UNITED CONSULTING ENGINEERS

Engineers, Geotechnical, Construction Material Inspection & Testing

QUALITY ASSURANCE & QUALITY CONTROL
(QA/QC) PROGRAM

PROJECT MANAGER

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General Quality Assurance / Quality Control Unit

PURPOSE: The purpose of the Quality Assurance / Quality Control (QA/QC) Unit is to assure a high level of quality of construction for contracts of United Consulting Engineers, Inc. The QA/QC Unit has two functions: Quality Assurance and Quality Control. Quality Assurance seeks to be proactive in preventing a re-occurrence of problems while Quality Control is primarily reactive and remedial.

QUALITY ASSURANCE: Quality Assurance is the monitoring and improvement of processes and systems in the design and construction of projects. One of the primary QA tools is the Non-Conformance Report (NCR). The NCR identifies a problem encountered during design or construction and acts as the nexus in starting the QA investigation. When the QA investigation results in finding a systemic problem, based on performance measurements, it provides feedback on future designs to help eliminate mistakes and/or create new efficiencies during design and construction.

The second major tool of QA is periodic review of systems, processes, designs, and NCR's.

QUALITY CONTROL: Quality control is the inspection of materials and workmanship on the construction project to insure that they meet testing standards selected for the scope of Work. QC of workmanship and the final Work is primarily the responsibility of the Project Manager. The QA/QC Unit is responsible for the independent inspection of the construction materials to insure that they are to the quality that is required by the contract. Materials QC falls into three broad categories, each requiring special training and certification; concrete, soils, and equipment. Each are discussed in the following sections.

QC accomplished by two basic methodologies: The first way is through inspection at the points of manufacture (batch plants, factories) or fabrication. The second is by evaluation of material certifications.

The United Consulting Engineers QA/QC Unit is composed of three personnel. These are: one Project Manager, one Project engineer, and one Field technician. Listed below are their locations of work and main responsibilities:

Position Title	Location	Responsibility
Project Manager	UCE Office	QA/QC Engineer
Project Engineer	UCE Office ,Lab	Field Inspector Supervisor
Field Technician	UCE Office, Lab	Field Inspector

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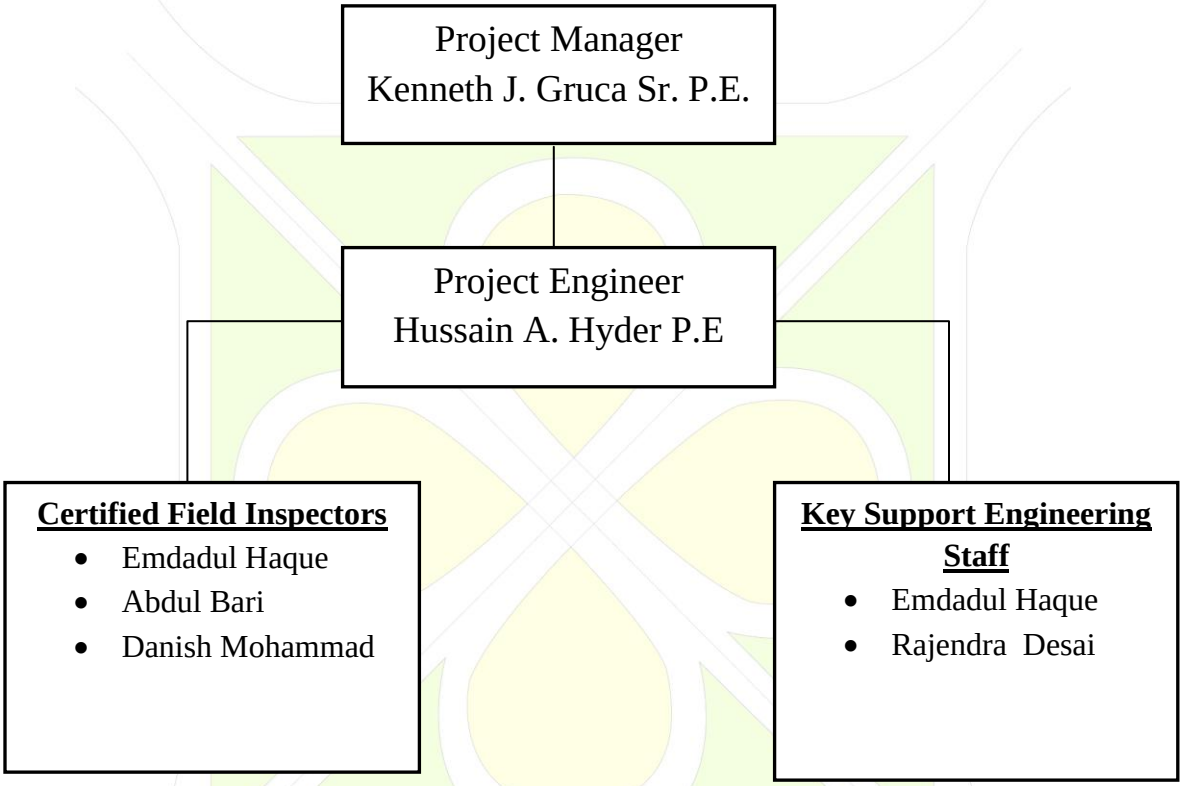
Company Organization Chart



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QA/QC Field Operations

The United Consulting Engineers QA/QC office and soils lab is located at 3044 W. Peterson Ave., Suite A, Chicago, IL 60659. The soils lab has various testing equipment including sieves, sieve shakers, drying oven, scales, and concrete compression machine. It provides storage space for extra testing equipment, including the Troxler 3440 nuclear density gauge. It serves as a base of operations where the QA/QC field inspectors go to write reports and conducts lab tests. The field inspectors receive their assignments from the Project Engineer at the end of the preceding day. They notify the main office of any other inspections that may come up during the day or anything that needs immediate attention.

Individual Duties:

QA/QC Field Inspection Supervisor: The field inspection supervisor performs the following duties:

1. Coordinating the activities of the field inspectors by reassigning duties as needed.
2. Providing the technical assistance to the field inspectors as needed.
3. Aiding the contractors and construction personnel in interpreting the contract specifications regarding material and quality requirements
4. Performing inspection duties as a field inspector

Field Inspectors: The field inspectors are primarily concerned with the inspection of ready mix or batch plant concrete, precast concrete products, reinforced concrete pipe, aggregates, bituminous concrete, backfill materials, and field welding. Other products may be inspected by the inspector if the products are produced locally. Inspections are performed at the points of manufacture when possible. Otherwise, they are performed at the construction site.

MANAGEMENT REQUIREMENTS

Quality Management System (QMS):

The laboratory shall establish, implement, and maintain a quality management system (QMS) appropriate to the scope of its activities. The QMS shall be available for use and understood by laboratory staff.

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Document Control:

Each QMS document shall indicate its preparation date. When a document is revised, the date of revision shall be indicated on the document.

Test Methods, Practices, Procedures, and Specifications:

The laboratory shall maintain copies of standards for the testing performed and shall ensure that the procedures are the most current and are readily accessible to the employees performing the testing.

Organization:

The legal name and address of the laboratory—and that of the main office or company, if different—and any other information needed to identify the organization, shall be documented. The ownership and management structure of the laboratory shall be documented. Names, affiliations, and positions of principal officers and directors shall be listed. The laboratory shall maintain an organization chart showing relevant internal organizational components, including positions and names that are part of the organization. The organization chart shall clearly define relationships with other partner organizations where applicable.

Staff:

The laboratory shall maintain a position description for each technical operational position shown on the laboratory's organization chart. Position descriptions shall identify the position and include a description of the duties, required skills, and education and experience associated with the position.

Technical Manager—The laboratory shall have a technical manager (however named) who has overall responsibility for the technical operations of the laboratory. In addition, the laboratory shall nominate an individual to serve in the technical manager's absence.

QMS Management—The laboratory shall designate a person(s) having responsibility for determining whether quality management system activities are being implemented by laboratory staff. This individual(s) shall have direct access to top management.

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Technician Training and Evaluation:

The laboratory shall maintain a procedure which describes the method used to ensure that new laboratory personnel are trained to perform tests in accordance with standard procedures. In addition to the description of training methods, the document shall indicate what position or employee is responsible for the laboratory training program and the maintenance of training records (see Page 16).

The laboratory shall maintain a procedure describing the method used to evaluate staff competency to ensure that each test covered by the scope of this standard is performed in accordance with standard procedures. This description shall include the frequency of competency evaluations for each technician and indicate what position or employee is responsible for evaluating staff competency and maintaining records. The procedure shall ensure that each technician receives a performance evaluation for each test that technician performs (see Page 17).

The laboratory shall maintain records of technician training and competency evaluation activities. The records shall include the test method for which the technician was evaluated, the date on which competence was determined or confirmed, the name of the individual who evaluated the technician's competency, and comments about the training or competency evaluation activity.

Internal Audits:

The laboratory shall maintain a document describing the scope of internal audits. Internal audits shall verify that the laboratory's operations continue to comply with its policies and procedures and the requirements of this standard.

The document shall include the frequency of the reviews and identification of the individual(s) responsible for the review. The internal audit program shall address all elements of the quality management system and shall be conducted at least every 12 months by trained personnel independent of the activity being audited, where possible. Findings from internal audits shall be recorded (see Pages 18 & 19).

Corrective Action:

The laboratory shall maintain a procedure for implementing corrective action when nonconforming work or departures from policies and procedures have been discovered. The procedure shall identify the individual responsible for implementing corrective action and shall begin with an investigation to determine the root cause of the problem. Records of corrective action shall be maintained (see Pages 20 and 21).

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The laboratory shall document the method used in responding to customer complaints (see Page 22). Records of customer complaints and the resulting actions shall be maintained.

Records Retention:

Quality Management System Records—Records pertaining to external assessments, internal audits, proficiency sample testing, technician training and evaluation, and personnel shall be retained by the laboratory for a minimum of 5 years.

Technical Records—The laboratory shall retain records of test data, test reports, equipment calibration, standardization, check, and maintenance activities for a minimum of 5 years.

TECHNICAL REQUIREMENTS

Equipment:

Inventory—The laboratory shall maintain an inventory of major sampling, testing, calibration, standardization and check equipment, and measurement standards. The list shall include, where available, the name, date placed in service, manufacturer, and model and serial number.

Equipment Calibrations, Standardizations, and Checks:

The laboratory shall maintain a list giving a general description of equipment which requires calibration, standardization, and checks. For each item the list shall include the interval of calibration, standardization, or checks and a reference to the procedure used (see Page 23).

The laboratory shall have a procedure which describes the method for ensuring that the calibration, standardization, and checks are performed for all required equipment at the specified intervals. This procedure shall include the name of the individual(s) or position(s) responsible for ensuring that these activities are performed, and procedures for handling equipment which is newly acquired, removed from service, or defective (see Page 24 and 25).

The laboratory shall have detailed written procedures for all in-house calibration, standardization, and check activities not addressed in standards or operating instructions. These procedures shall indicate the equipment required to perform the calibration, standardization, or check (see Pages 26 thru 31). If a piece of laboratory testing equipment is used over a range of measurements (e.g. thermometer, dial indicator, etc.), the calibration or standardization shall include several measurements over that range.

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The laboratory shall calibrate, standardize, and check all significant equipment associated with tests which the laboratory performs. As a minimum, the applicable equipment listed on Page 23 shall be included.

Calibration, Standardization, and Check Frequencies—Applicable measurement equipment shall be calibrated, standardized, or checked at the intervals specified in the laboratory's QMS. The laboratory shall establish intervals according to the following guidelines:

The intervals specified by the laboratory shall be no greater than those indicated on Page 23 unless such equipment is calibrated, standardized, or checked before each use or the laboratory has documented evidence to show that the conformance of the equipment to the specification requirements is stable.

When a maximum interval for a specific piece of measurement equipment is specified in a standard, the interval specified by the laboratory shall not exceed this interval unless the equipment is calibrated, standardized, or checked before each use.

Equipment that has been removed from service and newly acquired equipment without a manufacturer's certification shall be calibrated, standardized, or checked before being placed in service.

Measurement Standards:

The laboratory shall maintain calibration certificates that establish the traceability of measurement standards or in-house equipment used for calibrations, standardizations, and checks. The calibration certificates shall include estimates of measurement uncertainty. The QMS shall include a procedure that describes how the laboratory ensures the calibration of its measurement standards.

Equipment Maintenance:

The laboratory shall have a system in place for performing regular maintenance on any equipment or test system in which repeated use could degrade the equipment's or test system's ability to produce repeatable results.

The laboratory shall maintain a list giving a general description of equipment which requires maintenance. For each item, the list shall include the interval of maintenance and a reference to the procedure used (see Page 35 for an example of a maintenance table).

The laboratory shall have detailed written procedures for all in-house maintenance activities. These procedures shall indicate the equipment required to perform the maintenance and a general

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explanation of the work performed. If manufacturer's instructions for maintenance are available, they shall be referenced on the in-house procedure (see Page 36).

The maintenance records shall contain the name of the individual that performed the maintenance, the date that the work was completed, and any comments.

The laboratory shall maintain the manufacturers' instructions for operating and maintaining equipment, where applicable.

***Equipment Records*—**The laboratory shall maintain calibration, standardization, check, and maintenance records for all equipment specified in the QMS. Such records shall include:

Detailed results of the work performed (dimensions, mass, force, frequency, temperature, time, etc.);

Description of the equipment calibrated, standardized, checked, or maintained, including model and serial number or other acceptable identification;

Date the work was done;

Identification of the individual who performed the work; Identification of the calibration, standardization, check, or maintenance procedure used; and identification of any device used for in-house calibration, standardization, check, or maintenance, including serial numbers, laboratory numbers, or other identification.

Sample Management:

The laboratory shall have a procedure for the storage, retention, and disposal of test samples (see Page 32).

The laboratory shall have a procedure for identifying test samples. The identification shall be retained throughout the life of the sample in the laboratory. The laboratory shall have a procedure for identifying test samples. The identification shall be retained throughout the life of the sample in the laboratory.

Test Records and Reports:

The laboratory shall have a document which describes methods used by the laboratory to produce test records and to prepare, check, and amend test reports. The document shall identify the individual(s) responsible for maintaining test records and reports and shall describe the distribution of test reports (see Pages 33 and 34).

***Test Records*—**The laboratory shall maintain test records which contain sufficient information to permit verification of any test reports. Records pertaining to testing shall include original

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observations, calculations, derived data, and an identification of personnel involved in sampling and testing.

The laboratory shall prepare test reports which clearly, accurately, and unambiguously present the information specified in Table 1.

Table 1—Test Report Requirements

Identification of the report and the date issued
Description, identification, and condition of the test sample
Identification of the standard test method used
Test results and other pertinent data required by the standard test method
Identification of any test results obtained from tests performed by a subcontractor
Name of the person(s) accepting technical responsibility for the test report (if applicable

In addition to the requirements listed above, the information listed in Table 2 shall be available and traceable to the test reports.

Table 2—Test Report Information

Name and address of the testing laboratory
Name and address of the client or identification of the project
Date of receipt of the test sample
Date(s) of test performance
Deviations from, additions to, or exclusions from the test method

The procedure for amending reports shall require that the previously existing report be clearly referenced when an amendment is made. The references shall establish a clear audit trail from the latest issuance or deletion to the original report and its supporting data.

***Subcontracting*—**The laboratory shall maintain a document describing the policies that the laboratory follows relative to subcontracting, if it engages in such activities. These policies shall include procedures followed by the laboratory in selecting competent subcontractors and reporting the results of testing performed by subcontractors.

Assuring the Quality of Results:

The laboratory shall have procedures for monitoring the validity of test results. The monitoring shall be planned and may include one or more of the following:
Participation in external assessment programs;
Participation in proficiency sample or interlaboratory comparison testing; and retesting of retained items.

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***Records*—**The laboratory shall retain results of the monitoring activities, including the steps taken to determine the root cause of any nonconformities and the corrective actions taken.

October 1, 2013

TRAINING PROGRAM FOR TESTING TECHNICIANS

The Laboratory Manager is responsible for the training program and maintenance of all training records. Copies of the results of all training shall be distributed to and retained by the Office Manager. Training records shall be retained in the Office Manager's office. All materials technicians shall be trained prior to performing test procedures not previously performed. The following training procedures shall be followed for each test:

1. The trainee shall obtain a copy of the applicable test procedure and report form.

2. The trainee shall study the test procedure and test report forms to become familiar with the equipment, terminology, test procedure, calculations, and test reports.

3. A qualified technician shall demonstrate the test procedure for the trainee.

4. The trainee shall repeatedly perform the test procedure under the guidance of a qualified technician until proficiency is obtained.

5. The laboratory supervisor shall observe the trainee demonstrating the procedure and document that the trainee has demonstrated the ability to perform the test procedure, if it is performed properly, by making an entry in the trainee's training record.

October 1, 2013

METHOD FOR REVIEWING TECHNICIAN'S COMPETENCY

Each laboratory supervisor is responsible for evaluating their test technician's competency at least once every 12 months by requiring each technician to demonstrate the AASHTO and/or ASTM test procedures for which he/she has been trained to perform. [If a technician does not routinely perform a test, it may not be necessary to evaluate his or her competency to perform the test every 12 months. However, the technician's competency shall be evaluated prior to performing the test.] Copies of the results of all competency evaluations shall be maintained by the Office Manager. Competency evaluation records shall be retained in the Office Manager's office.

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For each testing technician, the supervisor shall record the test demonstrated, the date of the demonstration, and the results of the evaluation (satisfactory or unsatisfactory). In addition, the supervisor shall sign each entry on the evaluation record.

If an unsatisfactory result is recorded for a specific test, the supervisor shall review all observed deviations from the standard AASHTO or

ASTM procedure with the testing technician, observe the technician re-demonstrate the test procedure and record the results as indicated above.

October 1, 2013

INTERNAL AUDIT PROCEDURE

1. The Quality Manager shall review the following records, reports, and associated documentation every 12 months to ensure that established quality procedures are being followed:

a) Proficiency Sample Reports

b) On-Site Assessment Reports

c) Previous Internal Audit Findings and Corrective Actions

d) Equipment Calibration, Standardization, Check, and Maintenance Records

e) Technician Training Records

f) Technician Evaluation Records

g) Customer Feedback Records

h) Test Records and Reports

i) Quality Management System

2. After each 12-month review the Quality Manager shall discuss any deficiencies noted with appropriate staff, ensure corrective action is taken, and prepare a memorandum to the Laboratory Manager describing the items reviewed, the deficiencies identified, and the corrective action taken.

3. The Office Manager shall maintain a file containing all documents relating to quality management system review in his office.

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Date:

Internal Audit Check Sheet

	All records adequate and/or deficiencies corrected?					
	Binder Lab	Hot Mix Lab	Soil Lab	Agg. Lab	Conc. Lab	Date Checked
Equipment Records						
Personnel Training/Competency Records						
Test Records and Reports						
Proficiency Sample Reports						
On-Site Assessment Corrective Actions						
Internal Audit Records and Corrective Actions						
Customer Feedback Records						

Have there been any changes made or updates required in the following sections of the QMS? Describe any actions taken below.

	Changes made?	QMS updated?
a) Organizational charts		
b) Staff position descriptions		
c) Staff biographical sketches		
d) Staff training methods		
e) Staff evaluation methods		
f) Equipment inventory list		
g) Equipment calibration/check list		
h) Procedure describing in-house calibrations/checks		
i) In-house equipment calibration/check procedures		
j) Equipment calibration certificates		
k) Procedures followed to produce test records		
l) Procedures followed to prepare, check, and amend test reports		
m) Procedures for sample identification, storage, retention, and disposal		
n) Policies relative to customer complaints		
o) Policies relative to internal audits		
p) Policies relative to subcontracting		

Actions taken:

_____

_____

Reviewed by: _____ Date: _____ Next Review Date: _____

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PROCEDURES RELATED TO PROFICIENCY SAMPLE TESTING AND ON-SITE ASSESSMENTS

GENERAL:

It is the responsibility of the Quality Manager to review all reports pertaining to proficiency sample testing, on-site assessment, and quality management system evaluations and to bring poor results or differences to the attention of the appropriate unit supervisor. It is the responsibility of the unit supervisor to ensure that corrective action is taken and documented. (In some cases it may be necessary for the Quality Manager to take corrective action and prepare documentation relative to specific differences.)

Reports covering the results of proficiency sample testing and on-site assessment and quality management system evaluations, and memorandums summarizing investigations and any corrective action taken shall be maintained by the Quality Manager in the Quality Manager's office.

PROFICIENCY SAMPLE TESTING:

Participation:

AMRL Soil Proficiency Sample Program
AMRL Aggregate Proficiency Sample Program
CCRL Concrete Proficiency Sample Program

Identifying poor results:

Any result that is beyond 2 standard deviations from the average value.

Procedures to follow when poor results occur:

1. Determine if the Agency conducting the program correctly entered the data reported.
2. Determine if the test result obtained was properly transferred to the data sheet submitted.
3. Determine if all calculations leading to the test results obtained were correct.
4. Determine if the equipment used to perform the test meets specification requirements.
5. Determine if the procedures followed when performing the test conformed to specification requirements.
6. Take corrective action to repair or take steps to replace defective equipment or instruct the technician of the correct procedure to follow.
7. Prepare a memorandum of record summarizing the results of the investigation, identifying the cause of the poor results if determined, and describing any corrective action taken.

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ON-SITE ASSESSMENTS:

Participation:

AMRL Soils Inspection
AMRL Aggregate Inspection
CCRL Portland Cement Concrete Inspection

Procedures to follow when findings are reported:

(Apparatus Deficiencies)
1. Determine if the equipment meets specification requirements.
2. If the equipment is found to be defective, take necessary steps to repair or replace it.
3. Prepare a memorandum of record summarizing the results of the investigation and any corrective action taken.

(Procedural Deficiencies)
1. Discuss each procedural deficiency with the testing technician and review the proper procedure.
2. Observe the technician perform the test properly.
3. Prepare a memorandum of record summarizing the action taken.

(Quality Management System Deficiencies)
1. The Quality Manager shall review each deficiency cited by the evaluator with the responsible employee.
2. Take appropriate action.
3. Prepare a memorandum of record summarizing the action taken.

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HANDLING CUSTOMER FEEDBACK

Upon receipt of a customer complaint, the following actions shall be taken:
1. The Director of the laboratory shall be notified.
2. Complaint is brought to the attention of the Supervisor of the department or section in question.
3. Supervisor contacts the customer to verify all aspects of the complaint and establish resolution date (if necessary).
4. All reports, records, and pertinent data shall be reviewed; and all calculations are to be checked for accuracy.
5. The technician(s) performing the test is consulted by the Supervisor to determine any unusual problems or circumstances involved.
6. Supervisor reports all information gathered to the Director.
7. The Director shall formulate an appropriate reply and issue same to the complainee.

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Equipment Calibration, Standardization and Check Information

Item(s)	Interval	Requirement	Procedure
Balances	12 Month	Standardization	ASTM 4753
Analytical Balances and Masses	12 Month	Calibrate	Outside Contractor
Mechanical Compactors	12 Month	Standardization	ASTM 2168
L A Abrasion Equipment	12 Month	Check	In-House Proc. A-2
Proctor Hammer	12 Month	Check	In-House Proc.S-1
Compression Machines	12 Month	Standardization	Outside Contractor
Proctor Molds	4 Month	Check	In-House Proc. S-2
Marshall Molds	4 Month	Check	In-House Proc. B-2
Unit Weight Buckets	6 Month	Standardization	AASHTO T 19
Thermometers	6 Month	Standardization	ASTM E 77
Mechanical Shakers	12 Month	Check Sieving Thoroughness	ASTM C 1077
Ovens	12 Month	Standardize Thremo. Device	ASTM E 145
Calipers	12 Month	Standardize	T19/C29
Length Measuring Devices	12 Month	Standardize	T19/C29
Liquid Limit Device	12 Month	Check wear, Critical Dimensions	T89/D4318
Grooving Tool	12 Month	Check Critical Dimensions	T89/D4318
Mixer/Steel Jar	24Month	Standardize	T88/D422
Hydrometers	24 Month	Check Critical Dimensions	T88/D422/E100
Water Bath	6 Month	Standardize	ASTM D 2726
Aggregate Splitters	12 Month	Check wear, Critical Dimensions	ASTM C 702
Straightedge	12 Month	Check Planeness of Edge	T19/C29

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EQUIPMENT CALIBRATION, STANDARDIZATION, CHECK, AND MAINTENANCE POLICIES AND PROCEDURES

General Policies:

1. Required equipment shall be calibrated, standardized, checked, or maintained at specified intervals following the general procedures indicated below.

2. Newly acquired equipment without a manufacturer's certification and equipment that has not been calibrated, standardized, or checked because it has been removed from service shall be calibrated or checked before being returned to service.

3. When any of the Unit's test equipment is overloaded, mishandled, giving results that are suspect, or is not meeting specification tolerances, the Unit Supervisor shall remove it from service and clearly mark it by attaching a red ribbon or tape. The equipment shall be returned to service only after appropriate repairs are made and calibration, standardization, or checks confirm the equipment functions satisfactorily or meets specification tolerances.

General Procedures:

1. The Supervisor in each Testing Unit is responsible for ensuring that calibration, standardization, checks, and maintenance activities are performed. He shall maintain a file for each piece of equipment in his unit requiring calibration, standardization, check, or maintenance. The file for each piece of equipment shall contain detailed records of calibration, standardization, check, or maintenance work performed in chronological order and shall be kept in the Supervisor's office.

2. The Supervisor in each Testing Unit shall maintain a set of 12 labeled folders in his office—one for each month of the year. Each month's folder shall contain a partially completed calibration, standardization, check, or maintenance record form for each piece of equipment requiring calibration, standardization, checks, or maintenance during the month indicated on the folder's label.

3. During the first week in each month, the Supervisor in each Testing Unit shall remove the partially completed record forms from the current month's folder and instruct the appropriate staff to perform the necessary calibration, standardization, check, or maintenance work within the next week and return the completed record forms.

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4. The Supervisor shall prepare partially filled out record forms for each piece of equipment calibrated, standardized, checked, or maintained that month—identifying the equipment and the next date that calibration, standardization, check, or maintenance work is required
(Month and year)—and file each partially filled out form in the appropriate monthly folder.

5. The Supervisor shall file each of the completed record forms in the appropriate equipment record file in chronological order.

October 1, 2013 **Procedure: G-2**

Equipment Checked: SIEVES

Purpose:
This method provides instructions for checking the physical condition of laboratory tests sieves ranging in size from 75 mm (3 in.) to 0.075 mm (No. 200) and for measuring the openings of coarse sieves having openings greater than or equal to 4.75 mm (No. 4).

Equipment Required:
1. A caliper readable to 0.01 mm (use for 4.75-mm sieve and coarser).
2. An eye comparator with a 0.1-mm scale or a magnifier (for use with sieves finer than 4.75 mm).

Tolerance:
Sieves shall meet the physical requirements specified in AASHTO M 92 (ASTM E 11).

Procedure:
1. For sieves having openings equal to or greater than 4.75 mm, select and measure, using the calipers, the dimensions of at least four or five sieve openings in each sieve to ensure that the openings in the wire cloth conform to the requirements in Table 1 of AASHTO M 92
(ASTM E 11). Be sure to include, in the selection, any openings that appear distorted or unusual in size. Measure each of the openings as the distance between parallel wires measured at the center of each opening. Measure each opening in both the x (horizontal) and y (vertical) directions. Record the measurements for each of the selected openings. If a sieve has less than five full openings, measure all full openings.
2. For sieves smaller than 4.75 mm, inspect the sieve cloth against a uniformly illuminated background. Use the eye comparator or magnifier to examine any suspicious areas of the cloth. If obvious deviations, such as weaving defects, creases, wrinkles, or excessive foreign matter in the cloth are found, the wire cloth is unacceptable.

3. Inspect the general condition of the sieve. Check the frame and solder joints for cracks or holes. (Check for pin holes in the finer sieves.)

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4. Ensure that the sieve has an appropriate label.
5. Check for tightness of the wires on each individual sieve.

October 1, 2013 **Procedure: S-1**

Equipment Checked: MANUAL HAMMER (AASHTO T 99, T 180) (ASTM D 698, D 1557)

Purpose:
This method provides instructions for checking the critical dimensions of the proctor hammers.

Equipment Required:
1. Calipers readable to 0.01 mm.
2. Tape measure readable to 1 mm.
3. Balance, capacity 5 kg, readable to 1 g.

Tolerance:
Equipment shall meet the dimensional tolerances specified in the applicable test method.

Procedure:
1. Measure and record the diameter of the rammer face determined by taking two readings 90° apart using the calipers.
2. Pull up the handle, measure, and record the drop height of the hammer. Determine this height inside the guide-sleeve using the tape measure.
3. Remove the hammer from the guide-sleeve. Determine and record its mass to the nearest 1 g.
4. Measure and record the diameters of the vent holes near the end of the hammer.

October 1, 2013 **Procedure: A-1**

Equipment Checked: CONICAL MOLD, TAMPER (AASHTO T 84)
(ASTM C 128)

Purpose:
This method provides instructions for checking the critical dimensions of the sand cone and tamper used in the above test method.

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Equipment Required:

1. Calipers readable to 0.1 mm.
2. Balance, 500 g capacity, readable to 0.1 g.
3. Ruler readable to 1 mm.

Tolerance:

Equipment shall meet the dimensional tolerances specified in the test method.

Procedure:

(Cone)

1. Measure the inside diameter at the top of the cone to the nearest 1 mm by taking two readings 90° apart using the ruler and record the results.
2. Invert the cone and repeat step 1.
3. Place the cone on a flat glass surface. Measure and record the depth of the cone.
4. Using the calipers, measure the thickness of the cone to the nearest 0.1 mm by taking two readings 90° apart at the top of the cone and two readings 90° apart at the bottom of the cone and record the results.

(Tamper)

1. Measure and record the diameter of the tamping face to the nearest 1 mm by taking two readings 90° apart using the ruler.
2. Determine and record the mass of the tamper to the nearest 0.1 g.

October 1, 2013 **Procedure: B-3**

Equipment Checked: TIMERS (AASHTO T 72, T 201, T 202) (ASTM D 88, D 2170, D 2171)

Purpose:

This procedure provides instructions for checking the accuracy of timing devices.

Inspection Equipment Required:

1. Timer, readable to 0.1 s., having a verified accuracy within the tolerance listed in above test methods.

Tolerance:

Timers shall meet the accuracy requirements specified in the applicable test methods listed above.

Procedure:

1. Hold the calibrated timer in one hand and the timer to be checked in the opposite hand.
2. Start the timers simultaneously by pressing the “start” buttons at the same time.
3. Allow the timers to run for at least 15 min. Then stop the timers simultaneously. Record the time indicated by both timers.

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4. Record the difference between the two timers. Calculate and record the percent accuracy.

$$\% \text{ accuracy} = \frac{(A - B)}{B} \times 100$$

***A* = Reading on lab timer (s)**
***B* = Reading on standard timer (s)**

October 1, 2013 **Procedure: B-4**

Equipment Checked: PENETRATION APPARATUS (AASHTO T 49) (ASTM D 5)

Purpose:

This procedure provides instructions for checking the equipment used to perform the penetration test.

Equipment Required:

1. Balance, readable to 0.01 g.
2. Microscope or eyepiece, 10×.
3. Metal block, 10.0 mm high. Metal block, 25.4 mm (1 in.) high.
4. Support block, 75–87.5 mm high.
5. Ruler, readable to 1 mm.
6. Calibrated stopwatch, readable to 0.1 s.

Tolerance:

The equipment shall meet the tolerances specified in test methods AASHTO T 49 & ASTM D 5.

Procedure:

1. Remove the spindle, 50- and 100-g weights from the penetrometer. Record the weight of each to the nearest 0.01 g.
2. Weigh each needle to the nearest 0.01 g. Visually examine each needle with a microscope or eyepiece. Each needle should be straight and free of burrs. The base of each needle should be flat.
3. If an automatic timing mechanism is used on the penetrometer start the calibrated stopwatch when the plunger is released and stop the calibrated stopwatch when the plunger stops. Record the time indicated on the calibrated stopwatch to the nearest 0.1 s. If a manual device is used to release the plunger, check the accuracy of the timing device used over a 60-s interval. Record the elapsed time to the nearest 0.1s.

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October 1, 2013

PROCESSING OF SAMPLES

IDENTIFICATION:

Each sample shall be accompanied by a sample tag indicating the sample number. This identifies the material in terms of the project, the location of use within the project, the quantity of material represented by the sample, and the material's intended use. The sample tag is kept with the sample as long as it remains in the materials laboratory.

STORAGE:

After being logged in, samples are stored in the area of the laboratory in which testing is to be done. During storage, care is taken to avoid disturbance or contamination. Any AASHTO requirements for storage (e.g., the moist storage of Portland cement concrete cylinders) are followed.

RETENTION:

Samples with acceptable test results are generally discarded when testing is completed. Those with failing results are retained until review of those results is completed. At that time, the decision is made whether to discard, retest, or continue to retain the sample.

DISPOSAL:

Discarded non-hazardous materials are transported daily by materials section personnel to an appropriate area. Hazardous materials (e.g., bituminous concrete extraction solution) are stored in proper containers in an isolated area of the laboratory. Disposal by an approved disposal contractor is arranged periodically by the hazardous waste disposal officer.

October 1, 2013

TEST RECORDS

PREPARING SAMPLE LOG:

Each sample brought to the materials laboratory for testing is recorded in a log book maintained by the Laboratory Manager. The following information is recorded for each sample:

1. Sample number (this is assigned sequentially to each line of the log book).
2. Project name or contract number.
3. Description of the material.
4. Supplier of the material.
5. Location from which the sample was taken.
6. Name of person(s) who sampled the material.
7. Date of sampling.
8. Date the sample was received in the materials laboratory.
9. The word "RESAMPLE" in red ink (when applicable).

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10. The date testing was completed.
11. The initials of the tester.

PREPARING AND CHECKING TEST REPORTS:

Test results are recorded on standard materials section worksheets, which are submitted to the materials lab supervisor who reviews them prior to preparing a test report. An original and two copies of the test report are prepared for review by the laboratory manager. The original test report is filed in the project folder. One copy of the test report is kept on file with the worksheets in the materials laboratory, and the other copy is sent to the project engineer for review. Test records and reports are maintained by the Office Manager.

AMENDING REPORTS:

When a report must be amended, a report form shall be filled out indicating the amended test results; the report status field "amended" on the report form shall be checked; the comment section on the report form shall state the reason for the amended report; the amended report shall be attached to the original report and processed in the normal manner; and the amended report shall be filed with the original report.

Date: October 1, 2013

Maintenance Intervals

Equipment	Activity	Interval (months)
Compression machine	Clean, lubricate	1
Moist room	Ensure Spray Nozzles unclogged Check for leaks Check position of temperature probe	3
Mechanical shakers	Lubricate, check for wear	3
Air Compressor	Lubricate, check for wear	3

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Date: October 1, 2013 **Maintenance Procedure: M-2**

MECHANICAL SHAKER MAINTENANCE PROCEDURE

Equipment Needed: wrench, grease, brush

Procedure:

1. Clean all loose dust and particles from all exposed surfaces of machine
2. Check each paddle for looseness – tighten where necessary
3. Replace any paddles that are in poor condition
4. Clean and grease rotating base
5. Operate shaker without sieves in place to determine how shaker is working
6. Explore any other possible issues and resolve them

MECHANICAL SHAKER MAINTENANCE RECORD

Date	Name	Comments

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