

# 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, the project's Materials Testing Summary, and the Materials Certification 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 & Modifying MSTF Tables

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.

The Materials Testing Summary is prepared by project staff or quality assurance staff. If it is prepared by project staff it should be reviewed by quality assurance staff. It provides the Project Engineer with a complete list of material tests and testing frequencies for all testable materials included under each pay item in the contract. The Materials Testing Summary is developed from the frequencies in the airport or highway Material Sampling & Testing Frequency (MSTF) tables, and the material quantities in the contract. The project staff will update the Materials Testing Summary if items are added by change documents or quantities change.

The Materials Testing Summary is provided to the contractor.

The Project Engineer uses the Materials Testing Summary as a baseline for scheduling project staff and material tests for acceptance. Complete a final Materials Testing Summary by the end of the project. See Section 5.4 for more information.

### 11.2.1 Modifying MSTF Tables

The non-project specific MSTF tables are on the D&ES Statewide Materials website at:

[http://www.dot.state.ak.us/stwddes/desmaterials/material\\_resource.shtml](http://www.dot.state.ak.us/stwddes/desmaterials/material_resource.shtml).

On FAA projects, modifying the Materials Sampling & Testing Frequency Table requires FAA approval if it reduces the frequency or type of testing.

For FHWA projects on NHS routes, modification of the Materials Sampling & Testing Frequency Table requires FHWA approval if it reduces the frequency or type of testing.

For FHWA projects on non-NHS routes and other non-FHWA highway projects, the Project Engineer

may request a project specific modification to the testing frequency based on local conditions. The regional materials engineer/quality assurance engineer must approve any modification.

### **11.3. Mix Designs**

#### **11.3.1 Asphalt Paving**

On projects containing asphalt paving, the contract specifies the design parameters of the mixture. The Department must approve the mix design before the contractor uses mix on the project. All mix designs, including transfers from previously approved mix designs on other projects, require the approval of the regional quality assurance or regional materials engineer (RQE or RME).

#### **11.3.2 Department Furnished Mix Design**

The contractor must submit samples of aggregate, asphalt, and anti-stripping agent, along with information on aggregate stockpile gradations, proposed blend ratios of stockpiles, and proposed gradation of final mix, to the Project Engineer. The samples must be submitted at least 15 days before production of hot mix asphalt.

The Project Engineer will transfer the contractor's samples and proposed aggregate gradations to the RQE or RME. The Department's materials lab will develop the job mix design in conjunction with RQE or RME and send test results and approved oil content in a lab report to the Project Engineer.

The Project Engineer will transmit the lab report to the contractor.

#### **11.3.3 Contractor Furnished Mix Design**

When the contractor is responsible for the job mix design, they must use an AASHTO accredited laboratory to prepare the contractor's mix design and an Alaska-licensed professional engineer must seal it (12 AAC 36.190). At least 15 days prior to the start of paving, the contractor must submit the sealed 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 transfer copies of the mix design to the RQE or RME.

The RQE or RME will review the mix design, and may require the contractor to submit materials for verification.

When the mix design is approved, the Project Engineer will notify the contractor.

#### **11.3.4 Concrete**

On projects containing structural concrete or concrete pavement, the contract specifies the requirements for the mix design. The concrete mix design is usually prepared by the company that will supply concrete to the project, or by a qualified testing laboratory hired by them.

All mix designs except prestressed concrete, including transfers from previously approved mix designs on other projects, require the approval of the RQE or RME. They may require the contractor to submit materials for verification. Mix designs for prestressed concrete members require the approval of the statewide materials engineer.

When the mix design is approved, the Project Engineer will notify the contractor.

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

The five broad categories of tests performed on project materials are:

- Contractor Quality Control
- Source Quality Testing
- Acceptance
- Independent Assurance
- Information

#### **11.4.1 Contractor Quality Control (QC) – Contractor Testing and Process Control**

The Contractor is responsible for the quality of construction and materials used in the work. Quality control is also process control, and includes all activities that ensure the construction and materials meet contract requirements. All QC work is performed by the contractor.

Contractor QC testing involves inspection, sampling and testing of materials, data analysis, and specific action to maintain the specified overall quality of the construction and materials. It requires the expertise to make timely corrective adjustments in order to achieve and maintain acceptable levels of quality or service. The contractor or supplier must maintain control of the manufacturing processes. In addition, QC work performed by the manufacturers or service provider includes inspection and adequate testing to

ensure that manufactured items meet the contract requirements.

When the contract requires the Department to review a QC plan, the contractor must submit their QC plan to the Project Engineer, prior to the preconstruction conference. The Project Engineer or Regional Quality Assurance staff will review the submittal. When the QC plan is found to meet contract requirements, the Project Engineer will notify the contractor in writing.

QC elements may include, but are not limited to:

- Schedule for permits, working drawing submittals, materials submittals, and mix design submittals
- QC personnel and qualifications
- Methods for producing and controlling the materials
- Regularly sampling and testing the materials
- Evaluating test results including action and suspension limit charts
- Adjusting the control process when needed, to produce materials within specifications
- Monitoring trends making refinements when needed
- A corrective action plan describing the action that will be taken when a process is out of control
- Inspection (plant, materials, and construction techniques)

#### **11.4.2 Source Quality Testing**

Usually the Department performs tests on aggregate material sources prior to the contractor developing the material source or prior to transporting aggregate to a project. Aggregate material is tested to determine soundness, wear, deleterious substances, and physical and chemical properties. The project staff is responsible for taking representative samples and shipping them to the regional lab for testing.

The contractor may also sample source material in the presence of project staff.

The project staff should be aware that sources may have variability.

#### **11.4.3 Acceptance Testing**

The Department is responsible for performing acceptance sampling and testing. The contractor QC test results are not allowed for use in acceptance testing determination.

Acceptance tests determine the acceptability of a particular lot of material incorporated into the project. The contract spells out the particular tests required. The Alaska Test Methods Manual describes most of the required test procedures for earthwork, bases and aggregates, asphalt, and concrete.

Perform all acceptance sampling and testing with WAQTC qualified technicians using equipment meeting WAQTC specifications. When material is sampled by others, the sampling must be witnessed by Department personnel and the sample transferred to Department personnel immediately.

The two categories of acceptance tests for pay items are:

- Pass/fail sampling and testing,
- Quality level analysis (QLA) sampling and testing, used when specifications include price adjustments

#### **Pass/Fail**

The Project Engineer or the materials inspector select the time and place of pass/fail sampling and testing.

Failing test results require corrective action by the contractor and retesting by the Department. The number of passing tests must meet minimum frequency requirements.

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.

#### **Quality Level Analysis**

The Project Engineer uses the project's Materials Testing Summary to determine the frequency of tests to perform on each pay item. A stratified random sampling program determines sampling points for QLA testing. The test results are statistically analyzed to determine the overall quality level of the material and construction. The amount paid to the contractor is adjusted for 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 apply the QLA. The contractor may request a retest, if allowed by the contract.

#### **11.4.4 Signing and Releasing Test Results**

Project staff shall make every reasonable effort to sample and test material in a timely manner. The testing technician shall provide the Project Engineer with test results as soon as practicable after the test is complete.

The Project Engineer shall provide the contractor with acceptance test results as soon as practicable after the acceptance tests are complete and the results are available.

For acceptance testing the person performing the test and the person checking the results must both sign the test report.

Upon request from the contractor the Project Engineer (including consultants) will provide hot mix asphalt draft test results. This is with the understanding that the test results are not checked and they may contain errors. All such test results should be marked "DRAFT".

#### **11.4.5 Off-Site Laboratories**

Samples sent to an off-site laboratory must have a transmittal sheet identifying the sample. Retain a copy of the transmittal sheet for the field lab records. Include the following information in the transmittal sheet to help the receiving lab positively identify the sample (see SP 12 in Alaska Test Methods Manual or Table VII in the ACM Appendix):

- Department, project name, and number
- Type of sample and sample number
- Tests required
- Source the material came from
- Location where the sample was taken indicated by station, offset, and layer or depth; or by GPS coordinates
- Specification pay item and quantity represented by the sample
- Description of the sample
- Date of the sample and the name of the sampler with WAQTC qualification number
- Do not write information on sample lids.

#### **11.4.6 Independent Assurance Program**

Independent Assurance (IA) serves to assure an unbiased and independent evaluation of the sampling and testing procedures used in the acceptance program. The IA Program performs audits that are both procedural and equipment based, that are separate from the project's material acceptance sampling and testing program. There are two methods to IA: the Project Approach and the System Approach.

The RQE will select either the Project or System approach to be used on each project.

Technicians that are performing sampling and testing materials for acceptance, must be qualified under the WAQTC Program.

Technician qualification status is listed at: [www.dot.state.ak.us/stwddes/desmaterials/mat\\_resource.shtml](http://www.dot.state.ak.us/stwddes/desmaterials/mat_resource.shtml).

An Active Testing Technician (ATT) is defined as a person who is qualified under the WAQTC Program, and is performing sampling and testing on DOT&PF projects in the reporting period. A technician is considered active only for the tests that they are performing sampling and testing for during the reporting period.

IA Inspectors (Quality Assurance Rovers or agency designated representatives) perform IA evaluations. All test procedures used in the IA Program are in the Alaska Test Methods Manual (ATMM) and AASHTO T 22.

The IA tests and frequencies listed in this section are minimums, additional evaluations and testing may be performed at the discretion of the Project Engineer, RQE or IA Inspectors.

When acceptance testing is performed in the Department's Regional Laboratories that are accredited in the specified test method, IA testing is not required. If the regional laboratories perform acceptance testing and choose to perform IA testing, they must use different personnel and equipment for IA testing than was used for acceptance testing.

#### 11.4.6.1 Independent Assurance (Project Approach)

The Project Approach evaluates project testing personnel and equipment used in the acceptance decision on each project. The Project Approach requires IA evaluation frequencies on a per pay item per project basis as detailed in the MSTF tables.

The Project Engineer must provide adequate notice to the project IA inspector that the IA test is due.

**Lab Tests:** To perform acceptance/IA laboratory testing (e.g. split sample for aggregates, soils, HMA) the technician shall:

1. Sample the material
2. Split the acceptance/assurance sample in the presence of the IA Inspector, when possible.
3. Test the acceptance portion (or split) in the field lab
4. Submit the assurance portion through the IA inspector to the Regional Materials Lab
5. Report acceptance test results through the IA inspector to the Regional Materials Lab

Using Table 11-1, the Regional Materials Lab reports the comparison of IA and field acceptance test results, to the Project Engineer and the IA inspector. The IA Inspector will investigate out-of-tolerance variances between the acceptance and IA test results.

**Field Tests:** To perform acceptance/IA field testing (e.g. concrete, densities) the technician shall:

1. Sample in presence of the IA Inspector
2. Test concurrently with or while being observed by, the IA Inspector
3. Report acceptance test results to the IA Inspector
4. Obtain the report from the IA Inspector that compares the acceptance and IA test results

The IA Inspector will investigate out-of-tolerance variances in the test results and report findings to the RQE and Project Engineer.

Use Table 11-1 when comparing acceptance and independent assurance test results. The RME, RQE, or designee must validate that a comparative analysis has been made.

**Table 11-1**

<b>Guidelines for Comparing Independent Assurance and Acceptance Test Results</b>	
<b>Type of Test</b>	<b>Maximum Difference</b>
<b>Sieve Analysis Sieves with Openings -</b>	
Greater than 3"	7%
2" to 3"	6%
3/8" to 1-1/2"	5%
No. 50 to No. 4	4%
No. 100	3%
No. 200	2.0%
<b>Liquid Limits</b>	
	3%
<b>Plasticity Index</b>	
	4%
<b>Fracture</b>	
	10%
<b>Flat and Elongated</b>	
	2%
<b>Sand Equivalent</b>	
	8
<b>Moistures Content of Soils and Aggregates</b>	
	1.0%
<b>Densities of Soils, Gravels, Sands, and Combinations -</b>	
Standard Density	4 pcf
In-Place Field Density	4 pcf
<b>Asphalt Content -</b>	
Ignition oven	0.4%
Nuclear Content Gauge	0.4%
<b>Maximum Specific Gravity</b>	
	0.020
<b>Percent Compaction of Asphalt Pavements</b>	
	1.5%
<b>Portland Cement Concrete -</b>	
Slump: less than 3"	3/4"
Slump: 3" to 5"	1"
Slump: Greater than 5"	1-1/2"
Unit Weight	2 pcf
Air Content	1.0%
Compressive and Flexural Strength	15%
<b>Grout Cubes – Comp. Strength</b>	20%

### 11.4.6.2 Independent Assurance (System Approach)

The System Approach evaluates Active Testing Technicians (ATT) and acceptance testing equipment on an annual basis.

ATTs will be evaluated, at a minimum, once per year for each test method the technician performs. IA evaluations will be performed by an IA Inspector using a standard checklist of sampling and testing performance criteria. Additional evaluations may be performed at the discretion of the project engineer, RQE or IA Inspector.

The goal is to perform at least 90% of the IA evaluations during the reporting period. Regularly scheduled IA evaluations will generally be conducted in the spring. The IA Inspectors and ATTs will coordinate to schedule additional IA evaluations, or additional IA evaluations may occur without advance notice.

ATTs will be evaluated using one or more of the following methods:

- Observation of test method performance
- Concurrent tests
- Split sample comparisons according to Table 11-1
- Proficiency sample comparisons according to guidelines established by the regional lab

Equipment will be evaluated once per project per calendar year using one or more of the following methods:

- Verification of calibration
- Verification of critical dimensions
- Visual observation
- Concurrent tests
- Split sample comparisons according to Table 11-1
- Proficiency sample comparisons according to guidelines established by the regional lab

At the conclusion of the IA evaluation, the ATT and supervisor will be provided with an evaluation of the results.

Unsatisfactory performance or deficient equipment will result in a failing evaluation. Deficient equipment shall be repaired or replaced, and the repaired or replaced equipment must be calibrated or verified prior to use.

After a failing evaluation, the IA Inspector will schedule a re-evaluation of the technician to occur as soon as possible, but no later than 30 days after the initial evaluation. Upon request, the re-evaluation may be performed by a different IA Inspector. The re-evaluation should be performed in the same manner as the initial evaluation.

An ATT, who refuses to participate in an evaluation, will be considered to have failed the evaluation and may be barred from acceptance testing. An ATT who fails three evaluations of the same test method in a single reporting period will be barred from acceptance testing.

**IA-Systems Approach Reports** By January 31, each Region using the IA-Systems Approach will report regional findings to D&ES, for the previous calendar year. An annual report will be prepared by D&ES and transmitted to FHWA and FAA Division Offices for those evaluations performed in the System Approach. The report will include:

1. The number of:
  - Statewide qualified technicians
  - active technicians in the System Approach
  - technicians evaluated by IA in the System Approach
  - percentage of evaluated technicians/active technicians
  - IA reported deviations
2. Summarize corrective actions, by test method, describing how deviations from allowable tolerances and ATMM procedures were addressed
3. Potential systematic solutions to recurring deficiencies

### 11.4.7 Informational Testing

The Project Engineer has the discretion to take tests for information. These tests may be used to:

- Evaluate materials placed in a stockpile prior to making stockpile payment
- Evaluate early concrete strength
- Provide helpful information in reviewing changes in materials sources

## 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.

### 11.6.1 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 may designate a staff member to be 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. Review or develop the scope of services for contracting the quality assurance welding inspection and nondestructive examination (NDE) when required; and
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.

If the project involves structural welding, the Project Engineer shall contact the TWA during the initial review of the project plans and specifications. 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.

### 11.6.2 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), fabricator's QC inspector qualifications, 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.

### 11.6.3 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 six QA term contracts. The State Materials Engineer is the contracting officer and will assign a contract manager to each term contract. The Project Engineer oversees the work of the term contractor.

At this writing, term contracts are available for:

- Pre-stressed and precast concrete inspection, sampling & testing (2).
- Field welding and coating inspection (2).
- Soils, aggregate, asphalt and concrete inspection, sampling, and testing
- Out-of-state fabrication, inspection, sampling, and testing.

For each of the six Term Contracts a Regional Notice to Proceed (NTP) is prepared for each regional Construction Section, for the purpose of issuing Job Orders for work not exceeding \$50,000. A project specific NTP will be issued for all project related work that will exceed \$50,000.

### 11.7.1 Procedures

Contact Statewide Materials contract manager to request services. The Statewide Materials contract manager will coordinate with the Group Chief/PM or Project Engineer to:

- develop a Request For Proposal (RFP)
- contact the term contractor with the RFP for cost estimate,
- prepare pre-proposal estimate (required for work over \$50,000)
- negotiate the scope & budget with term contractor
- get approval to issue the job order or NTP

The Statewide Materials contract manager will prepare the NTP (or job order) documents, prepare a Record of Negotiations (if required), acquire approval/acceptance signatures, encumber the funds, issue the approved NTP or job order, and maintain an accurate log of job order activity.

The Statewide Materials contracting officer approves each NTP for work over \$50,000.

Work that is less than \$50,000 will be issued as a Job Order under a Regional NTP. Only the Regional Construction Engineer or the Statewide Materials contracting officer may approve a job order.

When time is of the essence, the, Group Chief/PM or Project Engineer or the Statewide Materials contract manager may conduct the request for proposal and negotiation process orally. Following these negotiations, the Statewide Materials contracting officer may orally authorize a NTP, and will follow it with a written confirmation, generally within two working days of the verbal Notice To Proceed.

Authorization for overtime may be included in the job order/NTP; or in a written directive by the Group Chief/PM or Project Engineer. Amendments to the term contract are by the contract manager and approved by the contracting officer. Authority to issue verbal notice to proceed is given only to 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

### **11.7.2 Payments**

On FAA projects, the payment method shall be cost plus a fixed fee or fixed price. No payment by time and materials is allowed.

On FHWA projects, allowable payment methods are: time and materials, cost plus fixed fee, fixed price, or fixed price plus expenses.

The term contractor shall not perform any services or incur billable expense without receipt of an approved NTP or job order or a verbal NTP. The term contractor may only work overtime on a project when given written authorization in advance.

All invoices on Inspection Term Agreements will be processed through the Statewide Materials Contract Managers desk and approved by their Contracting Officer.

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.

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