contractor's welding plan to the QA consultant. The QA consultant will review the required WPSs, the PQRs, WPQRs, qualifications of the contractor's QC inspector, and the contractor's NDE technician qualifications. The quality assurance consultant will also review materials certifications and statements of origin. Once the contractor's welding plan satisfies the contract requirements, the QA consultant forwards the documents to the project engineer. The QA consultant will monitor the field welding and conduct/supervise NDE as required by the contract. If the QA consultant recommends a field weld inspection, it is the project engineer's responsibility to coordinate and schedule the inspection with the contractor. If the QA consultant determines that field welding is not in conformance with the contract, the QA notifies the project engineer and the TWA. The QA consultant will forward post-welding/NDE reports to the project engineer.

If the quality assurance consultant is not used, the project engineer submits the contractor's welding plan to the TWA. The TWA will review the contractor's

welding plan and advise the project engineer on whether or not the welding plan satisfies contract requirements. The TWA's points of contact would be the project engineer and the DER for all welding matters concerning the structure.

### **11.7. Term Contracts and Job Order Procedures**

Statewide Materials manages three quality assurance (QA) term contracts. The contracts are for:

- Pre-stressed and precast concrete, field welding and coating inspection.
- Soils, aggregate, asphalt and concrete inspection, sampling, and testing.
- Out-of-state fabrication, inspection, sampling, and testing.

A Notice to Proceed (NTP) is issued to the regional Construction Section. The responsible parties are:

- State materials engineer is the contracting officer for the term contracts. Statewide Materials has a contract manager for the term contracts.
- Regional construction engineer approves each job order.
- Construction project manager negotiates each job order.
- Regional construction contract coordinator issues the job order.
- Project engineer oversees the work by the term contractor.
- Construction project manager recommends payment of invoice for inspection services by the term contractor.

The construction project manager in conjunction with the design engineer of record and the technical welding advisor contacts the term contractor with a request for services, develops the scope of services and job order budget with the term contractor.

The regional construction contract coordinator prepares job order documents, acquires approval signatures, encumbers the funds and maintains an accurate log of job order activity.

On FAA projects, no time and materials is allowed, the contract shall be for cost plus a fixed fee. On

FHWA projects, time and materials is allowed, the contract may be for time and materials for determining the cost of the scope of work and a fixed fee to perform the work.

The term contractor shall not perform any services or incur billable expense under this agreement without receipt of an approved job order from the regional construction contract coordinator. The term contractor may not work overtime on any project without written authorization, in advance, from the construction project manager.

Inspection services performed by non-approved QA inspectors will not be acceptable, and the Department will not reimburse associated costs. The Department reserves the right to withdraw approval of any inspector by written notice to the term contractor.

When time is of the essence, the Department's project manager will conduct the request for proposal and negotiation process orally. Following these negotiations, the contracting officer for the term agreements may orally authorize a job order, and will follow it with a written confirmation, generally within two working days of the verbal job order.

Written overtime authorization for the term contractor may be included in the job order and/or in a written directive by the project manager/project engineer. Amendments to the term contract are by the contract manager and approved by the contracting officer. Verbal authority to proceed is given only by the contracting officer.

Total job orders may not exceed the total of the regional NTP for that term contract. A new job order is required if there is a change in:

- Performance period
- Scope of services and/or
- Compensation amount

An NTP can be written for a whole project when the limits of the regional NTP need to be exceeded. Job orders may not exceed \$40,000. The regional contract coordinator, project manager, and project engineer must monitor each job order for percent complete and percent of budget expended. When there are questions about this procedure, contact the contract manager in Statewide Materials.

Washington Department of Transportation may provide pre-stressed/pre-cast inspection on a Reimbursable Services Agreement when they are available to do the work.

For in-state field welding inspection with no term agreement in place, a Letter of Agreement for contract inspection services for less than \$5,000 and inspection services for more than \$5,000 will be done by a Professional Services Agreement (PSA) through the PSA unit.



