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To: All Holders of the Manual of Field Test Procedures

From: Chris M. Bucher, PE
Interim Construction and Materials Engineer

Subject: 2020 Revision of the Manual of Field Test Procedures

Enclosed is the 2020 revision to the Manual of Field Test Procedures. The revision package also includes a document providing a general list of the associated changes based on the layout of the Manual of Field Test Procedures. The revisions are based on comments from the Quality Assurance Steering Committee, Construction Training Coordinator, Quality Control Compliance Specialist's and industry material testing technicians.

The change package effects contracts advertised after this change date, any contract advertised prior to this change package falls under the appropriate MFTP change for that advertisement date. AASHTO test procedures are to be followed according to the latest MFTP change or the appropriate AASHTO test version to date. ODOT and WAQTC test procedures are in effect for the date the contract is advertised and may be modified to the new update change package through a Contract Change Order established by the Project Manager.

The following pages identify the appropriate add and remove sequence necessary to update the 2019 version of the MFTP. If an earlier version is being updated, then the appropriate update package will need to be applied before utilizing the enclosed documents.

To place these pages in your book, start with the package of white pages and do the following.

FIRST

SECTION 1 TAB

REMOVE	ADD	COMMENTS
INDEX (19) Pg. 1 & 2	INDEX (20) Pg. 1 & 2	Updated for 2020 Procedures

ODOT TAB

REMOVE	ADD	COMMENTS
------------------N/A------------------	ODOT TM 759 (18) 1~3	Insert after ODOT TM 400 Random Number Table

AASHTO TAB *(Note: Replacement is based on the procedure date, upper Rt. corner of document).*

REMOVE	ADD	COMMENTS
AASHTO T 22 (17) Pg. T22-1~T22-11	AASHTO T 22 (20) Pg. T22-1~T22-11	See Change Sheet for Details
AASHTO T 27/11 (19) Pg. 12-1~12-40	AASHTO T 27/11 (20) Pg. 12-1~12-40	" " " " "
AASHTO T 30 (19) Pg. 20-1~20-12	AASHTO T 30 (19) Pg. 20-1~20-12	" " " " "
AASHTO T 85 (16) Pg. 17-1~17-6	AASHTO T 85 (20) Pg. 16-1~16-6	" " " " "
AASHTO T 99/180 (19) Pg. 14-1~14-18	AASHTO T 99/180 (20) Pg. 13-1~13-16	" " " " "
AASHTO T 121 (19) Pg. 12-1~12-16	AASHTO T 121 (20) Pg. 12-1~12-16	" " " " "
AASHTO T152 (19) Pg. 13-1~13-6	AASHTO T 152 (20) Pg. 13-1~13-6	" " " " "
AASHTO T 166 (18) Pg. 18-1~18-10	AASHTO T 166 (20) Pg. 18-1~18-8	" " " " "
AASHTO T 176 (19) Pg. 14-1~14-8	AASHTO T 176 (19) Pg. 14-1~14-8	" " " " "
AASHTO T 209 (19) Pg. 17-1~17-8	AASHTO T 209 (20) Pg. 15-1~15-10	" " " " "
AASHTO T 255/265 (16) Pg. 13-1~13-7	AASHTO T 255/265 (16) Pg. 12-1~12-8	" " " " "
AASHTO T 308 (19) Pg. 16-1~16-12	AASHTO T 308 (20) Pg. 16-1~16-12	" " " " "
AASHTO T 309 (10) Pg. 10-1~10-2	AASHTO T 309 (20) Pg. 10-1~10-2	" " " " "
AASHTO T 310 (19) Pg. 19-1~19-6	AASHTO T 310 (20) Pg. 17-1~17-6	" " " " "
------------------N/A------------------	AASHTO T 324 (19) Pg. T324-1~T324-13	Insert after T 310 Procedure
AASHTO T 329 (16) Pg. 15-1~15-4	AASHTO T 329 (20) Pg. 15-1~15-4	See Change Sheet for Details
AASHTO T 355 (18) Pg. 22-1~22-10	AASHTO T 355 (20) Pg. 22-1~22-10	" " " " "
AASHTO R 67 (16) Pg. R67-1~R67-4	AASHTO R 67 (20) Pg. R67-1~R67-5	" " " " "
AASHTO R 76 (16) Pg. 10-1~10-5	AASHTO R76 (20) Pg. 10-1~10-6	" " " " "
AASHTO R 90 (18) Pg. 9-1~9-5	AASHTO R 90 (18) Pg. 9-1~9-6	" " " " "
AASHTO R 97 (19) Pg. 13-1~13-8	AASHTO R 97 (20) Pg. 13-1~13-8	" " " " "

WAQTC TAB *(Note: Replacement is based on the procedure date, upper Rt. corner of document).*

REMOVE	ADD	COMMENTS
WAQTC TM 2 (14) Pg. 9-1~9-3	WAQTC TM 2 (20) Pg. 9-1~9-4	See Change Sheet for Details

SECTION 3 TAB (Report Forms & Examples)

REMOVE	**ADD**	**COMMENTS**
Forms Intro. & Index (19) Pg. 1~4	Forms Intro. & Index (20) Pg. 1~4	See Change Sheet for Details
734-1793 S (10-2016) & Example	734-1793 S (10-2020) & Example	" " " " "
734-2327 IC (10-2015) & Example	734-2327 IC (10-2020) & Example	" " " " "
734-3468 (10-2015) & Example	734-3468 (10-2020) & Example	" " " " "
734-3468 B (10-2014) & Example	734-1793 B (10-2020) & Example	" " " " "
------------------N/A------------------	734-5292 (10-2020) & Example	Insert after 734-5189 (10-2019) Ex.

SECTION 4(D) TAB (Acceptance Guide)

REMOVE	**ADD**	**COMMENTS**
Guide Pages 1~62 (November 2019)	Guide Pages 1~64 (November 2020)	See Change Sheet for Details

SECTION 5 "Green" TAB (Acceptance Guide)

REMOVE	**ADD**	**COMMENTS**
Guide Pages 1~62 (November 2019)	Guide Pages 1~64 (November 2020)	See Change Sheet for Details

SECOND

Take the yellow packet and place or remove the yellow sheets in front of the appropriate test method.

REMOVE	**ADD**	**COMMENTS**
AASHTO TAB		
Yellow Sheet T 30 (17)	Yellow Sheet T 30 (20)	See Change Sheet for Details
Yellow Sheet T 152 (17)	Yellow Sheet T 152 (20)	" " " " "
Yellow Sheet T 209 (17) Pg. 1 & 2	Yellow Sheet T 209 (20) Pg. 1 & 2	" " " " "
Yellow Sheet R 47 (15)	Yellow Sheet R 47 (20)	" " " " "
Yellow Sheet R 67 (15) Pg. 1 & 2	Yellow Sheet R 67 (20)	" " " " "
Yellow Sheet R 90 (19)	Yellow Sheet R 90 (20)	" " " " "

The yellow sheet letters provide additional information for the test procedure or define which method in a test procedure to use for ODOT projects.

FORMS

The forms to use on ODOT construction projects are available in Microsoft Excel format. These forms can be copied from the forms included herein or accessed and downloaded from our website at: **http://www.oregon.gov/ODOT/Construction/Pages/Forms.aspx**

We in the ODOT Construction Section welcome your questions, comments, or suggestions concerning this Manual. We will consider your input for future modifications to the Manual.

MFTP 2020 Update

Summary of Changes

Introduction – No Changes

Section 1 – Test Procedures Index

This section was updated according to the test procedure date change, if applicable.

ODOT – Test Procedures

TM 759 (Static Modulus of Elasticity of Polymer Concrete Cylinders) – Section 00557, Premixed Polymer Concrete Overlays has been added to the New 2021 Standards Specifications. The Specification calls for the measurement of "Modulus of Elasticity", which is determined according to TM 759. TM 759 is being added to the ODOT Test Procedure section and is also referenced in the acceptance guide.

AASHTO - Test Procedures

All of the FOP's for AASHTO test procedures have a revision date located in the upper right hand corner and a publishing date at the lower right hand corner. The publishing date will change each year, but the test procedure date only changes with major content related modifications, not grammatical or punctuation corrections.

Other AASHTO test procedures in this section are from the AASHTO organization and haven't been modified or reformatted.

T 22 (Compressive Strength of Cylindrical Concrete Specimens) – The following subsections have been modified:

- Section 5.2.1.1 – added the following: If required, the bottom bearing block may be fully supported by spacer blocks. One vertical center hole up (0.75 in.) in diameter is permissible. Space blocks shall not be in direct contact with the specimen or the retainers for un-bonded caps.
- Section 5.3.1 – Note 9, the English metric equivalent for 2 mm was corrected from 0.06 in. to 0.08 in. in two locations.
- Section 7 – Table 2 (Permissible Time Tolerances) the 12 h test age and permissible Tolerance of ±0.25 h or 2.1% has been removed from the table. Also, tolerance percentages have been removed from the table and the following note added "For test ages not listed, the test age tolerance is ±2.0 percent of the specified age".
- Section 8 – added formulas for computing the compressive strength in SI or Inch-Pound Units.
- Section 8.3.1 – added formulas for computing cylinder density in SI or Inch-Pound Units.
- Section 8.3.2 – added a formula for computing the cylinder volume from submerged weighing.
- Section 9 – Added the following criteria for reporting:
    - Age of specimen at time of testing. Report age in days for ages three days or greater; report age in hours if the age is less than three days.

- Reformatted the "Types of Fracture" section and added 4 more diagrams of fracture type and defined each type.

T 27/11 (Sieve Analysis of Fine and Coarse Aggregates) – Under scope the AASHTO date version for T 27 and T 11 was changed to 2020.

Under procedure Method A the following bullets identify additions, deletions or modifications to the procedure:

- Below step 4, a new note 2 was added stating "Washing longer than 10 minutes with a mechanical washer has been shown to cause significant amounts of degradation depending upon aggregate type".

  This was determined by an AASHTO task force that studied the effects of prolonged mechanical washer usage.

- All subsequent notes have been renumbered, due to the note 2 insertion.
- Step 11, modified the first sentence to include a reference to Annex B "Overload Determination".
- Step 12, removed the term "washed" from the sentence. Step 10 already indicates the sample was washed, so this was a redundant reference.

Method B

- The mentioned changes under Method A were also applied to Method B.
- Step 17, the Annex B "Overload Determination" reference was added.

Method C

- Step 3, modified the first sentence to include a reference to Annex B "Overload Determination".
- Below step 12, a new note 4 was added stating "Washing longer than 10 minutes with a mechanical washer has been shown to cause significant amounts of degradation depending upon aggregate type".
- Step 19, modified the first sentence to include a reference to Annex B "Overload Determination".
- Step 20, removed the term "washed" from the sentence. Step 18, already indicated the sample was washed, so this redundant reference was removed.
- Under Annex A and B, added the Phrase (Mandatory Information) under the Time Evaluation and Overload Determination sub titles.

Minor formatting and editorial items were also addressed.

T 30 (Mechanical Analysis of Extracted Aggregates) – Under Annex A and B, added the Phrase (Mandatory Information) under the Time Evaluation and Overload Determination sub titles.

Minor formatting and editorial items were also addressed.

- ❖ **T 30 (Yellow Sheet) –** Removed the step 1 reference from the first bullet. This was a carry-over reference from the 2016 version that is no longer applicable.

T 85 (Specific Gravity and Absorption of Coarse Aggregate) – The following bullets identify additions, deletions or modifications to the procedure:

- Under the Apparatus section, first bullet "Balance or Scale", changed the scale sensitivity from 1 g to 0.1 g.
- Under the Sample Preparation section, step 5 was modified to include the T 255/265 reference for drying the sample to constant mass.
- Under Procedure, step 7, added a temperature reference (110 ± 5°C (230 ± 9°F)) for drying the sample after SSD mass determination.
- Under Procedure, step 7, removed the existing phrase "Designate this mass as "A" and created a new step 8 to include this phrase and state "Determine and record the dry mass".

Minor formatting, spelling and editorial items were also addressed.

T 99/180 (Moisture-Density Relations of Soils) – The following bullets identify additions, deletions or modifications to the procedure:

- Under the Scope section, updated the AASHTO reference date to 2020.
- Under Procedure, step 9, added the (rho) variable ρ_w after the wet density.
- Under the Calculation Section for Wet Density and Dry Density, replaced D_w with the (rho) variable ρ_w and replaced D_d with the (rho) variable ρ_d, both of these references have been corrected throughout the rest of the calculation section.
- Under Annex A, added the phrase (Mandatory Information) and above step 1 added the sub-title "Procedure".
- Under Annex A, Density Correction Equation, replaced the variable D_d with the (rho) variable ρ_d throughout the calculation and example section.
- Under Annex B, added the phrase (Mandatory Information).
- Under Annex B, Calculations, added the (rho) variable for the density of water (ρ_{water}).

Minor formatting and editorial items were also addressed.

T 121 (Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete – The following bullets identify additions, deletions or modifications to the procedure:

- Under the Scope updated the AASHTO reference to 2019.
- Under the Apparatus section, 4th bullet "Vibrator" added the term "longer" to describe the length of the shaft in relation to the section being vibrated.
- Removed the sampling language from the Procedure Section, Rodding, and created a new section "Sampling". The sampling langue is now in its own section and references the entire procedure.

Rodding

- Under Procedure, removed step 14 thru 17, striking the measure surface, cleaning of the rim, recording the mass etc. and placed in a new established section "Strike-off and Determining Mass". This new format will be used for each option; rodding, internal vibration and SCC.
- Added a step 13, to reference the new "Strike-off and Determining Mass" section.
- Removed step 17, the existing language related to air-content determination is now located under the "Strike-off and Determining Mass" section.

Internal Vibration

- Removed existing step 1. Added a new step 1, determine and record mass of empty measure and new step 2 dampen the insider of the measure and empty excess water.
- Added a step 9 language to ensure the measure is full 1/8" above the rim. Adjustment of the concrete can be made if the measure is under full; only after final consolidation.
- Added a step 10 "Continue with 'Strike-off and Determining Mass'.

Self-Consolidating Concrete

- Removed the existing step 1 referencing the Rodding section. Added a new step 1, determine and record mass of empty measure and step 2 dampen the inside of the measure and empty excess water.
- A new section was created "Strike-off and Determining Mass". This new section now contains all of the steps to strike-off the measure and determine the mass. This section also references the air-content determination, if applicable.
- Under Annex A, added the phrase (Mandatory Information).

Minor formatting and editorial items were also addressed.

T 152 (Air Content of Freshly Mixed Concrete by the Pressure Method) – The following bullets identify additions, deletions or modifications to the procedure:

- Removed the sampling language from the Procedure Section, Rodding, and created a new section "Sampling". The sampling langue is now in its own section and references the entire procedure.

Rodding

- Under Procedure, removed steps 13 thru 27, striking the measure surface, cleaning of the rim, recording the mass etc. and placed in a new established section "Strike-off and Air Content". Removed all of the procedural steps for placing the lid on the measure, removing the internal air through water addition and making final adjustments prior to air content measurement and reading. These steps are now located under the new established section 'Strike-off and Air Content'.

Internal Vibration

- Removed step 1, sampling, this language is now located under the new section "Sampling".
- Renumbered steps and added "Continue with 'Strike-off and Air Content' as new step 8 language. The existing step 9 language, returning the user to the Rodding section, has been removed.

Self-Consolidating Concrete

- Removed step 1, sampling, this language is now located under the new section "Sampling".
- A new section was created "Strike-off and Air Content". This new section now contains all of the steps to strike-off the measure and complete the air content determination.
- Under Annex A, added the phrase (Mandatory Information).

Minor formatting and editorial items were also addressed.

❖ **T 152 (Yellow Sheet) –** Second bullet, first sentence was deleted and replaced with the following: Under Sampling, step 1, second sentence, delete 1 ½" and replace with 2". Deleted the third bullet. This reference has been removed from the internal vibration section of the procedure and the wet sieving language for 1 ½" aggregate is only located under the sampling section of the procedure.

T 166 (Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens) – The following bullets identify additions, deletions or modifications to the procedure:

- Under Test Specimens section, added the word "sampled" after "or" to correct the sentence structure. Also, removed the sentence below the first paragraph that indicated samples removed from the pavement "will" be sampled according to AASHTO R 67. ODOT TM 327 references core removal according to AASHTO R 67, so the deletion has no impact on the QA program.
- Under Procedure (Method A, Suspension) 1-b, removed step references i thru vii. Now step 1-b, reads "Vacuum dry method according to the FOP for AASHTO R 79".
- Under the Calculations for (Method A, Suspension), added givens for the example.
- Under Procedure (Method B, Volumeter) 1-b, removed step references i thru vii. Now step 1-b, reads "Vacuum dry method according to the FOP for AASHTO R 79.
- Under the Calculations for (Method B, Volumeter), added givens for the example.

Minor formatting and editorial items were also addressed.

T 176 (Plastic Fines in Graded Aggregates and Soils by the use of the Sand Equivalent Test) – Under the "Sample Preparation" section, step 2, modified the existing sentence to read "Sieve the sample over the 4.75 mm (No. 4) sieve.

Minor formatting, spelling and grammar items were also addressed.

T 209 (Theoretical Maximum Specific Gravity of HMA) – The following bullets identify additions, deletions or modifications to the procedure:

- Under the Scope the AASHTO reference date has been changed to 2020.

Apparatus

- First bullet, added the scale must meet the requirements of AASHTO M231, Class G2.
- Second bullet, modified the sentence to state the "container" must be able to withstand the pressure of a full vacuum and not a partial vacuum.
- Sixth bullet, added "Vacuum measurement device" to the beginning of the sentence and added the manometer or vacuum gauge must be accurate to 0.1 kPa (1 mm Hg).
- Eighth bullet, clarified the water bath is (optional for Pyconometer or Volumetric Flask Method).
- Ninth bullet, thermometers, removed the existing statement "Standardized liquid in glass, or electronic digital total immersion type" and stated "Thermometric devices".
- Added an additional item to the apparatus list "Towel".

Procedure

- Modified the Standardization of Pycnometer or Volumetric Flask section to reference a new established Annex A, which now provides steps for the Standardization process.
- Under the Test Sample Preparation section, step 2, clarified that if two or more samples are run the results will be combined by calculating a weighted average.
- Under the Procedure section, changed the term "content" to "sample" throughout the test procedure.
- Under the Procedure section, Bowl, removed steps 16A thru 18A. Determination of the bowl weight in water is now under Annex A "Standardization".
- Under the Calculation section, Bowl Procedure, modified the G_{mm} formula to account for the standardized submerged weight of the bowl.
- Under the Calculation section, added the formula and example for the "Weighted Average" calculation.
- Added a new Annex A "Standardization of Bowl and Pycnometer or Volumetric Flask". This section provides steps to standardize the Bowl and Pycnometer or Volumetric Flask for initial use. This section also includes a check of the Standardization value for the Bowl, Pycnometer or Volumetric Flask in the event test results become questionable or verification of the Standardization value is required by the agency.

Minor formatting and editorial items were also addressed.

❖ ***T 209 (Yellow Sheet)*** **–** the following bullets identify additions, deletions or modifications to the yellow sheet entries:

  - Deleted the second bullet and added the following: Under the Standardization Section, delete the second sentence and add the following: The container shall be standardized annually and when the calibration value is in question. The existing standardization frequency was deleted and the new procedure frequency will be followed (see new Annex A for details).

- Under the sixth bullet, removed the last sentence. The R=1.0000 reference is no longer applicable.

T 255/265 (Total Evaporable Moisture Content of Aggregate by Drying and Laboratory Determination of Moisture Content of Soils) – The following bullets identify additions, deletions or modifications to the procedure:

- Under Procedure, step 4, added the variable M_w to designate wet mass of sample.
- Under Procedure, step 16, added the variable M_d to designate dry mass of sample.
- Under the Calculation section, Constant Mass, removed the term "dry" from the example expressions. The sample is being evaluated for a dry state, so the term "dry" isn't appropriate.

Minor formatting and editorial items were addressed.

T 308 (Determining the Asphalt Binder Content of HMA by Ignition Method)

The following bullets identify additions, deletions or modifications to the procedure:

- Under Procedure, Method A (Internal Balance), a step was added to verify the furnace scale is reading zero, if not, reset to zero. The rest of steps were renumbered to reference this addition.
- Under Procedure, Method A (Internal Balance), new step 14, modified the existing second sentence to state if the moisture content and correction factor aren't entered into the furnace controller they will need to be deducted from the printed ticket to accurately compute Asphalt Binder content percentage.
- Under Annex – Correction Factors, the third paragraph was removed that referenced the use of historical data or scientific studies may be used to determine correction factor(s) in lieu of using the correction procedure.

  With ongoing change of ACP constituents e.g. RAP, binder and aggregate sources, it would be extremely difficult to utilize historical data and accurately determine asphalt binder content and aggregate gradations. All of the WAQTC member states, including Oregon, require annual calibrations of the ignition furnaces. This change is also being recommended to AASHTO for removal.

Minor formatting and editorial items were also addressed.

T 309 (Temperature of Freshly Mixed Portland Cement Concrete) - The following bullets identify additions, deletions or modifications to the procedure:

- Under the Scope the AASHTO reference date has been changed to 2020.
- Under Sample Locations and Times, removed the third paragraph referencing temperature measurement of concrete with large nominal size aggregate (greater than 3"). The AASHTO Standard has moved this language from the procedural section to the "Significance and Use" section of the document, so it's no longer part of the required steps, the committee recommended its removal from the FOP.

Minor formatting and editorial items were also addressed.

T 310 (In-Place Density and Moisture Content of Soil and Soil Aggregate by Nuclear Methods) – The following bullets identify additions, deletions or modifications to the procedure:

- Throughout the procedure all references to the term "probe" have been replaced with the term "source rod". Some areas of the procedure referenced source rod, while other sections referenced probe, so this change creates consistency throughout the document and is the term commonly used by gauge manufacturers.

Minor formatting and editorial items were also addressed.

T 324 (Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures) – This is a new procedure for mix design verification and long term performance measurement. T 283 (TSR) will still be utilized until the Hamburg test can be fully implemented.

T 329 (Moisture Content of Asphalt Mixtures by Oven Method) – The following bullets identify additions, deletions or modifications to the procedure:

- Under Procedure, note 1 has been removed and subsequent notes renumbered. Comparison or repeatability testing between labs isn't a requirement of the procedure or for its intended use.

Minor formatting and editorial items were also addressed.

T 355 (In-place Density of Asphalt Mixtures by Nuclear Method) – The following bullets identify additions, deletions or modifications to the procedure:

- Throughout the procedure all references to the term "probe" have been replaced with the term "source rod". Some areas of the procedure referenced source rod, while other sections referenced probe, so this change creates consistency throughout the document and is the term commonly used by gauge manufacturers.

Minor formatting and editorial items were also addressed.

❖ **R 47 (Yellow Sheet for Reducing Samples of Asphalt Mixtures to Testing Size)** – First bullet, removed the Type A (Quartermaster) reference. The Quartermaster is no longer referenced in the procedure.

R 67 (Sampling Asphalt Mixtures after Compaction (Obtaining Cores) – The following bullets identify additions, deletions or modifications to the procedure:

- Procedural date updated to 2020 (R 67-20).
- Added a new section (Referenced Document) and included ASTM D3549 (Standard Test Method for Thickness or Height of Compacted Asphalt Mixture Specimen). All subsequent sections were also renumbered.
- Under the Procedure section, the sentence stating "to accelerate the coring process, compacted asphalt samples may be cooled to expedite the core removal using, water, ice, dry ice, or liquid nitrogen" was converted into a note. All subsequent notes have been renumbered.

- Under Procedure section, step 5.6, added language stating "remove loose particles adhering to the core by brushing or washing specimen". Also, added "embedded granular material should be carefully removed from cores taken over aggregate base".
- Under Packaging and Transporting Samples section, step 6.3 added "to prevent breaking or deforming" to the end of the existing sentence. Now the sentence reads "prevent cores from freezing or from excessive heat during transport to prevent breaking or deforming".
- A new Appendixes (Non-mandatory Information) has been added, Procedure to Remove Cut Aggregates from Asphalt Pavement Cores for Laboratory Testing. If gradation of the existing core sample is desired, this section provides a means to remove any cut aggregate that occurred during the coring process.

Minor formatting and editorial items were also addressed.

- **R 67 (Yellow Sheet)** – the following bullets identify additions, deletions or modifications to the yellow sheet entries:
  - The Apparatus section has been changed from 3 to 4, based on the procedural addition of "Reference Document" section.
  - The first bullet has been changed from section reference 3.2 to 4.2.
  - The second bullet has been changed from section reference 3.3 to 4.3.
  - The third bullet has been changed from section reference 3.4 to 4.4.
  - Deleted the last section referencing "Filling Core Holes" and replaced with the following: Under Procedure, step 5.8 delete and replace with the following: "The Hole created from the coring operation shall be filled with fast setting non-shrink grout from the QPL (Qualified Product List). Set time shall be less than 20 minutes. Ensure that the final surface is flush with the surrounding surface".
  - Under Layer Separation, changed the section reference from section 6 (step 6.1) to section 7 (step 7.1).

R 76 (Reducing Samples of Aggregates to Testing Size) – The following bullets identify additions, deletions or modifications to the procedure:

- Under the Apparatus section, Method B – Quartering, third bullet, removed the dimension statement (6 by 9 ft.) and added "appropriate for the amount and size of the material being reduced".
- Under Procedure, Method A – Mechanical Splitter, the existing paragraphs were reduced into procedural steps and reworded.
- The existing splitter bias formula and example was given a new section title "Mechanical Splitter Check".
- Added a new section "Alternative to Mechanical Splitter Check", so technicians can waive the calculation check and either combine a heavy pan with a light pan or simply swap pans during the reduction phase (See Figure 1 and 2 for an illustration).

Minor formatting and editorial items were also addressed.

R 90 (Sampling of Aggregate Products) – The following bullets identify additions, deletions or modifications to the procedure:

- Under Table 1, Note 1, third sentence changed the existing T 27/11 table reference from 2 to 1.
- Deleted Note 3, stating "obtain samples at stockpiles should be avoided whenever possible due to problems involved in obtaining a representative gradation of material". This statement isn't part of the AASHTO Standard and contradicts the test procedure, which has an allowance for sampling from the stockpile.

Minor formatting and editorial items were also addressed.

❖ **R 90 (Yellow Sheet) –** Removed existing bullet, which referenced note 3, under Stockpiles. This note has been removed from the procedure.

R 97 (Sampling of Asphalt Mixtures) – The following bullets identify additions, deletions or modifications to the procedure:

- Under the Scope, added a safety statement to cover all of the sampling methods in the procedure.
- Under Procedure, Windrow Method, added labels to both windrow figures.

Minor formatting and editorial items were also addressed.

WAQTC Test Procedures

TM 2 (Sampling Freshly Mixed Concrete) – The following bullets identify additions, deletions or modifications to the procedure:

- Under Apparatus, added a bullet to define Receptacle, as a wheelbarrow, bucket or other suitable container that does not alter the properties of the material being sampled.
- Throughout the Procedure, all references to "sample container" have been changed to "receptacle".

Minor formatting and editorial items were also addressed.

Section 2 QA Program

Section I, Overview – No Changes

Section II, Roles and Responsibilities – No Changes

Lab Certification Program – No Changes

Technician Certification Program – No Changes

Section VI, Product Specific QC/QA Testing Plan – No Changes

- **Table 1 IA parameters** – No Changes

Appendix A, ODOT Approved Commercial Aggregate Product Program – No Changes

Appendix B, Contractor Quality Control Plan – No Changes

Appendix C, Troubleshooting Guide – No Changes

Section 3 Report Forms and Examples

Forms Index and Introduction – in the form index added a new form 734-5292 for Mechanical Anchors under the subcategory Miscellaneous.

Forms Description of Worksheet and Calculation Explanations – No Changes

The following forms have been modified:

734-1793 S (Nuclear Compaction Test Report for Soils) – Replaced the Df variable with the row variable ρf representing the density of the fines in all applicable form fields.

734-3468 (Maximum Density of Construction Materials) – Replaced the Df variable with the row variable ρf representing the density of the fines in all applicable form fields.

734-3468 B (Maximum Density of Aggregate Base Materials) – Replaced the Df variable with the row variable ρf representing the density of the fines in all applicable form fields.

734-2327 IC (ACP Incinerator Oven Calibration Worksheet) – A spelling error was corrected regarding the term sieve.

734-5292 (Mechanical Anchor Pull Test) – Added a new form for Mechanical Anchor Pull Testing (Demonstration and Production) for Specification Section 00535, which now includes Mechanical Anchor's.

Section 4A Product Compliance – No Changes

Section 4(B) Small Quantity Guidelines – No Changes

Section 4(C) Laboratory Samples - No Changes

Section 4D Acceptance Guide

How to Use the Field Tested Materials Acceptance Guide – No Changes

Types of Tests – No Changes

Acceptance Guide Section 4D – The following specification sections were modified, updated or deleted:

- The revision date has been updated to 2020, due to multiple modifications in the document.

- Section 00535, Post-Installed Anchor Systems, added Mechanical Anchor's and the appropriate testing frequency. The specification has been changed to now include Resin Bonded Anchor's and Mechanical Anchors under the new of "Post-Installed Anchor Systems".

- Section 00557, Premixed Polymer Concrete Overlays, this a new Standard Specification addition that was currently only referenced in contract Special Provisions. Aggregate, Surface Texture Material, Trial Strip and Polymer Concrete testing and frequencies have been created. ODOT TM 759 (Modulus of Elasticity) will be added to the MFTP to supplement this new specification.

- Section 00559, Structural Concrete Overlays, is a new Standard Specification addition and replaces the existing Silica Fume and Latex Modified Concrete Overlay section. The existing 00559 aggregate and concrete testing frequencies have been retained, but the title of the section has been changed.

  Also, the existing 00559.10 references will be removed, they are no longer applicable under the new specification.

- Section 00590, Polymer Membrane, is a new Standard Specification addition. Only moisture content testing is required from a material testing perspective for packaging of the Broadcast Aggregate and at time of mixing with the Polymer Resin.

- Section 00596A, Mechanically Stabilized Earth Retaining Walls, the 02690 sub-section references have been corrected due to changes in section 02690.

- Section 00596B, Prefabricated Modular Retaining Walls, the 02960 sub-section references have been corrected due to changes in section 02690.

- Section 00743, Porous Asphalt Concrete (PAC), added a reference that TM 323 Calibration Incinerator Samples are required to be submitted a minimum of 2 days prior to ACP production.

- Section 00744, Porous Asphalt Concrete (PAC), added a reference that TM 323 Calibration Incinerator Samples are required to be submitted a minimum of 2 days prior to ACP production.

- Section 00745, Porous Asphalt Concrete (PAC), added a reference that TM 323 Calibration Incinerator Samples are required to be submitted a minimum of 2 days prior to ACP production.

- Section(s) 00754, 00755, 00756, 00758, Concrete Pavement and Repairs, changed the Smoothness reference from "Determining Profile Index (TM770)" to "Determining IRI with an Inertial Laser Profiler (TM 772)".

Section 5 Type D & E Acceptance Guide – The same changes in section 4D will be made to this section, if applicable.

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ODOT Construction, Quality Assurance

INSERT TAB

SECTION 1
Test Procedures

INDEX OF FIELD TEST PROCEDURES

PROCEDURE DATE	TITLE OF PROCEDURE	ODOT TM*	AASHTO T / R*	WAQTC TM*
2009	Embankment and Base Using Deflection Requirements	158		
2017	Establishing Maximum Dry Density and Optimum Moisture Content of Aggregate Base Materials	223		
2018	Presence of Wood Waste in Produced Aggregates	225		
2016	Evaluating Cleanness of Cover Coat Material	227		
2018	Determination of Elongated Material in Coarse Aggregates	229		
2015	Establishing Roller Patterns For Thin Lifts of ACP	301		
2016	Nuclear Density/Moisture Gauge Calibration and Effect of Hot Substrate	304		
2017	Calculating the Moving Average Maximum Density (MAMD)	305		
2015	Performing A Control Strip for ACP Pavement	306		
2019	Asphalt Content of Bituminous Mixtures by Plant Recordation	321		
2015	Asphalt Plant Calibration Procedure	322		
2018	Determination of Calibration Factors for Determining Asphalt Cement Content of ACP by Ignition Method	323		
2015	Preparation of Field Compacted Gyratory Specimens; Determination of Average G_{mb} for ACP Volumetric Calculations	326		
2018	Correlation of Nuclear Gauge Reading with Pavement Cores	327		
2018	Presence of Harmful Materials in Recycled Asphalt Shingles	335		
2015	Determining Random Sampling and Testing Locations	400		
2018	Static Modulus of Elasticity of Polymer Concrete Cylinders	759		
2019	Certification of Inertial Profiler-Operators and Equipment	769		
2008	Determining the Graphic Profile Index with a Profilograph	770		
2019	Determining the International Roughness Index with An Inertial Laser Profiler	772		
2007	Non-destructive Depth Measurement of Concrete Pavement	775		
2014	Evaluation of Retroreflectivity of Durable & High Performance Pavement Markings Using Portable Hand-Operated Instrument	777		
2018	Unit Weight and Voids in Aggregate		19	
2020	Compressive Strength of Cylindrical Concrete Specimens		22	
2018	Making and Curing Concrete Test Specimens in Field		23	
2020	Sieve Analysis of Fine and Coarse Aggregate, including Wet Sieve		27/11	
2019	Mechanical Analysis of Extracted Aggregate		30	
2017	Specific Gravity and Absorption of Fine Aggregate		84	
2020	Specific Gravity and Absorption of Coarse Aggregate		85	
2020	Moisture-Density Relations of Soils Using a 2.5kg Rammer and a 305-mm Drop and Moisture-Density Relations of Soils Using a 4.54kg Rammer and a 457-mm Drop		99/180	
2019	Slump of Hydraulic Cement Concrete		119	
2020	Mass Per Cubic Meter, Yield, and Air Content of Concrete		121	
2020	Air Content of Freshly Mixed Concrete by the Pressure Method		152	
2020	Bulk Specific Gravity of Compacted Bituminous Mixtures		166	

INDEX OF FIELD TEST PROCEDURES (CONTINUED)

PROCEDURE DATE	TITLE OF PROCEDURE	ODOT TM*	AASHTO T / R*	WAQTC TM*
2019	Plastic Fines In Graded Aggregates and Soils by the Use of the Sand Equivalent Test		176	
2020	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures		209	
2018	Determination of Moisture in Soils and Fine Aggregate by Means of Calcium Carbide Gas Pressure Moisture Tester		217	
2017	Capping Cylindrical Concrete Specimens		231	
2016	Total Moisture Content of Construction Materials by Drying/Laboratory Determination of Moisture Content of Soils		255/265	
2018	One-Point Method for Determining Maximum Dry Density and Optimum Moisture		272	
2007	Resistance of Compacted Bituminous Mixture to Moisture Induced Damage		283	
2020	Determining the Asphalt Cement Content of HMAC by the Ignition Method		308	
2020	Temperature of Freshly Mixed Portland Cement Concrete		309	
2020	In-Place Density of Embankment and Base using the Nuclear Moisture-Density Gauge		310	
2019	Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures		324	
2020	Moisture Content of Hot Mix Asphalt (HMA) by Oven Method		329	
2017	Determining the Percentage of Fracture in Coarse Aggregate		335	
2020	In-Place Density of Asphalt Mixes by the Nuclear Method		355	
2019	Reducing Samples of Hot Mix Asphalt to Testing Size		R-47	
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2016	Developing a Family of Curves		R 75	
2020	Reducing Samples of Aggregates to Testing Size		R 76	
2020	Sampling of Aggregates		R 90	
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2020	Sampling Freshly Mixed Concrete			2
2019	Volumetric Properties of Hot Mix Asphalt (HMA)			13

* (T) – Test Method is a definitive procedure (such as identification, measurement or evaluation of properties) that produces a test result.
(R) – Recommended Practices are a definitive set of instructions for performing specific operations (such as sampling, collection, or inspection) that do not produce a test result.
(TM) – Test Method.

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ODOT

ODOT TM 759

Method of Test For

STATIC MODULUS OF ELASTICITY OF POLYMER CONCRETE CYLINDERS

1. Scope*

1.1 This test method covers determination of modulus of elasticity (Young's).

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Significance and Use

2.1 This test method provides a stress to strain ratio value and a ratio of lateral to longitudinal strain for Premixed Polymer Concrete (PPC) at whatever age and curing conditions may be designated.

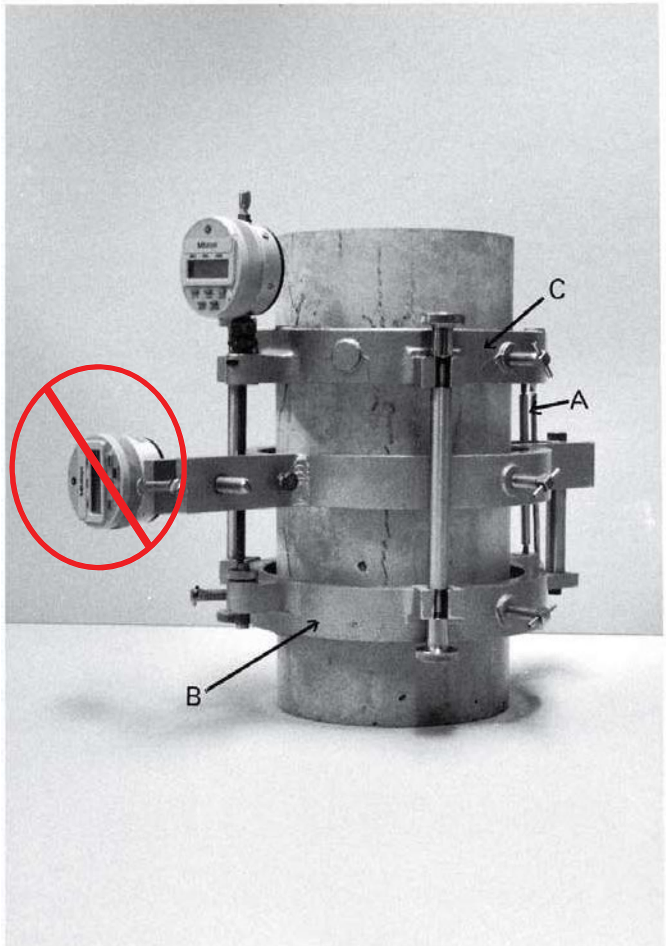
2.2 The modulus of elasticity values, applicable within the customary working stress range (0 to 40 % of ultimate PPC strength), are used for acceptance of Premixed Polymer Concrete.

2.3 The modulus of elasticity values obtained will usually be less than moduli derived under rapid load application (dynamic or seismic rates, for example), and will usually be greater than values under slow load application or extended load duration, given other test conditions being the same.

3. Apparatus

3.1 *Testing Machine- Use* a testing machine capable of imposing a load at the rate and of the magnitude prescribed in 6.4. of ASTM C469/C469M. The machine shall conform to the requirements of Practices E4 (Constant-Rate of-Traverse CRT-Type Testing Machines section). The spherical head and bearing blocks shall conform to the Apparatus Section of Test Method C39/C39M.

3.2 *Compressometer3- For* determining the modulus of elasticity use a bonded or unbonded sensing device that measures to the nearest 5 millionths the average deformation of two diametrically opposite gauge lines, each parallel to the axis, and each centered about mid-height of the specimen.



4. Procedure

4.1 Use three specimens to determine the modulus of elasticity and compressive strength.

4.2 Place the specimen, with the strain-measuring equipment attached, on the lower platen or bearing block of the testing machine. Carefully align the axis of the specimen with the center of thrust of the spherically-seated upper bearing block. Note the reading on the strain indicators. Before applying the load on the specimen, tilt the movable portion of the spherically seated block by hand so that the bearing face appears to be parallel to the top of the test specimen based on visual observation.

4.3 Load the specimen two (2) times. Do not record any data during the first loading. Base calculations on the second loading of the specimen.

4.4 Apply the load continuously and without shock. Set testing machines of the screw type so that the moving head travels at a rate of about 1 mm/min [0.05 in./min] when the machine is running idle. In hydraulically operated machines, apply the load at a constant rate within the range 250 +/- 50 kPa/s [35 +/- 7 psi/s]. Load the specimen until the applied load is 10,000 lbs.

4.5 During the first loading, observe the performance of the gauge. Correct any attachment or alignment defects that may be causing erratic readings prior to the second loading. For the second loading of the sample, apply 100 lb. and zero all gauges and obtain each set of readings as follows: Record, without interruption of loading, the applied load and longitudinal strain every 5,000 lbs. to a minimum 40,000 lbs. If intermediate readings are taken, plot the results of each of the tests with the longitudinal strain as the abscissa and the compressive stress as the ordinate.

4.6 Continue loading the sample until the ultimate load is achieved and recorded. Calculate the compressive stress by dividing the ultimate load by the cross-sectional area of the specimen calculated from the diameter.

5. Calculation

5.1 Calculate the modulus of elasticity, to the nearest 200 MPa [29,000 psi].

$$E = (S_2 \_ S_1) / £2 - 0.000050)$$

Where:

E = chord modulus of elasticity, MPa [psi],

S_2 = stress corresponding to 40% of ultimate load,

S_1 = stress corresponding to a longitudinal strain, £1, of 50 millionths, MPa [psi], and

$£2$ = longitudinal strain produced by stress S_2.

Take the average of the modulus of elasticity of the three specimens to determine pass/fail results.

INSERT TAB

AASHTO

Compressive Strength of Cylindrical Concrete Specimens

AASHTO Designation: T 22-20
ASTM Designation: C39/C 39M-05

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES
FOP FOR AASHTO T 27
MATERIALS FINER THAN 75 μM (NO. 200) SIEVE IN MINERAL AGGREGATE BY WASHING
FOP FOR AASHTO T 11

Scope

A sieve analysis, or 'gradation,' measures distribution of aggregate particle sizes within a given sample.

Accurate determination of the amount of material smaller than 75 µm (No. 200) cannot be made using just AASHTO T 27. If quantifying this material is required, use AASHTO T 11 in conjunction with AASHTO T 27.

This FOP covers sieve analysis in accordance with AASHTO T 27-20 and materials finer than 75 µm (No. 200) in accordance with AASHTO T 11-20 performed in conjunction with AASHTO T 27. The procedure includes three methods: A, B, and C.

Apparatus

- Balance or scale: Capacity sufficient for the masses shown in Table 1, accurate to 0.1 percent of the sample mass or readable to 0.1 g, and meeting the requirements of AASHTO M 231
- Sieves: Meeting the requirements of ASTM E11
- Mechanical sieve shaker: Meeting the requirements of AASHTO T 27
- Suitable drying equipment (refer to FOP for AASHTO T 255)
- Containers and utensils: A pan or vessel of sufficient size to contain the sample covered with water and permit vigorous agitation without loss of material or water
- Optional
  - Mechanical washing device
  - Mallet: With a rubber or rawhide head having a mass of 0.57 ±0.23 kg (1.25 ±0.5 lb)

Sample Sieving

- In all procedures, the sample is shaken in nested sieves. Sieves are selected to furnish information required by specification. Intermediate sieves are added for additional information or to avoid overloading sieves, or both.
- The sieves are nested in order of increasing size from the bottom to the top, and the sample, or a portion of the sample, is placed on the top sieve.
- The loaded sieves are shaken in a mechanical shaker for approximately 10 minutes, refer to Annex A, *Time Evaluation*.

- Care must be taken so that sieves are not overloaded, refer to Annex B, *Overload Determination*. The sample may be sieved in increments and the mass retained for each sieve added together from each sample increment to avoid overloading sieves.

Sample Preparation

Obtain samples according to the FOP for AASHTO R 90 and reduce to sample size, shown in Table 1, according to the FOP for AASHTO R 76.

TABLE 1
Sample Sizes for Aggregate Gradation Test

Nominal Maximum Size* mm (in.)	Minimum Dry Mass g (lb)
125 (5)	300,000 (660)
100 (4)	150,000 (330)
90 (3 1/2)	100,000 (220)
75 (3)	60,000 (130)
63 (2 1/2)	35,000 (77)
50 (2)	20,000 (44)
37.5 (1 1/2)	15,000 (33)
25.0 (1)	10,000 (22)
19.0 (3/4)	5000 (11)
12.5 (1/2)	2000 (4)
9.5 (3/8)	1000 (2)
6.3 (1/4)	1000 (2)
4.75 (No. 4)	500 (1)

*Nominal maximum size: One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps between specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Sample sizes in Table 1 are standard for aggregate sieve analysis, due to equipment restraints samples may need to be divided into several "subsamples." For example, a gradation that requires 100 kg (220 lbs.) of material would not fit into a large tray shaker all at once.

Some agencies permit reduced sample sizes if it is proven that doing so is not detrimental to the test results. Some agencies require larger sample sizes. Check agency guidelines for required or permitted sample sizes.

Selection of Procedure

Agencies may specify which method to perform. If a method is not specified, perform Method A.

Overview

Method A

- Determine original dry mass of the sample
- Wash over a 75µm (No. 200) sieve
- Determine dry mass of washed sample
- Sieve washed sample
- Calculate and report percent retained and passing each sieve

Method B

- Determine original dry mass of the sample
- Wash over a 75 µm (No. 200) sieve
- Determine dry mass of washed sample
- Sieve sample through coarse sieves, 4.75 mm (No. 4) sieves and larger
- Determine mass of fine material, minus 4.75 mm (No. 4)
- Reduce fine material
- Determine mass of reduced portion
- Sieve reduced portion
- Calculate and report percent retained and passing each sieve

Method C

- Determine original dry mass of the sample
- Sieve sample through coarse sieves, 4.75 mm (No. 4) sieves and larger
- Determine mass of fine material, minus 4.75 mm (No. 4)
- Reduce fine material
- Determine mass of reduced portion
- Wash reduced portion over a 75µm (No. 200) sieve
- Determine dry mass of washed reduced portion
- Sieve washed reduced portion
- Calculate and report percent retained and passing each sieve

Procedure Method A

1. Dry the sample to constant mass according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the original dry mass of the sample to the nearest 0.1 percent or 0.1 g. Designate this mass as *M*.

   When the specification does not require the amount of material finer than 75 µm (No. 200) be determined by washing, skip to Step 11.

2. Nest a sieve, such as a 2.0 mm (No. 10), above the 75 µm (No. 200) sieve.
3. Place the sample in a container and cover with water.

Note 1: A detergent, dispersing agent, or other wetting solution may be added to the water to assure a thorough separation of the material finer than the 75 µm (No. 200) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.

4. Agitate vigorously to ensure complete separation of the material finer than 75 µm (No. 200) from coarser particles and bring the fine material into suspension above the coarser material. Avoid degradation of the sample when using a mechanical washing device.

Note 2: Washing longer than 10 minutes in a mechanical washer has been shown to cause significant amounts of degradation depending upon aggregate type.

5. Immediately pour the wash water containing the suspended material over the nested sieves; be careful not to pour out the coarser particles or over fill the 75 µm (No. 200) sieve.
6. Add water to cover material remaining in the container, agitate, and repeat Step 5. Continue until the wash water is reasonably clear.
7. Remove the upper sieve and return material retained to the washed sample.
8. Rinse the material retained on the 75 µm (No. 200) sieve until water passing through the sieve is reasonably clear and detergent or dispersing agent is removed, if used.
9. Return all material retained on the 75 µm (No. 200) sieve to the container by rinsing into the washed sample.

Note 3: Excess water may be carefully removed with a bulb syringe; the removed water must be discharged back over the 75 µm (No. 200) sieve to prevent loss of fines.

10. Dry the washed sample to constant mass according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the dry mass of the sample.
11. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 75 µm
    (No. 200).
12. Place the sample, or a portion of the sample, on the top sieve. Sieves may already be in the mechanical shaker, if not place sieves in mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

Note 4: Excessive shaking (more than 10 minutes) may result in degradation of the sample.

13. Determine and record the individual or cumulative mass retained for each sieve and in the pan. Ensure that all material trapped in full openings of the sieve are removed and included in the mass retained.

Note 5: For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft bristle brushes for smaller sieves.

Note 6: In the case of coarse / fine aggregate mixtures, distribute the minus 4.75 mm (No. 4) among two or more sets of sieves to prevent overloading of individual sieves.

14. Perform the *Check Sum* calculation – Verify the *total mass after sieving* agrees with the *dry mass before sieving* to within 0.3 percent. The *dry mass before sieving* is the dry mass after wash or the original dry mass (*M*) if performing the sieve analysis without washing. Do not use test results for acceptance if the *Check Sum* result is greater than 0.3 percent.
15. Calculate the total percentages passing, and the individual or cumulative percentages retained to the nearest 0.1 percent by dividing the individual sieve masses or cumulative sieve masses by the original dry mass (*M*) of the sample.
16. Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method A Calculations

Check Sum

$$Check\ Sum = \frac{dry\ mass\ before\ seiving - total\ mass\ after\ sieving}{dry\ mass\ before\ sieving} \times 100$$

Percent Retained

$$IPR = \frac{IMR}{M} \times 100 \qquad or \qquad CPR = \frac{CMR}{M} \times 100$$

Where:

IPR	=	Individual Percent Retained
CPR	=	Cumulative Percent Retained
M	=	Original dry mass of the sample
IMR	=	Individual Mass Retained
CMR	=	Cumulative Mass Retained

Percent Passing (PP)

$$PP = PPP - IPR \qquad or \qquad PP = 100 - CPR$$

Where:

PP	=	Percent Passing
PPP	=	Previous Percent Passing

Method A Example Individual Mass Retained

Original dry mass of the sample (*M*):	5168.7 g
Dry mass of the sample after washing:	4911.3 g
Total mass after sieving equals	
Sum of Individual Masses Retained (IMR), including minus 75 µm (No. 200) in the pan:	4905.9 g
Amount of 75µm (No. 200) minus washed out (5168.7 g – 4911.3 g):	257.4 g

Check Sum

$$Check\ Sum = \frac{4911.3\ g - 4905.9\ g}{4911.3\ g} \times 100 = 0.1\%$$

The result is less than 0.3 percent therefore the results can be used for acceptance purposes.

Individual Percent Retained (IPR) for 9.5 mm (3/8 in.) sieve:

$$IPR = \frac{619.2\ g}{5168.7\ g} \times 100 = 12.0\%$$

Percent Passing (PP) 9.5 mm (3/8 in.) sieve:

$$PP = 86.0\% - 12.0\% = 74.0\%$$

Reported Percent Passing = 74%

Method A Individual
Gradation on All Sieves

Sieve Size mm (in.)	Individual Mass Retained g (IMR)	Determine IPR Divide IMR by *M* and multiply by 100	Individual Percent Retained (IPR)	Determine PP by subtracting IPR from Previous PP	Percent Passing (PP)	Reported Percent Passing*
19.0 (3/4)	0		0		100.0	100
12.5 (1/2)	724.7	$\frac{724.7}{5168.7} \times 100 =$	14.0	$100.0 - 14.0 =$	86.0	86
9.5 (3/8)	619.2	$\frac{619.2}{5168.7} \times 100 =$	12.0	$86.0 - 12.0 =$	74.0	74
4.75 (No. 4)	1189.8	$\frac{1189.8}{5168.7} \times 100 =$	23.0	$74.0 - 23.0 =$	51.0	51
2.36 (No. 8)	877.6	$\frac{877.6}{5168.7} \times 100 =$	17.0	$51.0 - 17.0 =$	34.0	34
1.18 (No. 16)	574.8	$\frac{574.8}{5168.7} \times 100 =$	11.1	$34.0 - 11.1 =$	22.9	23
0.600 (No. 30)	329.8	$\frac{329.8}{5168.7} \times 100 =$	6.4	$22.9 - 6.4 =$	16.5	17
0.300 (No. 50)	228.5	$\frac{228.5}{5168.7} \times 100 =$	4.4	$16.5 - 4.4 =$	12.1	12
0.150 (No. 100)	205.7	$\frac{205.7}{5168.7} \times 100 =$	4.0	$12.1 - 4.0 =$	8.1	8
0.075 (No. 200)	135.4	$\frac{135.7}{5168.7} \times 100 =$	2.6	$8.1 - 2.6 =$	5.5	5.5
minus 0.075 (No. 200) in the pan	20.4					
Total mass after sieving = sum of sieves + mass in the pan = 4905.9 g						
Original dry mass of the sample *(M)*: 5168.7g						

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method A Example Cumulative Mass Retained

Original dry mass of the sample (*M*):	5168.7 g
Dry mass of the sample after washing:	4911.3 g
Total mass after sieving equals Final Cumulative Mass Retained (FCMR) (includes minus 75 µm (No. 200) from the pan):	4905.9 g
Amount of 75µm (No. 200) minus washed out (5168.7 g – 4911.3 g):	257.4 g

Check Sum

$$Check\ Sum = \frac{4911.3\ g - 4905.9\ g}{4911.3\ g} \times 100 = 0.1\%$$

The result is less than 0.3 percent therefore the results can be used for acceptance purposes.

Cumulative Percent Retained (CPR) for 9.5 mm (3/8 in.) sieve:

$$CPR = \frac{1343.9\ g}{5168.7\ g} \times 100 = 26.0\%$$

Percent Passing (PP) 9.5 mm (3/8 in.) sieve:

$$PP = 100.0\% - 26.0\% = 74.0\%$$

Reported Percent Passing = 74%

Method A Cumulative
Gradation on All Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Determine CPR Divide CMR by M and multiply by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)	Reported Percent Passing*
19.0 (3/4)	0		0.0		100.0	100
12.5 (1/2)	724.7	$\frac{724.7}{5168.7} \times 100 =$	14.0	$100.0 - 14.0 =$	86.0	86
9.5 (3/8)	1343.9	$\frac{1343.9}{5168.7} \times 100 =$	26.0	$100.0 - 26.0 =$	74.0	74
4.75 (No. 4)	2533.7	$\frac{2533.7}{5168.7} \times 100 =$	49.0	$100.0 - 49.0 =$	51.0	51
2.36 (No. 8)	3411.3	$\frac{3411.3}{5168.7} \times 100 =$	66.0	$100.0 - 66.0 =$	34.0	34
1.18 (No. 16)	3986.1	$\frac{3986.1}{5168.7} \times 100 =$	77.1	$100.0 - 77.1 =$	22.9	23
0.600 (No. 30)	4315.9	$\frac{4315.9}{5168.7} \times 100 =$	83.5	$100.0 - 83.5 =$	16.5	17
0.300 (No. 50)	4544.4	$\frac{4544.4}{5168.7} \times 100 =$	87.9	$100.0 - 87.9 =$	12.1	12
0.150 (No. 100)	4750.1	$\frac{4750.1}{5168.7} \times 100 =$	91.9	$100.0 - 91.9 =$	8.1	8
0.075 (No. 200)	4885.5	$\frac{4885.5}{5168.7} \times 100 =$	94.5	$100.0 - 94.5 =$	5.5	5.5
FCMR	4905.9					
Total mass after sieving: 4905.9 g						
Original dry mass of the sample *(M)*: 5168.7 g						

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Procedure Method B

1. Dry the sample to constant mass according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the original dry mass of the sample to the nearest 0.1 percent or 0.1 g. Designate this mass as *M*.

   When the specification does not require the amount of material finer than 75 µm (No. 200) be determined by washing, skip to Step 11.

2. Nest a protective sieve, such as a 2.0 mm (No. 10), above the 75 µm (No. 200) sieve.
3. Place the sample in a container and cover with water.

Note 1: A detergent, dispersing agent, or other wetting solution may be added to the water to assure a thorough separation of the material finer than the 75 µm (No. 200) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.

4. Agitate vigorously to ensure complete separation of the material finer than 75 µm (No. 200) from coarser particles and bring the fine material into suspension above the coarser material. Avoid degradation of the sample when using a mechanical washing device.

Note 2: Washing longer than 10 minutes in a mechanical washer has been shown to cause significant amounts of degradation depending upon aggregate type.

5. Immediately pour the wash water containing the suspended material over the nested sieves; be careful not to pour out the coarser particles or over fill the 75 µm (No. 200) sieve.
6. Add water to cover material remaining in the container, agitate, and repeat Step 5. Continue until the wash water is reasonably clear.
7. Remove the upper sieve and return material retained to the washed sample.
8. Rinse the material retained on the 75 µm (No. 200) sieve until water passing through the sieve is reasonably clear and detergent or dispersing agent is removed, if used.
9. Return all material retained on the 75 µm (No. 200) sieve to the container by rinsing into the washed sample.

Note 3: Excess water may be carefully removed with a bulb syringe; the removed water must be discharged back over the 75 µm (No. 200) sieve to prevent loss of fines.

10. Dry the washed sample to constant mass according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the dry mass after wash.
11. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 4.75 mm
    (No. 4).
12. Place the sample, or a portion of the sample, on the top sieve. Sieves may already be in the mechanical shaker, if not place the sieves in the mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

Note 4: Excessive shaking (more than 10 minutes) may result in degradation of the sample.

13. Determine and record the individual or cumulative mass retained for each sieve. Ensure that all particles trapped in full openings of the sieve are removed and included in the mass retained.

Note 5: For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft hair bristle for smaller sieves.

14. Determine and record the mass of the minus 4.75 mm (No. 4) material in the pan. Designate this mass as M_1.

15. Perform the *Coarse Check Sum* calculation – Verify the *total mass after coarse sieving* agrees with the *dry mass before sieving* to within 0.3 percent. The *dry mass before sieving* is the dry mass after wash or the original dry mass (M) if performing the sieve analysis without washing. Do not use test results for acceptance if the *Check Sum* result is greater than 0.3 percent.

16. Reduce the minus 4.75 mm (No. 4) according to the FOP for AASHTO R 76 to produce a sample with a minimum mass of 500 g. Determine and record the mass of the minus 4.75 mm (No. 4) split, designate this mass as M_2.

17. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 75 µm (No. 200) up to, but not including, the 4.75 mm (No. 4) sieve.

18. Place the sample portion on the top sieve and place the sieves in the mechanical shaker. Shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

19. Determine and record the individual or cumulative mass retained for each sieve and in the pan. Ensure that all particles trapped in full openings of the sieve are removed and included in the mass retained.

Note 6: For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft hair bristle for smaller sieves.

20. Perform the *Fine Check Sum* calculation – Verify the *total mass after sieving* agrees with the *dry mass before sieving* (M_2) to within 0.3 percent. Do not use test results for acceptance if the *Check Sum* result is greater than 0.3 percent.

21. Calculate to the nearest 0.1 percent, the Individual Mass Retained (IMR) or Cumulative Mass Retained (CMR) of the size increment of the reduced sample and the original sample.

22. Calculate the total percent passing.

23. Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method B Calculations

Check Sum

$$Coarse\ Check\ Sum = \frac{dry\ mass\ before\ sieveing - total\ mass\ after\ coarse\ sieving}{dry\ mass\ before\ sieving} \times 100$$

$$Fine\ Check\ Sum = \frac{M_2 - total\ mass\ after\ fine\ sieving}{M_2} \times 100$$

Percent Retained for 4.75 mm (No. 4) and larger

$$IPR = \frac{IMR}{M} \times 100 \qquad or \qquad CPR = \frac{CMR}{M} \times 100$$

Where:

IPR	=	Individual Percent Retained
CPR	=	Cumulative Percent Retained
M	=	Original dry mass of the sample
IMR	=	Individual Mass Retained
CMR	=	Cumulative Mass Retained

Percent Passing (PP) for 4.75 mm (No. 4) and larger

$$PP = PPP - IPR \qquad or \qquad PP = 100 - CPR$$

Where:

PP	=	Percent Passing
PPP	=	Previous Percent Passing

Minus 4.75mm (No. 4) adjustment factor (R)

The mass of material retained for each sieve is multiplied by the adjustment factor, the total mass of the minus 4.75 mm (No. 4) from the pan, M_1, divided by the mass of the reduced split of minus 4.75 mm (No. 4), M_2. For consistency, this adjustment factor is carried to three decimal places.

$$R = \frac{M_1}{M_2}$$

where:

R	= minus 4.75 mm (No. 4) adjustment factor
M_1	= total mass of minus 4.75 mm (No. 4) before reducing
M_2	= mass of the reduced split of minus 4.75 mm (No. 4)

Adjusted Individual Mass Retained (AIMR):

$$AIMR = R \times B$$

where:

AIMR	= Adjusted Individual Mass Retained
R	= minus 4.75 mm (No. 4) adjustment factor
B	= individual mass of the size increment in the reduced portion sieved

Adjusted Cumulative Mass Retained (ACMR)

$$ACMR = (R \times B) + D$$

where:

ACMR	= Adjusted Cumulative Mass Retained
R	= minus 4.75 mm (No. 4) adjustment factor
B	= cumulative mass of the size increment in the reduced portion sieved
D	= cumulative mass of plus 4.75mm (No. 4) portion of sample

Method B Example Individual Mass Retained

Dry mass of total sample, before washing:	3214.0 g
Dry mass of sample after washing:	3085.1 g
Total mass after sieving	
Sum of Individual Masses Retained (IMR) plus the minus 4.75 mm (No. 4) from the pan:	3085.0 g
Amount of 75 µm (No. 200) minus washed out (3214.0 g – 3085.1 g):	128.9 g

Coarse Check Sum

$$Coarse\ Check\ Sum = \frac{3085.1\ g - 3085.0\ g}{3085.1\ g} \times 100 = 0.0\%$$

The result is less than 0.3 percent therefore the results can be used for acceptance purposes.

Individual Percent Retained (IPR) for 9.5 mm (3/8 in.) sieve

$$IPR = \frac{481.4\ g}{3214.0\ g} \times 100 = 15.0\%$$

Percent Passing (PP) for 9.5 mm (3/8 in.) sieve:

$$PP = 95.0\% - 15.0\% = 80.0\%$$

Reported Percent Passing = 80%

Method B Individual
Gradation on Coarse Sieves

Sieve Size mm (in.)	Individual Mass Retained g (IMR)	Determine IPR Divide IMR by M and multiply by 100	Individual Percent Retained (IPR)	Determine PP by subtracting IPR from Previous PP	Percent Passing (PP)
16.0 (5/8)	0		0		100
12.5 (1/2)	161.1	$\frac{161.1}{3214.0} \times 100 =$	5.0	$100.0 - 5.0 =$	95.0
9.50 (3/8)	481.4	$\frac{481.4}{3214.0} \times 100 =$	15.0	$95.0 - 15.0 =$	80.0
4.75 (No. 4)	475.8	$\frac{475.8}{3214.0} \times 100 =$	14.8	$80.0 - 14.8 =$	65.2
Minus 4.75 (No. 4) in the pan	1966.7 (**M_1**)				
Total mass after sieving: sum of sieves + mass in the pan = 3085.0 g					
Original dry mass of the sample *(M)*: 3214.0 g					

Fine Sample

The minus 4.75 mm (No. 4) from the pan, M_1 (1966.7 g), was reduced according to the FOP for AASHTO R 76, to at least 500 g. In this case, the reduced mass was determined to be **512.8 g**. This is M_2.

The reduced mass was sieved.

Total mass after sieving equals

Sum of Individual Masses Retained (IMR) including minus 75 µm (No. 200) in the pan 511.8 g

Fine Check Sum

$$Fine\ Check\ Sum = \frac{512.8\ g - 511.8\ g}{512.8\ g} \times 100 = 0.2\%$$

The result is less than 0.3 percent therefore the results can be used for acceptance purposes.

Adjustment Factor (*R*) for Adjusted Individual Mass Retained (AIMR) on minus 4.75 (No. 4) sieves

The mass of material retained for each sieve is multiplied by the adjustment factor (*R*) carried to three decimal places.

$$R = \frac{M_1}{M_2} = \frac{1{,}966.7\ g}{512.8\ g} = 3.835$$

where:

R	= minus 4.75 mm (No. 4) adjustment factor
M_1	= total mass of minus 4.75 mm (No. 4) from the pan
M_2	= mass of the reduced split of minus 4.75 mm (No. 4)

Each "individual mass retained" on the fine sieves must be multiplied by *R* to obtain the *Adjusted Individual Mass Retained*.

Adjusted Individual Mass Retained (AIMR) for 2.00 mm (No. 10) sieve

$$AIMR\ = 3.835\ \times\ 207.1\ g\ =\ 794.2\ g$$

Individual Percent Retained (IPR) for 2.00 mm (No. 10) sieve:

$$IPR\ = \frac{794.2\ g}{3214.0\ g} \times 100 = 24.7\%$$

Percent Passing (PP) 2 mm (No. 10) sieve:

$$PP = 65.2\% - 24.7\% = 40.5\%$$

Reported Percent Passing = 41%

Method B Individual Gradation on Fine Sieves

Sieve Size mm (in.)	**Individual Mass Retained g (IMR)**	Determine TIMR Multiply IMR by R $\left(\frac{M_1}{M_2}\right)$	**Total Individual Mass Retained (TIMR)**
2.00 (No. 10)	207.1	$207.1 \times 3.835 =$	794.2
0.425 (No. 40)	187.9	$187.9 \times 3.835 =$	720.6
0.210 (No. 80)	59.9	$59.9 \times 3.835 =$	229.7
0.075 (No. 200)	49.1	$49.1 \times 3.835 =$	188.3
minus 0.075 (No. 200) in the pan	7.8		
Total mass after sieving: sum of fine sieves + the mass in the pan = 511.8 g			

Method B Individual
Final Gradation on All Sieves

Sieve Size mm (in.)	Total Individual Mass Retained g (TIMR)	Determine IPR Divide TIMR by M and multiply by 100	Individual Percent Retained (IPR)	Determine PP by subtracting IPR from Previous PP	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0		0		100	100
12.5 (1/2)	161.1	$\frac{161.1}{3214.0} \times 100 =$	5.0	$100.0 - 5.0 =$	95.0	95
9.50 (3/8)	481.4	$\frac{481.4}{3214.0} \times 100 =$	15.0	$95.0 - 15.0 =$	80.0	80
4.75 (No. 4)	475.8	$\frac{475.8}{3214.0} \times 100 =$	14.8	$80.0 - 14.8 =$	65.2	65
2.00 (No. 10)	794.2	$\frac{794.2}{3214.0} \times 100 =$	24.7	$65.2 - 24.7 =$	40.5	41
0.425 (No. 40)	720.6	$\frac{720.6}{3214.0} \times 100 =$	22.4	$40.5 - 22.4 =$	18.1	18
0.210 (No. 80)	229.7	$\frac{229.7}{3214.0} \times 100 =$	7.1	$18.1 - 7.1 =$	11.0	11
0.075 (No. 200)	188.3	$\frac{188.3}{3214.0} \times 100 =$	5.9	$11.0 - 5.9 =$	5.1	5.1
minus 0.075 (No. 200) in the pan	29.9					
Original dry mass of the sample *(M)*: 3214.0 g						

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method B Example Cumulative Mass Retained

Original dry mass of the sample *(M)*:	3214.0 g
Dry mass of sample after washing:	3085.1 g
Total mass after sieving equals	
Cumulative Mass Retained (CMR) on the 4.75 (No. 4) plus the minus 4.75 mm (No. 4) in the pan:	3085.0 g
Amount of 75 µm (No. 200) minus washed out (3214.0 g – 3085.1 g):	128.9 g

Coarse Check Sum

$$\boldsymbol{Coarse\ Check\ Sum} = \frac{3085.1\ g - 3085.0\ g}{3085.1\ g} \times 100 = 0.0\%$$

The result is less than 0.3 percent therefore the results can be used for acceptance purposes.

Cumulative Percent Retained (CPR) for 9.5 mm (3/8 in.) sieve

$$CPR = \frac{642.5\ g}{3214.0\ g} \times 100 = 20.0\%$$

Percent Passing (PP) for 9.5 mm (3/8 in.) sieve

$$PP = 100.0\% - 20.0\% = 80.0\%$$

Reported Percent Passing = 80%

Method B Cumulative
Gradation on Coarse Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Determine CPR Divide CMR by M and multiply by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)
16.0 (5/8)	0		0		100
12.5 (1/2)	161.1	$\frac{161.1}{3214.0} \times 100 =$	5.0	$100.0 - 5.0 =$	95.0
9.50 (3/8)	642.5	$\frac{642.5}{3214.0} \times 100 =$	20.0	$100.0 - 20.0 =$	80.0
4.75 (No. 4)	1118.3 (*D*)	$\frac{1118.3}{3214.0} \times 100 =$	34.8	$100.0 - 34.8 =$	65.2
Minus 4.75 (No. 4) in the pan	1966.7 (M_1)				
CMR: 1118.3 + 1966.7 = 3085.0					
Original dry mass of the sample *(M)*: 3214.0 g					

Fine Sample

The mass of minus 4.75 mm (No. 4) material in the pan, M_1 (1966.7 g), was reduced according to the FOP for AASHTO R 76, to at least 500 g. In this case, the reduced mass was determined to be **512.8 g**. This is M_2.

The reduced mass was sieved.

Total mass after fine sieving equals

Final Cumulative Mass Retained (FCMR) (includes minus 75 µm (No. 200) from the pan): 511.8 g

Fine Check Sum

$$Fine\ Check\ Sum = \frac{512.8\ g - 511.8\ g}{512.8\ g} \times 100 = 0.2\%$$

The result is less than 0.3 percent therefore the results can be used for acceptance purposes.

The cumulative mass of material retained for each sieve is multiplied by the adjustment factor (*R*) carried to three decimal places and added to the cumulative mass retained on the 4.75 mm (No. 4) sieve, *D,* to obtain the *Adjusted Cumulative Mass Retained (ACMR)*.

Adjustment factor (*R*) for Cumulative Mass Retained (CMR) in minus 4.75 (No. 4) sieves

$$R = \frac{M_1}{M_2} = \frac{1{,}966.7\ g}{512.8\ g} = 3.835$$

where:

R	= minus 4.75 mm (No. 4) adjustment factor
M_1	= total mass of minus 4.75 mm (No. 4) from the pan
M_2	= mass of the reduced split of minus 4.75 mm (No. 4)

Adjusted Cumulative Mass Retained (ACMR) for the 2.00 mm (No. 10) sieve

$$ACMR = 3.835 \times 207.1\ g = 794.2\ g$$

Total Cumulative Mass Retained (TCMR) for the 2.00 mm (No. 10) sieve

$$TCMR = 794.2\ g + 1118.3\ g = 1912.5\ g$$

Cumulative Percent Retained (CPR) for 2.00 mm (No. 10) sieve:

$$CPR = \frac{1912.5\ g}{3214.0\ g} \times 100 = 59.5\%$$

Percent Passing (PP) 2.00 mm (No. 10) sieve:

$$PP = 100.0\% - 59.5\% = 40.5\%$$

Reported Percent Passing = 41%

Method B Cumulative
Gradation on Fine Sieves

Sieve Size mm (in.)	Cumulative Mass Retained, g (CMR)	Determine AIMR Multiply IMR by R $\left(\frac{M_1}{M_2}\right)$ and adding D	Total Cumulative Mass Retained (TCMR)
2.00 (No. 10)	207.1	$207.1 \times 3.835 + 1118.3 =$	1912.5
0.425 (No. 40)	395.0	$395.0 \times 3.835 + 1118.3 =$	2633.1
0.210 (No. 80)	454.9	$454.9 \times 3.835 + 1118.3 =$	2862.8
0.075 (No. 200)	504.0	$504.0 \times 3.835 + 1118.3 =$	3051.1
FCMR	511.8		
Total: sum of masses on fine sieves + minus 75 µm (No. 200) in the pan = 511.8			

Method B Cumulative
Final Gradation on All Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Determine CPR Divide CMR by M and multiply by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0		0		100.0	100
12.5 (1/2)	161.1	$\frac{161.1}{3214.0} \times 100 =$	5.0	$100.0 - 5.0 =$	95.0	95
9.5 (3/8)	642.5	$\frac{642.5}{3214.0} \times 100 =$	20.0	$100.0 - 20.0 =$	80.0	80
4.75 (No. 4)	1118.3 (*D*)	$\frac{1118.3}{3214.0} \times 100 =$	34.8	$100.0 - 34.8 =$	65.2	65
2.00 (No. 10)	1912.5	$\frac{1912.5}{3214.0} \times 100 =$	59.5	$100.0 - 59.5 =$	40.5	41
0.425 (No. 40)	2633.1	$\frac{2633.1}{3214.0} \times 100 =$	81.9	$100.0 - 81.9 =$	18.1	18
0.210 (No. 80)	2862.8	$\frac{2862.8}{3214.0} \times 100 =$	89.1	$100.0 - 89.1 =$	10.9	11
0.075 (No. 200)	3051.1	$\frac{3051.1}{3214.0} \times 100 =$	94.9	$100.0 - 94.9 =$	5.1	5.1
FCMR	3081.1					
Original dry mass of the sample *(M):* 3214.0 g						

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Procedure Method C

1. Dry the sample to constant mass according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the original dry mass of the sample to the nearest 0.1 percent or 0.1 g. Designate this mass as *M*.
2. Break up any aggregations or lumps of clay, silt, or adhering fines to pass the 4.75 mm (No. 4) sieve.
3. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 4.75 mm (No. 4) sieve.
4. Place the sample, or a portion of the sample, on the top sieve. Sieves may already be in the mechanical shaker, if not place the sieves in the mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

Note 1: Excessive shaking (more than 10 minutes) may result in degradation of the sample.

5. Determine and record the cumulative mass retained for each sieve. Ensure that all material trapped in full openings of the sieve are removed and included in the mass retained.

Note 2: For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft bristle brush for smaller sieves.

6. Determine and record the mass of the minus 4.75 mm (No. 4) material in the pan. Designate this mass as M_1.
7. Perform the *Coarse Check Sum* calculation –Verify the *total mass after coarse sieving* agrees with the *original dry mass (M)* within 0.3 percent.
8. Reduce the minus 4.75 mm (No. 4) according to the FOP for AASHTO R 76, to produce a sample with a minimum mass of 500 g.
9. Determine and record the mass of the minus 4.75 mm (No. 4) split, designate this mass as M_3.
10. Nest a protective sieve, such as a 2.0 mm (No. 10), above the 75 µm (No. 200) sieve.
11. Place the sample in a container and cover with water.

Note 3: A detergent, dispersing agent, or other wetting solution may be added to the water to assure a thorough separation of the material finer than the 75 µm (No. 200) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.

12. Agitate vigorously to ensure complete separation of the material finer than 75 µm (No. 200) from coarser particles and bring the fine material into suspension above the coarser material. Avoid degradation of the sample when using a mechanical washing device.

Note 4: Washing longer than 10 minutes in a mechanical washer has been shown to cause significant amounts of degradation depending upon aggregate type.

13. Immediately pour the wash water containing the suspended material over the nested sieves; be careful not to pour out the coarser particles or over fill the 75 µm (No. 200) sieve.
14. Add water to cover material remaining in the container, agitate, and repeat Step 12. Repeat until the wash water is reasonably clear.
15. Remove the upper sieve and return material retained to the washed sample.
16. Rinse the material retained on the 75 µm (No. 200) sieve until water passing through the sieve is reasonably clear and detergent or dispersing agent is removed, if used.
17. Return all material retained on the 75 µm (No. 200) sieve to the container by flushing into the washed sample.

Note 5: Excess water may be carefully removed with a bulb syringe; the removed water must be discharged back over the 75 µm (No. 200) sieve to prevent loss of fines.

18. Dry the washed sample portion to constant mass according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the dry mass, designate this mass as *dry mass before sieving*.
19. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 75 µm (No. 200) sieve up to, but not including, the 4.75 mm (No. 4) sieve.
20. Place the sample portion on the top sieve. Place the sieves in the mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

Note 6: Excessive shaking (more than 10 minutes) may result in degradation of the sample.

21. Determine and record the cumulative mass retained for each sieve. Ensure that all material trapped in full openings of the sieve are removed and included in the mass retained.

Note 7: For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft bristle brushes for smaller sieves.

22. Perform the *Fine Check Sum* calculation – Verify the *total mass after fine sieving* agrees with the *dry mass before sieving* within 0.3 percent. Do not use test results for acceptance if the *Check Sum* is greater than 0.3 percent.
23. Calculate the Cumulative Percent Retained (CPR) and Percent Passing (PP) for the 4.75 mm (No. 4) and larger.
24. Calculate the Cumulative Percent Retained ($CPR_{-\#4}$) and the Percent Passing ($PP_{-\#4}$) for minus 4.75 mm (No. 4) split and Percent Passing (PP) for the minus 4.75 mm (No. 4).
25. Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method C Calculations

Check Sum

$$Coarse\ check\ sum = \frac{M - total\ mass\ after\ coarse\ sieving}{M} \times 100$$

$$Fine\ check\ sum = \frac{dry\ mass\ before\ sieving - total\ mass\ after\ fine\ sieving}{dry\ mass\ before\ sieving} \times 100$$

where:

M = Original dry mass of the sample

Cumulative Percent Retained (CPR) for 4.75 mm (No. 4) sieve and larger

$$CPR = \frac{CMR}{M} \times 100$$

where:

CPR = Cumulative Percent Retained of the size increment for the total sample

CMR = Cumulative Mass Retained of the size increment for the total sample

M = Total dry sample mass before washing

Percent Passing (PP) 4.75 mm (No. 4) sieve and larger

$$PP = 100 - CPR$$

where:

PP = Percent Passing of the size increment for the total sample

CPR = Cumulative Percent Retained of the size increment for the total sample

Or, calculate PP for sieves larger than 4.75 mm (No. 4) sieve without calculating CPR

$$\frac{M - CMR}{M} \times 100$$

Cumulative Percent Retained ($CPR_{-\#4}$) for minus 4.75 mm (No. 4) split

$$CPR_{-\#4} = \frac{CMR_{-\#4}}{M_3} \times 100$$

where:

$CPR_{-\#4}$ = Cumulative Percent Retained for the sieve sizes of M_3

$CMR_{-\#4}$ = Cumulative Mass Retained for the sieve sizes of M_3

M_3 = Total mass of the minus 4.75 mm (No. 4) split before washing

Percent Passing ($PP_{-\#4}$) for minus 4.75 mm (No. 4) split

$$PP_{-\#4} = 100 - CPR_{-\#4}$$

where:

$PP_{-\#4}$ = Percent Passing for the sieve sizes of M_3

$CPR_{-\#4}$ = Cumulative Percent Retained for the sieve sizes of M_3

Percent Passing (PP) for sieves smaller than 4.75 mm (No. 4) sieve

$$PP = \frac{(PP_{-\#4} \times \#4\ PP)}{100}$$

where:

PP = Total Percent Passing

$PP_{-\#4}$ = Percent Passing for the sieve sizes of M_3

#4 PP = Total Percent Passing the 4.75 mm (No. 4) sieve

Or, calculate PP for sieves smaller than 4.75 mm (No. 4) sieve without calculating $CPR_{-\#4}$ and $PP_{-\#4}$

$$PP = \frac{\#4\ PP}{M_3} \times (M_3 - CMR_{-\#4})$$

where:

PP	=	Total Percent Passing
#4 PP	=	Total Percent Passing the 4.75 mm (No. 4) sieve
M_3	=	Total mass of the minus 4.75 mm (No. 4) split before washing
$CMR_{-\#4}$	=	Cumulative Mass Retained for the sieve sizes of M_3

Method C Example

Original dry mass of the sample (*M*): 3304.5 g

Total mass after sieving equals

Cumulative Mass Retained (CMR) on the 4.75 (No. 4) plus the minus 4.75 mm (No. 4) from the pan: 3085.0 g

Coarse Check Sum

$$Coarse\ Check\ Sum = \frac{3304.5\ g - 3304.5\ g}{3304.5\ g} \times 100 = 0.0\%$$

The result is less than 0.3 percent therefore the results can be used for acceptance purposes.

Cumulative Percent Retained (CPR) for the 9.5 mm (3/8 in.) sieve:

$$CPR = \frac{604.1\ g}{3304.5\ g} \times 100 = 18.3\%$$

Percent Passing (PP) for the 9.5 mm (3/8 in.) sieve:

$$PP = 100.0\% - 18.3\% = 81.7\%$$

Reported Percent Passing = 82%

Example for Alternate Percent Passing (PP) formula for the 9.5 mm (3/8 in.) sieve:

$$PP = \frac{3304.5 \ - 604.1}{3304.5} \times 100 = 81.7\%$$

Reported Percent Passing = 82%

Method C Cumulative
Gradation on Coarse Sieves

Sieve Size mm (in.)	Cumulative Mass Retained, g (CMR)	Determine CPR Divide CMR by M and multiply by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0		0.0		100.0	100
12.5 (1/2)	125.9	$\frac{125.9}{3304.5} \times 100 =$	3.8	$100.0 - 3.8 =$	96.2	96
9.50 (3/8)	604.1	$\frac{604.1}{3304.5} \times 100 =$	18.3	$100.0 - 18.3 =$	81.7	82
4.75 (No. 4)	1295.6	$\frac{1295.6}{3304.5} \times 100 =$	39.2	$100.0 - 39.2 =$	**60.8 (#4 PP)**	61
Mass in pan	2008.9					
CMR: 1295.6 + 2008.9 = 3304.5						
Original dry mass of the sample *(M)*: 3304.5						

Fine Sample

The pan (2008.9 g) was reduced according to the FOP for AASHTO R 76, to at least 500 g. In this case, the reduced mass was determined to be **527.6 g**. This is M_3.

Dry mass of minus 4.75mm (No. 4) reduced portion before wash (M_3): 527.6 g

Dry mass of minus 4.75mm (No. 4) reduced portion after wash: 495.3 g

Total mass after fine sieving equals

Final Cumulative Mass Retained (FCMR)
(includes minus 75 µm (No. 200) from the pan): 495.1 g

Fine Check Sum

$$Fine\ Check\ Sum = \frac{495.3\ g - 495.1\ g}{495.3\ g} \times 100 = 0.04\%$$

The result is less than 0.3 percent therefore the results can be used for acceptance purposes.

Cumulative Percent Retained ($CPR_{-\#4}$) for minus 4.75 mm (No. 4) for the 2.0 mm (No. 10) sieve:

$$CPR_{-\#4} = \frac{194.3\ g}{527.6\ g} \times 100 = 36.8\%$$

Percent Passing ($PP_{-\#4}$) for minus 4.75 mm (No. 4) for the 2.0 mm (No. 10) sieve:

$$PP_{-\#4} = 100.0\% - 36.8\% = 63.2\%$$

Method C Cumulative Gradation on Fine Sieves 77

Sieve Size mm (in.)	Cumulative Mass Retained g ($CMR_{-\#4}$)	Determine $CPR_{-\#4}$ Divide CMR by M_3 and multiply by 100	Cumulative Percent Retained$_{-\#4}$ ($CPR_{-\#4}$)	Determine $PP_{-\#4}$ by subtracting $CPR_{-\#4}$ from 100.0	Percent Passing$_{-\#4}$ ($PP_{-\#4}$)
2.0 (No. 10)	194.3	$\frac{194.3}{527.6} \times 100 =$	36.8	$100.0 - 36.8 =$	63.2
0.425 (No. 40)	365.6	$\frac{365.6}{527.6} \times 100 =$	69.3	$100.0 - 69.3 =$	30.7
0.210 (No. 80)	430.8	$\frac{430.8}{527.6} \times 100 =$	81.7	$100.0 - 81.7 =$	18.3
0.075 (No. 200)	484.4	$\frac{484.4}{527.6} \times 100 =$	91.8	$100.0 - 91.8 =$	8.2
FCMR	495.1				
Dry mass of minus 4.75mm (No. 4) reduced portion before wash *(M_3)*: 527.6 g					
Dry mass after washing: 495.3 g					

Percent Passing (PP) for the 2.0 mm (No. 10) sieve for the entire sample:

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#4 PP (Total Percent Passing the 4.75 mm (No. 4) sieve) = 60.8%

$$PP = \frac{63.2\% \times 60.8\%}{100} = 38.4\%$$

Reported Percent Passing = 38%

Method C Cumulative
Final Gradation on All Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Cumulative Percent Retained (CPR)	Percent Passing (PP -#4)	Determine PP multiply $PP_{-\#4}$ by #4 PP and divide by 100	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0	0.0			100.0	100
12.5 (1/2)	125.9	3.8			96.2	96
9.5 (3/8)	604.1	18.3			81.7	82
4.75 (No. 4)	1295.6	39.2			**60.8 (#4 PP)**	61
2.0 (No. 10)	194.3	36.8	63.2	$\frac{63.2 \times 60.8}{100} =$	38.4	38
0.425 (No. 40)	365.6	69.3	30.7	$\frac{30.7 \times 60.8}{100} =$	18.7	19
0.210 (No. 80)	430.8	81.7	18.3	$\frac{18.3 \times 60.8}{100} =$	11.1	11
0.075 (No. 200)	484.4	91.8	8.2	$\frac{8.2 \times 60.8}{100} =$	5.0	5.0
FCMR	495.1					

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Example for Alternate Percent Passing (PP) for the 4.75 mm (No. 4) sieve for the entire sample:

#4 PP (Total Percent Passing the 4.75 mm (No. 4) sieve) = 60.8%

$$PP = \frac{60.8\%}{527.6} \times (527.6 - 194.3) = 38.4\%$$

Reported Percent Passing = 38%

Alternate Method C Cumulative Gradation on Coarse Sieves

Sieve Size mm (in.)	Cumulative Mass Retained, g (CMR)	Determine PP subtract CMR from M, divide result by M multiply by 100	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0.0		100.0	100
12.5 (1/2)	125.9	$\frac{3304.5 - 125.9}{3304.5} \times 100 =$	96.2	96
9.5 (3/8)	604.1	$\frac{3304.5 - 604.1}{3304.5} \times 100 =$	81.7	82
4.75 (No. 4)	1295.6	$\frac{3304.5 - 1295.6}{3304.5} \times 100 =$	**60.8 (#4 PP)**	61
Mass in Pan	2008.9			
Cumulative sieved mass: 1295.6 + 2008.9 = 3304.5				
Original dry mass of the sample *(M)*: 3304.5				

Alternate Method C Cumulative Gradation on Fine Sieves

Sieve Size mm (in.)	**Cumulative Mass Retained g ($CMR_{-\#4}$)**	Determine $PP_{-\#4}$ subtract $CMR_{-\#4}$ from M_3, divide result by M_3 multiply by 100	**Percent Passing$_{-\#4}$ ($PP_{-\#4}$)**
2.0 (No. 10)	194.3	$\frac{527.6-194.3}{527.6}\times 100=$	63.2
0.425 (No. 40)	365.6	$\frac{527.6-365.6}{527.6}\times 100=$	30.7
0.210 (No. 80)	430.8	$\frac{527.6-430.8}{527.6}\times 100=$	18.3
0.075 (No. 200)	484.4	$\frac{527.6-484.4}{527.6}\times 100=$	8.2
FCMR	495.1		
Dry mass of minus 4.75mm (No. 4) reduced portion before wash (**M_3**): 527.6 g			
Dry mass after washing: 495.3 g			

Alternate Method C Cumulative
Final Gradation on All Sieves

Sieve Size mm (in.)	Percent Passing$_{-\#4}$ (PP$_{-\#4}$)	Determine PP multiply PP$_{-\#4}$ by #4 PP and divide by 100	Determined Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)			100.0	100
12.5 (1/2)			96.2	96
9.5 (3/8)			81.7	82
4.75 (No. 4)			**60.8 (#4 PP)**	61
2.0 (No. 10)	63.2	$\frac{63.2 \times 60.8}{100} =$	38.4	38
0.425 (No. 40)	30.7	$\frac{30.7 \times 60.8}{100} =$	18.7	19
0.210 (No. 80)	18.3	$\frac{18.3 \times 60.8}{100} =$	11.1	11
0.075 (No. 200)	8.2	$\frac{8.2 \times 60.8}{100} =$	5.0	5.0

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

FINENESS MODULUS

Fineness Modulus (FM) is used in determining the degree of uniformity of the aggregate gradation in PCC mix designs. It is an empirical number relating to the fineness of the aggregate. The higher the FM the coarser the aggregate. Values of 2.40 to 3.00 are common for fine aggregate in PCC.

The sum of the cumulative percentages retained on specified sieves in the following table divided by 100 gives the FM.

Sample Calculation

	Example A				Example B		
	Percent				Percent		
		Retained				Retained	
Sieve Size mm (in)	**Passing**		**On Spec'd Sieves***		**Passing**		**On Spec'd Sieves***
75*(3)	100	0	0		100	0	0
37.5*(11/2)	100	0	0		100	0	0
19*(3/4)	15	85	85		100	0	0
9.5*(3/8)	0	100	100		100	0	0
4.75*(No.4)	0	100	100		100	0	0
2.36*(No.8)	0	100	100		87	13	13
1.18*(No.16)	0	100	100		69	31	31
0.60*(No.30	0	100	100		44	56	56
0.30*(No.50)	0	100	100		18	82	82
0.15*(100)	0	100	100		4	96	96
			$\sum = 785$				$\sum = 278$
			FM = 7.85				FM = 2.78

In decreasing size order, each * sieve is one-half the size of the preceding * sieve.

Report

- On forms approved by the agency
- Sample ID
- Percent passing for each sieve
- Individual mass retained for each sieve
- Individual percent retained for each sieve

  or

- Cumulative mass retained for each sieve
- Cumulative percent retained for each sieve
- FM to the nearest 0.01

Report percentages to the nearest 1 percent except for the percent passing the 75 µm (No. 200) sieve, which shall be reported to the nearest 0.1 percent.

ANNEX A
Time Evaluation

(Mandatory information)

The sieving time for each mechanical sieve shaker shall be checked at least annually to determine the time required for complete separation of the sample by the following method:

1. Shake the sample over nested sieves for approximately 10 minutes.
2. Provide a snug-fitting pan and cover for each sieve and hold in a slightly inclined position in one hand.
3. Hand shake each sieve by striking the side of the sieve sharply and with an upward motion against the heel of the other hand at the rate of about 150 times per minute, turning the sieve about one sixth of a revolution at intervals of about 25 strokes.

Note A1: A mallet may be used instead of the heel of the hand if comparable force is used.

If more than 0.5 percent by mass of the total sample before sieving passes any sieve after one minute of continuous hand shaking adjust shaker time and re-check.

In determining sieving time for sieve sizes larger than 4.75 mm (No. 4), limit the material on the sieve to a single layer of particles.

ANNEX B
Overload Determination

(Mandatory information)

Additional sieves may be necessary to keep from overloading sieves or to provide other information, such as fineness modulus. The sample may also be sieved in increments to prevent overloading.

- For sieves with openings smaller than 4.75 mm (No. 4), the mass retained on any sieve shall not exceed 7 kg/m^2 (4 g/in^2) of sieving surface.
- For sieves with openings 4.75 mm (No. 4) and larger, the mass, in grams shall not exceed the product of 2.5 × (sieve opening in mm) × (effective sieving area). See Table B1.

TABLE B1

Maximum Allowable Mass of Material Retained on a Sieve, g
Nominal Sieve Size, mm (in.)
Exact size is smaller (see AASHTO T 27)

Sieve Size mm (in.)		203 dia (8)	305 dia (12)	305 by 305 (12 × 12)	350 by 350 (14 × 14)	372 by 580 (16 × 24)
				Sieving Area m^2		
		0.0285	**0.0670**	**0.0929**	**0.1225**	**0.2158**
90	(3 1/2)	*	15,100	20,900	27,600	48,500
75	(3)	*	12,600	17,400	23,000	40,500
63	(2 1/2)	*	10,600	14,600	19,300	34,000
50	(2)	3600	8400	11,600	15,300	27,000
37.5	(1 1/2)	2700	6300	8700	11,500	20.200
25.0	(1)	1800	4200	5800	7700	13,500
19.0	(3/4)	1400	3200	4400	5800	10,200
16.0	(5/8)	1100	2700	3700	4900	8600
12.5	(1/2)	890	2100	2900	3800	6700
9.5	(3/8)	670	1600	2200	2900	5100
6.3	(1/4)	440	1100	1500	1900	3400
4.75	(No. 4)	330	800	1100	1500	2600
-4.75	(-No. 4)	200	470	650	860	1510

MECHANICAL ANALYSIS OF EXTRACTED AGGREGATE
FOP FOR AASHTO T 30

Scope

This procedure covers mechanical analysis of aggregate recovered from asphalt mix samples in accordance with AASHTO T 30-19. This FOP utilizes the aggregate recovered from the ignition furnace used in AASHTO T 308. AASHTO T 30 was developed for analysis of extracted aggregate and thus includes references to extracted bitumen and filter element, which do not apply in this FOP.

Sieve analyses determine the gradation or distribution of aggregate particles within a given sample in order to determine compliance with design and production standards.

Apparatus

- Balance or scale: Capacity sufficient for the sample mass, accurate to 0.1 percent of the sample mass or readable to 0.1 g
- Sieves, meeting the requirements of FOP for AASHTO T 27/T 11.
- Mechanical sieve shaker, meeting the requirements of FOP for AASHTO T 27/T 11.
- Mechanical Washing Apparatus (optional)
- Suitable drying equipment, meeting the requirements of the FOP for AASHTO T 255.
- Containers and utensils: A pan or vessel of a size sufficient to contain the sample covered with water and to permit vigorous agitation without loss of any part of the sample or water.

Sample Sieving

- In this procedure, it is required to shake the sample over nested sieves. Sieves are selected to furnish information required by specification. Intermediate sieves are added for additional information or to avoid overloading sieves, or both.
- The sieves are nested in order of increasing size from the bottom to the top, and the test sample, or a portion of the test sample, is placed on the top sieve.
- The loaded sieves are shaken in a mechanical shaker for approximately 10 minutes, refer to Annex A; *Time Evaluation*.

Mass Verification

Using the aggregate sample obtained from the FOP for AASHTO T 308, determine and record the mass of the sample, $M_{(T30)}$, to 0.1 g. This mass shall agree with the mass of the aggregate remaining after ignition, M_f from T 308, within 0.10 percent. If the variation exceeds 0.10 percent, the results cannot be used for acceptance.

Calculation

$$Mass\ verification = \frac{M_{f\,(T308)} - M_{(T30)}}{M_{f\,(T308)}} \times 100$$

Where:

$M_{f(T308)}$ = Mass of aggregate remaining after ignition from the FOP for AASHTO T 308

$M_{(T30)}$ = Mass of aggregate sample obtained from the FOP for AASHTO T 308

Example:

$$Mass\ verification = \frac{2422.5\ g\ -\ 2422.3\ g}{2422.5\ g} \times\ 100\ = 0.01\%$$

Given:

$M_{f(T308)}$ = 2422.5 g

$M_{(T30)}$ = 2422.3 g

Procedure

1. Nest a sieve, such as a 2.0 mm (No. 10) or 1.18 mm (No. 16), above the 75µm (No. 200) sieve.
2. Place the test sample in a container and cover with water. Add a detergent, dispersing agent, or other wetting solution to the water to assure a thorough separation of the material finer than the 75µm (No. 200) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.
3. Agitate vigorously to ensure complete separation of the material finer than 75µm (No. 200) from coarser particles and bring the fine material into suspension above the coarser material. Avoid degradation of the sample when using a mechanical washing device. Maximum agitation is 10 min.

Note 1: When mechanical washing equipment is used, the introduction of water, agitating, and decanting may be a continuous operation. Use care not to overflow or overload the 75µm (No. 200) sieve.

4. Immediately pour the wash water containing the suspended material over the nested sieves; be careful not to pour out the coarser particles or over fill the 75 µm (No. 200) sieve.
5. Add water to cover material remaining in the container, agitate, and repeat Step 4. Continue until the wash water is reasonably clear.

6. Remove the upper sieve, return material retained to the washed sample.
7. Rinse the material retained on the 75 µm (No. 200) sieve until water passing through the sieve is reasonably clear and detergent or dispersing agent is removed.
8. Return all material retained on the 75 µm (No. 200) sieve to the washed sample by rinsing into the washed sample.
9. Dry the washed test sample to constant mass according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the "dry mass after washing."
10. Select sieves required by the specification and those necessary to avoid overloading. With a pan on bottom, nest the sieves increasing in size starting with the 75 µm (No. 200).
11. Place the test sample, or a portion of the test sample, on the top sieve. Place sieves in mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

Note 2: Excessive shaking (more than 10 minutes) may result in degradation of the sample.

12. Determine and record the individual or cumulative mass retained for each sieve including the pan. Ensure that all material trapped in full openings of the sieves are removed and included in the mass retained.

Note 3: For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft bristle brushes for smaller sieves.

13. Perform the *Check Sum* calculation – Verify the *total mass after sieving* of material agrees with the *dry mass after washing* within 0.2 percent. Do not use test results for acceptance if the *Check Sum* result is greater than 0.2 percent.
14. Calculate the total percentages passing, and the individual or cumulative percentages retained, to the nearest 0.1 percent by dividing the individual sieve masses or cumulative sieve masses by the total mass of the initial dry sample.
15. Apply the Aggregate Correction Factor (ACF) to the calculated percent passing, as required in the FOP for AASHTO T 308 "Correction Factor," to obtain the reported percent passing.
16. Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Calculations

Check Sum

$$check\ sum = \frac{dry\ mass\ after\ washing - total\ mass\ after\ sieving}{dry\ mass\ after\ washing} \times 100$$

Percent Retained

Individual

$$\text{IPR} = \frac{IMR}{M_{T30}} \times 100$$

Cumulative

$$\text{CPR} = \frac{CMR}{M_{T30}} \times 100$$

Where:

IPR	=	Individual Percent Retained
CPR	=	Cumulative Percent Retained
M_{T30}	=	Total dry sample mass before washing
IMR	=	Individual Mass Retained
CMR	=	Cumulative Mass Retained

Percent Passing

Individual

$$PP = PCP - IPR$$

Cumulative

$$PP = 100 - CPR$$

Where:

PP	=	Calculated Percent Passing
PCP	=	Previous Calculated Percent Passing

Reported Percent Passing

$$RPP = PP + ACF$$

Where:

RPP	=	Reported Percent Passing
ACF	=	Aggregate Correction Factor (if applicable)

Example

Dry mass of total sample, before washing (M_{T30}):	2422.3 g
Dry mass of sample, after washing out the 75 µm (No. 200) minus:	2296.2 g
Amount of 75 µm (No. 200) minus washed out (2422.3 g – 2296.2g):	126.1 g

Check sum

$$check\ sum = \frac{2296.2\ g - 2295.3\ g}{2296.2\ g} \times 100 = 0.04\%$$

This is less than 0.2 percent therefore the results can be used for acceptance purposes.

Percent Retained for the 75 µm (No. 200) sieve

$$IPR = \frac{63.5\ g}{2422.3\ g} \times 100 = 2.6\%$$

or

$$CPR = \frac{2289.6\ g}{2422.3\ g} \times 100 = 94.5\%$$

Percent Passing using IPR and PCP for the 75 µm (No. 200) sieve

$$PP = 8.1\% - 2.6\% = 5.5\%$$

Percent Passing using CPR for the 75 µm (No. 200) sieve

$$PP = 100.0\% - 94.5\% = 5.5\%$$

Reported Percent Passing

$$RPP = 5.5\% = (-0.6\%) = 4.9\%$$

Individual
Gradation on All Sieves

Sieve Size mm (in.)	Individual Mass Retained g (IMR)	Determine IPR Divide IMR by *M* and multiply by 100	Individual Percent Retained (IPR)	Determine PP by subtracting IPR from Previous PP	Percent Passing (PP)	Agg. Corr. Factor from T 308 (ACF)	Reported Percent Passing*
19.0 (3/4)	0		0		100.0		100
12.5 (1/2)	346.9	$\frac{346.9}{2422.3} \times 100 =$	14.3	$100.0 - 14.3 =$	85.7		86
9.5 (3/8)	207.8	$\frac{207.8}{2422.3} \times 100 =$	8.6	$85.7 - 8.6 =$	77.1		77
4.75 (No. 4)	625.4	$\frac{625.4}{2422.3} \times 100 =$	25.8	$77.1 - 25.8 =$	51.3		51
2.36 (No. 8)	416.2	$\frac{416.2}{2422.3} \times 100 =$	17.2	$51.3 - 17.2 =$	34.1		34
1.18 (No. 16)	274.2	$\frac{274.2}{2422.3} \times 100 =$	11.3	$34.1 - 11.3 =$	22.8		23
0.600 (No. 30)	152.1	$\frac{152.1}{2422.3} \times 100 =$	6.3	$22.8 - 6.3 =$	16.5		17
0.300 (No. 50)	107.1	$\frac{107.1}{2422.3} \times 100 =$	4.4	$16.5 - 4.4 =$	12.1		12
0.150 (No. 100)	96.4	$\frac{96.4}{2422.3} \times 100 =$	4.0	$12.1 - 4.0 =$	8.1		8
0.075 (No. 200)	63.5	$\frac{63.5}{2422.3} \times 100 =$	2.6	$8.1 - 2.6 =$	5.5	-0.6 ($5.5 - 0.6 =$)	4.9
minus 75 µm (No. 200) in the pan	5.7						
Total mass after sieving = sum of sieves + mass in the pan = 2295.3 g							
Dry mass of total sample, before washing (M_{T30}): 2422.3g							

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Cumulative
Gradation on All Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Determine CPR Divide CMR by M and multiply by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)	Agg. Corr. Factor from T 308 (ACF)	Reported Percent Passing*
19.0 (3/4)	0		0.0		100.0		100
12.5 (1/2)	346.9	$\frac{346.9}{2422.3} \times 100 =$	14.3	$100.0 - 14.3 =$	85.7		86
9.5 (3/8)	554.7	$\frac{554.7}{2422.3} \times 100 =$	22.9	$100.0 - 22.9 =$	77.1		77
4.75 (No. 4)	1180.1	$\frac{1180.1}{2422.3} \times 100 =$	48.7	$100.0 - 48.7 =$	51.3		51
2.36 (No. 8)	1596.3	$\frac{1596.3}{2422.3} \times 100 =$	65.9	$100.0 - 65.9 =$	34.1		34
1.18 (No. 16)	1870.5	$\frac{1870.5}{2422.3} \times 100 =$	77.2	$100.0 - 77.2 =$	22.8		23
0.600 (No. 30)	2022.6	$\frac{2022.6}{2422.3} \times 100 =$	83.5	$100.0 - 83.5 =$	16.5		17
0.300 (No. 50)	2129.7	$\frac{2129.7}{2422.3} \times 100 =$	87.9	$100.0 - 87.9 =$	12.1		12
0.150 (No. 100)	2226.1	$\frac{2226.1}{2422.3} \times 100 =$	91.9	$100.0 - 91.9 =$	8.1		8
0.075 (No. 200)	2289.6	$\frac{2289.6}{2422.3} \times 100 =$	94.5	$100.0 - 94.5 =$	5.5	-0.6 $(5.5 - 0.6 =)$	4.9
minus 75 µm (No. 200) in the pan	2295.3						
Total mass after sieving = 2295.3 g							
Dry mass of total sample, before washing (M_{T30}): 2422.3g							

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Report

- On forms approved by the agency
- Sample ID
- Depending on the agency, this may include:
  - Individual mass retained on each sieve
  - Individual percent retained on each sieve
  - Cumulative mass retained on each sieve
  - Cumulative percent retained on each sieve
  - Aggregate Correction Factor for each sieve from AASHTO T 308
  - Calculated percent passing each sieve to 0.1 percent
- Percent passing to the nearest 1 percent, except 75 µm (No. 200) sieve to the nearest 0.1 percent.

ANNEX A TIME EVALUATION

(Mandatory Information)

The minimum time requirement should be evaluated for each shaker at least annually by the following method:

1. Shake the sample over nested sieves for approximately 10 minutes.
2. Provide a snug-fitting pan and cover for each sieve and hold in a slightly inclined position in one hand.
3. Hand-shake each sieve by striking the side of the sieve sharply and with an upward motion against the heel of the other hand at the rate of about 150 times per minute, turning the sieve about one sixth of a revolution at intervals of about 25 strokes.

If more than 0.5 percent by mass of the total sample before sieving passes any sieve after one minute of continuous hand sieving adjust shaker time and re-check.

In determining sieving time for sieve sizes larger than 4.75 mm (No. 4), limit the material on the sieve to a single layer of particles.

ANNEX B OVERLOAD DETERMINATION

(Mandatory Information)

- For sieves with openings smaller than 4.75 mm (No. 4), the mass retained on any sieve shall not exceed 7 kg/m^2 (4 g/in^2) of sieving surface.
- For sieves with openings 4.75 mm (No. 4) and larger, the mass (in kg) shall not exceed the product of 2.5 x (sieve opening in mm) x (effective sieving area). See Table B1.

Additional sieves may be necessary to keep from overloading the specified sieves. The sample may also be sieved in increments or sieves with a larger surface area.

TABLE B1
Maximum Allowable Mass of Material Retained on a Sieve, g
Nominal Sieve Size, mm (in.)
Exact size is smaller (see AASHTO T 27)

Sieve Size mm (in.)		203 dia (8)	305 dia (12)	305 by 305 (12 × 12)	350 by 350 (14 × 14)	372 by 580 (16 × 24)
		Sieving Area m^2				
		0.0285	0.0670	0.0929	0.1225	0.2158
90	(3 1/2)	*	15,100	20,900	27,600	48,500
75	(3)	*	12,600	17,400	23,000	40,500
63	(2 1/2)	*	10,600	14,600	19,300	34,000
50	(2)	3600	8400	11,600	15,300	27,000
37.5	(1 1/2)	2700	6300	8700	11,500	20,200
25.0	(1)	1800	4200	5800	7700	13,500
19.0	(3/4)	1400	3200	4400	5800	10,200
16.0	(5/8)	1100	2700	3700	4900	8600
12.5	(1/2)	890	2100	2900	3800	6700
9.5	(3/8)	670	1600	2200	2900	5100
6.3	(1/4)	440	1100	1500	1900	3400
4.75	(No. 4)	330	800	1100	1500	2600
-4.75	(-No. 4)	200	470	650	860	1510

SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE FOP FOR AASHTO T 85

Scope

This procedure covers the determination of specific gravity and absorption of coarse aggregate in accordance with AASHTO T 85-14. Specific gravity may be expressed as bulk specific gravity (G_{sb}), bulk specific gravity, saturated surface dry (G_{sb} SSD), or apparent specific gravity (G_{sa}). G_{sb} and absorption are based on aggregate after soaking in water. This procedure is not intended to be used with lightweight aggregates.

Terminology

Absorption – the increase in the mass of aggregate due to water being absorbed into the pores of the material, but not including water adhering to the outside surface of the particles, expressed as a percentage of the dry mass. The aggregate is considered "dry" when it has been maintained at a temperature of 110 ±5°C (230 ±9°F) for sufficient time to remove all uncombined water.

Saturated Surface Dry (SSD) – condition of an aggregate particle when the permeable voids are filled with water, but no water is present on exposed surfaces.

Specific Gravity – the ratio of the mass, in air, of a volume of a material to the mass of the same volume of gas-free distilled water at a stated temperature.

Apparent Specific Gravity (G_{sa})– the ratio of the mass, in air, of a volume of the impermeable portion of aggregate to the mass of an equal volume of gas-free distilled water at a stated temperature.

Bulk Specific Gravity (G_{sb})– the ratio of the mass, in air, of a volume of aggregate (including the permeable and impermeable voids in the particles, but not including the voids between particles) to the mass of an equal volume of gas-free distilled water at a stated temperature.

Bulk Specific Gravity (SSD) (G_{sb} SSD) – the ratio of the mass, in air, of a volume of aggregate, including the mass of water within the voids filled to the extent achieved by submerging in water for 15 to 19 hours (but not including the voids between particles), to the mass of an equal volume of gas-free distilled water at a stated temperature.

Apparatus

- Balance or scale: with a capacity of 5 kg, sensitive to 0.1 g. Meeting the requirements of AASHTO M 231.
- Sample container: a wire basket of 3.35 mm (No. 6) or smaller mesh, with a capacity of 4 to 7 L (1 to 2 gal) to contain aggregate with a nominal maximum size of 37.5 mm (1 1/2 in.) or smaller; or a larger basket for larger aggregates, or both.
- Water tank: watertight and large enough to completely immerse aggregate and basket, equipped with an overflow valve to keep water level constant.

- Suspension apparatus: wire used to suspend apparatus shall be of the smallest practical diameter.
- Sieves: 4.75 mm (No. 4) or other sizes as needed, meeting the requirements of FOP for AASHTO T 27/T 11.
- Large absorbent towel

Sample Preparation

1. Obtain the sample in accordance with the FOP for AASHTO R 90 (see Note 1).
2. Mix the sample thoroughly and reduce it to the approximate sample size required by Table 1 in accordance with the FOP for AASHTO R 76.
3. Reject all material passing the appropriate sieve by dry sieving.
4. Thoroughly wash sample to remove dust or other coatings from the surface.
5. Dry the test sample to constant mass according to the FOP for AASHTO T 255/T 265 at a temperature of 110 ±5°C (230 ±9°F) and cool in air at room temperature for 1 to 3 hours.

Note 1: Where the absorption and specific gravity values are to be used in proportioning concrete mixtures in which the aggregates will be in their naturally moist condition, the requirement for initial drying to constant mass may be eliminated, and, if the surfaces of the particles in the sample have been kept continuously wet until test, the 15-to-19 hour soaking may also be eliminated.

6. Re-screen the sample over the appropriate sieve. Reject all material passing that sieve.
7. The sample shall meet or exceed the minimum mass given in Table 1.

Note 2: If this procedure is used only to determine the G_{sb} of oversized material for the FOP for AASHTO T 99 / T 180, the material can be rejected over the appropriate sieve. For T 99 / T 180 Methods A and B, use the 4.75 mm (No. 4) sieve; T 99 / T 180 Methods C and D use the 19 mm (3/4 in).

Table 1

Nominal Maximum Size* mm (in.)	Minimum Mass of Test Sample, g (lb)
12.5 (1/2) or less	2000 (4.4)
19.0 (3/4)	3000 (6.6)
25.0 (1)	4000 (8.8)
37.5 (1 1/2)	5000 (11)
50 (2)	8000 (18)
63 (2 1/2)	12,000 (26)
75 (3)	18,000 (40)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Procedure

1. Immerse the aggregate in water at room temperature for a period of 15 to 19 hours.

Note 3: When testing coarse aggregate of large nominal maximum size requiring large test samples, it may be more convenient to perform the test on two or more subsamples, and then combine the values obtained.

2. Place the empty basket into the water bath and attach to the balance. Inspect the immersion tank to ensure the water level is at the overflow outlet height. Tare the balance with the empty basket attached in the water bath.
3. Remove the test sample from the water and roll it in a large absorbent cloth until all visible films of water are removed. Wipe the larger particles individually. If the test sample dries past the SSD condition, immerse in water for 30 min, and then resume the process of surface-drying.

Note 4: A moving stream of air may be used to assist in the drying operation but take care to avoid evaporation of water from aggregate pores.

4. Determine the SSD mass of the sample, and record this and all subsequent masses to the nearest 0.1 g or 0.1 percent of the sample mass, whichever is greater. Designate this mass as “B.”
5. Immediately place the SSD test sample in the sample container and weigh it in water maintained at 23.0 ±1.7°C (73.4 ±3°F). Shake the container to release entrapped air before recording the weight. Re-inspect the immersion tank to ensure the water level is at the overflow outlet height. Designate this submerged weight as “C.”

Note 5: The container should be immersed to a depth sufficient to cover it and the test sample during mass determination. Wire suspending the container should be of the smallest practical size to minimize any possible effects of a variable immersed length.

6. Remove the sample from the basket. Ensure all material has been removed. Place in a container of known mass.
7. Dry the test sample to constant mass according to the FOP for AASHTO T 255 / T 265 at 110 ±5°C (230 ±9°F) and cool in air at room temperature for 1 to 3 hours.
8. Determine and record the dry mass. Designate this mass as “A.”

Calculations

Perform calculations and determine values using the appropriate formula below.

Bulk specific gravity (G_{sb})

$$G_{sb} = \frac{A}{B - C}$$

Bulk specific gravity, SSD (G_{sb} SSD)

$$G_{sb}SSD = \frac{B}{B - C}$$

Apparent specific gravity (G_{sa})

$$G_{sa} = \frac{A}{A - C}$$

Absorption

$$\text{Absorption} = \frac{B - A}{A} \times 100$$

Where:

A	= oven dry mass, g
B	= SSD mass, g
C	= weight in water, g

Sample Calculations

Sample	A	B	C	B - C	A - C	B - A
1	2030.9	2044.9	1304.3	740.6	726.6	14.0
2	1820.0	1832.5	1168.1	664.4	651.9	12.5
3	2035.2	2049.4	1303.9	745.5	731.3	14.2

Sample	G_{sb}	G_{sb} SSD	G_{sa}	Absorption
1	2.742	2.761	2.795	0.7
2	2.739	2.758	2.792	0.7
3	2.730	2.749	2.783	0.7

These calculations demonstrate the relationship between G_{sb}, G_{sb} SSD, and G_{sa}. G_{sb} is always lowest since the volume includes voids permeable to water. G_{sb} SSD is always intermediate. G_{sa} is always highest since the volume does not include voids permeable to water. When running this test, check to make sure the values calculated make sense in relation to one another.

Report

- On forms approved by the agency
- Sample ID
- Specific gravity values to the nearest 0.001
- Absorption to the nearest 0.1 percent

MOISTURE-DENSITY RELATIONS OF SOILS: USING A 2.5 KG (5.5 LB) RAMMER AND A 305 MM (12 IN.) DROP

FOP FOR AASHTO T 99
USING A 4.54 KG (10 LB) RAMMER AND A 457 MM (18 IN.) DROP
FOP FOR AASHTO T 180

Scope

This procedure covers the determination of the moisture-density relations of soils and soil-aggregate mixtures in accordance with two similar test methods:

- AASHTO T 99-19: Methods A, B, C, and D
- AASHTO T 180-20: Methods A, B, C, and D

This test method applies to soil mixtures having 40 percent or less retained on the 4.75 mm (No. 4) sieve for methods A or B, or, 30 percent or less retained on the 19 mm (¾ in.) with methods C or D. The retained material is defined as oversize (coarse) material. If no minimum percentage is specified, 5 percent will be used. Samples that contain oversize (coarse) material that meet percent retained criteria should be corrected by using *Annex A, Correction of Maximum Dry Density and Optimum Moisture for Oversized Particles*. Samples of soil or soil-aggregate mixture are prepared at several moisture contents and compacted into molds of specified size, using manual or mechanical rammers that deliver a specified quantity of compactive energy. The moist masses of the compacted samples are multiplied by the appropriate factor to determine wet density values. Moisture contents of the compacted samples are determined and used to obtain the dry density values of the same samples. Maximum dry density and optimum moisture content for the soil or soil-aggregate mixture is determined by plotting the relationship between dry density and moisture content.

Apparatus

- Mold – Cylindrical mold made of metal with the dimensions shown in Table 1 or Table 2. If permitted by the agency, the mold may be of the “split” type, consisting of two half-round sections, which can be securely locked in place to form a cylinder. Determine the mold volume according to *Annex B, Standardization of the Mold.*
- Mold assembly – Mold, base plate, and a detachable collar.
- Rammer – Manually or mechanically operated rammers as detailed in Table 1 or Table 2. A manually operated rammer shall be equipped with a guide sleeve to control the path and height of drop. The guide sleeve shall have at least four vent holes no smaller than 9.5 mm (3/8 in.) in diameter, spaced approximately 90 degrees apart and approximately 19 mm (3/4 in.) from each end. A mechanically operated rammer will uniformly distribute blows over the sample and will be calibrated with several soil types, and be adjusted, if necessary, to give the same moisture-density results as with the manually operated rammer. For additional information concerning calibration, see the FOP for AASHTO T 99 and T 180.

- Sample extruder – A jack, lever frame, or other device for extruding compacted specimens from the mold quickly and with little disturbance.
- Balance(s) or scale(s) of the capacity and sensitivity required for the procedure used by the agency.

  A balance or scale with a capacity of 11.5 kg (25 lb) and a sensitivity of 1 g for obtaining the sample, meeting the requirements of AASHTO M 231, Class G 5.

  A balance or scale with a capacity of 2 kg and a sensitivity of 0.1 g is used for moisture content determinations done under both procedures, meeting the requirements of AASHTO M 231, Class G 2.
- Drying apparatus – A thermostatically controlled drying oven, capable of maintaining a temperature of 110 ±5°C (230 ±9°F) for drying moisture content samples in accordance with the FOP for AASHTO T 255/T 265.
- Straightedge – A steel straightedge at least 250 mm (10 in.) long, with one beveled edge and at least one surface plane within 0.1 percent of its length, used for final trimming.
- Sieve(s) – 4.75 mm (No. 4) and/or 19.0 mm (3/4 in.), meeting the requirements of FOP for AASHTO T 27/T 11.
- Mixing tools – Miscellaneous tools such as a mixing pan, spoon, trowel, spatula, etc., or a suitable mechanical device, for mixing the sample with water.
- Containers with close-fitting lids to prevent gain or loss of moisture in the sample.

Table 1
Comparison of Apparatus, Sample, and Procedure – Metric

	T 99	T 180
Mold Volume, m^3	Methods A, C: 0.000943 ±0.000014	Methods A, C: 0.000943 ±0.000014
	Methods B, D: 0.002124 ±0.000025	Methods B, D: 0.002124 ±0.000025
Mold Diameter, mm	Methods A, C: 101.60 ±0.40	Methods A, C: 101.60 ±0.4
	Methods B, D: 152.40 ±0.70	Methods B, D: 152.40 ±0.70
Mold Height, mm	116.40 ±0.50	116.40 ±0.50
Detachable Collar Height, mm	50.80 ±0.64	50.80 ±0.64
Rammer Diameter, mm	50.80 ±0.25	50.80 ±0.25
Rammer Mass, kg	2.495 ±0.009	4.536 ±0.009
Rammer Drop, mm	305	457
Layers	3	5
Blows per Layer	Methods A, C: 25	Methods A, C: 25
	Methods B, D: 56	Methods B, D: 56
Material Size, mm	Methods A, B: 4.75 minus	Methods A, B: 4.75 minus
	Methods C, D: 19.0 minus	Methods C, D: 19.0 minus
Test Sample Size, kg	Method A: 3 Method B: 7 Method C: 5 (1) Method D: 11(1)	
Energy, kN-m/m^3	592	2,693

(1) This may not be a large enough sample depending on your nominal maximum size for moisture content samples.

Table 2
Comparison of Apparatus, Sample, and Procedure – English

	T 99	T 180
Mold Volume, ft^3	Methods A, C: 0.0333 ±0.0005	Methods A, C: 0.0333 ±0.0005
	Methods B, D: 0.07500 ±0.0009	Methods B, D: 0.07500 ±0.0009
Mold Diameter, in.	Methods A, C: 4.000 ±0.016	Methods A, C: 4.000 ±0.016
	Methods B, D: 6.000 ±0.026	Methods B, D: 6.000 ±0.026
Mold Height, in.	4.584 ±0.018	4.584 ±0.018
Detachable Collar Height, in.	2.000 ±0.025	2.000 ±0.025
Rammer Diameter, in.	2.000 ±0.025	2.000 ±0.025
Rammer Mass, lb	5.5 ±0.02	10 ±0.02
Rammer Drop, in.	12	18
Layers	3	5
Blows per Layer	Methods A, C: 25	Methods A, C: 25
	Methods B, D: 56	Methods B, D: 56
Material Size, in.	Methods A, B: No. 4 minus	Methods A, B: No.4 minus
	Methods C, D: 3/4 minus	Methods C, D: 3/4 minus
Test Sample Size, lb	Method A: 7 Method B: 16 Method C: 12(1) Method D: 25(1)	
Energy, lb-ft/ft^3	12,375	56,250

(1) This may not be a large enough sample depending on your nominal maximum size for moisture content samples.

Sample

If the sample is damp, dry it until it becomes friable under a trowel. Drying may be in air or by use of a drying apparatus maintained at a temperature not exceeding 60°C (140°F). Thoroughly break up aggregations in a manner that avoids reducing the natural size of individual particles.

Obtain a representative test sample of the mass required by the agency by passing the material through the sieve required by the agency. See Table 1 or Table 2 for test sample mass and material size requirements.

In instances where the material is prone to degradation, i.e., granular material, a compaction sample with differing moisture contents should be prepared for each point.

If the sample is plastic (clay types), it should stand for a minimum of 12 hours after the addition of water to allow the moisture to be absorbed. In this case, several samples at different moisture contents should be prepared, put in sealed containers, and tested the next day.

Note 1: Both T 99 and T 180 have four methods (A, B, C, D) that require different masses and employ different sieves.

Procedure

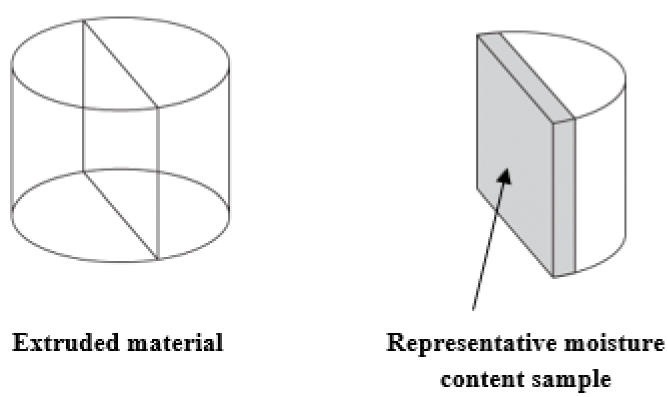
During compaction, rest the mold firmly on a dense, uniform, rigid, and stable foundation, or base. This base shall remain stationary during the compaction process.

1. Determine the mass of the clean, dry mold. Include the base plate but exclude the extension collar. Record the mass to the nearest 1 g (0.005 lb).
2. Thoroughly mix the selected representative sample with sufficient water to dampen it to approximately 4 to 8 percentage points below optimum moisture content. For many materials, this condition can be identified by forming a cast by hand.
   a. Prepare individual samples of plastic or degradable material, increasing moisture contents 1 to 2 percent for each point.
   b. Allow samples of plastic soil to stand for 12 hrs.
3. Form a specimen by compacting the prepared soil in the mold assembly in approximately equal layers. For each layer:
   a. Spread the loose material uniformly in the mold.

   Note 2: It is recommended to cover the remaining material with a non-absorbent sheet or damp cloth to minimize loss of moisture.

   b. Lightly tamp the loose material with the manual rammer or other similar device, this establishes a firm surface.
   c. Compact each layer with uniformly distributed blows from the rammer. See Table 1 for mold size, number of layers, number of blows, and rammer specification for the various test methods. Use the method specified by the agency.
   d. Trim down material that has not been compacted and remains adjacent to the walls of the mold and extends above the compacted surface.

4. Remove the extension collar. Avoid shearing off the sample below the top of the mold. The material compacted in the mold should not be over 6 mm (¼ in.) above the top of the mold once the collar has been removed.
5. Trim the compacted soil even with the top of the mold with the beveled side of the straightedge.
6. Clean soil from exterior of the mold and base plate.
7. Determine and record the mass of the mold, base plate, and wet soil to the nearest 1 g (0.005 lb) or better.
8. Determine and record the wet mass (M_w) of the sample by subtracting the mass in Step 1 from the mass in Step 7.
9. Calculate the wet density (ρ_w), in kg/m^3 (lb/ft^3), by dividing the wet mass by the measured volume (V_m).
10. Extrude the material from the mold. For soils and soil-aggregate mixtures, slice vertically through the center and take a representative moisture content sample from one of the cut faces, ensuring that all layers are represented. For granular materials, a vertical face will not exist. Take a representative sample. This sample must meet the sample size requirements of the test method used to determine moisture content.



Note 3: When developing a curve for free-draining soils such as uniform sands and gravels, where seepage occurs at the bottom of the mold and base plate, taking a representative moisture content from the mixing bowl may be preferred in order to determine the amount of moisture available for compaction.

11. Determine and record the moisture content of the sample in accordance with the FOP for AASHTO T 255 / T 265.
12. If the material is degradable or plastic, return to Step 3 using a prepared individual sample. If not, continue with Steps 13 through 15.
13. Thoroughly break up the remaining portion of the molded specimen until it will again pass through the sieve, as judged by eye, and add to the remaining portion of the sample being tested.

14. Add sufficient water to increase the moisture content of the remaining soil by 1 to 2 percentage points and repeat steps 3 through 11.
15. Continue determinations until there is either a decrease or no change in the wet mass. There will be a minimum of three points on the dry side of the curve and two points on the wet side. For non-cohesive, drainable soils, one point on the wet side is sufficient.

Calculations

Wet Density

$$\rho_w = \frac{M_w}{V_m}$$

Where:

ρ_w = wet density, kg/m^3 (lb/ft^3)

M_w = wet mass

V_m = volume of the mold, Annex B

Dry Density

$$\rho_d = \left(\frac{D_w}{w + 100}\right) \times 100 \quad or \quad \rho_d = \frac{D_w}{\left(\frac{w}{100}\right) + 1}$$

Where:

ρ_d = dry density, kg/m^3 (lb/ft^3)

w = moisture content, as a percentage

Example for 4-inch mold, Methods A or C

Wet mass, M_w = 1.928 kg (4.25 lb)

Moisture content, w = 11.3%

Measured volume of the mold, V_m = 0.000946 m^3 (0.0334 ft^3)

Wet Density

$$\rho_w = \frac{1.928\ kg}{0.000946\ m^3} = 2038\ kg/m^3 \quad \rho_w = \frac{4.25\ lb}{0.0334\ ft^3} = 127.2\ lb/ft^3$$

Dry Density

$$\rho_d = \left(\frac{2038\, kg/m^3}{11.3 + 100}\right) \times 100 = 1831\ kg/m^3 \quad \rho_d = \left(\frac{127.2\ lb/ft^3}{11.3 + 100}\right) \times 100 = 114.3\, lb/ft^3$$

Or

$$\rho_d = \left(\frac{2038\, kg/m^3}{\frac{11.3}{100} + 1}\right) = 1831\, kg/m^3 \quad \rho_d = \left(\frac{127.2\ lb/ft^3}{\frac{11.3}{100} + 1}\right) = 114.3\, lb/ft^3$$

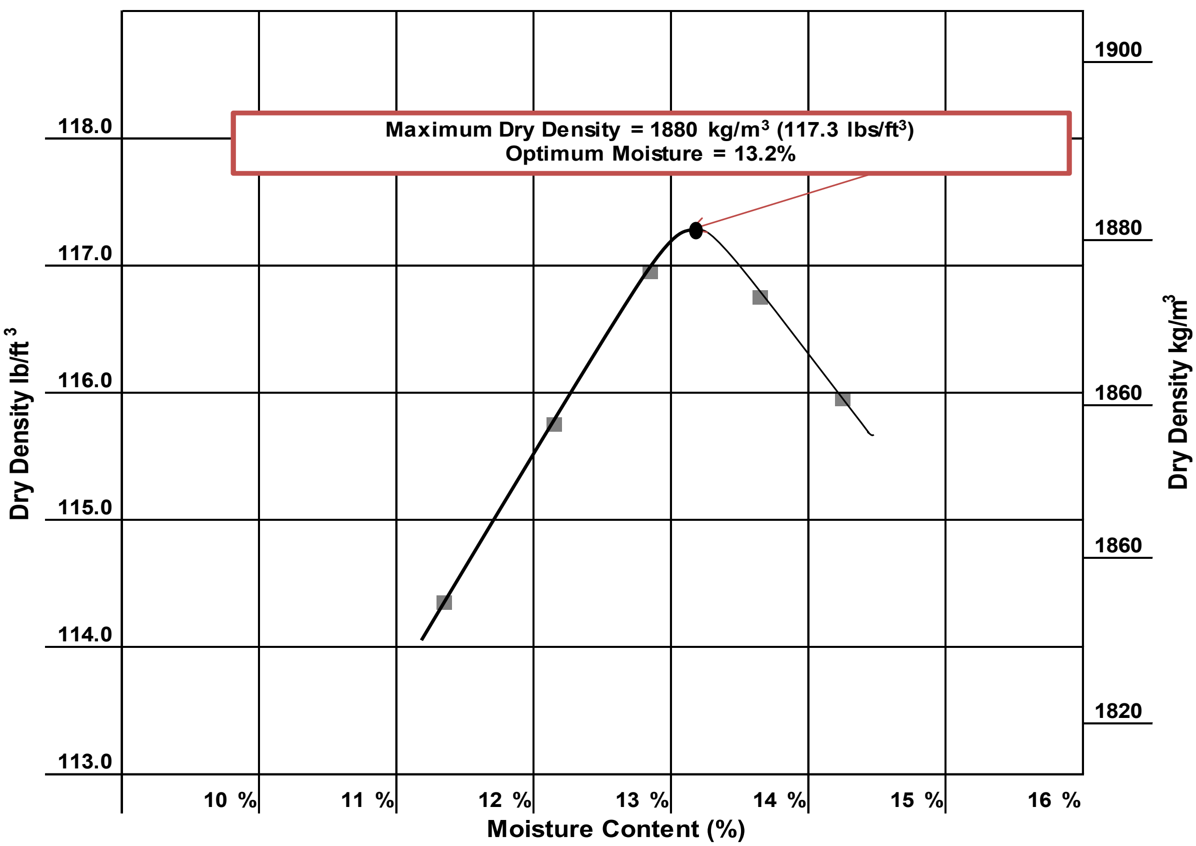
Moisture-Density Curve Development

When dry density is plotted on the vertical axis versus moisture content on the horizontal axis and the points are connected with a smooth line, a moisture-density curve is developed. The coordinates of the peak of the curve are the maximum dry density, or just “maximum density,” and the “optimum moisture content” of the soil.

Example

Given the following dry density and corresponding moisture content values develop a moisture-density relations curve and determine maximum dry density and optimum moisture content.

Dry Density		**Moisture Content, %**
kg/m³	**lb/ft³**	
1831	114.3	11.3
1853	115.7	12.1
1873	116.9	12.8
1869	116.7	13.6
1857	115.9	14.2



In this case, the curve has its peak at:

Maximum dry density	=	1880 kg/m^3 (117.3 lb/ft^3)
Optimum moisture content	=	13.2%

Note that both values are approximate since they are based on sketching the curve to fit the points.

Report

- Results on forms approved by the agency
- Sample ID
- Maximum dry density to the nearest 1 kg/m^3 (0.1 lb/ft^3)
- Optimum moisture content to the nearest 0.1 percent

ANNEX A

CORRECTION OF MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE FOR OVERSIZED PARTICLES

(Mandatory Information)

This section corrects the maximum dry density and moisture content of the material retained on the 4.75 mm (No. 4) sieve, Methods A and B; or the material retained on the 19 mm (¾ in.) sieve, Methods C and D. The maximum dry density, corrected for oversized particles and total moisture content, are compared with the field-dry density and field moisture content.

This correction can be applied to the sample on which the maximum dry density is performed. A correction may not be practical for soils with only a small percentage of oversize material. The agency shall specify a minimum percentage below which the method is not needed. If not specified, this method applies when more than 5 percent by weight of oversize particles is present.

Bulk specific gravity (G_{sb}) of the oversized particles is required to determine the corrected maximum dry density. Use the bulk specific gravity as determined using the FOP for AASHTO T 85 in the calculations. For construction activities, an agency established value or specific gravity of 2.600 may be used.

This correction can also be applied to the sample obtained from the field while performing in-place density.

Procedure

1. Use the sample from this procedure or a sample obtained according to the FOP for AASHTO T 310.
2. Sieve the sample on the 4.75 mm (No. 4) sieve for Methods A and B or the 19 mm (¾ in.) sieve, Methods C and D.
3. Determine the dry mass of the oversized and fine fractions (M_{DC} and M_{DF}) by one of the following:
   a. Dry the fractions, fine and oversized, in air or by use of a drying apparatus that is maintained at a temperature not exceeding 60ºC (140ºF).
   b. Calculate the dry masses using the moisture samples.

To determine the dry mass of the fractions using moisture samples.

1. Determine the moist mass of both fractions, fine (M_{Mf}) and oversized (M_{Mc}):
2. Obtain moisture samples from the fine and oversized material.
3. Determine the moisture content of the fine particles (MC_f) and oversized particles (MC_C) of the material by FOP for AASHTO T 255/T 265 or agency approved method.
4. Calculate the dry mass of the oversize and fine particles.

$$M_D = \frac{M_m}{1 + \mathrm{MC}}$$

Where:

M_D = mass of dry material (fine or oversize particles)

M_m = mass of moist material (fine or oversize particles)

MC = moisture content of respective fine or oversized, expressed as a decimal

5. Calculate the percentage of the fine (P_f) and oversized (P_c) particles by dry weight of the total sample as follows: See Note 2.

$$P_f = \frac{100 \times M_{DF}}{M_{DF} + M_{DC}} \qquad \frac{100\ \times 15.4\ lb}{15.4\ lbs + 5.7\ lb} = 73\% \qquad \frac{100\ \times 6.985\ kg}{6.985\ kg + 2.585\ kg} = 73\%$$

And

$$P_c = \frac{100 \times M_{DC}}{M_{DF} + M_{DC}} \qquad \frac{100\ \times 5.7\ lb}{15.4\ lbs + 5.7\ lb} = 27\% \qquad \frac{100\ \times 2.585 kg}{6.985\ kg + 2.585\ kg} = 27\%$$

Or for **P_c**:

$$P_c = 100 - P_f$$

Where:

P_f = percent of fine particles, of sieve used, by weight

P_c = percent of oversize particles, of sieve used, by weight

M_{DF} = mass of dry fine particles

M_{DC} = mass of dry oversize particles

Optimum Moisture Correction Equation

1. Calculate the corrected moisture content as follows:

$$MC_T = \frac{(MC_F \times P_f) + (MC_c \times P_c)}{100} \qquad \frac{(13.2\% \times 73.0\%) + (2.1\% \times 27.0\%)}{100} = 10.2\%$$

MC_T = corrected moisture content of combined fines and oversized particles, expressed as a % moisture

MC_F = moisture content of fine particles, as a % moisture

MC_C = moisture content of oversized particles, as a % moisture

Note 1: Moisture content of oversize material can be assumed to be two (2) percent for most construction applications.

Note 2: In some field applications agencies will allow the percentages of oversize and fine materials to be determined with the materials in the wet state.

Density Correction Equation

2. Calculate the corrected dry density (ρ_d) of the total sample (combined fine and oversized particles) as follows:

$$\rho_d = \frac{100\%}{\left[\left(\frac{P_f}{\rho_f}\right) + \left(\frac{P_c}{k}\right)\right]}$$

Where:

ρ_d = corrected total dry density (combined fine and oversized particles) kg/m^3 (lb/ft^3)

ρ_f = dry density of the fine particles kg/m^3 (lb/ft^3), determined in the lab

P_c = percent of dry oversize particles, of sieve used, by weight.

P_f = percent of dry fine particles, of sieve used, by weight.

k = Metric: 1,000 * Bulk Specific Gravity (G_{sb}) (oven dry basis) of coarse particles (kg/m^3).

k = English: 62.4 * Bulk Specific Gravity (G_{sb}) (oven dry basis) of coarse particles (lb/ft^3)

Note 3: If the specific gravity is known, then this value will be used in the calculation. For most construction activities the specific gravity for aggregate may be assumed to be 2.600.

Calculation

Example

- Metric:

  Maximum laboratory dry density (ρ_f): 1880 kg/m^3

  Percent coarse particles (P_c): 27%

  Percent fine particles (P_f): 73%

  Mass per volume coarse particles (k): (2.697) (1000) = 2697 kg/m^3

$$\rho_d = \frac{100\%}{\left[\left(\frac{P_f}{\rho_f}\right) + \left(\frac{P_c}{k}\right)\right]}$$

$$\rho_d = \frac{100\%}{\left[\left(\frac{73\%}{1880\,kg/m^3}\right) + \left(\frac{27\%}{2697\,kg/m^3}\right)\right]}$$

$$\rho_d = \frac{100\%}{[0.03883\,kg/m^3 + 0.01001\,kg/m^3]}$$

$$\rho_d = 2047.5\,kg/m^3\ report\ \ 2048\,kg/m^3$$

English:

Maximum laboratory dry density (ρ_f): 117.3 lb/ft^3

Percent coarse particles (P_c): 27%

Percent fine particles (P_f): 73%

Mass per volume of coarse particles (k): (2.697) (62.4) = 168.3 lb/ft^3

$$\rho_d = \frac{100\%}{\left[\left(\frac{P_f}{\rho_f}\right) + \left(\frac{P_c}{k}\right)\right]}$$

$$\rho = \frac{100\%}{\left[\left(\frac{73\%}{117.3\ lb/ft^3}\right) + \left(\frac{27\%}{168.3\ lb/ft^3}\right)\right]}$$

$$\rho_d = \frac{100\%}{[0.6223\ lb/ft^3 + 0.1604\ lb/ft^3]}$$

$$\rho_d = \frac{100\%}{0.7827\ lb/ft^3}$$

$$\rho_d = 127.76\ lb/ft^3 \quad Report\ 127.8\ lb/ft^3$$

Report

- On forms approved by the agency
- Sample ID
- Corrected maximum dry density to the nearest 1 kg/m^3 (0.1 lb/ft^3)
- Corrected optimum moisture to the nearest 0.1 percent

ANNEX B
STANDARDIZATION OF THE MOLD

(Mandatory Information)

Standardization is a critical step to ensure accurate test results when using this apparatus. Failure to perform the standardization procedure as described herein will produce inaccurate or unreliable test results.

Apparatus

- Mold and base plate
- Balance or scale – Accurate to within 45 g (0.1 lb) or 0.3 percent of the test load, whichever is greater, at any point within the range of use.
- Cover plate – A piece of plate glass, at least 6 mm (1⁄4 in.) thick and at least 25 mm (1 in.) larger than the diameter of the mold.
- Thermometers – Standardized liquid-in-glass, or electronic digital total immersion type, accurate to 0.5°C (1°F)

Procedure

1. Create a watertight seal between the mold and base plate.
2. Determine and record the mass of the dry sealed mold, base plate, and cover plate.
3. Fill the mold with water at a temperature between 16°C and 29°C (60°F and 85°F) and cover with the cover plate in such a way as to eliminate bubbles and excess water.
4. Wipe the outside of the mold, base plate, and cover plate dry, being careful not to lose any water from the mold.
5. Determine and record the mass of the filled mold, base plate, cover plate, and water.
6. Determine and record the mass of the water in the mold by subtracting the mass in Step 2 from the mass in Step 5.
7. Measure the temperature of the water and determine its density from Table B1, interpolating, as necessary.
8. Calculate the volume of the mold, V_m, by dividing the mass of the water in the mold by the density of the water at the measured temperature.

Calculations

$$V_m = \frac{M}{\rho_{water}}$$

Where:

V_m = volume of the mold

M = mass of water in the mold

ρ_{water} = density of water at the measured temperature

Example

Mass of water in mold = 0.94367 kg (2.0800 lb)

ρ_{water} at 23°C (73.4°F) = 997.54 kg/m^3 (62.274 lb/ft^3)

$$V_m = \frac{0.94367\ kg}{997.54\ kg/m^3} = 0.000946\ m^3 \qquad V_m = \frac{2.0800\ lb}{62.274\ lb/ft^3} = 0.0334\ ft^3$$

Table B1
Unit Mass of Water
15°C to 30°C

°C	(°F)	kg/m^3	(lb/ft^3)	°C	(°F)	kg/m^3	(lb/ft^3)
15	(59.0)	999.10	(62.372)	23	(73.4)	997.54	(62.274)
15.6	(60.0)	999.01	(62.366)	23.9	(75.0)	997.32	(62.261)
16	(60.8)	998.94	(62.361)	24	(75.2)	997.29	(62.259)
17	(62.6)	998.77	(62.350)	25	(77.0)	997.03	(62.243)
18	(64.4)	998.60	(62.340)	26	(78.8)	996.77	(62.227)
18.3	(65.0)	998.54	(62.336)	26.7	(80.0)	996.59	(62.216)
19	(66.2)	998.40	(62.328)	27	(80.6)	996.50	(62.209)
20	(68.0)	998.20	(62.315)	28	(82.4)	996.23	(62.192)
21	(69.8)	997.99	(62.302)	29	(84.2)	995.95	(62.175)
21.1	(70.0)	997.97	(62.301)	29.4	(85.0)	995.83	(62.166)
22	(71.6)	997.77	(62.288)	30	(86.0)	995.65	(62.156)

Report

- Mold ID
- Date Standardized
- Temperature of the water
- Volume, V_m, of the mold to the nearest 0.000001 m^3 (0.0001 ft^3)

DENSITY (UNIT WEIGHT), YIELD, AND AIR CONTENT (GRAVIMETRIC) OF CONCRETE
FOP FOR AASHTO T 121

Scope

This procedure covers the determination of density, or unit weight, of freshly mixed concrete in accordance with AASHTO T 121-19. It also provides formulas for calculating the volume of concrete produced from a mixture of known quantities of component materials and provides a method for calculating cement content and cementitious material content – the mass of cement or cementitious material per unit volume of concrete. A procedure for calculating water/cement ratio is also covered.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Measure: May be the bowl portion of the air meter used for determining air content under the FOP for AASHTO T 152. Otherwise, it shall be a metal cylindrical container meeting the requirements of AASHTO T 121. The capacity and dimensions of the measure shall conform to those specified in Table 1.
- Balance or scale: Accurate to within 45 g (0.1 lb) or 0.3 percent of the test load, whichever is greater, at any point within the range of use.
- Tamping rod: 16 mm (5/8 in.) diameter and 400 mm (16 in.) to 600 mm (24 in.) long, having a hemispherical tip the same diameter as the rod. (Hemispherical means "half a sphere"; the tip is rounded like half of a ball.)
- Vibrator: frequency at least 9000 vibrations per minute (150 Hz), at least 19 to 38 mm (3/4 to 1 1/2 in.) in diameter but not greater than 38 mm (1 1/2 in.), and the length of the shaft shall be at least 75 mm (3 in.) longer than the depth of the section being vibrated.
- Scoop: a receptacle of appropriate size so that each representative increment of the concrete sample can be placed in the container without spillage.
- Strike-off plate: A flat rectangular metal plate at least 6 mm (1/4 in.) thick or a glass or acrylic plate at least 12 mm (1/2 in.) thick, with a length and width at least 50 mm (2 in.) greater than the diameter of the measure with which it is to be used. The edges of the plate shall be straight and smooth within tolerance of 1.5 mm (1/16 in.).
- Mallet: With a rubber or rawhide head having a mass of 0.57 ±0.23 kg (1.25 ±0.5 lb) for use with measures of 0.014 m^3 (1/2 ft^3) or less, or having a mass of 1.02 ±0.23 kg (2.25 ±0.5 lb) for use with measures of 0.028 m^3 (1 ft^3).

Table 1
Dimensions of Measures*

Capacity	Inside Diameter	Inside Height	Minimum Thicknesses mm (in.)		Nominal Maximum Size of Coarse Aggregate***
m^3 (ft^3)	mm (in.)	mm (in.)	Bottom	Wall	mm (in.)
0.0071	203 ±2.54	213 ±2.54	5.1	3.0	25
(1/4)**	(8.0 ±0.1)	(8.4 ±0.1)	(0.20)	(0.12)	(1)
0.0142	254 ±2.54	279 ±2.54	5.1	3.0	50
(1/2)	(10.0 ±0.1)	(11.0 ±0.1)	(0.20)	(0.12)	(2)
0.0283	356 ±2.54	284 ±2.54	5.1	3.0	76
(1)	(14.0 ±0.1)	(11.2 ±0.1)	(0.20)	(0.12)	(3)

* ***Note 1:*** The indicated size of measure shall be for aggregates of nominal maximum size equal to or smaller than that listed.

** Measure may be the base of the air meter used in the FOP for AASHTO T 152.

*** Nominal maximum size: One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Procedure Selection

There are two methods of consolidating the concrete – rodding and vibration. If the slump is greater than 75 mm (3 in.), consolidation is by rodding. When the slump is 25 to 75 mm (1 to 3 in.), internal vibration or rodding can be used to consolidate the sample, but the method used must be that required by the agency in order to obtain consistent, comparable results. For concrete with slump less than 25 mm (1 in.), consolidate the sample by internal vibration. Do not consolidate self-consolidating concrete (SCC).

When using measures greater than 0.0142 m^3 (1/2 ft^3) see AASHTO T 121.

Procedure

Sampling

1. Obtain the sample in accordance with the FOP for WAQTC TM 2. Testing may be performed in conjunction with the FOP for AASHTO T 152. When doing so, this FOP should be performed before the FOP for AASHTO T 152.

   Note 2: If the two tests are being performed using the same sample, this test shall begin within five minutes of obtaining the sample.

Rodding

1. Determine and record the mass of the empty measure.
2. Dampen the inside of the measure and empty excess water.

3. Use the scoop to fill the measure approximately 1/3 full with concrete. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
4. Consolidate the layer with 25 strokes of the tamping rod, using the rounded end. Distribute the strokes evenly over the entire cross section of the concrete. Rod throughout its depth without hitting the bottom too hard.
5. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet to close voids and release trapped air.
6. Add the second layer, filling the measure about 2/3 full. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
7. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 25 mm (1 in.) into the bottom layer.
8. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
9. Add the final layer, slightly overfilling the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
10. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 25 mm (1 in.) into the second layer.
11. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
12. After consolidation, the measure should be slightly over full, about 3 mm (1/8 in.) above the rim. If there is a great excess of concrete, remove a portion with the scoop. If the measure is under full, add a small quantity. This adjustment may be done only after consolidating the final layer and before striking off the surface of the concrete.
13. Continue with 'Strike-off and Determining Mass.'

Internal Vibration

1. Determine and record the mass of the empty measure.
2. Dampen the inside of the measure and empty excess water.
3. Use the scoop to fill the measure approximately 1/2 full with concrete. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
4. Insert the vibrator at three different points in each layer. Do not let the vibrator touch the bottom or side of the measure. Continue vibration only long enough to achieve proper consolidation of the concrete. Over vibration may cause segregation and loss of appreciable quantities of intentionally entrained air.
5. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
6. Slightly overfill the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
7. Insert the vibrator at three different points, penetrating the first layer approximately 25 mm (1 in.). Do not let the vibrator touch the side of the measure.
8. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.

9. After consolidation, the measure should be slightly over full, about 3 mm (1/8 in.) above the rim. If there is a great excess of concrete, remove a portion with the scoop. If the measure is under full, add a small quantity. This adjustment may be done only after consolidating the final layer and before striking off the surface of the concrete.
10. Continue with 'Strike-off and Determining Mass.'

Self-Consolidating Concrete

1. Determine and record the mass of the empty measure.
2. Dampen the inside of the measure and empty excess water.
3. Use the scoop to slightly overfill the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
5. Continue with 'Strike-off and Determining Mass.'

Strike-off and Determining Mass

1. Press the strike-off plate flat against the top surface, covering approximately 2/3 of the measure.
2. Withdraw the strike-off plate with a sawing motion to finish the 2/3 originally covered.
3. Cover the original 2/3 again with the plate; finishing the remaining 1/3 with a sawing motion (do not lift the plate; continue the sawing motion until the plate has cleared the surface of the measure).
4. Final finishing may be accomplished with several strokes with the inclined edge of the strike-off plate. The surface should be smooth and free of voids.
5. Clean off all excess concrete from the exterior of the measure including the rim.
6. Determine and record the mass of the measure and the concrete.
7. If the air content of the concrete is to be determined, ensure the rim (flange) is clean and proceed to 'Strike-off and Air Content' Step 3 of the FOP for AASHTO T 152.

Calculations

Mass of concrete in the measure

$$concrete\ mass = M_c - M_m$$

Where:

Concrete mass	=	mass of concrete in measure
M_c	=	mass of measure and concrete
M_m	=	mass of measure

Density

$$D = \frac{concrete\ mass}{V_m}$$

Where:

D	=	density of the concrete mix
V_m	=	volume of measure (Annex A)

Yield m^3

$$Y_{m^3} = \frac{W}{D}$$

Where:

$Y_m{}^3$	=	yield (m^3 of the batch of concrete)
W	=	total mass of the batch of concrete

Yield yd^3

$$Y_{ft^3} = \frac{W}{D} \qquad\qquad Y_{yd^3} = \frac{Y_{ft^3}}{27ft^3/yd^3}$$

Where:

Y_{ft}^3	=	yield (ft^3 of the batch of concrete)
Y_{yd}^3	=	yield (yd^3 of the batch of concrete)
W	=	total mass of the batch of concrete
D	=	density of the concrete mix

Note 5: The total mass, W, includes the masses of the cement, water, and aggregates in the concrete.

Cement Content

$$N = \frac{N_t}{Y}$$

Where:

N	=	actual cementitous material content per Y_m^3 or Y_{yd}^3
N_t	=	mass of cementitious material in the batch
Y	=	Y_m^3 or Y_{yd}^3

Note 6: Specifications may require Portland Cement content and supplementary cementitious materials content.

Water Content

The mass of water in a batch of concrete is the sum of:

- water added at batch plant
- water added in transit
- water added at jobsite
- free water on coarse aggregate*
- free water on fine aggregate*
- liquid admixtures (if required by the agency)

*Mass of free water on aggregate

This information is obtained from concrete batch tickets collected from the driver. Use the Table 2 to convert liquid measures.

Table 2
Liquid Conversion Factors

To Convert From	To	Multiply By
Liters, L	Kilograms, kg	1.0
Gallons, gal	Kilograms, kg	3.785
Gallons, gal	Pounds, lb	8.34
Milliliters, mL	Kilograms, kg	0.001
Ounces, oz	Milliliters, mL	28.4
Ounces, oz	Kilograms, kg	0.0284
Ounces, oz	Pounds, lb	0.0625
Pounds, lb	Kilograms, kg	0.4536

Mass of free water on aggregate

$$Free\ Water\ Mass = CA\ or\ FC\ Aggregate - \frac{CA\ or\ FC\ Aggregate}{1 + (Free\ Water\ Percentage/100)}$$

Where:

Free Water Mass	=	on coarse or fine aggregate
FC or CA Aggregate	=	mass of coarse or fine aggregate
Free Water Percentage	=	percent of moisture of coarse or fine aggregate

Water/Cement Ratio

$$\frac{Water\ Content}{C}$$

Where:

Water Content	=	total mass of water in the batch
C	=	total mass of cementitious materials

Example

Mass of concrete in measure (M_m)	16.290 kg (36.06 lb)
Volume of measure (V_m)	0.007079 m^3 (0.2494 ft^3)

<u>From batch ticket:</u>

Yards batched	4 yd^3
Cement	950 kg (2094 lb)
Fly ash	180 kg (397 lb)
Coarse aggregate	3313 kg (7305 lb)
Fine aggregate	2339 kg (5156 lb)
Water added at plant	295 L (78 gal)

<u>Other</u>

Water added in transit	0
Water added at jobsite	38 L (10 gal)
Total mass of the batch of concrete (W)	7115 kg (15,686 lb)
Moisture content of coarse aggregate	1.7%
Moisture content of coarse aggregate	5.9%

Density

$$D = \frac{M_m}{V_m}$$

$$D = \frac{16.920\ kg}{0.007079\ m^3} = 2390\ \ kg/m^3 \quad D = \frac{36.06\ lb}{0.2494\ ft^3} = 144.6\ \ lb/ft^3$$

Given:

M_m	=	16.920 kg (36.06 lb)
V_m	=	0.007079 m^3 (0.2494 ft^3) (Annex A)

Yield m^3

$$Y_{m^3} = \frac{W}{D}$$

$$Y_{m^3} = \frac{7115\ kg}{2390\ kg/m^3} = 2.98\ m^3$$

Given:

Total mass of the batch of concrete (W), kg = 7115 kg

Yield yd^3

$$Y_{ft^3} = \frac{W}{D} \qquad Y_{yd^3} = \frac{Y_{ft^3}}{27 ft^3/yd^3}$$

$$Y_{ft^3} = \frac{15{,}686\ lb}{144.6\ lb/ft^3} = 108.48\ ft^3 \qquad Y_{yd^3} = \frac{108.48\ ft^3}{27\ ft^3/yd^3} = 4.02\ yd^3$$

Given:

Total mass of the batch of concrete (W), lb = 15,686 lb

Cement Content

$$N = \frac{N_t}{Y}$$

$$N = \frac{950\ kg + 180\ kg}{2.98\ m^3} = 379\ kg/m^3 \quad N = \frac{2094\ lb + 397\ lb}{4.02\ yd^3} = 620\ lb/yd^3$$

Given:

N_t (cement)	=	950 kg (2094 lb)
N_t (flyash)	=	180 kg (397 lb)
Y	=	Y_{m^3} or Y_{yd^3}

Note 6: Specifications may require Portland Cement content and supplementary cementitious materials content.

Free water

$$Free\ Water\ Mass = CA\ or\ FC\ Aggregate - \frac{CA\ or\ FC\ Aggregate}{1 + (Free\ Water\ Percentage/100)}$$

$$CA\ Free\ Water = 3313\ kg - \frac{3313\ kg}{1 + (1.7/100)} = 55\ kg$$

$$CA\ Free\ Water = 7305\ lb - \frac{7305\ lb}{1 + (1.7/100)} = 122\ lb$$

$$FA\ Free\ Water = 2339\ kg - \frac{2339\ kg}{1 + (5.9/100)} = 130\ kg$$

$$FA\ Free\ Water = 5156\ lb - \frac{5156\ lb}{1 + (5.9/100)} = 287\ lb$$

Given:

CA aggregate	=	3313 kg (7305 lb)
FC aggregate	=	2339 kg (5156 lb)
CA moisture content	=	1.7%
FC moisture content	=	5.9%

Water Content

Total of all water in the mix.

$$Water\ Content = [(78\ gal + 10\ gal) * 3.785\ kg/gal] + 55\ kg + 130\ kg = 518\ kg$$

$$Water\ Content = [(78\ gal + 10\ gal) * 8.34\ lb/gal] + 122\ lb + 287\ lb = 1143\ lb$$

Given:

Water added at plant	=	295 L (78 gal)
Water added at the jobsite	=	38 L (10 gal)

Water/ Cement Ratio

$$W/C = \frac{518\ kg}{950\ kg + 180\ kg} = 0.458 \quad W/C = \frac{1143\ lb}{2094\ lb + 397\ lb} = 0.459$$

Report 0.46

Report

- Results on forms approved by the agency
- Sample ID
- Density (unit weight) to the nearest 1 kg/m^3 (0.1 lb/ft^3)
- Yield to the nearest 0.01 m^3 (0.01 yd^3)
- Cement content to the nearest 1 kg/m^3 (1 lb/yd^3)
- Cementitious material content to the nearest 1 kg/m^3 (1 lb/yd^3)
- Water/Cement ratio to the nearest 0.01

ANNEX A – STANDARDIZATION OF MEASURE

(Mandatory Information)

Standardization is a critical step to ensure accurate test results when using this apparatus. Failure to perform the standardization procedures as described herein will produce inaccurate or unreliable test results.

Apparatus

- Listed in the FOP for AASHTO T 121
  - Measure
  - Balance or scale
  - Strike-off plate
- Thermometer: Standardized liquid-in-glass, or electronic digital total immersion type, accurate to 0.5°C (1°F)

Procedure

1. Determine the mass of the dry measure and strike-off plate.
2. Fill the measure with water at a temperature between 16°C and 29°C (60°F and 85°F) and cover with the strike-off plate in such a way as to eliminate bubbles and excess water.
3. Wipe the outside of the measure and cover plate dry, being careful not to lose any water from the measure.
4. Determine the mass of the measure, strike-off plate, and water in the measure.
5. Determine the mass of the water in the measure by subtracting the mass in Step 1 from the mass in Step 4.
6. Measure the temperature of the water and determine its density from Table A1, interpolating as necessary.
7. Calculate the volume of the measure, V_m, by dividing the mass of the water in the measure by the density of the water at the measured temperature.

Calculations

$$V_m = \frac{M}{D}$$

Where:

V_m	=	volume of the mold
M	=	mass of water in the mold
D	=	density of water at the measured temperature

Example

Mass of water in Measure	=	7.062 kg (15.53 lb)
Density of water at 23°C (73.4°F)	=	997.54 kg/m^3 (62.274 lb/ft^3)

$$V_m = \frac{7.062\ kg}{997.54\ kg/m^3} = 0.007079\ m^3 \qquad V_m = \frac{15.53\ lb}{62.274\ lb/ft^3} = 0.2494\ ft^3$$

Table A1
Unit Mass of Water
15°C to 30°C

°C	(°F)	kg/m^3	(lb/ft^3)	°C	(°F)	kg/m^3	(lb/ft^3)
15	(59.0)	999.10	(62.372)	23	(73.4)	997.54	(62.274)
15.6	(60.0)	999.01	(62.366)	23.9	(75.0)	997.32	(62.261)
16	(60.8)	998.94	(62.361)	24	(75.2)	997.29	(62.259)
17	(62.6)	998.77	(62.350)	25	(77.0)	997.03	(62.243)
18	(64.4)	998.60	(62.340)	26	(78.8)	996.77	(62.227)
18.3	(65.0)	998.54	(62.336)	26.7	(80.0)	996.59	(62.216)
19	(66.2)	998.40	(62.328)	27	(80.6)	996.50	(62.209)
20	(68.0)	998.20	(62.315)	28	(82.4)	996.23	(62.192)
21	(69.8)	997.99	(62.302)	29	(84.2)	995.95	(62.175)
21.1	(70.0)	997.97	(62.301)	29.4	(85.0)	995.83	(62.166)
22	(71.6)	997.77	(62.288)	30	(86.0)	995.65	(62.156)

Report

- Measure ID
- Date Standardized
- Temperature of the water
- Volume, V_m, of the measure

AIR CONTENT OF FRESHLY MIXED CONCRETE BY THE PRESSURE METHOD FOP FOR AASHTO T 152

Scope

This procedure covers determination of the air content in freshly mixed Portland Cement Concrete containing dense aggregates in accordance with AASHTO T 152-19, Type B meter. It is not for use with lightweight or highly porous aggregates. This procedure includes standardization of the Type B air meter gauge, Annex A.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Air meter: Type B, as described in AASHTO T 152
- Balance or scale: Accurate to 0.3 percent of the test load at any point within the range of use (for Method 1 standardization only)
- Tamping rod: 16 mm (5/8 in.) diameter and 400 mm (16 in.) to 600 mm (24 in.) long, having a hemispherical tip the same diameter as the rod. (Hemispherical means "half a sphere"; the tip is rounded like half of a ball.)
- Vibrator: frequency at least 9000 vibrations per minute (150 Hz), at least 19 to 38 mm (3/4 to 1 1/2 in.) in diameter but not greater than 38 mm (1 1/2 in.), and the length of the shaft shall be at least 75 mm (3 in.) than the depth of the section being vibrated.
- Scoop: a receptacle of appropriate size so that each representative increment of the concrete sample can be placed in the container without spillage.
- Container for water: rubber syringe (may also be a squeeze bottle)
- Strike-off bar: Approximately 300 mm x 22 mm x 3 mm (12 in. x 3/4 in. x 1/8 in.)
- Strike-off plate: A flat rectangular metal plate at least 6 mm (1/4 in.) thick or a glass or acrylic plate at least 12 mm (1/2 in.) thick, with a length and width at least 50 mm (2 in.) greater than the diameter of the measure with which it is to be used. The edges of the plate shall be straight and smooth within tolerance of 1.5 mm (1/16 in.).

  Note 1: Use either the strike-off bar or strike-off plate; both are not required.

- Mallet: With a rubber or rawhide head having a mass of 0.57 ±0.23 kg (1.25 ±0.5 lb)

Procedure Selection

There are two methods of consolidating the concrete – rodding and vibration. If the slump is greater than 75 mm (3 in.), consolidation is by rodding. When the slump is 25 to 75 mm (1 to 3 in.), internal vibration or rodding can be used to consolidate the sample, but the method used must be that required by the agency in order to obtain consistent, comparable results. For concrete with slumps less than 25 mm (1 in.), consolidate the sample by internal vibration. Do not consolidate self-consolidating concrete (SCC).

Procedure

Sampling

1. Obtain the sample in accordance with the FOP for WAQTC TM 2. If the concrete mixture contains aggregate retained on the 37.5mm (1½ in.) sieve, the aggregate must be removed in accordance with the Wet Sieving portion of the FOP for WAQTC TM 2.

   Testing shall begin within five minutes of obtaining the sample.

Rodding

1. Dampen the inside of the air meter measure and place on a firm level surface.
2. Use the scoop to fill the measure approximately 1/3 full with concrete. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
3. Consolidate the layer with 25 strokes of the tamping rod, using the rounded end. Distribute the strokes evenly over the entire cross section of the concrete. Rod throughout its depth without hitting the bottom too hard.
4. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet to close voids and release trapped air.
5. Add the second layer, filling the measure about 2/3 full. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
6. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 25 mm (1 in.) into the bottom layer.
7. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
8. Add the final layer, slightly overfilling the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
9. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 25 mm (1 in.) into the second layer.
10. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
11. After consolidation, the measure should be slightly over full, about 3 mm (1/8 in.) above the rim. If there is a great excess of concrete, remove a portion with the trowel or scoop. If the measure is under full, add a small quantity. This adjustment may be done only after consolidating the final layer and before striking off the surface of the concrete.
12. Continue with 'Strike-off and Air Content.'

Internal Vibration

1. Dampen the inside of the air meter measure and place on a firm level surface.
2. Use the scoop to fill the measure approximately 1/2 full with concrete. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
3. Insert the vibrator at three different points. Do not let the vibrator touch the bottom or side of the measure. Remove the vibrator slowly, so that no air pockets are left in the material. Continue vibration only long enough to achieve proper consolidation of the concrete. Over vibration may cause segregation and loss of appreciable quantities of intentionally entrained air.
4. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
5. Use the scoop to fill the measure a bit over full. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
6. Insert the vibrator at three different points, penetrating the first layer approximately 25 mm (1 in.). Do not let the vibrator touch the side of the measure. Remove the vibrator slowly, so that no air pockets are left in the material. Continue vibration only long enough to achieve proper consolidation of the concrete. Over vibration may cause segregation and loss of appreciable quantities of intentionally entrained air.
7. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
8. Continue with 'Strike-off and Air Content.'.

Self-Consolidating Concrete

1. Dampen the inside of the air meter measure and place on a firm level surface.
2. Use the scoop to slightly overfill the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
3. Continue with 'Strike-off and Air Content.'

Strike-Off and Air Content

1. Strike off the surface of the concrete and finish it smoothly with a sawing action of the strike-off bar or plate, using great care to leave the measure just full. The surface should be smooth and free of voids.
2. Clean the top flange of the measure to ensure a proper seal.
3. Moisten the inside of the cover and check to see that both petcocks are open, and the main air valve is closed.
4. Clamp the cover on the measure.
5. Inject water through a petcock on the cover until water emerges from the petcock on the other side.

6. Incline slightly and gently rock the air meter until no air bubbles appear to be coming out of the second petcock. The petcock expelling water should be higher than the petcock where water is being injected. Return the air meter to a level position and verify that water is present in both petcocks.
7. Close the air bleeder valve and pump air into the air chamber until the needle goes past the initial pressure determined for the gauge. Allow a few seconds for the compressed air to cool.
8. Tap the gauge gently with one hand while slowly opening the air bleeder valve until the needle rests on the initial pressure. Close the air bleeder valve.
9. Close both petcocks.
10. Open the main air valve.
11. Tap the side of the measure smartly with the mallet.
12. With the main air valve open, lightly tap the gauge to settle the needle, and then read the air content to the nearest 0.1 percent.
13. Release or close the main air valve.
14. Open both petcocks to release pressure, remove the concrete, and thoroughly clean the cover and measure with clean water.
15. Open the main air valve to relieve the pressure in the air chamber.

Report

- On forms approved by the agency
- Sample ID
- Percent of air to the nearest 0.1 percent.
- Some agencies require an aggregate correction factor in order to determine total percent of entrained air.

  Total % entrained air = Gauge reading – aggregate correction factor from mix design

  (See AASHTO T 152 for more information.)

ANNEX A
STANDARDIZATION OF AIR METER GAUGE

(Mandatory Information)

Standardization is a critical step to ensure accurate test results when using this apparatus. Failure to perform the standardization procedures as described below will produce inaccurate or unreliable test results.

Standardization shall be performed at a minimum of once every three months. Record the date of the standardization, the standardization results, and the name of the technician performing the standardization in the logbook kept with each air meter.

There are two methods for standardizing the air meter, mass or volume, both are covered below.

1. Screw the short piece of straight tubing into the threaded petcock hole on the underside of the cover.
2. Determine and record the mass of the dry, empty air meter measure and cover assembly (mass method only).
3. Fill the measure nearly full with water.
4. Clamp the cover on the measure with the tube extending down into the water. Mark the petcock with the tube attached for future reference.
5. Add water through the petcock having the pipe extension below until all air is forced out the other petcock. Rock the meter slightly until all air is expelled through the petcock.
6. Wipe off the air meter measure and cover assembly; determine and record the mass of the filled unit (mass method only).
7. Pump up the air pressure to a little beyond the predetermined initial pressure indicated on the gauge. Wait a few seconds for the compressed air to cool, and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.
8. Close both petcocks and immediately open the main air valve exhausting air into the measure. Wait a few seconds until the meter needle stabilizes. The gauge should now read 0 percent. If two or more tests show a consistent variation from 0 percent in the result, change the initial pressure line to compensate for the variation, and use the newly established initial pressure line for subsequent tests.
9. Determine which petcock has the straight tube attached to it. Attach the curved tube to external portion of the same petcock.
10. Pump air into the air chamber. Open the petcock with the curved tube attached to it. Open the main air valve for short periods of time until 5 percent of water by mass or volume has been removed from the air meter. Remember to open both petcocks to release the pressure in the measure and drain the water in the curved tube back into the measure. To determine the mass of the water to be removed, subtract the mass found in Step 2 from the mass found in Step 6. Multiply this value by 0.05. This is the mass of the water that must be removed. To remove 5 percent by volume, remove water until the external standardization vessel is level full.

Note A1: Many air meters are supplied with a standardization vessel(s) of known volume that are used for this purpose. Standardization vessel must be protected from crushing or denting. If an external standardization vessel is used, confirm what percentage volume it represents for the air meter being used. Vessels commonly represent 5 percent volume, but they are for specific size meters. This should be confirmed by mass.

11. Remove the curved tube. Pump up the air pressure to a little beyond the predetermined initial pressure indicated on the gauge. Wait a few seconds for the compressed air to cool, and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.
12. Close both petcocks and immediately open the main air valve exhausting air into the measure. Wait a few seconds until the meter needle is stabilized. The gauge should now read 5.0 ±0.1 percent. If the gauge is outside that range, the meter needs adjustment. The adjustment could involve adjusting the starting point so that the gauge reads 5.0 ±0.1 percent when this standardization is run or could involve moving the gauge needle to read 5.0 percent. Any adjustment should comply with the manufacturer's recommendations.
13. When the gauge hand reads correctly at 5.0 percent, additional water may be withdrawn in the same manner to check the results at other values such as 10 percent or 15 percent.
14. If an internal standardization vessel is used, follow Steps 1 through 8 to set initial reading.
15. Release pressure from the measure and remove cover. Place the internal standardization vessel into the measure. This will displace 5 percent of the water in the measure. (See AASHTO T 152 for more information on internal standardization vessels.)
16. Place the cover back on the measure and add water through the petcock until all the air has been expelled.
17. Pump up the air pressure chamber to the initial pressure. Wait a few seconds for the compressed air to cool, and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.
18. Close both petcocks and immediately open the main air valve exhausting air into the measure. Wait a few seconds until the meter needle stabilizes. The gauge should now read 5 percent.
19. Remove the extension tubing from threaded petcock hole in the underside of the cover before starting the test procedure.

Report

- Air meter ID
- Date standardized
- Initial pressure (IP)

BULK SPECIFIC GRAVITY (G_{mb}) OF COMPACTED ASPHALT MIXTURES USING SATURATED SURFACE-DRY SPECIMENS FOP FOR AASHTO T 166

Scope

This procedure covers the determination of bulk specific gravity (G_{mb}) of compacted asphalt mixtures using three methods – A, B, and C – in accordance with AASHTO T 166-16. This FOP is for use on specimens not having open or interconnecting voids or absorbing more than 2.00 percent water by volume, or both. When specimens have open or interconnecting voids or absorbing more than 2.00 percent water by volume, or both, AASHTO T 275 or AASHTO T 331 should be performed.

Overview

- Method A: Suspension
- Method B: Volumeter
- Method C: Rapid test for A or B

Test Specimens

Test specimens may be either laboratory-molded or sampled from asphalt mixture pavement. For specimens it is recommended that the diameter be equal to four times the maximum size of the aggregate and the thickness be at least one and one half times the maximum size.

Terminology

Constant Mass: The state at which a mass does not change more than a given percent, after additional drying for a defined time interval, at a required temperature.

Apparatus – Method A (Suspension)

- Balance or scale: 5 kg capacity, readable to 0.1 g, and fitted with a suitable suspension apparatus and holder to permit weighing the specimen while suspended in water, conforming to AASHTO M 231.
- Suspension apparatus: Wire of the smallest practical size and constructed to permit the container to be fully immersed.
- Water bath: For immersing the specimen in water while suspended under the balance or scale and equipped with an overflow outlet for maintaining a constant water level.
- Towel: Damp cloth towel used for surface drying specimens.
- Oven: Capable of maintaining a temperature of 110 ±5°C (230 ±9°F) for drying the specimens to a constant mass.

- Pan: Pan or other suitable container of known mass, large enough to hold a sample for drying in oven.
- Thermometer: Having a range of 19 to 27°C (66 to 80°F), graduated in 0.1°C (0.2°F) subdivisions.
- Vacuum device: refer to the FOP for AASHTO R 79 (optional)

Procedure – Method A (Suspension)

Recently molded laboratory samples that have not been exposed to moisture do not need drying.

1. Dry the specimen to constant mass, if required.
   a. Oven method
      i. Initially dry overnight at 52 ±3°C (125 ±5°F).
      ii. Determine and record the mass of the specimen. Designate this mass as M_p.
      iii. Return the specimen to the oven for at least 2 hours.
      iv. Determine and record the mass of the specimen. Designate this mass as M_n.
      v. Determine percent change by subtracting the new mass determination, M_n, from the previous mass determination, M_p, divide by the previous mass determination M_p, and multiply by 100.
      vi. Continue drying until there is no more than 0.05 percent change in specimen mass after 2-hour drying intervals (constant mass).
      vii. Constant mass has been achieved; sample is defined as dry.

   Note 1: To expedite the procedure, steps 1 and 2 may be performed last. To further expedite the process, see Method C.

   b. Vacuum dry method according to the FOP for AASHTO R 79.
2. Cool the specimen in air to 25 ±5°C (77 ±9°F), and determine and record the dry mass to the nearest 0.1 g. Designate this mass as A.
3. Fill the water bath to overflow level with water at 25 ±1°C (77 ±1.8°F) and allow the water to stabilize.
4. Zero or tare the balance with the immersion apparatus attached, ensuring that the device is not touching the sides or the bottom of the water bath.
5. Immerse the specimen shaking to remove the air bubbles. Place the specimen on its side in the suspension apparatus. Leave it immersed for 4 ±1 minutes.
6. Determine and record the submerged weight to the nearest 0.1 g. Designate this submerged weight as C.
7. Remove the sample from the water and quickly surface dry with a damp cloth towel within 5 seconds.

8. Zero or tare the balance.
9. Immediately determine and record the mass of the saturated surface-dry (SSD) specimen to nearest 0.1 g. Designate this mass as B. Any water that seeps from the specimen during the mass determination is considered part of the saturated specimen. Do not to exceed 15 seconds performing Steps 7 through 9.

Calculations – Method A (Suspension)

Constant Mass:

Calculate constant mass using the following formula:

$$\%Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement, g

M_n = new mass measurement, g

Bulk specific gravity (G_{mb}) and percent water absorbed:

$$G_{mb} = \frac{A}{B - C}$$

$$Percent\ Water\ Absorbed\ (by\ volume) = \frac{B - A}{B - C} \times 100$$

Where:

A = Mass of dry specimen in air, g

B = Mass of SSD specimen in air, g

C = Weight of specimen in water at 25 ±1°C (77 ±1.8°F), g

Example:

$$G_{mb} = \frac{4833.6\ g}{4842.4\ g - 2881.3\ g} = 2.465$$

$$\%\ Water\ Absorbed\ (by\ volume) = \frac{4842.4\ g - 4833.6\ g}{4842.4\ g - 2881.3\ g} \times 100 = 0.45\%$$

Given:

A	=	4833.6 g
B	=	4842.4 g
C	=	2881.3 g

Apparatus – Method B (Volumeter)

- Balance or scale: 5 kg capacity, readable to 0.1 g and conforming to AASHTO M 231.
- Water bath: Thermostatically controlled to 25 ±0.5°C (77 ±0.9°F).
- Thermometer: Range of 19 to 27°C (66 to 80°F) and graduated in 0.1°C (0.2°F) subdivisions.
- Volumeter: Calibrated to 1200 mL or appropriate capacity for test sample and having a tapered lid with a capillary bore.
- Oven: Capable of maintaining a temperature of 110 ±5°C (230 ±9°F) for drying the specimens to a constant mass.
- Pan: Pan or other suitable container of known mass, large enough to hold a sample for drying in oven.
- Towel: Damp cloth towel used for surface drying specimens.
- Vacuum device: refer to the FOP for AASHTO R 79 (optional)

Procedure – Method B (Volumeter)

Recently molded laboratory samples that have not been exposed to moisture do not need drying.

1. Dry the specimen to constant mass, if required.
   a. Oven method:
      i. Initially dry overnight at 52 ±3°C (125 ±5°F).
      ii. Determine and record the mass of the specimen. Designate this mass as M_p.
      iii. Return the specimen to the oven for at least 2 hours.
      iv. Determine and record the mass of the specimen. Designate this mass as M_n.
      v. Determine percent change by subtracting the new mass determination, M_n, from the previous mass determination, M_p, divide by the previous mass determination, M_p, and multiply by 100.
      vi. Continue drying until there is no more than 0.05 percent change in specimen mass after 2-hour drying intervals (constant mass).
      vii. Constant mass has been achieved; sample is defined as dry.

   Note 1: To expedite the procedure, steps 1 and 2 may be performed last. To further expedite the process, see Method C.

   b. Vacuum dry method according to the FOP for AASHTO R 79.
2. Cool the specimen in air to 25 ±5°C (77 ±9°F), and determine and record the dry mass to the nearest 0.1 g. Designate this mass as A.
3. Immerse the specimen in the temperature-controlled water bath for at least 10 minutes.
4. Fill the volumeter with distilled water at 25 ±1°C (77 ±1.8°F) making sure some water escapes through the capillary bore of the tapered lid.
5. Wipe the volumeter dry. Determine the mass of the volumeter to the nearest 0.1 g. Designate this mass as D.
6. At the end of the ten-minute period, remove the specimen from the water bath and quickly surface dry with a damp cloth towel within 5 seconds.
7. Immediately determine and record the mass of the SSD specimen to the nearest 0.1 g. Designate this mass as B. Any water that seeps from the specimen during the mass determination is considered part of the saturated specimen.
8. Place the specimen in the volumeter and let stand 60 seconds.
9. Bring the temperature of the water to 25 ±1°C (77 ±1.8°F) and cover the volumeter, making sure some water escapes through the capillary bore of the tapered lid.
10. Wipe the volumeter dry.
11. Determine and record the mass of the volumeter and specimen to the nearest 0.1 g. Designate this mass as E.

    Note 2: Method B is not acceptable for use with specimens that have more than 6 percent air voids.

Calculations – Method B (Volumeter)

Constant Mass:

Calculate constant mass using the following formula:

$$\%Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement, g

M_n = new mass measurement, g

Bulk specific gravity (G_{mb}) and percent water absorbed:

$$G_{mb} = \frac{A}{B + D - E}$$

$$Percent\ Water\ Absorbed\ (by\ volume) = \frac{B - A}{B + D - E} \times 100$$

Where:

G_{mb} = Bulk specific gravity

A = Mass of dry specimen in air, g

B = Mass of SSD specimen in air, g

D = Mass of volumeter filled with water at 25 ±1°C (77 ±1.8°F), g

E = Mass of volumeter filled with specimen and water, g

Example:

$$G_{mb} = \frac{4833.6\ g}{4842.4\ g + 2924.4\ g - 5806.0\ g} = 2.465$$

$$\%\ Water\ Absorbed\ (by\ volume) = \frac{4842.4\ g - 4833.6\ g}{4842.4\ g + 2924.4\ g - 5806.0\ g} \times 100 = 0.45\%$$

Given:

A	=	4833.6 g
B	=	4842.4 g
D	=	2924.4 g
E	=	5806.0 g

Method C (Rapid Test for Method A or B)

See Methods A or B.

Note 3: This procedure can be used for specimens that are not required to be saved and contain substantial amounts of moisture. Cores can be tested the same day as obtained by this method.

Procedure – Method C (Rapid Test for Method A or B)

1. Start on Step 3 of Method A or B, and complete that procedure, then determine dry mass, A, as follows.
2. Determine and record mass of a large, flat-bottom container.
3. Place the specimen in the container.
4. Place in an oven at a minimum of 105°C (221°F). Do not exceed the Job Mix Formula mixing temperature.
5. Dry until the specimen can be easily separated into fine aggregate particles that are not larger than 6.3 mm (¼ in.).
6. Determine and record the mass of the specimen. Designate this mass as M_p.
7. Return the specimen to the oven for at least 2 hours.
8. Determine and record the mass of the specimen. Designate this mass as M_n.
9. Determine percent change by subtracting the new mass determination, M_n, from the previous mass determination, M_p, divide by the previous mass determination, M_p, and multiply by 100.

10. Continue drying until there is no more than 0.05 percent change in specimen mass after 2-hour drying intervals (constant mass).
11. Constant mass has been achieved; sample is defined as dry.
12. Cool in air to 25 ±5°C (77 ±9°F).
13. Determine and record the mass of the container and dry specimen to the nearest 0.1 g.
14. Determine and record the mass of the dry specimen to the nearest 0.1 g by subtracting the mass of the container from the mass determined in Step 13. Designate this mass as A.

Calculations – Method C (Rapid Test for Method A or B)

Complete the calculations as outlined in Methods A or B, as appropriate.

Report

- On forms approved by the agency
- Sample ID
- G_{mb} to the nearest 0.001
- Absorption to the nearest 0.01 percent
- Method performed.

PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY THE USE OF THE SAND EQUIVALENT TEST
FOP FOR AASHTO T 176

Scope

This procedure covers the determination of plastic fines in accordance with AASHTO T 176-02. It serves as a rapid test to show the relative proportion of fine dust or clay-like materials in fine aggregates (FA) and soils.

Apparatus

See AASHTO T 176 for a detailed listing of sand equivalent apparatus. Note that the siphon tube and blow tube may be glass or stainless steel as well as copper.

- Graduated plastic cylinder.
- Rubber stopper.
- Irrigator tube.
- Weighted foot assembly: Having a mass of 1000 ±5g. There are two models of the weighted foot assembly. The older model has a guide cap that fits over the upper end of the graduated cylinder and centers the rod in the cylinder. It is read using a slot in the centering screws. The newer model has a sand-reading indicator 254 mm (10 in.) above this point and is preferred for testing clay-like materials.
- Bottle: clean, glass or plastic, of sufficient size to hold working solution
- Siphon assembly: The siphon assembly will be fitted to a 4 L (1 gal.) bottle of working calcium chloride solution placed on a shelf 915 ±25 mm (36 ±1 in.) above the work surface.
- Measuring can: With a capacity of 85 ±5 mL (3 oz.).
- Funnel: With a wide-mouth for transferring sample into the graduated cylinder.
- Quartering cloth: 600 mm (2 ft.) square nonabsorbent cloth, such as plastic or oilcloth.
- Mechanical splitter: See the FOP for AASHTO R 76.
- Strike-off bar: A straightedge or spatula.
- Clock or watch reading in minutes and seconds.

- Manually-operated sand equivalent shaker: Capable of producing an oscillating motion at a rate of 100 complete cycles in 45 ±5 seconds, with a hand assisted half stroke length of 127 ±5 mm (5 ±0.2 in.). It may be held stable by hand during the shaking operation. It is recommended that this shaker be fastened securely to a firm and level mount, by bolts or clamps, if a large number of determinations are to be made.

- Mechanical shaker: See AASHTO T 176 for equipment and procedure.

- Oven: Capable of maintaining a temperature of 110 ±5°C (230 ±9°F).

- Thermometer: Calibrated liquid-in-glass or electronic digital type designed for total immersion and accurate to 0.1°C (0.2°F).

Materials

- Stock calcium chloride solution: Obtain commercially prepared calcium chloride stock solution meeting AASHTO requirements.

- Working calcium chloride solution: Make 3.8 L (1 gal) of working solution. Fill the bottle with 2 L (1/2 gal) of distilled or demineralized water, add one 3 oz. measuring can (85 ±5 mL) of stock calcium chloride solution. Agitate vigorously for 1 to 2 minutes. Add the remainder of the water, approximately 2 L (1/2 gal.) for a total of 3.8 L (1 gal) of working solution. Repeat the agitation process. Tap water may be used if it is proven to be non-detrimental to the test and if it is allowed by the agency. The shelf life of the working solution is approximately 30 days. Label working solution with the date mixed. Discard working solutions more than 30 days old.

Note 1: The graduated cylinder filled to 4.4 in. contains 88 mL and may be used to measure the stock solution.

Control

The temperature of the working solution should be maintained at 22 ±3°C (72 ±5°F) during the performance of the test. If field conditions preclude the maintenance of the temperature range, reference samples should be submitted to the Central/Regional Laboratory, as required by the agency, where proper temperature control is possible. Samples that meet the minimum sand equivalent requirement at a working solution temperature outside of the temperature range need not be subject to reference testing.

Sample Preparation

1. Obtain the sample in accordance with the FOP for AASHTO R 90 and reduce in accordance with the FOP for AASHTO R 76.

2. Sieve the sample over the 4.75 mm (No. 4) sieve. If the material is in clods, break it up and re-screen it over a 4.75 mm (No. 4) sieve. Clean all fines from particles retained on the 4.75 mm (No. 4) sieve and include with the material passing that sieve.

3. Split or quarter 1000 to 1500 g of material from the portion passing the 4.75 mm (No. 4) sieve. Use extreme care to obtain a truly representative portion of the original sample.

Note 2: Experiments show that, as the amount of material being reduced by splitting or quartering is decreased, the accuracy of providing representative portions is reduced. It is imperative that the sample be split or quartered carefully. When it appears necessary, dampen the material before splitting or quartering to avoid segregation or loss of fines.

Note 3: All tests, including reference tests, will be performed using Alternative Method No. 2 as described in AASHTO T 176, unless otherwise specified.

4. The sample must have the proper moisture content to achieve reliable results. This condition is determined by tightly squeezing a small portion of the thoroughly mixed sample in the palm of the hand. If the cast that is formed permits careful handling without breaking, the correct moisture content has been obtained.

Note 4: Clean sands having little 75 µm (No. 200), such as sand for Portland Cement Concrete (PCC), may not form a cast.

If the material is too dry, the cast will crumble and it will be necessary to add water and remix and retest until the material forms a cast. When the moisture content is altered to provide the required cast, the altered sample should be placed in a pan, covered with a lid or with a damp cloth that does not touch the material, and allowed to stand for a minimum of 15 minutes. Samples that have been sieved without being air-dried and still retain enough natural moisture are exempted from this requirement.

If the material shows any free water, it is too wet to test and must be drained and air dried. Mix frequently to ensure uniformity. This drying process should continue until squeezing provides the required cast.

5. Place the sample on the quartering cloth and mix by alternately lifting each corner of the cloth and pulling it over the sample toward the diagonally opposite corner, being careful to keep the top of the cloth parallel to the bottom, thus causing the material to be rolled. When the material appears homogeneous, finish the mixing with the sample in a pile near the center of the cloth.

6. Fill the measuring can by pushing it through the base of the pile while exerting pressure with the hand against the pile on the side opposite the measuring can. As the can is moved through the pile, hold enough pressure with the hand to cause the material to fill the tin to overflowing. Press firmly with the palm of the hand, compacting the material and placing the maximum amount in the can. Strike off the can level full with the straightedge or spatula.

7. When required, repeat steps 5 and 6 to obtain additional samples.

Procedure

1. Start the siphon by forcing air into the top of the solution bottle through the tube while the pinch clamp is open. Siphon 101.6 ±2.5 mm (4 ±0.1 in.) of working calcium chloride solution into the plastic cylinder.

2. Pour the prepared test sample from the measuring can into the plastic cylinder, using the funnel to avoid spilling.

3. Tap the bottom of the cylinder sharply on the heel of the hand several times to release air bubbles and to promote thorough wetting of the sample.

4. Allow the wetted sample to stand undisturbed for 10 ±1 minutes.

5. At the end of the 10-minute period, stopper the cylinder and loosen the material from the bottom by simultaneously partially inverting and shaking the cylinder.

6. After loosening the material from the bottom of the cylinder, shake the cylinder and contents by any one of the following methods:

   a. Mechanical Method – Place the stoppered cylinder in the mechanical shaker, set the timer, and allow the machine to shake the cylinder and contents for 45 ±1 seconds.

Caution: Agencies may require additional operator qualifications for the next two methods.

   b. Manually-operated Shaker Method – Secure the stoppered cylinder in the three spring clamps on the carriage of the manually-operated sand equivalent shaker and set the stroke counter to zero. Stand directly in front of the shaker and force the pointer to the stroke limit marker painted on the backboard by applying an abrupt horizontal thrust to the upper portion of the right hand spring strap.

      Remove the hand from the strap and allow the spring action of the straps to move the carriage and cylinder in the opposite direction without assistance or hindrance. Apply enough force to the right-hand spring steel strap during the thrust portion of each stroke to move the pointer to the stroke limit marker by pushing against the strap with the ends of the fingers to maintain a smooth oscillating motion. The center of the stroke limit marker is positioned to provide the proper stroke length and its width provides the maximum allowable limits of variation.

      Proper shaking action is accomplished when the tip of the pointer reverses direction within the marker limits. Proper shaking action can best be maintained by using only the forearm and wrist action to propel the shaker. Continue shaking for 100 strokes.

   c. Hand Method – Hold the cylinder in a horizontal position and shake it vigorously in a horizontal linear motion from end to end. Shake the cylinder 90 cycles in approximately 30 seconds using a throw of 229 mm ±25 mm (9 ±1 in.). A cycle is defined as a complete back and forth motion. To properly shake the cylinder at this speed, it will be necessary for the operator to shake with the forearms only, relaxing the body and shoulders.

7. Set the cylinder upright on the work table and remove the stopper.

8. Insert the irrigator tube in the cylinder and rinse material from the cylinder walls as the irrigator is lowered. Force the irrigator through the material to the bottom of the cylinder by applying a gentle stabbing and twisting action while the working solution flows from the irrigator tip. Work the irrigator tube to the bottom of the cylinder as quickly as possible, since it becomes more difficult to do this as the washing proceeds. This flushes the fine material into suspension above the coarser sand particles.

   Continue to apply a stabbing and twisting action while flushing the fines upward until the cylinder is filled to the 381 mm (15 in.) mark. Then raise the irrigator slowly without shutting off the flow so that the liquid level is maintained at about 381 mm (15 in.) while the irrigator is being withdrawn. Regulate the flow just before the irrigator is entirely withdrawn and adjust the final level to 381 mm (15 in.).

Note 5: Occasionally the holes in the tip of the irrigator tube may become clogged by a particle of sand. If the obstruction cannot be freed by any other method, use a pin or other sharp object to force it out, using extreme care not to enlarge the size of the opening. Also, keep the tip sharp as an aid to penetrating the sample.

9. Allow the cylinder and contents to stand undisturbed for 20 minutes ±15 seconds. Start timing immediately after withdrawing the irrigator tube.

Note 6: Any vibration or movement of the cylinder during this time will interfere with the normal settling rate of the suspended clay and will cause an erroneous result.

10. Clay and sand readings:

    a. At the end of the 20-minute sedimentation period, read and record the level of the top of the clay suspension. This is referred to as the clay reading.

Note 7: If no clear line of demarcation has formed at the end of the 20-minute sedimentation period, allow the sample to stand undisturbed until a clay reading can be obtained, then immediately read and record the level of the top of the clay suspension and the total sedimentation time. If the total sedimentation time exceeds 30 minutes, rerun the test using three individual samples of the same material. Read and record the clay column height of the sample requiring the shortest sedimentation period only. Once a sedimentation time has been established, subsequent tests will be run using that time. The time will be recorded along with the test results on all reports.

    b. After the clay reading has been taken, place the weighted foot assembly over the cylinder and gently lower the assembly until it comes to rest on the sand. Do not allow the indicator to hit the mouth of the cylinder as the assembly is being lowered. Subtract 254 mm (10 in.) from the level indicated by the extreme top edge of the indicator and record this value as the sand reading.

    c. If clay or sand readings fall between 2.5 mm (0.1 in.) graduations, record the level of the higher graduation as the reading. For example, a clay reading that appears to be 7.95 would be recorded as 8.0; a sand reading that appears to be 3.22 would be recorded as 3.3.

d. If two Sand Equivalent (SE) samples are run on the same material and the second varies by more than ±4, based on the first cylinder result, additional tests shall be run.

e. If three or more Sand Equivalent (SE) samples are run on the same material, average the results. If an individual result varies by more than ±4, based on the average result, additional tests shall be run.

Calculations

Calculate the SE to the nearest 0.1 using the following formula:

$$SE = \frac{Sand\ Reading}{Clay\ Reading} \times 100$$

Example

Given:

Sand Reading	=	3.3
Clay Reading	=	8.0

$$SE = \frac{3.3}{8.0} \times 100 = 41.25\ or\ 41.3 \qquad \text{Report 42}$$

Note 8: This example reflects the use of equipment made with English units. At this time, equipment made with metric units is not available.

Report the SE as the next higher whole number. In the example above, the 41.3 would be reported as 42. An SE of 41.0 would be reported as 41.

When averaging two or more samples, raise each calculated SE value to the next higher whole number (reported value) before averaging.

Example:

calculated value 1	=	41.3
calculated value 2	=	42.8

These values are reported as 42 and 43, respectively.

Average the two reported values:

$$Average\ SE = \frac{42 + 43}{2} = 42.5 \quad \text{Report 43}$$

If the average value is not a whole number, raise it to the next higher whole number.

Report

- On forms approved by the agency
- Sample ID
- Results to the next higher whole number
- Sedimentation time if over 20 minutes

THEORETICAL MAXIMUM SPECIFIC GRAVITY (G_{mm}) AND DENSITY OF ASPHALT MIXTURES
FOP FOR AASHTO T 209

Scope

This procedure covers the determination of the maximum specific gravity (G_{mm}) of uncompacted asphalt mixtures in accordance with AASHTO T 209-20. Two methods using different containers – bowl and pycnometer / volumetric flask– are covered.

Specimens prepared in the laboratory shall be cured according to agency standards.

Apparatus

- Balance or scale: 10,000 g capacity, readable to 0.1 g, meeting AASHTO M 231, Class G2
- Container: A glass, metal, or plastic bowl, pycnometer or volumetric flask between 2000 and 10,000 mL as required by the minimum sample size requirements in Table 1 sample and capable of withstanding full vacuum applied
- Pycnometer / volumetric flask cover: A glass plate or a metal or plastic cover with a vented opening
- Vacuum lid: A transparent lid with a suitable vacuum connection, with a vacuum opening to be covered with a fine wire mesh
- Vacuum pump or water aspirator: Capable of evacuating air from the container to a residual pressure of 4.0 kPa (30 mm Hg)
- Vacuum measurement device: Residual pressure manometer or vacuum gauge, capable of measuring residual pressure down to 4.0 kPa (30 mm Hg) or less and accurate to 0.1 kPa (1 mm Hg)
- Manometer or vacuum gauge: Capable of measuring the vacuum being applied at the source of the vacuum
- Water bath: A constant-temperature water bath (optional for Pycnometer or Volumetric Flask Method)
- Thermometers: Thermometric devices accurate to 0.5°C (1°F)
- Bleeder valve to adjust vacuum
- Automatic vacuum control unit (optional)
- Timer
- Towel

Standardization

Use a container that has been standardized according to Annex A. The container shall be standardized periodically in conformance with procedures established by the agency.

Test Sample Preparation

1. Obtain samples in accordance with the FOP for AASHTO R 97 and reduce according to the FOP for AASHTO R 47.
2. Test sample size shall conform to the requirements of Table 1. Samples larger than the capacity of the container may be tested in two or more increments. Results will be combined by calculating the weighted average ($G_{mm\ (avg)}$.). If the increments have a specific gravity difference greater than 0.014, the test must be re-run.

Table 1
Test Sample Size for G_{mm}

Nominal Maximum* Aggregate Size mm (in.)	Minimum Mass g
37.5 or greater (1½)	4000
19 to 25 (3/4 to 1)	2500
12.5 or smaller (1/2)	1500

*Nominal maximum size: One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained.

Procedure – General

Two procedures – bowl and pycnometer / volumetric flask – are covered. The first 11 steps are the same for both.

1. Separate the particles of the sample, taking care not to fracture the mineral particles, so that the particles of the fine aggregate portion are not larger than 6.3 mm (1/4 in.). If the mixture is not sufficiently soft to be separated manually, place it in a large flat pan and warm in an oven only until it is pliable enough for separation.
2. Cool the sample to room temperature.
3. Determine and record the mass of the dry container to the nearest 0.1 g.
4. Place the sample in the container.
5. Determine and record the mass of the dry container and sample to the nearest 0.1 g.
6. Determine and record the mass of the sample by subtracting the mass determined in Step 3 from the mass determined in Step 5. Designate this mass as "A."
7. Add sufficient water at approximately 25° C (77° F) to cover the sample by about 25 mm (1 in.).

Note 1: The release of entrapped air may be facilitated by the addition of a wetting agent. Check with the agency to see if this is permitted and, if it is, for a recommended agent.

8. Place the lid on the container and attach the vacuum line. To ensure a proper seal between the container and the lid, wet the O-ring or use a petroleum gel.
9. Remove entrapped air by subjecting the sample to a partial vacuum of 3.7 ±0.3 kPa (27.5 ±2.5 mm Hg) residual pressure for 15 ±2 minutes.
10. Agitate the container and sample, either continuously by mechanical device or manually by vigorous shaking, at 2-minute intervals. This agitation facilitates the removal of air.
11. Release the vacuum. Increase the pressure to atmospheric pressure in 10 to 15 seconds if the vacuum release is not automated. Turn off the vacuum pump and remove the lid. When performing the pycnometer / volumetric flask method, complete steps 12B through 16B within 10 ±1 minute.

Procedure – Bowl

12A. Fill the water bath to overflow level with water at 25 ±1°C (77 ±2°F) and allow the water to stabilize.

13A. Zero or tare the balance with the immersion apparatus attached, ensuring that the device is not touching the sides or the bottom of the water bath.

14A. Suspend and immerse the bowl and sample in water at 25 ±1°C (77 ±2°F) for 10 ±1 minute. The holder shall be immersed sufficiently to cover both it and the bowl.

15A. Determine and record the submerged weight of the bowl and sample to the nearest 0.1 g. Designate as 'C.'

Procedure – Pycnometer or Volumetric Flask

12B. Immediately fill the pycnometer / volumetric flask with water without reintroducing air.

13B. Stabilize the temperature of the pycnometer / volumetric flask and sample so that the final temperature is within 25 ±1°C (77 ±2°F).

14B. Finish filling the pycnometer / volumetric flask with water that is 25 ±1°C (77 ±2°F), place the cover or a glass plate on the pycnometer / volumetric flask, and eliminate all air.

Note 2: When using a metal pycnometer and cover, place the cover on the pycnometer and push down slowly, forcing excess water out of the hole in the center of the cover. Use care when filling the pycnometer to avoid reintroducing air into the water.

15B. Towel dry the outside of the pycnometer / volumetric flask and cover.

16B. Determine and record the mass of the pycnometer / volumetric flask, cover, de-aired water, and sample to the nearest 0.1 g. within 10 ±1 minute of completion of Step 11. Designate this mass as "E."

Procedure – Mixtures Containing Uncoated Porous Aggregate

If the pores of the aggregates are not thoroughly sealed by a bituminous film, they may become saturated with water during the vacuuming procedure, resulting in an error in maximum density. To determine if this has occurred, complete the general procedure and then:

1. Carefully drain water from sample through a towel held over the top of the container to prevent loss of material.
2. Spread sample in a flat shallow pan and place before an electric fan to remove surface moisture.
3. Determine the mass of the sample when the surface moisture appears to be gone.
4. Continue drying and determine the mass of the sample at 15-minute intervals until less than a 0.5 g loss is found between determinations.
5. Record the mass as the saturated surface dry mass to the nearest 0.1 g. Designate this mass as "A_{SSD}."
6. Calculate, as indicated below, G_{mm} using "A" and "A_{SSD}," and compare the two values.

Calculation

Calculate the G_{mm} to three decimal places as follows:

Bowl Procedure

$$G_{mm} = \frac{A}{A + B - C} \qquad or \qquad G_{mm} = \frac{A}{A_{SSD} + B - C}$$

(for mixes containing uncoated aggregate materials)

Where:

A = mass of dry sample in air, g

A_{SSD} = mass of saturated surface dry sample in air, g

B = standardized submerged weight of the bowl, g, (see Annex A)

C = submerged weight of sample and bowl, g

Example:

$$G_{mm} = \frac{1432.7\ g}{1432.7\ g + 286.3\ g - 1134.9\ g} = 2.453 \quad or$$

$$G_{mm} = \frac{1432.7\ g}{1434.2\ g + 286.3\ g - 1134.9\ g} = 2.447$$

Given:

A	= 1432.7 g
A_{SSD}	= 1434.2 g
B	= 286.3 g
C	= 1134.9 g

Pycnometer / Volumetric Flask Procedure

$$G_{mm} = \frac{A}{A + D - E} \qquad or \qquad G_{mm} = \frac{A}{A_{SSD} + D - E}$$

(for mixtures containing uncoated materials)

Where:

A	=	mass of dry sample in air, g
A_{SSD}	=	mass of saturated surface-dry sample in air, g
D	=	standardized mass of pycnometer / volumetric flask filled with water at 25°C (77°F), g, (See Annex A)
E	=	mass of pycnometer / volumetric flask filled with water and the test sample at test temperature, g

Example (two increments of a large sample):

$$G_{mm_1} = \frac{2200.3\ g}{2200.3\ g + 7502.5\ g - 8812.0\ g} = 2.470$$

$$G_{mm_2} = \frac{1960.2\ g}{1960.2\ g + 7525.5\ g - 8690.8\ g} = 2.466$$

Given:

Increment 1	Increment 2
A_1 = 2200.3 g	A_2 = 1960.2 g
D_1 = 7502.5 g	D_2 = 7525.5 g
E_1 = 8812.0 g	E_2 = 8690.8 g

Variation = 2.470 - 2.466 = 0.004, which is < 0.014

Allowable variation is: 0.014. The values may be used.

Weighted average

For large samples tested a portion at a time, calculate the $G_{mm\ (avg)}$ by multiplying the dry mass of each increment by its G_{mm}, add the results together (Σ) and divide by the sum (Σ) of the dry masses.

$$G_{mm(avg)} = \frac{\sum\left(A_x \times G_{mm_x}\right)}{\sum A_x}$$

or

$$G_{mm(avg)} = \frac{\left(A_1 \times G_{mm_1}\right) + \left(A_2 \times G_{mm_2}\right)}{A_1 + A_2}\ etc.$$

Where:

A_x = mass of dry sample increment in air, g

G_{mmx} = theoretical maximum specific gravity of the increment

Example:

$$G_{mm(avg)} = \frac{(2200.3\ g \times 2.470) + (1960.2\ g \times 2.466)}{2200.3\ g + 1960.2\ g} = \frac{10{,}268.6}{4160.5\ g} = 2.468$$

Theoretical Maximum Density

To calculate the theoretical maximum density at 25°C (77°F) use one of the following formulas. The density of water at 25°C (77°F) is 997.1 in Metric units or 62.245 in English units.

Theoretical maximum density kg/m^3 = G_{mm} × 997.1 kg/ m^3

2.468 × 997.1 kg/ m^3 = 2461 kg/ m^3

or

Theoretical maximum density lb/ft^3 = G_{mm} × 62.245 lb/ft^3

2.468 × 62.245 lb/ft^3 = 153.6 lb/ft^3

Report

- On forms approved by the agency
- Sample ID
- G_{mm} to the nearest 0.001
- Theoretical maximum density to the nearest 1 kg/m^3 (0.1 lb/ft^3)

ANNEX A – STANDARDIZATION OF BOWL AND PYCNOMETER OR VOLUMETRIC FLASK

(Mandatory Information)

Bowl – Standardization

1. Fill the water bath to overflow level with 25 ±1°C (77 ±2°F) water and allow the water to stabilize.
2. Zero or tare the balance with the immersion apparatus attached, ensuring that the device is not touching the sides or the bottom of the water bath.
3. Suspend and completely immerse the bowl for 10 ±1 minute.
4. Determine and record the submerged weight of the bowl to the nearest 0.1 g.
5. Refill the water bath to overflow level.
6. Repeat Steps 2 through 5 two more times for a total of three determinations.
7. If the three determinations are within 0.3 g., average the determinations. Designate as "B."
8. If the variation of the three determinations is greater than 0.3 g., take corrective action and perform the standardization procedure again.

Bowl – Check

1. Fill the water bath to overflow level 25 ±1°C (77 ±2°F) water and allow the water to stabilize.
2. Zero or tare the balance with the immersion apparatus attached, ensuring that the device is not touching the sides or the bottom of the water bath.
3. Suspend and completely immerse the bowl for 10 ±1 minute.
4. Determine and record the submerged weight of the bowl to the nearest 0.1 g.
5. If this determination is within 0.3 g of the standardized value, use the standardized value for "B."
6. If it is not within 0.3 g, take corrective action and perform the standardization procedure again.

Pycnometer or Volumetric Flask – Standardization

1. Fill the pycnometer / volumetric flask with water at approximately 25°C (77°F).
2. Place the metal or plastic cover, or a glass plate on the pycnometer / volumetric flask and eliminate all air. (See Note 2.)
3. Stabilize the pycnometer / volumetric flask at 25 ± 1ºC (77 ± 2ºF) for 10 ± 1 min.
4. Towel dry the outside of the pycnometer / volumetric flask and cover.
5. Determine and record the mass of the pycnometer / volumetric flask, water, and lid to the nearest 0.1 g.

6. Repeat Steps 2 through 5 two more times for a total of three determinations.
7. If the three determinations are within 0.3 g, average the three determinations. Designate as "D."
8. If the variation of the determinations is greater than 0.3 g., take corrective action and perform the "Pycnometer or Volumetric Flask – Standardization" again.

Pycnometer or Volumetric Flask – Check

1. Fill the pycnometer / volumetric flask with water at approximately 25°C (77°F).
2. Place the metal or plastic cover or a glass plate on the pycnometer / volumetric flask and eliminate all air. (See Note 2.)
3. Stabilize the pycnometer / volumetric flask at 25 ± 1ºC (77 ± 2ºF) for 10 ± 1 min.
4. Towel dry the outside of the pycnometer / volumetric flask and cover.
5. Determine and record the mass of the pycnometer / volumetric flask, water, and lid.
6. If this determination is within 0.3 g of the standardized value, use the standardized value for "D."
7. If it is not within 0.3 g, perform the standardization procedure again.

TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING FOP FOR AASHTO T 255 LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS FOP FOR AASHTO T 265

Scope

This procedure covers the determination of moisture content of aggregate and soil in accordance with AASHTO T 255-00 and AASHTO T 265-15. It may also be used for other construction materials.

Overview

Moisture content is determined by comparing the wet mass of a sample and the mass of the sample after drying to constant mass. The term constant mass is used to define when a sample is dry.

Constant mass – the state at which a mass does not change more than a given percent, after additional drying for a defined time interval, at a required temperature.

Apparatus

- Balance or scale: capacity sufficient for the principle sample mass, accurate to 0.1 percent of sample mass or readable to 0.1 g, and meeting the requirements of AASHTO M 231
- Containers, clean, dry, and capable of being sealed
- Suitable drying containers
- Microwave safe container with ventilated lid
- Heat source, controlled:
  - Forced draft oven
  - Ventilated oven
  - Convection oven
- Heat source, uncontrolled:
  - Infrared heater/heat lamp, hot plate, fry pan, or any other device/method that will dry the sample without altering the material being dried
  - Microwave oven (900 watts minimum)
- Utensils such as spoons
- Hot pads or gloves

Sample Preparation

In accordance with the FOP for AASHTO R 90 obtain a representative sample in its existing condition.

For aggregates the representative sample size is based on Table 1 or other information that may be specified by the agency.

TABLE 1
Sample Sizes for Moisture Content of Aggregate

Nominal Maximum Size* mm (in.)	Minimum Sample Mass g (lb)
4.75 (No. 4)	500 (1.1)
9.5 (3/8)	1500 (3.3)
12.5 (1/2)	2000 (4)
19.0 (3/4)	3000 (7)
25.0 (1)	4000 (9)
37.5 (1 1/2)	6000 (13)
50 (2)	8000 (18)
63 (2 1/2)	10,000 (22)
75 (3)	13,000 (29)
90 (3 1/2)	16,000 (35)
100 (4)	25,000 (55)
150 (6)	50,000 (110)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum.

For soils the representative sample size is based on Table 2 or other information that may be specified by the agency.

TABLE 2
Sample Sizes for Moisture Content of Soil

Maximum Particle Size mm (in.)	Minimum Sample Mass g
0.425 (No. 40)	10
4.75 (No. 4)	100
12.5 (1/2)	300
25.0 (1)	500
50 (2)	1000

Immediately seal or cover samples to prevent any change in moisture content or follow the steps in “Procedure.”

Procedure

Determine and record the sample mass as follows:

- For aggregate, determine and record all masses to the nearest 0.1 percent of the sample mass or to the nearest 0.1 g.
- For soil, determine and record all masses to the nearest 0.1 g.

When determining the mass of hot samples or containers or both, place and tare a buffer between the sample container and the balance. This will eliminate damage to or interference with the operation of the balance or scale.

1. Determine and record the mass of the container (and lid for microwave drying).
2. Place the wet sample in the container.
   a. For oven(s), hot plates, infrared heaters, etc.: Spread the sample in the container.
   b. For microwave oven: Heap sample in the container; cover with ventilated lid.
3. Determine and record the total mass of the container and wet sample.
4. Determine and record the wet mass of the sample (M_W) by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 3.
5. Place the sample in one of the following drying apparatus:
   a. For aggregate –
      i. Controlled heat source (oven): at 110 ±5°C (230 ±9°F).
      ii. Uncontrolled heat source (Hot plate, infrared heater, etc.): Stir frequently to avoid localized overheating.
   b. For soil – controlled heat source (oven): at 110 ±5°C (230 ±9°F).

Note 1: Soils containing gypsum or significant amounts of organic material require special drying. For reliable moisture contents dry these soils at 60°C (140°F). For more information see AASHTO T 265, Note 2.

6. Dry until sample appears moisture free.
7. Determine mass of sample and container.
8. Determine and record the mass of the sample by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 7.
9. Return sample and container to the heat source for additional drying.
   a. For aggregate –
      i. Controlled heat source (oven): 30 minutes
      ii. Uncontrolled heat source (Hot plate, infrared heater, etc.): 10 minutes
      iii. Uncontrolled heat source (Microwave oven): 2 minutes

Caution: Some minerals in the sample may cause the aggregate to overheat, altering the aggregate gradation.

   b. For soil – controlled heat source (oven): 1 hour

10. Determine mass of sample and container.
11. Determine and record the mass of the sample by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 10.
12. Determine percent change by subtracting the new mass determination (M_n) from the previous mass determination (M_p) divide by the previous mass determination (M_p) multiply by 100.
13. Continue drying, performing steps 9 through 12, until there is less than a 0.10 percent change after additional drying time.
14. Constant mass has been achieved; sample is defined as dry.
15. Allow the sample to cool. Immediately determine and record the total mass of the container and dry sample.
16. Determine and record the dry mass of the sample (M_D) by subtracting the mass of the container determined in Step 1 from the mass of the container and sample determined in Step 15.
17. Determine and record percent moisture (w) by subtracting the final dry mass determination (M_D) from the initial wet mass determination (M_W) divide by the final dry mass determination (M_D) multiply by 100.

Table 3
Methods of Drying

Aggregate		
Heat Source	**Specific Instructions**	**Drying intervals to achieve constant mass (minutes)**
Controlled: Forced draft (preferred), ventilated, or convection oven	110 ±5°C (230 ±9°F)	30
Uncontrolled:		
Hot plate, infrared heater, etc.	Stir frequently	10
Microwave	Heap sample and cover with ventilated lid	2
Soil		
Heat Source	**Specific Instructions**	**Drying increments (minutes)**
Controlled: Forced draft (preferred), ventilated, or convection oven	110 ±5°C (230 ±9°F)	1 hour

Calculation

Constant Mass:

Calculate constant mass using the following formula:

$$\% \, Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement

M_n = new mass measurement

Example:

Mass of container:	1232.1 g
Mass of container and sample after first drying cycle:	2637.2 g
Mass, M_p, of possibly dry sample:	2637.2 g - 1232.1 g = 1405.1 g
Mass of container and sample after second drying cycle:	2634.1 g
Mass, M_n, of sample:	2634.1 g - 1232.1 g = 1402.0 g

$$\% \, Change = \frac{1405.1 \, g - 1402.0 \, g}{1405.1 \, g} \times 100 = 0.22\%$$

0.22 percent is not less than 0.10 percent, so continue drying

Mass of container and sample after third drying cycle: 2633.0 g

Mass, M_n, of sample: 2633.0 g - 1232.1 g = 1400.9 g

$$\% \, Change = \frac{1402.0 \, g - 1400.9 \, g}{1402.0 \, g} \times 100 = 0.08\%$$

0.08 percent is less than 0.10 percent, so constant mass has been reached.

Moisture Content:

Calculate the moisture content, as a percent, using the following formula:

$$w = \frac{M_W - M_D}{M_D} \times 100$$

Where:

w = moisture content, percent

M_W = wet mass

M_D = dry mass

Example:

Mass of container:	1232.1 g
Mass of container and wet sample:	2764.7 g
Mass, M_W, of wet sample:	2764.7 g - 1232.1 g = 1532.6 g
Mass of container and dry sample (COOLED):	2633.5 g
Mass, M_D, of dry sample:	2633.5 g - 1232.1 g = 1401.4 g

$$w = \frac{1532.6\ g - 1401.4\ g}{1401.4\ g} \times 100 = \frac{131.2g}{1401.4\ g} \times 100 = 9.36\% \quad report\ 9.4\%$$

Report

- On forms approved by the agency
- Sample ID
- M_W, wet mass
- M_D, dry mass
- w, moisture content to the nearest 0.1 percent

DETERMINING THE ASPHALT BINDER CONTENT OF ASPHALT MIXTURES BY THE IGNITION METHOD
FOP FOR AASHTO T 308

Scope

This procedure covers the determination of asphalt binder content of asphalt mixtures by ignition of the binder in accordance with AASHTO T 308-18.

Overview

The sample is heated in a furnace at 538°C (1000°F) or less; samples may be heated by convection or direct infrared irradiation (IR). The aggregate remaining after burning can be used for sieve analysis using the FOP for AASHTO T 30.

Some agencies allow the use of recycled asphalt mixtures. When using recycled asphalt mixtures, check with the agency for specific correction procedures.

Asphalt binder in the asphalt mixture is ignited in a furnace. Asphalt binder content is calculated as the percentage difference between the initial mass of the asphalt mixture and the mass of the residual aggregate, with the asphalt binder correction factor, and moisture content subtracted. The asphalt binder content is expressed as percent of moisture-free mix mass.

Two methods, A and B, are presented.

Apparatus

Note 1: The apparatus must be calibrated for the specific mix design. See "Correction Factors" at the end of this FOP.

The apparatus for the Methods A and B is the same except that the furnace for Method A requires an internal balance.

- Ignition Furnace: A forced-air ignition furnace that heats the specimens by either the convection or direct IR irradiation method. The convection-type furnace must be capable of maintaining the temperature at 538 ± 5°C (1000 ± 9°F).

  For Method A, the furnace will be equipped with an internal scale thermally isolated from the furnace chamber and accurate to 0.1 g. The scale shall be capable of determining the mass of a 3500 g sample in addition to the sample baskets. A data collection system will be included so that mass can be automatically determined and displayed during the test. The furnace shall have a built-in computer program to calculate the change in mass of the sample baskets and provide for the input of a correction factor for aggregate loss. The furnace shall provide a printed ticket with the initial specimen mass, specimen mass loss, temperature compensation, correction factor, corrected asphalt binder content, test time, and test temperature. The furnace shall provide an audible alarm and indicator light when the sample mass loss does not exceed 0.01 percent of the total sample mass for three consecutive minutes. Perform lift test according to manufacturer's instructions weekly during use, if applicable.

Note 2: The furnace shall be designed to permit the operator to change the ending mass loss percentage from 0.01 percent to 0.02 percent.

For both Method A and Method B, the furnace chamber dimensions shall be adequate to accommodate a 3500 g sample. The furnace door shall be equipped so that it cannot be opened during the ignition test. A method for reducing furnace emissions shall be provided and the furnace shall be vented so that no emissions escape into the laboratory. The furnace shall have a fan to pull air through the furnace to expedite the test and to eliminate the escape of smoke into the laboratory.

- Sample Basket Assembly: consisting of sample basket(s), catch pan, and basket guards. Sample basket(s) will be of appropriate size allowing samples to be thinly spread and allowing air to flow through and around the sample particles. Sets of two or more baskets shall be nested. A catch pan: of sufficient size to hold the sample basket(s) so that aggregate particles and melting asphalt binder falling through the screen mesh are caught. Basket guards will completely enclose the basket and be made of screen mesh, perforated stainless steel plate, or other suitable material.
- Thermometer, or other temperature measuring device, with a temperature range of 10 - 260°C (50-500°F).
- Oven capable of maintaining 110 ±5°C (230 ±9°F).
- Balance or scale: Capacity sufficient for the sample mass and conforming to the requirements of M 231, Class G2.
- **Safety equipment**: Safety glasses or face shield, high temperature gloves, long sleeved jacket, a heat resistant surface capable of withstanding 650°C (1202°F), a protective cage capable of surrounding the sample baskets during the cooling period, and a particle mask for use during removal of the sample from the basket assembly.
- Miscellaneous equipment: A pan larger than the sample basket(s) for transferring sample after ignition, spatulas, bowls, and wire brushes.

Sampling

1. Obtain samples of asphalt mixture in accordance with the FOP for AASHTO R 97.
2. Reduce asphalt mixture samples in accordance with the FOP for AASHTO R 47.
3. If the mixture is not sufficiently soft to separate with a spatula or trowel, place it in a large flat pan in an oven at 110 ±5°C (230 ±9°F) until soft enough.
4. Test sample size shall conform to the mass requirement shown in Table 1.

Note 3: When the mass of the test specimen exceeds the capacity of the equipment used or for large samples of fine mixes, the test specimen may be divided into suitable increments, tested, and the results appropriately combined through a weighted average for calculation of the asphalt binder content.

Table 1

Nominal Maximum Aggregate Size* mm (in.)	Minimum Mass Specimen g	Maximum Mass Specimen g
37.5 (1 ½)	4000	4500
25.0 (1)	3000	3500
19.0 (3/4)	2000	2500
12.5 (1/2)	1500	2000
9.5 (3/8)	1200	1700
4.75 (No. 4)	1200	1700

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Procedure – Method A (Internal Balance)

1. For the convection-type furnace, preheat the ignition furnace to 538 ± 5°C (1000 ± 9°F) or to the temperature determined in the "Correction Factor" section, Step 9 of this method. Manually record the furnace temperature (set point) before the initiation of the test if the furnace does not record automatically. For the direct IR irradiation-type furnace, use the same burn profile as used during the correction factor determination.
2. Dry the sample to constant mass, according to the FOP for AASHTO T 329; or determine the moisture content of a companion sample in accordance with the FOP for AASHTO T 329.
3. Determine and record the mass to the nearest 0.1 g of the sample basket assembly.
4. Evenly distribute the sample in the sample basket assembly, taking care to keep the material away from the edges of the basket. Use a spatula or trowel to level the sample.
5. Determine and record the total mass of the sample and sample basket assembly at room temperature to the nearest 0.1 g. Calculate and record the initial mass of the sample (total mass minus the mass of the sample basket assembly) to the nearest 0.1 g. Designate this mass as (M_i).
6. Record the correction factor or input into the furnace controller for the specific asphalt mixture.
7. Input the initial mass of the sample (M_i) into the ignition furnace controller. Verify that the correct mass has been entered.
8. Verify the furnace scale is reading zero, if not, reset to zero.

   CAUTION: Operator should wear safety equipment – high temperature gloves, face shield, fire-retardant shop coat – when opening the door to load or unload the sample.

9. Open the chamber door and gently set the sample basket assembly in the furnace. Carefully position the sample basket assembly so it is not in contact with the furnace wall. Close the chamber door and verify that the sample mass displayed on the furnace scale equals the total mass of the sample and sample basket assembly recorded in Step 5 within ±5 g.

   Note 4: Furnace temperature will drop below the set point when the door is opened but will recover when the door is closed, and ignition begins. Sample ignition typically increases the temperature well above the set point – relative to sample size and asphalt binder content.

10. Initiate the test by pressing the start button. This will lock the sample chamber and start the combustion blower.

    Safety note: Do not attempt to open the furnace door until the asphalt binder has been completely burned off.

11. Allow the test to continue until the stable light and audible stable indicator indicate that the change in mass does not exceed 0.01 percent for three consecutive minutes. Press the stop button. This will unlock the sample chamber and cause the printer to print out the test results.

    Note 5: An ending mass loss percentage of 0.02 may be used, if allowed by the agency, when aggregate that exhibits an excessive amount of loss during ignition testing is used.

12. Open the chamber door, remove the sample basket assembly, and place on the cooling plate or block. Place the protective cage over the sample basket assembly and allow it to cool to room temperature (approximately 30 minutes).

13. Determine and record the total after ignition mass to the nearest 0.1 g. Calculate and record the mass of the sample, after ignition (total after ignition mass minus the mass of the sample basket assembly) to the nearest 0.1 g. Designate this mass as M_f.

14. Use the asphalt binder content percentage from the printed ticket. Subtract the moisture content and the correction factor if not entered into the furnace controller from the printed ticket asphalt binder content and report the difference as the corrected asphalt binder content.

    Asphalt binder content percentage can also be calculated using the formula from "Method B" Step 16.

Calculation

Corrected asphalt binder content:

$$P_b = BC - MC - C_f^{\,*}$$

*If correction factor is not entered into the furnace controller

where:

P_b = the corrected asphalt binder content as a percent by mass of the asphalt mixture

BC = asphalt binder content shown on printed ticket

MC = moisture content of the companion asphalt mixture sample, percent, as determined by the FOP for AASHTO T 329 (if the specimen was oven-dried before initiating the procedure, MC=0)

C_f = correction factor as a percent by mass of the asphalt mixture sample

Procedure – Method B (External Balance)

1. Preheat the ignition furnace to 538 ± 5°C (1000 ± 9°F) or to the temperature determined in the "Correction Factor" section, Step 9 of this method. Manually record the furnace temperature (set point) before the initiation of the test if the furnace does not record automatically.
2. Dry the sample to constant mass, according to the FOP for AASHTO T 329; or determine the moisture content of a companion sample in accordance with the FOP for AASHTO T 329.
3. Determine and record the mass of the sample basket assembly to the nearest 0.1 g.
4. Place the sample basket(s) in the catch pan. Evenly distribute the sample in the sample basket(s), taking care to keep the material away from the edges of the basket. Use a spatula or trowel to level the sample.
5. Determine and record the total mass of the sample and sample basket assembly at room temperature to the nearest 0.1 g. Calculate and record the initial mass of the sample (total mass minus the mass of the sample basket assembly) to the nearest 0.1 g. Designate this mass as (M_i).
6. Record the correction factor for the specific asphalt mixture.
7. Open the chamber door and gently set the sample basket assembly in the furnace. Carefully position the sample basket assembly so it is not in contact with the furnace wall. Burn the asphalt mixture sample in the furnace for 45 minutes or the length of time determined in the "Correction Factors" section.

8. Open the chamber door, remove the sample basket assembly, and place on the cooling plate or block. Place the protective cage over the sample and allow it to cool to room temperature (approximately 30 min).
9. Determine and record the total after ignition mass to the nearest 0.1 g. Calculate and record the mass of the sample, after ignition (total after ignition mass minus the mass of the sample basket assembly) to the nearest 0.1 g.
10. Place the sample basket assembly back into the furnace.
11. Burn the sample for at least 15 minutes after the furnace reaches the set temperature.
12. Open the chamber door, remove the sample basket assembly, and place on the cooling plate or block. Place the protective cage over the sample basket assembly and allow it to cool to room temperature (approximately 30 min.).
13. Determine and record the total after ignition mass to the nearest 0.1 g. Calculate and record the mass of the sample, after ignition (total after ignition mass minus the mass of the sample basket assembly) to the nearest 0.1 g.
14. Repeat Steps 10 through 13 until the change in measured mass of the sample after ignition does not exceed 0.01 percent of the previous sample mass after ignition.

    Note 6: An ending mass loss percentage of 0.02 may be used, if allowed by the agency, when aggregate that exhibits an excessive amount of loss during ignition testing is used.

15. Determine and record the total after ignition mass to the nearest 0.1 g. Calculate and record the mass of the sample, after ignition (total after ignition mass minus the mass of the sample basket assembly) to the nearest 0.1 g. Designate this mass as M_f.
16. Calculate the asphalt binder content of the sample.

Calculations

Calculate the asphalt binder content of the sample as follows:

$$P_b = \frac{M_i - M_f}{M_i} \times 100 - MC - C_f$$

where:

P_b = the corrected asphalt binder content as a percent by mass of the asphalt mixture sample

M_f = the final mass of aggregate remaining after ignition, g

M_i = the initial mass of the asphalt mixture sample before ignition, g

MC= moisture content of the companion asphalt mixture sample, percent, as determined by the FOP for AASHTO T 329 (if the specimen was oven-dried before initiating the procedure, MC = 0).

C_f = correction factor as a percent by mass of the asphalt mixture sample

Example

Correction Factor	= 0.42%
Moisture Content	= 0.04%
Initial Mass of Sample and Basket	= 5292.7 g
Mass of Basket Assembly	= 2931.5 g
M_i	= 2361.2 g
Total Mass after First ignition + basket	= 5154.4 g
Sample Mass after First ignition	= 2222.9 g
Sample Mass after additional 15 min ignition	= 2222.7 g

$$\%change = \frac{2222.9\ g - 2222.7\ g}{2222.9\ g} \times 100 = 0.009\%$$

%change is not greater than 0.01 percent, so $\mathbf{M_f}$ = 2222.7 g

$$P_b = \frac{2361.2\ g - 2222.7\ g}{2361.2\ g} \times 100 - 0.42\% - 0.04\% = 5.41\%$$

P_b= 5.41%

Gradation

1. Empty contents of the basket(s) into a flat pan, being careful to capture all material. Use a small wire brush to ensure all residual fines are removed from the baskets.

   Note 7: Particle masks are a recommended safety precaution.

2. Perform the gradation analysis in accordance with the FOP for AASHTO T 30.

Report

- On forms approved by the agency
- Sample ID
- Method of test (A or B)
- Corrected asphalt binder content, P_b, per agency standard
- Correction factor, C_f , to the nearest 0.01 percent
- Temperature compensation factor (Method A only)
- Total percent loss
- Sample mass
- Moisture content to the nearest 0.01%
- Test temperature

Attach the original printed ticket with all intermediate values (continuous tape) to the report for furnaces with internal balances.

ANNEX – CORRECTION FACTORS

ASPHALT BINDER AND AGGREGATE

(Mandatory Information)

Asphalt binder content results may be affected by the type of aggregate in the mixture and by the ignition furnace. Asphalt binder and aggregate correction factors must, therefore, be established by testing a set of correction specimens for each Job Mix Formula (JMF) mix design. Each ignition furnace will have its own unique correction factor determined in the location where testing will be performed.

This procedure must be performed before any acceptance testing is completed, and repeated each time there is a change in the mix ingredients or design. Any changes greater than 5 percent in stockpiled aggregate proportions should require a new correction factor.

All correction samples will be prepared by a central / regional laboratory unless otherwise directed.

Asphalt binder correction factor: A correction factor must be established by testing a set of correction specimens for each Job Mix Formula (JMF). Certain aggregate types may result in unusually high correction factors (> 1.00 percent). Such mixes should be corrected and tested at a lower temperature as described below.

Aggregate correction factor: Due to potential aggregate breakdown during the ignition process, a correction factor will need to be determined for the following conditions:

a. Aggregates that have a proven history of excessive breakdown

b. Aggregate from an unknown source.

This correction factor will be used to adjust the acceptance gradation test results obtained according to the FOP for AASHTO T 30.

Procedure

1. Obtain samples of aggregate in accordance with the FOP for AASHTO R 90.
2. Obtain samples of asphalt binder in accordance with the FOP for AASHTO R 66.

   Note 8: Include other additives that may be required by the JMF.

3. Prepare an initial, or "butter," mix at the design asphalt binder content. Mix and discard the butter mix before mixing any of the correction specimens to ensure accurate asphalt content.
4. Prepare two correction specimens at the JMF design asphalt binder content. Aggregate used for correction specimens shall be sampled from material designated for use on the project. An agency approved method will be used to combine aggregate. An additional "blank" specimen shall be batched and tested for aggregate gradation in accordance with the FOP for AASHTO T 30. The gradation from the "blank" shall fall within the agency specified mix design tolerances.
5. Place the freshly mixed specimens directly into the sample basket assembly. If mixed specimens are allowed to cool before placement in the sample basket assembly, the

specimens must be dried to constant mass according to the FOP for AASHTO T 329. Do not preheat the sample basket assembly.

6. Test the specimens in accordance with Method A or Method B of the procedure.
7. Once both of the correction specimens have been burned, determine the asphalt binder content for each specimen by calculation or from the printed ignition furnace tickets, if available.
8. If the difference between the asphalt binder contents of the two specimens exceeds 0.15 percent, repeat with two more specimens and, from the four results, discard the high and low result. Determine the correction factor from the two original or remaining results, as appropriate. Calculate the difference between the actual and measured asphalt binder contents for each specimen to 0.01 percent. The asphalt binder correction factor, C_f, is the average of the differences expressed as a percent by mass of asphalt mixture.
9. If the asphalt binder correction factor exceeds 1.00 percent, the test temperature must be lowered to 482 ± 5°C (900 ± 9°F) and new samples must be burned. If the correction factor is the same or higher at the lower temperature, it is permissible to use the higher temperature. The temperature for determining the asphalt binder content of asphalt mixture samples by this procedure shall be the same temperature determined for the correction samples.
10. For the direct IR irradiation-type burn furnaces, the **default** burn profile should be used for most materials. The operator may select burn-profile Option 1 or Option 2 to optimize the burn cycle. The burn profile for testing asphalt mixture samples shall be the same burn profile selected for correction samples.

    Option 1 is designed for aggregate that requires a large asphalt binder correction factor (greater than 1.00 percent) – typically very soft aggregate (such as dolomite).

    Option 2 is designed for samples that may not burn completely using the **default** burn profile.

11. Perform a gradation analysis on the residual aggregate in accordance with the FOP for AASHTO T 30, if required. The results will be utilized in developing an "Aggregate Correction Factor" and should be calculated and reported to 0.1 percent.
12. From the gradation results subtract the percent passing for each sieve, for each sample, from the percent passing each sieve of the "Blank" specimen gradation results from Step 4.
13. Determine the average difference of the two values. If the difference for any single sieve exceeds the allowable difference of that sieve as listed in Table 2, then aggregate gradation correction factors (equal to the resultant average differences) for all sieves shall be applied to all acceptance gradation test results determined by the FOP for AASHTO T 30. If the 75 µm (No. 200) is the only sieve outside the limits in Table 2, apply the aggregate correction factor to only the 75 µm (No. 200) sieve.

Table 2
Permitted Sieving Difference

Sieve	Allowable Difference
Sizes larger than or equal to 2.36 mm (No.8)	± 5.0%
Sizes larger than to 75 µm (No.200) and smaller than 2.36 mm (No.8)	± 3.0%
Sizes 75 µm (No.200) and smaller	± 0.5%

Examples:

Sieve Size mm (in.)	Correction Factor Blank Sample % Passing	Correction Factor Sample #1 % Passing	Correction Factor Sample #2 % Passing	Difference 1 / 2	Avg. Diff.	Sieves to adjust
19.0 (3/4)	100	100	100	0/0	0.0	
12.5 (1/2)	86.3	87.4	86.4	-1.1/-0.1	-0.6	
9.5 (3/8)	77.4	76.5	78.8	+0.9/-1.4	-0.3	
4.75 (No. 4)	51.5	53.6	55.9	-2.1/-4.4	-3.3	
2.36 (No. 8)	34.7	36.1	37.2	-1.4/-2.5	-2.0	
01.18 (No. 16)	23.3	25.0	23.9	-1.7/-0.6	-1.2	
0.600 (No. 30)	16.4	19.2	18.1	-2.8/-1.7	-2.3	
0.300 (No. 50)	12.0	11.1	12.7	+0.9/-0.7	+0.1	
0.150 (No. 100)	8.1	9.9	6.3	-1.8/+1.8	0.0	
75 µm (No. 200)	5.5	5.9	6.2	-0.4/-0.7	-0.6	**- 0.6**

In this example, all gradation test results performed on the residual aggregate (FOP for AASHTO T 30) would have an aggregate correction factor applied to the percent passing the 75 µm (No. 200) sieve. The correction factor must be applied because the average difference on the 75 µm (No. 200) sieve is outside the tolerance from Table 2.

In the following example, aggregate correction factors would be applied to each sieve because the average difference on the 4.75 mm (No. 4) is outside the tolerance from Table 2.

Sieve Size mm (in.)	Correction Factor Blank Sample % Passing	Correction Factor Sample #1 % Passing	Correction Factor Sample #2 % Passing	Difference 1 / 2	Avg. Diff.	Sieves to adjust
19.0 (3/4)	100	100	100	0/0	0.0	0.0
12.5 (1/2)	86.3	87.4	86.4	-1.1/-0.1	-0.6	**-0.6**
9.5 (3/8)	77.4	76.5	78.8	+0.9/-1.4	-0.3	**-0.3**
4.75 (No. 4)	51.5	55.6	57.9	-4.1/-6.4	-5.3	**-5.3**
2.36 (No. 8)	34.7	36.1	37.2	-1.4/-2.5	-2.0	**-2.0**
01.18 (No. 16)	23.3	25.0	23.9	-1.7/-0.6	-1.2	**-1.2**
0.600 (No. 30)	16.4	19.2	18.1	-2.8/-1.7	-2.3	**-2.3**
0.300 (No. 50)	12.0	11.1	12.7	+0.9/-0.7	+0.1	**+0.1**
0.150 (No. 100)	8.1	9.9	6.3	-1.8/+1.8	0.0	0.0
75 µm (No. 200)	5.5	5.9	6.2	-0.4/-0.7	-0.6	**-0.6**

TEMPERATURE OF FRESHLY MIXED PORTLAND CEMENT CONCRETE FOP FOR AASHTO T 309

Scope

This procedure covers the determination of the temperature of freshly mixed Portland Cement Concrete in accordance with AASHTO T 309-20.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Container — The container shall be made of non-absorptive material and large enough to provide at least 75 mm (3 in.) of concrete in all directions around the sensor; concrete cover must also be a least three times the nominal maximum size of the coarse aggregate.
- Temperature measuring device — The temperature measuring device shall be calibrated and capable of measuring the temperature of the freshly mixed concrete to ±0.5°C (±1°F) throughout the temperature range likely to be encountered. Partial immersion liquid-in-glass thermometers (and possibly other types) shall have a permanent mark to which the device must be immersed without applying a correction factor.
- Reference temperature measuring device — The reference temperature measuring device shall be a thermometric device readable to 0.2°C (0.5°F) that has been verified and calibrated. The calibration certificate or report indicating conformance to the requirements of ASTM E 77 shall be available for inspection.

Calibration of Temperature Measuring Device

Each temperature measuring device shall be verified for accuracy annually and whenever there is a question of accuracy. Calibration shall be performed by comparing readings on the temperature measuring device with another calibrated instrument at two temperatures at least 15°C or 27°F apart.

Sample Locations and Times

The temperature of freshly mixed concrete may be measured in the transporting equipment, in forms, or in sample containers, provided the sensor of the temperature measuring device has at least 75 mm (3 in.) of concrete cover in all direction around it.

Complete the temperature measurement of the freshly mixed concrete within 5 minutes of obtaining the sample.

Procedure

1. Dampen the sample container.
2. Obtain the sample in accordance with the FOP for WAQTC TM 2.
3. Place sensor of the temperature measuring device in the freshly mixed concrete so that it has at least 75 mm (3 in.) of concrete cover in all directions around it.
4. Gently press the concrete in around the sensor of the temperature measuring device at the surface of the concrete so that air cannot reach the sensor.
5. Leave the sensor of the temperature measuring device in the freshly mixed concrete for a minimum of two minutes, or until the temperature reading stabilizes.
6. Complete the temperature measurement of the freshly mixed concrete within 5 minutes of obtaining the sample.
7. Read and record the temperature to the nearest 0.5°C (1°F).

Report

- Results on forms approved by the agency
- Sample ID
- Measured temperature of the freshly mixed concrete to the nearest 0.5°C (1°F)

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IN-PLACE DENSITY AND MOISTURE CONTENT OF SOIL AND SOIL-AGGREGATE BY NUCLEAR METHODS (SHALLOW DEPTH) FOP FOR AASHTO T 310

Scope

This procedure covers the determination of density, moisture content, and relative compaction of soil, aggregate, and soil-aggregate mixes in accordance with AASHTO T 310-19. This field operating procedure is derived from AASHTO T 310. The nuclear moisture-density gauge is used in the direct transmission mode.

Apparatus

- Nuclear density gauge with the factory matched standard reference block.
- Drive pin, guide/scraper plate, and hammer for testing in direct transmission mode.
- Transport case for properly shipping and housing the gauge and tools.
- Instruction manual for the specific make and model of gauge.
- Radioactive materials information and calibration packet containing:
  - Daily Standard Count Log.
  - Factory and Laboratory Calibration Data Sheet.
  - Leak Test Certificate.
  - Shippers Declaration for Dangerous Goods.
  - Procedure Memo for Storing, Transporting and Handling Nuclear Testing Equipment.
  - Other radioactive materials documentation as required by local regulatory requirements.
- Sealable containers and utensils for moisture content determinations.

Radiation Safety

This method does not purport to address all of the safety problems associated with its use. This test method involves potentially hazardous materials. The gauge utilizes radioactive materials that may be hazardous to the health of the user unless proper precautions are taken. Users of this gauge must become familiar with the applicable safety procedures and governmental regulations. All operators will be trained in radiation safety prior to operating nuclear density gauges. Some agencies require the use of personal monitoring devices such as a thermoluminescent dosimeter or film badge. Effective instructions together with routine safety procedures such as source leak tests, recording and evaluation of personal monitoring device data, etc., are a recommended part of the operation and storage of this gauge.

Calibration

Calibrate the nuclear gauge as required by the agency. This calibration may be performed by the agency using manufacturer's recommended procedures or by other facilities approved by the agency. Verify or re-establish calibration curves, tables, or equivalent coefficients every 12 months.

Standardization

1. Turn the gauge on and allow it to stabilize (approximately 10 to 20 minutes) prior to standardization. Leave the power on during the day's testing.
2. Standardize the nuclear gauge at the construction site at the start of each day's work and as often as deemed necessary by the operator or agency. Daily variations in standard count shall not exceed the daily variations established by the manufacturer of the gauge. If the daily variations are exceeded after repeating the standardization procedure, the gauge should be repaired and/or recalibrated.
3. Record the standard count for both density and moisture in the Daily Standard Count Log. The exact procedure for standard count is listed in the manufacturer's Operator's Manual.

Note 1: New standard counts may be necessary more than once a day. See agency requirements.

Overview

There are two methods for determining in-place density of soil / soil aggregate mixtures. See agency requirements for method selection.

- Method A Single Direction
- Method B Two Direction

Procedure

1. Select a test location(s) randomly and in accordance with agency requirements. Test sites should be relatively smooth and flat and meet the following conditions:
   a. At least 10 m (30 ft) away from other sources of radioactivity
   b. At least 3 m (10 ft) away from large objects
   c. The test site should be at least 150 mm (6 in.) away from any vertical projection, unless the gauge is corrected for trench wall effect.
2. Remove all loose and disturbed material and remove additional material as necessary to expose the top of the material to be tested.
3. Prepare a flat area sufficient in size to accommodate the gauge. Plane the area to a smooth condition so as to obtain maximum contact between the gauge and the material being tested. For Method B, the flat area must be sufficient to permit rotating the gauge 90 or 180 degrees about the source rod.

4. Fill in surface voids beneath the gauge with fines of the material being tested passing the 4.75 mm (No. 4) sieve or finer. Smooth the surface with the guide plate or other suitable tool. The depth of the filler should not exceed approximately 3 mm (1/8 in.).
5. Make a hole perpendicular to the prepared surface using the guide plate and drive pin. The hole shall be at least 50 mm (2 in.) deeper than the desired source rod depth and shall be aligned such that insertion of the source rod will not cause the gauge to tilt from the plane of the prepared area. Remove the drive pin by pulling straight up and twisting the extraction tool.
6. Place the gauge on the prepared surface so the source rod can enter the hole without disturbing loose material.
7. Lower the source rod into the hole to the desired test depth using the handle and trigger mechanism.
8. Seat the gauge firmly by partially rotating it back and forth about the source rod. Ensure the gauge is seated flush against the surface by pressing down on the gauge corners and making sure that the gauge does not rock.
9. Pull gently on the gauge to bring the side of the source rod nearest to the scaler / detector firmly against the side of the hole.
10. Perform one of the following methods, per agency requirements:
    a. Method A Single Direction: Take a test consisting of the average of two, one-minute readings, and record both density and moisture data. The two wet density readings should be within 32 kg/m^3 (2.0 lb/ft^3) of each other. The average of the two wet densities and moisture contents will be used to compute dry density.
    b. Method B Two Direction: Take a one-minute reading and record both density and moisture data. Rotate the gauge 90 or 180 degrees, pivoting it around the source rod. Reseat the gauge by pulling gently on the gauge to bring the side of the source rod nearest to the scaler/detector firmly against the side of the hole and take a one-minute reading. (In trench locations, rotate the gauge 180 degrees for the second test.) Some agencies require multiple one-minute readings in both directions. Analyze the density and moisture data. A valid test consists of wet density readings in both gauge positions that are within 50 kg/m^3 (3.0 lb/ft^3). If the tests do not agree within this limit, move to a new location. The average of the wet density and moisture contents will be used to compute dry density.
11. If required by the agency, obtain a representative sample of the material, 4 kg (9 lb) minimum, from directly beneath the gauge full depth of material tested. This sample will be used to verify moisture content and / or identify the correct density standard. Immediately seal the material to prevent loss of moisture.

    The material tested by direct transmission can be approximated by a cylinder of soil approximately 300 mm (12 in.) in diameter directly beneath the centerline of the radioactive source and detector. The height of the cylinder will be approximately the depth of measurement. When organic material or large aggregate is removed during this operation, disregard the test information, and move to a new test site.

12. To verify the moisture content from the nuclear gauge, determine the moisture content with a representative portion of the material using the FOP for AASHTO T 255/T 265 or other agency approved methods. If the moisture content from the nuclear gauge is within ±1 percent, the nuclear gauge readings can be accepted. Moisture content verification is gauge and material specific. Retain the remainder of the sample at its original moisture content for a one-point compaction test under the FOP for AASHTO T 272, or for gradation, if required.

Note 2: Example: A gauge reading of 16.8 percent moisture and an oven dry of 17.7 percent are within the ±1 percent requirement. Moisture correlation curves will be developed according to agency guidelines. These curves should be reviewed and possibly redeveloped every 90 days.

13. Determine the dry density by one of the following.
    a. From nuclear gauge readings, compute by subtracting the mass (weight) of the water (kg/m^3 or lb/ft^3) from the wet density (kg/m^3 or lb/ft^3) or compute using the percent moisture by dividing wet density from the nuclear gauge by 1 plus the moisture content expressed as a decimal.
    b. When verification is required and the nuclear gauge readings cannot be accepted, the moisture content is determined by the FOP for AASHTO T 255/T 265 or other agency approved methods. Compute dry density by dividing wet density from the nuclear gauge by 1 plus the moisture content expressed as a decimal.

Percent Compaction

- Percent compaction is determined by comparing the in-place dry density as determined by this procedure to the appropriate agency density standard. For soil or soil-aggregate mixes, these are moisture-density curves developed using the FOP for AASHTO T 99/T 180. When using maximum dry densities from the FOP for AASHTO T 99/T 180 or FOP for AASHTO T 272, it may be necessary to use the Annex in the FOP for T 99/T 180 to determine corrected maximum dry density and optimum moisture content.

  For coarse granular materials, the density standard may be density-gradation curves developed using a vibratory method such as AKDOT&PF's ATM 212, ITD's T 74, WSDOT's TM 606, or WFLHD's Humphres.

See appropriate agency policies for use of density standards.

Calculation

Calculate the dry density as follows:

$$\rho_d = \left(\frac{\rho_w}{w + 100}\right) \times 100 \quad or \quad \rho_d = \frac{\rho_w}{\frac{w}{100} + 1}$$

Where:

ρ_d = Dry density, kg/m^3 (lb/ft^3)

ρ_w = Wet density, kg/m^3 (lb/ft^3)

w = Moisture content from the FOP's for AASHTO T 255 / T 265, as a percentage

Calculate percent compaction as follows:

$$\% \, Compaction = \frac{\rho_d}{Agency\ density\ standard} \times 100$$

Where:

ρ_d = Dry density, kg/m^3 (lb/ft^3)

Agency density standard = Corrected maximum dry density from the FOP from T 99/T 180 Annex

Example:

Wet density readings from gauge: 1948 kg/m^3 (121.6 lb/ft^3)

1977 kg/m^3 (123.4 lb/ft^3)

Avg: 1963 kg/m^3 (122.5 lb/ft^3)

Moisture readings from gauge: 14.2% and 15.4% = Avg 14.8%

Moisture content from the FOP's for AASHTO T 255/ T 265: 15.9%

Moisture content is greater than 1 percent different so the gauge moisture cannot be used.

Calculate the dry density as follows:

$$\rho_d = \left(\frac{1963\,kg/m^3\ or\ 122.5\ lb/ft^3}{15.9 + 100}\right) \times 100\ or\ \rho_d = \frac{1963\,kg/m^3\ or\ 122.5\ lb/ft^3}{\frac{15.9}{100} + 1}$$

$$= 1694\ kg/m^3\ or\ 105.7\ lb/ft^3$$

Given:

ρ_w = 1963 kg/m^3 or 122.5 lb/ft^3

w = 15.9%

Calculate percent compaction as follows:

$$\%\,Compaction = \frac{105.7\,lb/ft^3}{111.3\,lb/ft^3} \times 100 = 95\%$$

Given:

Agency density standard = 111.3 lb/ft^3

Report

- On forms approved by the agency
- Sample ID
- Location of test, elevation of surface, and thickness of layer tested
- Visual description of material tested
- Make, model and serial number of the nuclear moisture-density gauge
- Wet density to the nearest 0.1 lb/ft^3
- Moisture content as a percent, by mass, of dry soil mass to the nearest 0.1 percent
- Dry density to the nearest 0.1 lb/ft^3
- Density standard to the nearest 0.1 lb/ft^3
- Percent compaction the nearest 1 percent
- Name and signature of operator

Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures

AASHTO Designation: T 324-19

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MOISTURE CONTENT OF ASPHALT MIXTURES BY OVEN METHOD FOP FOR AASHTO T 329

Scope

This procedure covers the determination of moisture content of asphalt mixtures in accordance with AASHTO T 329-15.

Overview

Moisture content is determined by comparing the wet mass of a sample and the mass of the sample after drying to constant mass. The term constant mass is used to define when a sample is dry.

Constant mass – the state at which a mass does not change more than a given percent, after additional drying for a defined time interval, at a required temperature.

Apparatus

- Balance or scale: 2 kg capacity, readable to 0.1 g and conforming to AASHTO M 231.
- Forced draft, ventilated, or convection oven: Capable of maintaining the temperature surrounding the sample at 163 ±14°C (325 ±25°F).
- Sample Container: Clean, dry, not affected by heat and of sufficient size to contain a test sample without danger of spilling.
- Thermometer or other suitable device with a temperature range of 10-260°C (50-500°F).

Sample

The test sample shall be obtained in accordance with the FOP for AASHTO R 97 and reduced in accordance with the FOP for AASHTO R 47. The size of the test sample shall be a minimum of 1000 g.

Procedure

1. Preheat the oven to the Job Mix Formula (JMF) mixing temperature range. If the mixing temperature is not supplied, a temperature of 163 ±14ºC (325 ±25ºF) is to be used.
2. Determine and record the mass of the sample container, including release media, to the nearest 0.1 g.

   Note 1: When using paper or other absorptive material to line the sample container ensure it is dry before determining initial mass of sample container.

3. Place the test sample in the sample container.
4. Determine and record the temperature of the test sample.
5. Determine and record the total mass of the sample container and test sample to the nearest 0.1 g.
6. Calculate the initial, moist mass (M_i) of the test sample by subtracting the mass of the sample container as determined in Step 2 from the total mass of the sample container and the test sample as determined in Step 5.

7. The test sample shall be initially dried for 90 ±5 minutes, and its mass determined. Then it shall be dried at 30 ±5 minute intervals until further drying does not alter the mass by more than 0.05 percent.
8. Cool the sample container and test sample to ±9°C (±15°F) of the temperature determined in Step 4.
9. Determine and record the total mass of the sample container and test sample to the nearest 0.1 g.
10. Calculate the final, dry mass (M_f) of the test sample by subtracting the mass of the sample container as determined in Step 2 from the total mass of the sample container and the test sample as determined in Step 9.

Note 2: Moisture content and the number of samples in the oven will affect the rate of drying at any given time. Placing wet samples in the oven with nearly dry samples could affect the drying process.

Calculations

Constant Mass:

Calculate constant mass using the following formula:

$$\% \, Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement

M_n = new mass measurement

Example:

Mass of container:	232.6 g
Mass of container and sample after first drying cycle:	1361.8 g
Mass, M_p, of possibly dry sample:	1361.8 g – 232.6 g = 1129.2 g
Mass of container and possibly dry sample after second drying cycle:	1360.4 g
Mass, M_n, of possibly dry sample:	1360.4 g – 232.6 g = 1127.8 g

$$\% \, Change = \frac{1129.2\, g - 1127.8\, g}{1129.2\, g} \times 100 = 0.12\%$$

0.12 percent is not less than 0.05 percent, so continue drying the sample.

Mass of container and possibly dry sample after third drying cycle:	1359.9 g
Mass, M_n, of dry sample:	1359.9 g – 232.6 g = 1127.3 g

$$\% \, Change = \frac{1127.8\, g - 1127.3\, g}{1127.8\, g} \times 100 = 0.04\%$$

0.04 percent is less than 0.05 percent, so constant mass has been reached.

Moisture Content:

Calculate the moisture content, as a percent, using the following formula.

$$Moisture\ Content = \frac{M_i - M_f}{M_f} \times 100$$

Where:

M_i = initial, moist mass

M_f = final, dry mass

Example:

M_i = 1134.9 g

M_f = 1127.3 g

$$Moisture\ Content = \frac{1134.9\ g - 1127.3\ g}{1127.3\ g} \times 100 = 0.674, \text{say } 0.67\%$$

Report

- On forms approved by the agency
- Sample ID
- Moisture content to the nearest 0.01 percent

IN-PLACE DENSITY OF ASPHALT MIXTURES BY NUCLEAR METHODS FOP FOR AASHTO T 355

Scope

This test method describes a procedure for determining the density of asphalt mixtures by means of a nuclear gauge using the backscatter method in accordance with AASHTO T 355-18. Correlation with densities determined under the FOP for AASHTO T 166 is required by some agencies.

Apparatus

- Nuclear density gauge with the factory-matched standard reference block.
- Transport case for properly shipping and housing the gauge and tools.
- Instruction manual for the specific make and model of gauge.
- Radioactive materials information and calibration packet containing:
  - Daily standard count log
  - Factory and laboratory calibration data sheet
  - Leak test certificate
  - Shippers' declaration for dangerous goods
  - Procedure memo for storing, transporting, and handling nuclear testing equipment
  - Other radioactive materials documentation as required by local regulatory requirements

Material

- Filler material: Fine-graded sand from the source used to produce the asphalt pavement or other agency approved materials.

Radiation Safety

This method does not purport to address all of the safety problems associated with its use. This test method involves potentially hazardous materials. The gauge utilizes radioactive materials that may be hazardous to the health of the user unless proper precautions are taken. Users of this gauge must become familiar with the applicable safety procedures and governmental regulations. All operators will be trained in radiation safety before operating nuclear density gauges. Some agencies require the use of personal monitoring devices such as a thermoluminescent dosimeter or film badge. Effective instructions, together with routine safety procedures such as source leak tests, recording and evaluation of personal monitoring device data, etc., are a recommended part of the operation and storage of this gauge.

Calibration

Calibrate the nuclear gauge as required by the agency. This calibration may be performed by the agency using the manufacturer's recommended procedures or by other facilities approved by the agency. Verify or re-establish calibration curves, tables, or equivalent coefficients every 12 months.

Standardization

1. Turn the gauge on and allow it to stabilize (approximately 10 to 20 minutes) before standardization. Leave the power on during the day's testing.
2. Standardize the nuclear gauge at the construction site at the start of each day's work and as often as deemed necessary by the operator or agency. Daily variations in standard count shall not exceed the daily variations established by the manufacturer of the gauge. If the daily variations are exceeded after repeating the standardization procedure, the gauge should be repaired, recalibrated, or both.
3. Record the standard count for both density and moisture in the daily standard count log. The exact procedure for standard count is listed in the manufacturer's Operator's Manual.

Note 1: New standard counts may be necessary more than once a day. See agency requirements.

Test Site Location

1. Select a test location(s) randomly and in accordance with agency requirements. Test sites should be relatively smooth and flat and meet the following conditions:
    a. At least 10 m (30 ft.) away from other sources of radioactivity.
    b. At least 3 m (10 ft.) away from large objects.
    c. If the gauge will be closer than 600 mm (24 in.) to any vertical mass, or less than 300 mm (12 in.) from a vertical pavement edge, use the gauge manufacturer's correction procedure.

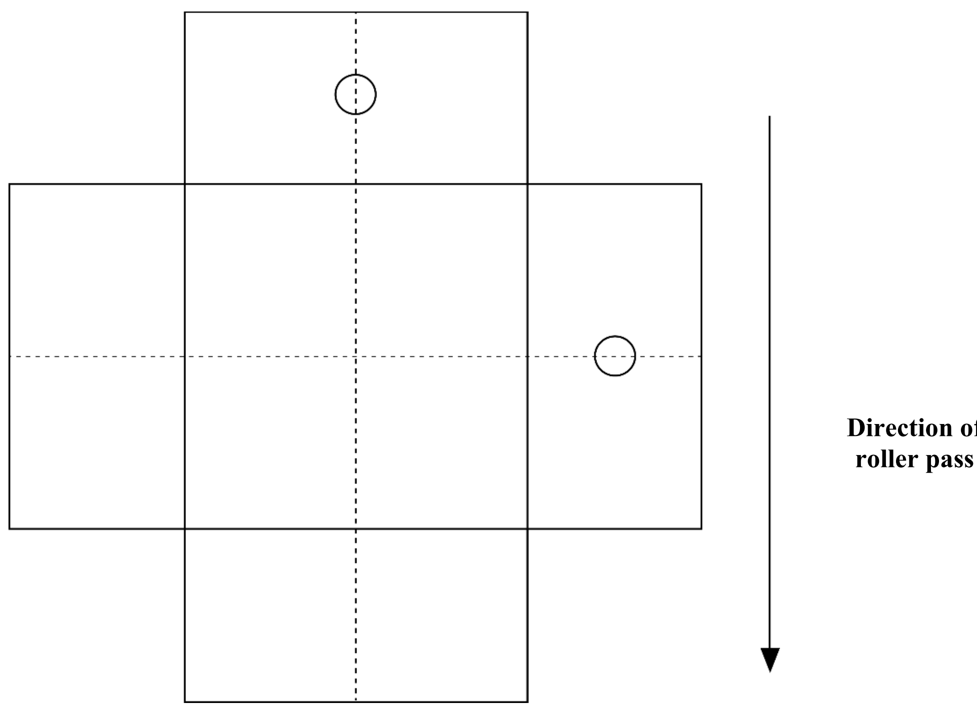
Procedure

1. Maintain maximum contact between the base of the gauge and the surface of the material under test.
2. Use filler material to fill surface voids.
3. Spread a small amount of filler material over the test site surface and distribute it evenly. Strike off the surface with a straightedge (such as a lathe or flat-bar steel) to remove excess material.
4. If using thin-layer mode, enter the anticipated overlay thickness into the gauge.

Note 2: If core correlation is required, entered thickness, anticipated thickness, and nominal core thickness may be required to match.

Method A – Average of two one-minute tests

1. Place the gauge on the test site, perpendicular to the roller passes.
2. Using a crayon (not spray paint), mark the outline or footprint of the gauge.
3. Extend the source rod to the backscatter position.
4. Take a one-minute test and record the wet density reading.
5. Rotate the gauge 90 degrees centered over the original footprint. Mark the outline or footprint of the gauge.
6. Take another one-minute test and record the wet density reading.
7. If the difference between the two one-minute tests is greater than 40 kg/m^3 (2.5 lb/ft^3), retest in both directions. If the difference of the retests is still greater than 40 kg/m^3 (2.5 lb/ft^3) test at 180 and 270 degrees.
8. The density reported for each test site shall be the average of the two individual one-minute wet density readings.

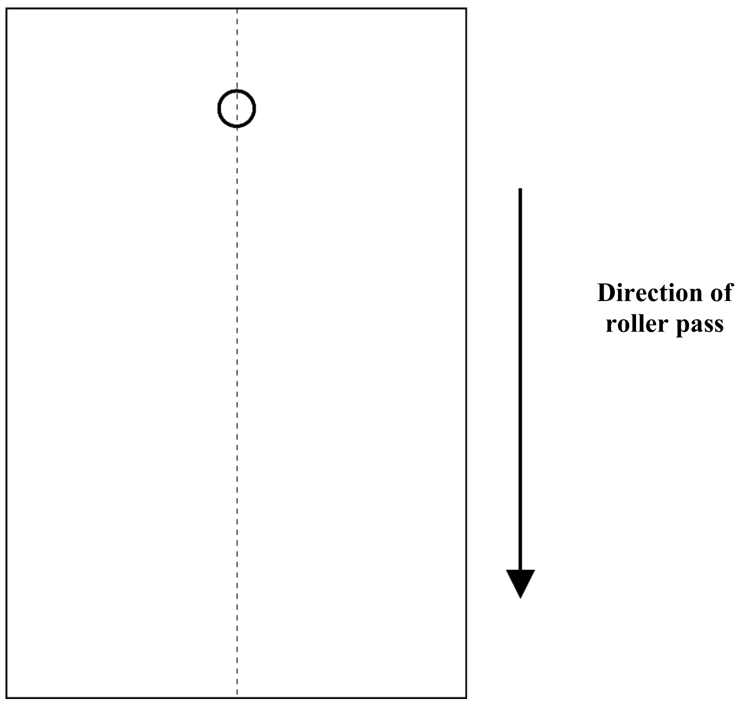


Method A

Footprint of the gauge test site

Method B – One four-minute test

1. Place the gauge on the test site, parallel to the roller passes.
2. Using a crayon (not spray paint), mark the outline or footprint of the gauge.
3. Extend the source rod to the backscatter position.
4. Take one 4-minute test and record the wet density reading.



Method B

Footprint of the gauge test site

Calculation of Results

Percent compaction is determined by comparing the in-place wet density as determined by this method to the appropriate agency density standard. See appropriate agency policy for use of density standards.

$$Percent\ compaction = \frac{Corrected\ Reading}{Maximum\ Density} \times 100$$

Method A Example:

Reading #1: 141.5 lb/ft^3

Reading #2: 140.1 lb/ft^3 Are the two readings within the tolerance? (YES)

Reading average: 140.8 lb/ft^3

Core correction: +2.1 lb/ft^3

Corrected reading: 142.9 lb/ft^3

Method B Example:

Reading: 140.8 lb/ft^3

Core correction: +2.1 lb/ft^3

Corrected reading 142.9 lb/ft^3

Example percent compaction:

From the FOP for AASHTO T 209:

$\mathbf{G_{mm}} = 2.466$

$$Theoretical\ Maximum\ Density = 2.466 \times 62.245 lb/ft^3 = 153.5 lb/ft^3$$

$$Percent\ compaction = \frac{142.9\ lb/ft^3}{153.5\ lb/ft^3} \times 100 = 93.1\%$$

Report

- On forms approved by the agency
- Test ID
- Location of test and thickness of layer tested
- Mixture type
- Make, model and serial number of the nuclear moisture-density gauge
- Calculated wet density of each measurement and any adjustment data
- Density standard
- Compaction to the nearest 0.1 percent
- Name and signature of operator

APPENDIX – CORRELATION WITH CORES

(Nonmandatory Information)

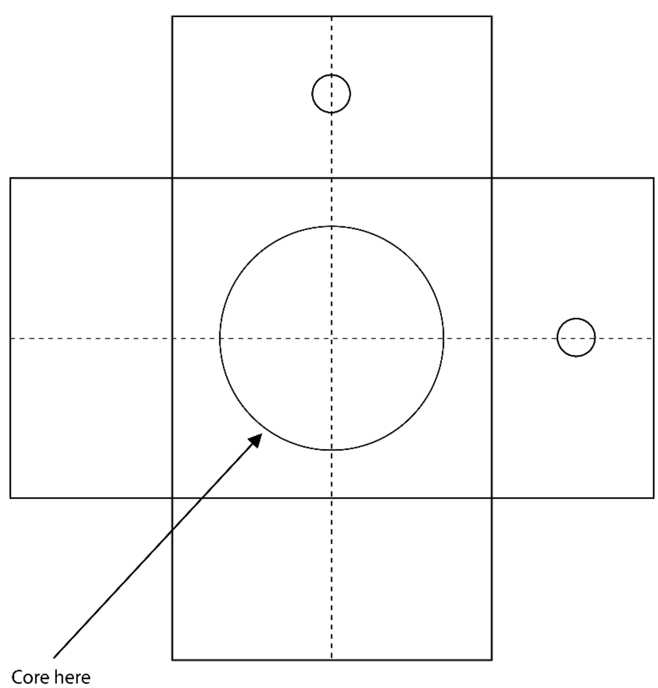
The bulk specific gravity (G_{mb}) of the core is a physical measurement of the in-place asphalt mixture and can be compared with the nuclear density gauge readings. Comparing the core value to the corresponding gauge values, a correlation can be established.

The correlation can then be used to adjust the gauge readings to the in-place density of the cores. The core correlation is gauge specific and must be determined without traffic allowed on the pavement between nuclear density gauge readings and obtaining the core. When using multiple nuclear density gauges each gauge should be correlated to the core locations before removal of the core.

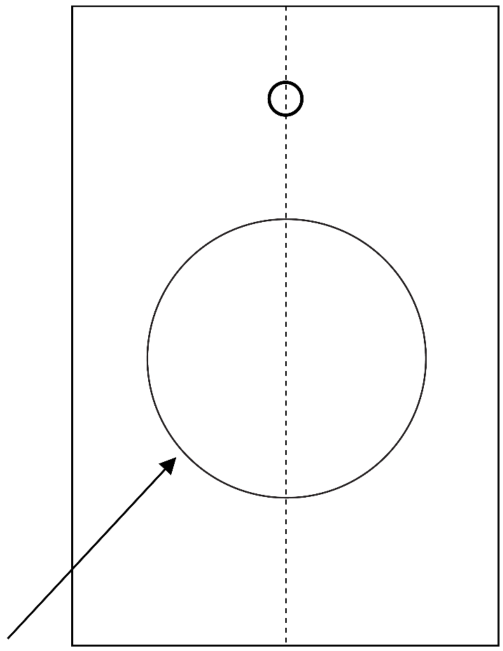
When density correlation with the FOP for AASHTO T 166 is required, correlation of the nuclear gauge with pavement cores shall be made on the first day's paving (within 24 hours) or from a test strip constructed before the start of paving. Cores must be taken before traffic is allowed on the pavement.

Correlation with Cores

1. Determine the number of cores required for correlation from the agency's specifications. Cores shall be located on the first day's paving or on the test strip. Locate the test sites in accordance with the agency's specifications. Follow the "Procedure" section above to establish test sites and obtain densities using the nuclear gauge.
2. Obtain a pavement core from each of the test sites according to AASHTO R 67. The core should be taken from the center of the nuclear gauge footprint.



Method A – Footprint of the gauge test site. Core location in the center of the footprint.



Method B - Footprint of the gauge test site.

3. Determine the density of the cores by the FOP for AASHTO T 166, Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface Dry Specimens.
4. Calculate a correlation factor for the nuclear gauge reading as follows:
    a. Calculate the difference between the core density and the average nuclear gauge density at each test site to the nearest 1 kg/m^3 (0.1 lb/ft^3). Calculate the average difference and standard deviation of the differences for the entire data set to the nearest 1 kg/m^3 (0.1 lb/ft^3).
    b. If the standard deviation of the differences is equal to or less than 40 kg/m^3 (2.5 lb/ft^3), the correlation factor applied to the average nuclear gauge density shall be the average difference calculated above in 4.a.
    c. If the standard deviation of the differences is greater than 40 kg/m^3 (2.5 lb/ft^3), the test site with the greatest variation from the average difference shall be eliminated from the data set and the data set properties and correlation factor recalculated following 4.a and 4.b.
    d. If the standard deviation of the modified data set still exceeds the maximum specified in 4.b, additional test sites will be eliminated from the data set and the data set properties and correlation factor recalculated following 4.a and 4.b. If the data set consists of less than five test sites, additional test sites shall be established.

Note A1: The exact method used in calculating the nuclear gauge correlation factor shall be defined by agency policy.

Note A2: The above correlation procedure must be repeated if there is a new job mix formula. Adjustments to the job mix formula beyond tolerances established in the contract documents will constitute a new job mix formula. A correlation factor established using this procedure is only valid for the particular gauge used in the correlation procedure. If another gauge is brought onto the project, it shall be correlated using the same procedure. Multiple gauges may be correlated from the same series of cores if done at the same time.

Note A3: For the purpose of this procedure, a job mix formula is defined as the percent and grade of paving asphalt used with a specified gradation of aggregate from a designated aggregate source. A new job mix formula may be required whenever compaction of the wearing surface exceeds the agency's specified maximum density or minimum air voids.

Calculations

Correlation Factor

$$\sqrt{\frac{\sum x^2}{n-1}}$$

Where:

$\sum$	=	Sum
x	=	Difference from the average Difference
n-1	=	number of data sets minus 1

Example

Core #	Core results from T 166:	Average Gauge reading	Difference:	x	x^2
1	144.9 lb/ft^3	142.1 lb/ft^3	2.8 lb/ft^3	-0.7	0.49
2	142.8 lb/ft^3	140.9 lb/ft^3	1.9 lb/ft^3	0.2	0.04
3	143.1 lb/ft^3	140.7 lb/ft^3	2.4 lb/ft^3	-0.3	0.09
4	140.7 lb/ft^3	138.9 lb/ft^3	1.8 lb/ft^3	0.3	0.09
5	145.1 lb/ft^3	143.6 lb/ft^3	1.5 lb/ft^3	0.6	0.36
6	144.2 lb/ft^3	142.4 lb/ft^3	1.8 lb/ft^3	0.3	0.09
7	143.8 lb/ft^3	141.3 lb/ft^3	2.5 lb/ft^3	-0.4	0.16
8	142.8 lb/ft^3	139.8lb/ft^3	3.0 lb/ft^3	0.9	0.81
9	144.8 lb/ft^3	143.3 lb/ft^3	1.5 lb/ft^3	-0.6	0.36
10	143.0 lb/ft^3	141.0 lb/ft^3	2.0 lb/ft^3	-0.1	0.01
	Average Difference:		+2.1 lb/ft^3	Σx^2	= 2.5

Number of data sets

$$\boldsymbol{n - 1 = 10 - 1 = 9}$$

Standard deviation

$$standard\ deviation = \sqrt{\frac{2.5}{9}} = 0.53$$

Given:

Sum of x^2 = 2.5

Number of data sets = 9

The standard deviation of 0.53 is less than 2.5 therefore no cores are eliminated. The average difference from all ten cores is used.

Standard Practice for

Sampling Asphalt Mixtures after Compaction (Obtaining Cores)

AASHTO Designation: R 67-20[1]

Technical Subcommittee: 2c, Asphalt–Aggregate Mixtures

Release: Group 3 (July)

AASHTO

American Association of State Highway and Transportation Officials
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Washington, D.C. 20004

Standard Practice for

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1. SCOPE

1.1. This method describes the process for removal of a core sample of compacted asphalt mixture from a pavement for laboratory testing. Cores may range in diameter from 2 in. to 12 in.

1.2. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENT

2.1. *ASTM Standard*:

- D3549, Standard Test Method for Thickness or Height of Compacted Asphalt Mixture Specimen

3. SIGNIFICANCE

3.1. Samples obtained in accordance with the procedure may be used for measuring asphalt mixture thickness, density, and other testing.

4. APPARATUS

4.1. *Core Drilling Machine*—A power-driven core drilling machine shall be used to obtain the sample. The device shall be capable of obtaining a core to the full depth of the asphalt mixture sampled and shall consist of a rigid frame or platform such that the core barrel can be maintained perpendicular to the pavement surface during the drilling process. The core drilling machine must be of sufficient horsepower and have the ability to reach a sufficient depth to minimize distortion of the compacted cores of asphalt mixture.

4.2. *Core Drill Bit*—The cutting edge of the core drill bit shall be made of hardened steel or other suitable material with diamond chips embedded in the metal or as recommended by the core drill bit manufacturer in order to drill through the compacted asphalt mixture cleanly. The inside diameter of the core barrel shall be as specified.

4.3. *Separation Equipment*—A saw or other method(s) that provides a clean, smooth plane representing the layer to be tested without damaging the specimen.

4.4. *Retrieval Device*—A device for removing core samples that will preserve the integrity of the core.

Note 1—Suitable devices have been made from steel rods, wire, or banding material.

4.5. *Cooling Agent*—Such as water, ice, dry ice, or liquid nitrogen.

4.6. *Sample Marking Tool*—A lumber crayon, paint stick, pen, or other suitable marking tool to mark the core sample for labeling, identifying the separation layers, identifying the layer to test, or as otherwise necessary.

4.7. *Package Containers*—Suitable packaging containers for securing and transporting the core samples.

5. PROCEDURE

5.1. Freshly compacted asphalt mixtures shall be allowed sufficient time to cool prior to coring in order to prevent damage to the core.

Note 2—To accelerate the coring process, compacted asphalt mixtures may be cooled to expedite the removal of the core by the following methods: water, ice, dry ice, or liquid nitrogen.

5.2. Provide a means such as water or air to aid in the removal of cuttings and to minimize the generation of heat caused by friction.

5.3. Position the coring machine above the selected location. Engage the power and water or air source to the coring machine. Slowly advance the core drill bit until it contacts the compacted asphalt mixture surface.

5.4. Keep the core bit perpendicular to the compacted asphalt mixture surface, applying constant pressure during the process.

Note 3—If any portion of the coring machine shifts during the operation, the core may break or distort. Failure to apply constant pressure or applying too much pressure may cause the core drill bit to bind or distort the core.

5.5. Continue the core drilling to the bottom or slightly below the bottom of the asphalt mixture intended to be sampled to allow separation of the core sample at the desired depth from the underlying pavement layers.

5.6. After drilling, separate the core sample from the underlying pavement layers using the retrieval device or other suitable means, without damaging or distorting the sample. Obtain the core sample using the retrieval device. Carefully brush off, or use water to wash off, any loose particles adhering to the field cores. For field cores taken immediately over a granular base, carefully remove any embedded granular material.

Note 4—If the core is damaged to a point that it cannot be used for its intended purpose, a new core shall be obtained within 6 in. of the original location.

5.7. Clearly label the core with a sample marking tool.

5.8. Fill the hole made from the coring operation with asphalt mixture, non-shrink grout, or other suitable material. Consolidate or compact the material in the hole in multiple lifts if necessary. Ensure that the final surface is level with the surrounding surface.

6. PACKAGING AND TRANSPORTING SAMPLES

6.1. Package core samples in suitable protective containers. If multiple core samples are packaged in one container, separate the samples from one another using a suitable separation material.

Note 5—Concrete cylinder molds and PVC or HDPE pipe have been found to be suitable containers for protecting and transporting core samples. Crumpled newspaper has been found to be a suitable separation material when packaging multiple core samples in one container.

6.2. Transport cores in a manner that prevents damage from jarring, rolling, or impact with any object.

6.3. Prevent cores from freezing or from excessive heat during transport to prevent breaking or deforming.

Note 6—In extreme ambient temperature conditions, an insulated container should be used during transport.

6.4. If the core is damaged in transport to a point it cannot be utilized for its intended purpose, the core will not be used.

7. LAYER SEPARATION

7.1. Using appropriate separation equipment, separate two or more pavement courses, lifts, or layers along the designated lift line.

Note 7—Lift lines are often more visible by rolling a wetted core on a flat surface.

8. REPORT

8.1. *The report shall include the following*:

8.1.1. Date the cores were obtained.

8.1.2. Paving date.

8.1.3. Coring location.

8.1.4. The lift/layer being evaluated.

8.1.5. Average thickness if required.

8.1.6. If known, provide the core identification information, such as the nominal-maximum aggregate size of the mixture, asphalt mixture design identification, performance grade of the asphalt binder, etc.

9. KEYWORDS

9.1. Asphalt mixture; core drilling; core sample.

APPENDIXES

(Nonmandatory Information)

X1. THICKNESS DETERMINATION

X1.1. Measure the thickness of the designated lift according to ASTM D3549/D3549M-11 to the nearest 0.01 ft, $^1/_8$ in., or 3 mm. Calculate an average of three or more measurements taken around the lift.

X2. PROCEDURE TO REMOVE CUT AGGREGATES FROM ASPHALT PAVEMENT CORES FOR LABORATORY TESTING

X2.1. *Scope*

X2.1.1. This procedure is used to remove aggregates that have been cut in the core drilling process. This procedure is only necessary in cases where the asphalt pavement core was obtained for the purpose of determining a mixture property that will be affected by the presence of aggregate cut by the coring drill.

X2.2. *Procedure*

X2.2.1. Place the core(s) in an oven at 230°F for a period between 30 and 60 min. Remove the core(s) when the material is sufficiently softened to easily remove cut aggregate particles according to Section X2.2.2. Cores shall be placed in the vertical position to prevent premature breakdown of the cores. See Figure X1 for an example of vertical versus horizontal placement.

(a) 30 min after oven storage at 230°F

(b) 60 min after oven storage at 230°F

Figure X1—Photographs of Cores Placed in Oven at 230°F

X2.2.2. Separate cut aggregate particles by any of the following methods: hand, chisel, spatula, trowel, or by pressing a cylindrical tube (with an internal diameter approximately 1 in. less than the diameter of the core) through the core. Dispose of the removed portion of the core.

X2.2.3. The remainder of the core is ready to proceed with the desired testing. Cores consisting of the same pavement layer and obtained from the same roadway section may be combined to meet the requirements of the minimum sample size according to the applicable test method as needed.

X3. REFERENCE

X3.1. D3549/D3549M-11, Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens

[1] This full standard was first published in 2015.

REDUCING SAMPLES OF AGGREGATE TO TESTING SIZE FOP FOR AASHTO R 76

Scope

This procedure covers the reduction of samples to the appropriate size for testing in accordance with AASHTO R 76-16. Techniques are used that minimize variations in characteristics between test samples and field samples. Method A (Mechanical Splitter) and Method B (Quartering) are covered.

This FOP applies to fine aggregate (FA), coarse aggregate (CA), and mixes of the two (FA / CA) and may also be used on soils.

Apparatus

Method A – Mechanical Splitter

Splitter chutes:

- Even number of equal width chutes
- Discharge alternately to each side
- Minimum of 8 chutes total for CA and FA / CA, 12 chutes total for FA
- Width:
    - Minimum 50 percent larger than largest particle
    - Maximum chute width of 19 mm (3/4 in.) for fine aggregate passing the 9.5 mm (3/8 in.) sieve

Feed control:

- Hopper or straightedge pan with a width equal to or slightly less than the overall width of the assembly of chutes
- Capable of feeding the splitter at a controlled rate

Splitter receptacles / pans:

- Capable of holding two halves of the sample following splitting

The splitter and accessory equipment shall be so designed that the sample will flow smoothly without restriction or loss of material.

Method B – Quartering

- Straightedge scoop, shovel, or trowel
- Broom or brush
- Canvas or plastic sheet, appropriate for the amount and size of the material being reduced

Method Selection

Samples of CA may be reduced by either Method A or Method B.

Samples of FA which are drier than the saturated surface dry (SSD) condition, as described in AASHTO T 84, shall be reduced by a mechanical splitter according to Method A. As a quick approximation, if the fine aggregate will retain its shape when molded with the hand, it is wetter than SSD.

Samples of FA / CA which are drier than SSD may be reduced by Method A or Method B.

Samples of FA and FA / CA that are at SSD or wetter than SSD shall be reduced by Method B, or the entire sample may be dried – using temperatures that do not exceed those specified for any of the tests contemplated – and then reduced to test sample size using Method A.

Table 1

	Drier than SSD	**Wetter than SSD**
Fine Aggregate (FA)	Method A (Mechanical)	Method B (Quartering)
Mixture of FA/CA	Either Method	Method B (Quartering)
Coarse Aggregate (CA)	Either Method	Either Method

Procedure

Method A – Mechanical Splitter

1. Place two clean empty receptacles under the splitter.
2. Empty the sample into the hopper or pan without loss of material.
3. Uniformly distribute the material in the hopper or pan from edge to edge so that approximately equal amounts flow through each chute.
4. Discharge the material at a uniform rate, allowing it to flow freely through the chutes.
5. Remove any material retained on the surface of the splitter and place into the appropriate receptacle.
6. Using one of the two receptacles containing material, repeat Steps 1 through 6 until the material in one of the two receptacles is the appropriate sample size for the required test.
7. Retain and properly identify the remaining unused sample for further testing if required.

Mechanical Splitter Check

- Determine the mass of each reduced portion. If the percent difference of the two masses is greater than 5 percent, corrective action must be taken.

Calculation

$$\frac{Smaller\ Mass}{Larger\ Mass} = Ratio \qquad (1 - ratio) \times 100 = \%\ Difference$$

Splitter check: 5127 g total sample mass

Splitter pan #1: 2583 g

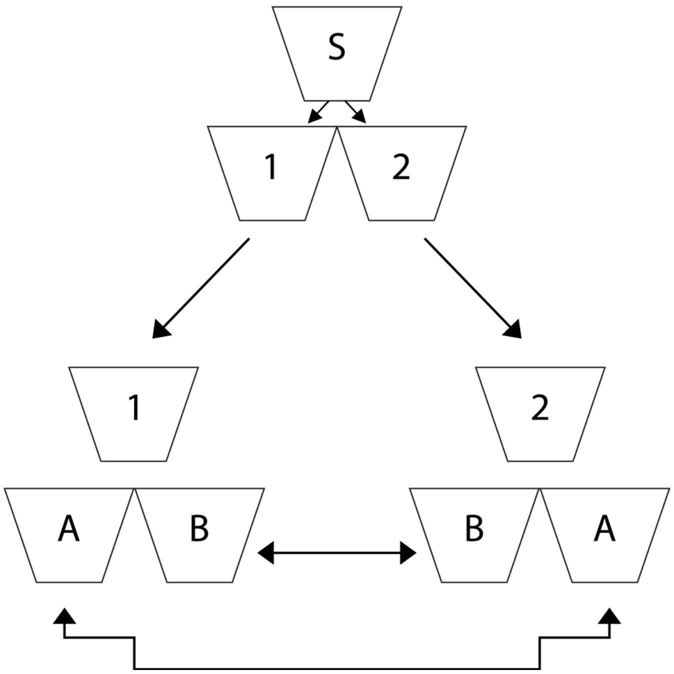
Splitter pan #2: 2544 g

$$\mathbf{\frac{2544\ g}{2583\ g} = 0.985} \qquad \mathbf{(1 - 0.985) \times 100 = 1.5\%}$$

Alternative to Mechanical Splitter Check

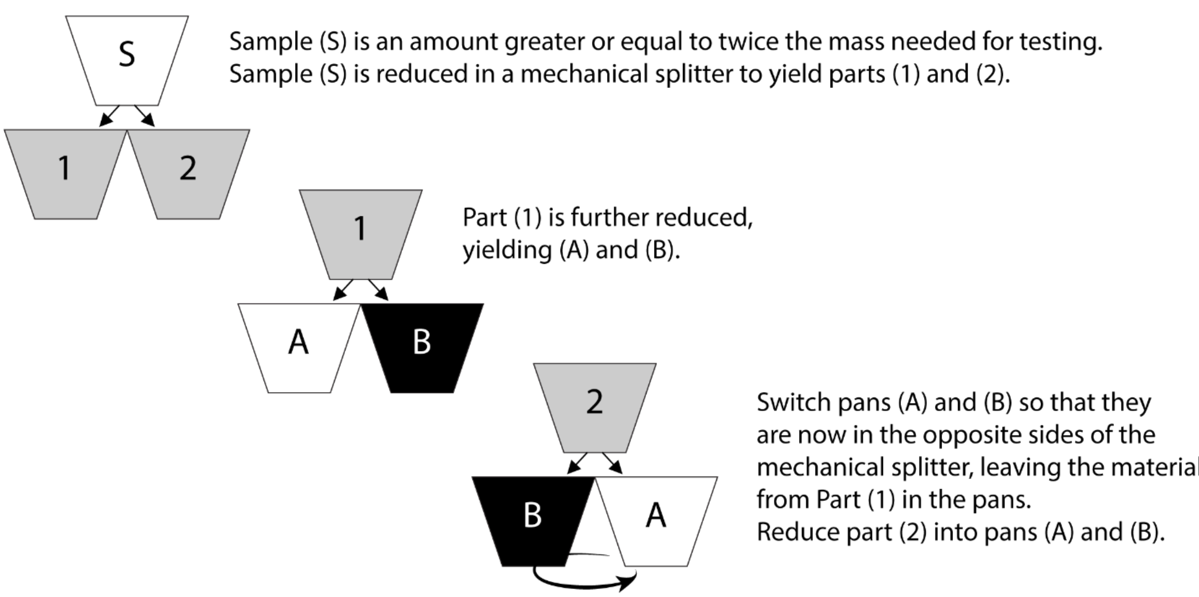
- In lieu of determining the mass of each reduced portion, use the method illustrated in Figure 1 or 2 during reduction.

Figure 1



- Sample (S) is an amount greater than or equal to twice the mass needed for testing. Sample (S) is reduced in a mechanical splitter to yield parts (1) and (2).
- Part (1) is further reduced yielding (A) and (B) while part (2) is reduced to yield (B) and (A).
- Final testing sample is produced by combining alternate pans, i.e. A/A or B/B only.

Figure 2



Method B – Quartering

Use either of the following two procedures or a combination of both.

Procedure 1: Quartering on a clean, hard, level surface:

1. Place the sample on a hard, clean, level surface where there will be neither loss of material nor the accidental addition of foreign material.
2. Mix the material thoroughly by turning the entire sample over a minimum of four times. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one.
3. Flatten the conical pile to a uniform thickness and diameter by pressing down with a shovel. The diameter should be four to eight times the thickness.
4. Divide the flattened pile into four approximately equal quarters with a shovel or trowel.
5. Remove two diagonally opposite quarters, including all fine material, and brush the cleared spaces clean.
6. Successively mix and quarter the remaining material until the sample is reduced to the desired size.
7. The final test sample consists of two diagonally opposite quarters.

Procedure 2: Quartering on a canvas or plastic sheet:

1. Place the sample on the sheet.
2. Mix the material thoroughly a minimum of four times by pulling each corner of the sheet horizontally over the sample toward the opposite corner. After the last turn, form a conical pile.
3. Flatten the conical pile to a uniform thickness and diameter by pressing down with a shovel. The diameter should be four to eight times the thickness.
4. Divide the flattened pile into four approximately equal quarters with a shovel or trowel, or, insert a stick or pipe beneath the sheet and under the center of the pile, then lift both ends of the stick, dividing the sample into two roughly equal parts. Remove the stick leaving a fold of the sheet between the divided portions. Insert the stick under the center of the pile at right angles to the first division and again lift both ends of the stick, dividing the sample into four roughly equal quarters.
5. Remove two diagonally opposite quarters, being careful to clean the fines from the sheet.

6. Successively mix and quarter the remaining material until the sample size is reduced to the desired size.

7. The final test sample consists of two diagonally opposite quarters.

SAMPLING AGGREGATE PRODUCTS
FOP FOR AASHTO R 90

Scope

This procedure covers sampling of coarse, fine, or a combination of coarse and fine aggregates (CA and FA) in accordance with AASHTO R 90-18. Sampling from conveyor belts, transport units, roadways, and stockpiles is covered.

Apparatus

- Shovels or scoops, or both
- Brooms, brushes, and scraping tools
- Sampling tubes of acceptable dimensions
- Mechanical sampling systems: normally a permanently attached device that allows a sample container to pass perpendicularly through the entire stream of material or diverts the entire stream of material into the container by manual, hydraulic, or pneumatic operation
- Belt template
- Sampling containers

Procedure – General

Sampling is as important as testing. The technician shall use every precaution to obtain samples that are representative of the material. Determine the time or location for sampling in a random manner.

1. Wherever samples are taken, obtain multiple increments of approximately equal size.

2. Mix the increments thoroughly to form a field sample that meets or exceeds the minimum mass recommended in Table 1.

TABLE 1
Recommended Sample Sizes

Nominal Maximum Size* mm (in.)	Minimum Mass g (lb)
90 (3 1/2)	175,000 (385)
75 (3)	150,000 (330)
63 (2 1/2)	125,000 (275)
50 (2)	100,000 (220)
37.5 (1 1/2)	75,000 (165)
25.0 (1)	50,000 (110)
19.0 (3/4)	25,000 (55)
12.5 (1/2)	15,000 (35)
9.5 (3/8)	10,000 (25)
4.75 (No. 4)	10,000 (25)
2.36 (No. 8)	10,000 (25)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size. Maximum size is one size larger than nominal maximum size.

Note 1: Sample size is based upon the test(s) required. As a general rule, the field sample size should be such that, when split twice will provide a testing sample of proper size. For example, the sample size may be four times that shown in Table 1 of the FOP for AASHTO T 27/T 11, if that mass is more appropriate.

Procedure – Specific Situations

Conveyor Belts

Avoid sampling at the beginning or end of the aggregate run due to the potential for segregation. Be careful when sampling in the rain. Make sure to capture fines that may stick to the belt or that the rain tends to wash away.

Method A (From the Belt)

1. Stop the belt.
2. Set the sampling template in place on the belt, avoiding intrusion by adjacent material.
3. Remove the material from inside the template, including all fines.
4. Obtain at least three approximately equal increments.
5. Combine the increments to form a single sample.

Method B (From the Belt Discharge)

1. Pass a sampling device through the full stream of the material as it runs off the end of the conveyor belt. The sampling device may be manually, semi-automatic or automatically powered.
2. The sampling device shall pass through the stream at least twice, once in each direction, without overfilling while maintaining a constant speed during the sampling process.
3. When emptying the sampling device into the container, include all fines.
4. Combine the increments to form a single sample.

Transport Units

1. Visually divide the unit into four quadrants.
2. Identify one sampling location in each quadrant.
3. Dig down and remove approximately 0.3 m (1 ft.) of material to avoid surface segregation. Obtain each increment from below this level.
4. Combine the increments to form a single sample.

Roadways

Method A (Berm or Windrow)

- Obtain sample before spreading.
- Take the increments from at least three random locations along the fully formed windrow or berm. Do not take the increments from the beginning or the end of the windrow or berm.
- Obtain full cross-section samples of approximately equal size at each location. Take care to exclude the underlying material.
- Combine the increments to form a single sample.

Note 2: Obtaining samples from berms or windrows may yield extra-large samples and may not be the preferred sampling location.

Method B (In-Place)

- Obtain sample after spreading and before compaction.
- Take the increments from at least three random locations.
- Obtain full-depth increments of approximately equal size from each location. Take care to exclude the underlying material.
- Combine the increments to form a single sample.

Stockpiles

Method A – Loader Sampling

1. Direct the loader operator to enter the stockpile with the bucket at least150 mm (6 in.) above ground level without contaminating the stockpile.
2. Discard the first bucketful.
3. Have the loader re-enter the stockpile and obtain a full loader bucket of the material, tilt the bucket back and up.
4. Form a small sampling pile at the base of the stockpile by gently rolling the material out of the bucket with the bucket just high enough to permit free-flow of the material. (Repeat as necessary.)
5. Create a flat surface by having the loader back drag the small pile.
6. Visually divide the flat surface into four quadrants.
7. Collect an increment from each quadrant by fully inserting the shovel into the flat pile as vertically as possible, take care to exclude the underlying material, roll back the shovel and lift the material slowly out of the pile to avoid material rolling off the shovel.

Method B – Stockpile Face Sampling

1. Create horizontal surfaces with vertical faces in the top, middle, and bottom third of the stockpile with a shovel or loader.
2. Prevent continued sloughing by shoving a flat board against the vertical face. Sloughed material will be discarded to create the horizontal surface.
3. Obtain sample from the horizontal surface as close to the intersection as possible of the horizontal and vertical faces.
4. Obtain at least one increment of equal size from each of the top, middle, and bottom thirds of the pile.
5. Combine the increments to form a single sample.

Method C – Alternate Tube Method (Fine Aggregate)

1. Remove the outer layer that may have become segregated.
2. Using a sampling tube, obtain one increment of equal size from a minimum of five random locations on the pile.
3. Combine the increments to form a single sample.

Identification and Shipping

- Identify samples according to agency standards.
- Include sample report (below).
- Ship samples in containers that will prevent loss, contamination, or damage of material.

Report

- On forms approved by the agency
- Date
- Time
- Sample ID
- Sampling method
- Location
- Quantity represented
- Material type
- Supplier

SAMPLING ASPHALT MIXTURES
FOP FOR AASHTO R 97

Scope

This procedure covers the sampling of asphalt mixtures from plants, haul units, and roadways in accordance with AASHTO R 97-19. Sampling is as important as testing, use care to obtain a representative sample and to avoid segregation and contamination of the material during sampling.

This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Apparatus

- Shovel or Metal Scoops, or Other Equipment: square-head metal shovels at least 125 mm (5.5 in.) wide.
- Sample containers: such as cardboard boxes, metal cans, stainless steel bowls, or other agency-approved containers
- Sampling plate: thick metal plate, minimum 8 gauge, sized to accommodate sample requirements, with a wire attached to one corner long enough to reach from the center of the paver to the outside of the farthest auger extension. A minimum of one hole 6 mm (0.25 in.) in diameter must be provided in a corner of the plate.
- Cookie cutter sampling device: formed steel angle with two 100 mm by 150 mm by 9 mm (4 in. by 6 in. by 3/8 in.) handles, sized to accommodate sample requirements. Minimum 50 mm (2 in.) smaller than the sampling plate when used together.

  Example: Sampling plate 380 mm (15 in.) square and a cookie cutter sampling device 330 mm (13 in.) square.
- Mechanical sampling device: a permanently attached device that allows a sample receptacle to pass perpendicularly through the entire stream of material or diverts the entire stream of material into the container by manual, hydraulic, or pneumatic operation.
- Release agent: a non-stick product that prevents the asphalt mixture from sticking to the apparatus and does not contain solvents or petroleum-based products that could affect asphalt binder properties.

Sample Size

Sample size depends on the test methods specified by the agency for acceptance. Check agency requirement for the size required.

Procedure

General

- Select sample locations using a random or stratified random sampling procedure, as specified by the agency. The material shall be tested to determine variations. The supplier/contractor shall provide equipment for safe and appropriate sampling, including sampling devices on plants when required.
- Ensure the container(s) and sampling equipment are clean and dry before sampling.
- For dense graded mixture samples use cardboard boxes, stainless steel bowls or other agency-approved containers.
- For hot open graded mixture samples use stainless steel bowls. Do not put open graded mixture samples in boxes until they have cooled to the point that asphalt binder will not migrate from the aggregate.

Attached Sampling Devices

These are normally permanently attached devices that allow a sample container to pass perpendicularly through the entire stream of material. Operation may be hydraulic, pneumatic, or manual and allows the sample container to pass through the stream twice, once in each direction, without overfilling. A sampling device may also divert the entire stream into a sampling receptacle.

1. Lightly coat the container attached to the sampling device with an agency-approved release agent or preheat it, or both, to approximately the same discharge temperature of the mix.
2. Pass the container twice through the material perpendicularly without overfilling the container.
3. Transfer the asphalt mixture to an agency-approved container without loss of material.
4. Repeat until proper sample size has been obtained.
5. Combine the increments to form a single sample.

Conveyor Belts

1. Avoid sampling at the beginning or end of an asphalt mixture production run due to the potential for segregation.
2. Stop the belt containing asphalt mixture.
3. Set the sampling template into the asphalt mixture on the belt, avoiding intrusion by adjacent material.
4. Remove the asphalt mixture from inside the template, including all fines, and place in a sample container.
5. Repeat, obtaining equal size increments, until proper sample size has been obtained.
6. Combine the increments to form a single sample.

Haul Units

1. Visually divide the haul unit into approximately four equal quadrants.
2. Identify one sampling location in each quadrant.
3. Dig down and remove approximately 0.3 m (1 ft.) of material to avoid surface segregation. Obtain each increment from below this level.
4. Combine the increments to form a sample of the required size.

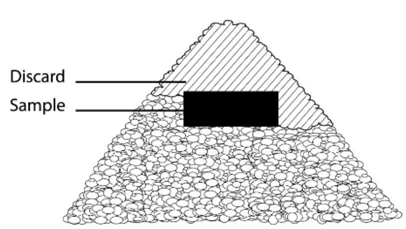
Paver Auger

1. Obtain samples from the end of the auger using a square head shovel.
2. Place the shovel in front of the auger extension, with the shovel blade flat upon the surface to be paved over.
3. Allow the front face of the auger stream to cover the shovel with asphalt mixture, remove the shovel before the auger reaches it by lifting as vertically as possible.
4. Place asphalt mixture in a sample container.
5. Repeat until proper sample size has been obtained.
6. Combine the increments to form a sample of the required size.

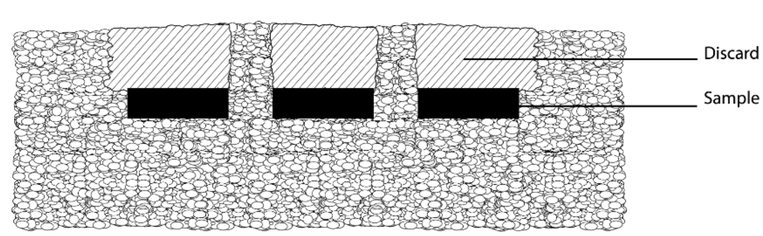
Note 1: First full shovel of material may be discarded to preheat and 'butter' the shovel.

Windrow

1. Obtain samples from the windrow of a transport unit. Avoid the beginning or the end of the windrow section.
2. Visually divide the windrow into approximately three equal sections.
3. Remove approximately 0.3 m (1 ft) from the top of each section.
4. Fully insert the shovel into the flat surface as vertically as possible, exclude the underlying material, roll back the shovel and lift the material slowly out of the windrow to avoid material rolling off the shovel.
5. Place in a sample container.
6. Repeat, obtaining equal size increments, in each of the remaining thirds.
7. Combine the increments to form a sample of the required size.



Windrow cross section



Windrow side view

Roadway before Compaction

There are two conditions that will be encountered when sampling asphalt mixtures from the roadway before compaction. The two conditions are:

- Laying asphalt mixture on grade or untreated base material requires Method 1.
- Laying asphalt mixture on existing asphalt or laying a second lift of asphalt mixture requires Method 2.

SAFETY:

Sampling is performed behind the paving machine and in front of the breakdown roller. For safety, the roller must remain at least 3 m (10 ft.) behind the sampling operation until the sample has been taken and the hole filled with loose asphalt mixture.

Method 1 requires a plate to be placed in the roadway in front of the paving operation and therefore there is always concern with moving, operating equipment. It is safest to stop the paving train while a plate is installed in front of the paver. When this is not possible the following safety rules must be followed.

1. The plate placing operation must be at least 3 m (10 ft.) in front of the paver or pickup device. The technician placing the plate must have eye contact and communication with the paving machine operator. If eye contact cannot be maintained at all time, a third person must be present to provide communication between the operator and the technician.
2. No technician is to be between the asphalt supply trucks and the paving machine. The exception to this rule is if the supply truck is moving forward creating a windrow, in which case the technician must be at least 3 m (10 ft.) behind the truck.

If at any time the Engineer feels that the sampling technique is creating an unsafe condition, the operation is to be halted until it is made safe or the paving operation will be stopped while the plate is being placed.

Method 1 - Obtaining a Sample on Grade or Untreated Base (Plate Method)

1. Following the safety rules detailed above, the technician is to:
    a. Smooth out a location in front of the paver at least 0.5 m (2 ft.) inside the edge of the mat.
    b. Lay the plate down diagonally with the direction of travel, keeping it flat and tight to the base with the lead corner facing the paving machine.

    Note 2: The plate may be secured by driving a nail through the hole in the lead corner of the plate.
2. Pull the wire, attached to the outside corner of the plate, taut past the edge of the asphalt mixture mat and secure it. Let the paving operation pass over the plate and wire.
3. Using the exposed end of the wire, pull the wire up through the fresh asphalt mixture to locate the corner of the plate.

a. Plate only:

   i. Using a small square head shovel or scoop, or both, remove the full depth of the asphalt mixture from the plate. Take care to prevent sloughing of adjacent material.

   ii. Place asphalt mixture, including any material adhering to the plate and scoop or shovel in a sample container.

b. "Cookie Cutter":

   i. Place the "cookie cutter" sample device, just inside the end of the wire; align the cutter over the plate. Press "cookie cutter" device down through the asphalt mixture to the plate.

   ii. Using a small square tipped shovel or scoop, or both, carefully remove all the asphalt mixture from inside of the cutter and place in a sample container.

   iii. Remove the sample cutter and the plate from the roadway. The hole made from the sampling must be filled by the contractor with loose asphalt mixture.

Method 2 - Obtaining a Sample on Asphalt Surface (Non-plate Method)

1. After the paving machine has passed the sampling point, immediately place the "cookie cutter" sampling device on the location to be sampled.
2. Push the cutter down through the asphalt mixture until it is flat against the underlying asphalt mat.
3. Using a small square tipped shovel or scoop, or both, carefully remove all the asphalt mixture from inside of the cutter and place in a sample container.
4. Remove the cutter from the roadway. The hole made from the sampling must be filled by the contractor with loose asphalt mixture.

Stockpiles

Remove at least 0.1 m (4 in.) from the surface before sampling; mixtures in a stockpile may develop an oxidized crust.

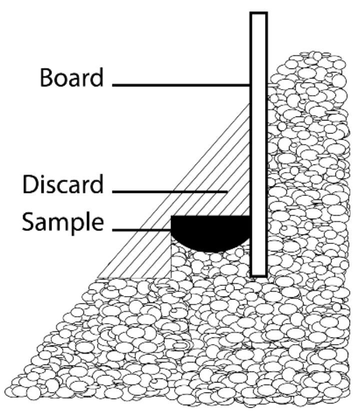
Method 1 – Loader

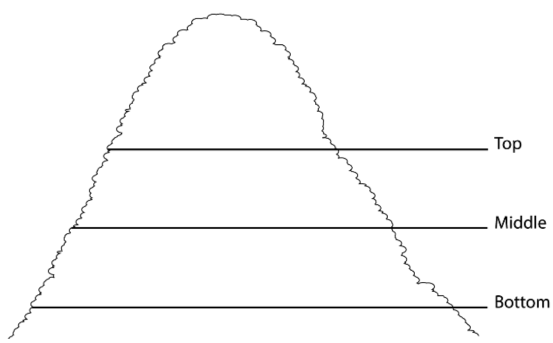
1. Direct the loader operator to enter the stockpile with the bucket at least 0.3 m (1 ft) above ground level without contaminating the stockpile.
2. Obtain a full loader bucket of the asphalt mixture; tilt the bucket back and up.
3. Form a small sampling pile at the base of the stockpile by gently rolling the asphalt mixture out of the bucket with the bucket just high enough to permit free-flow of the mixture. Repeat as necessary.
4. Create a flat surface by having the loader "back-drag" the small pile.

5. Obtain approximately equal increments from at least three randomly selected locations on the flat surface at least 0.3 m (1 ft) from the edge.
6. Fully insert the shovel, exclude the underlying material, roll back the shovel and lift the asphalt mixture slowly out of the pile to avoid mixture rolling off the shovel.
7. Combine the increments to form a sample.

Method 2 – Stockpile Face

1. Create horizontal surfaces with vertical faces in the top, middle, and bottom third of the stockpile with a shovel or a loader if one is available.
2. Shove a flat board against the vertical face behind the sampling location to prevent sloughing of asphalt mixture. Discard the sloughed mixture to create the horizontal surface.
3. Obtain the sample from the horizontal surface as close as possible to the intersection of the horizontal and vertical faces.
4. Obtain at least one sample increment of equal size from each of the top, middle, and bottom thirds of the pile.
5. Combine the increments to form a single sample.





Identification and Shipping

1. Identify sample containers as required by the agency.
2. Ship samples in containers that will prevent loss, contamination, or damage.

Report

- On forms approved by the agency
- Sample ID
- Date
- Time
- Location
- Quantity represented

INSERT TAB

WAQTC

SAMPLING FRESHLY MIXED CONCRETE
FOP FOR WAQTC TM 2

Scope

This method covers procedures for obtaining representative samples of fresh concrete delivered to the project site. The method includes sampling from stationary, paving and truck mixers, and from agitating and non-agitating equipment used to transport central mixed concrete.

This method also covers the removal of large aggregate particles by wet sieving.

Sampling concrete may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Receptacle: wheelbarrow, bucket or other suitable container that does not alter the properties of the material being sampled
- Sample cover (plastic, canvas, or burlap)
- Shovel
- Cleaning equipment, including scrub brush, rubber gloves, water
- Apparatus for wet sieving, including: a sieve(s), meeting the requirements of FOP for AASHTO T 27/T 11, minimum of 2 ft^2 (0.19 m^2) of sieving area, conveniently arranged and supported so that the sieve can be shaken rapidly by hand.

Procedure

1. Use every precaution in order to obtain samples representative of the true nature and condition of the concrete being placed being careful not to obtain samples from the very first or very last portions of the batch. The size of the sample will be 1.5 times the volume of concrete required for the specified testing, but not less than 0.03 m^3 (1 ft^3).
2. Dampen the surface of the receptacle just before sampling, empty any excess water.

Note 1: Sampling should normally be performed as the concrete is delivered from the mixer to the conveying vehicle used to transport the concrete to the forms; however, specifications may require other points of sampling, such as at the discharge of a concrete pump.

3. Use one of the following methods to obtain the sample:

   - **Sampling from stationary mixers**

     Obtain the sample after a minimum of 1/2 m^3 (1/2 yd^3) of concrete has been discharged. Perform sampling by passing a receptacle completely through the discharge stream, or by completely diverting the discharge into a receptacle. Take care not to restrict the flow of concrete from the mixer, container, or transportation unit so as to cause segregation. These requirements apply to both tilting and nontilting mixers.

   - **Sampling from paving mixers**

     Obtain the sample after the contents of the paving mixer have been discharged. Obtain material from at least five different locations in the pile and combine into one test sample. Avoid contamination with subgrade material or prolonged contact with absorptive subgrade. To preclude contamination or absorption by the subgrade, the concrete may be sampled by placing a shallow container on the subgrade and discharging the concrete across the container.

   - **Sampling from revolving drum truck mixers or agitators**

     Obtain the sample after a minimum of 1/2 m^3 (1/2 yd^3) of concrete has been discharged. Obtain samples after all of the water has been added to the mixer. Do not obtain samples from the very first or last portions of the batch discharge. Perform sampling by repeatedly passing a receptacle through the entire discharge stream or by completely diverting the discharge into a receptacle. Regulate the rate of discharge of the batch by the rate of revolution of the drum and not by the size of the gate opening.

   - **Sampling from open-top truck mixers, agitators, non-agitating equipment or other types of open-top containers**

     Obtain the sample by whichever of the procedures described above is most applicable under the given conditions.

   - **Sampling from pump or conveyor placement systems**

     Obtain sample after a minimum of 1/2 m^3 (1/2 yd^3) of concrete has been discharged. Obtain samples after all of the pump slurry has been eliminated. Perform sampling by repeatedly passing a receptacle through the entire discharge system or by completely diverting the discharge into a receptacle. Do not lower the pump arm from the placement position to ground level for ease of sampling, as it may modify the air content of the concrete being sampled. Do not obtain samples from the very first or last portions of the batch discharge.

4. Transport samples to the place where fresh concrete tests are to be performed and specimens are to be molded. They shall then be combined and remixed with a shovel the minimum amount necessary to ensure uniformity. Protect the sample from direct sunlight, wind, rain, and sources of contamination.

5. Complete test for temperature and start tests for slump and air content within 5 minutes of obtaining the sample. Start molding specimens for strength tests within 15 minutes of obtaining the sample. Complete the test methods as expeditiously as possible.

Wet Sieving

When required due to oversize aggregate, the concrete sample shall be wet sieved, after transporting but prior to remixing, for slump testing, air content testing or molding test specimens, by the following:

1. Place the sieve designated by the test procedure over the dampened receptacle.
2. Pass the concrete over the designated sieve. Do not overload the sieve (one particle thick).
3. Shake or vibrate the sieve until no more material passes the sieve. A horizontal back and forth motion is preferred.
4. Discard oversize material including all adherent mortar.
5. Repeat until sample of sufficient size is obtained. Mortar adhering to the wet-sieving equipment shall be included with the sample.
6. Using a shovel, remix the sample the minimum amount necessary to ensure uniformity.

Note 2: Wet sieving is not allowed for samples being used for density determinations according to the FOP for AASHTO T 121.

Report

- On standard agency forms
- Sample ID
- Date
- Time
- Location
- Quantity represented

INSERT TAB

SECTION 3
Report Forms & Examples

SAMPLE AND TEST REPORT FORMS

This Section includes a sample of each of the ODOT forms used for submitting samples and reporting test results. The forms can accommodate two different formats, Metric and English. At the top of the form is an area that allows the user to switch between the different units. Examples of completed reports, in English are also included. Located after the table of contents section is a forms description document that outlines the functions and calculation abilities, if applicable, of the various forms. Each form has a unique number identifier that starts with 734-xxxx and the forms are arranged in numerical order, 734-1792, 734-1793A etc.

If a certified technician elects to use forms other than ODOT, then the modified form must contain the same information and be presented in a similar format to the existing ODOT form. The technician must obtain the approval of the Project Manager prior to using different forms. When submitting material for testing to the Salem Materials Laboratory, the appropriate ODOT form must be utilized.

These forms are available electronically. They may be downloaded from our webpage in FTP format.

The URL address is:

https://www.oregon.gov/odot/Construction/Pages/Forms.aspx

Submittals of form 734-4000, 734-4000C or 734-4000 NFTM requires properly completing the required information as outlined in Section 4 (C) of the MFTP. **If the information required in Section 4(C) is not included on the submitted forms the material will not be accepted for testing.**

A unique data sheet number is also required on the form that is referenced to a submitted sample in chronological order. The data sheet number is a unique value assigned by the submitting party. Example: F-40123-001, the F is generic on all form 4000's, the next set of numbers, in this example, is the technician's certification number and the last series of values indicates the sequential order of submitted samples, 001, 002, 003, etc. If a technician certification number is not available contact the Salem Materials Laboratory at (503-986-6626) and a unique number will be assigned to the user. This eliminates duplicate data sheet numbers, maintains the integrity of the data base and provides for efficient retrieval of information.

The Contractor shall submit copies of the test results to the specified ODOT personnel within the timeframes set forth in the QA program and the project contract. Either the copy of the results or a facsimile of the results will be accepted. The Contractor shall retain the original results for at least three years after ODOT formally accepts the project.

Oregon Department of Transportation
Field Tested Materials Forms and Examples

Soils	
ODOT Form Number	*Description*
734-1793 S	Nuclear Compaction Report For Soil
734-3468	Maximum Density of Construction Materials
734-3468 FC	Family of Curves
Aggregate	
ODOT Form Number	*Description*
734-1792	Field Worksheet for Aggregate
734-1793 B	Nuclear Compaction Report For Base Aggregate
734-1825	Unit Weight and Specific Gravity W/S
734-1825 C	Bulk Density “Unit Weight” Measure Calibration
734-3468 B	Maximum Density of Aggregate Base Material
Asphalt Concrete Pavement (ACP)	
ODOT Form Number	*Description*
734-1793 A 734-1793 AR 734-1793 A10	Nuclear Compaction Report For ACP Nuclear Compaction Report For ACP with Random Location Nuclear Compaction Report For ACP, 10 shot locations
734-1972 A	Random Sample Locations for Density Testing of ACP
734-2043	Daily Asphalt Cement Report
734-2050	Specific Gravity and Maximum Density of ACP
734-2050 GV	Voids Worksheet Gyratory - Multiple
734-2050 GVS	Voids Worksheet Gyratory - Single
734-2050 TSR	Tensile Stripping Strength (TSR) Worksheet
734-2084	Control Strip Method of Compaction Testing
734-2084 T	Establishing Roller Pattern for Thin Lifts of ACP
734-2277	Field Worksheet for ACP (Plant Report)
734-2327	Nuclear-- Core Correlation Worksheet
734-2327 CB	Calibration Batch Form
734-2327 IC	ACP Incinerator Oven Calibration Worksheet

Asphalt Concrete Pavement (ACP)	
ODOT Form Number	*Description*
734-2401	Daily Asphalt Plant Production
734-2401 ACP	Daily Asphalt Plant Reconciliation ACP
734-5068	CAT II – MDV Startup Review
734-2560	CAT II – JMF Target Adjustment Summary
734-5069	CAT II – Density / Control Strip Reconciliation
Concrete	
ODOT Form Number	*Description*
734-3573 WS	Concrete Yield and WIC Ratio Worksheet
734-4000 C	Sample Data Sheet for Concrete Cylinders
Pavement Marking Retroreflectivity Testing	
ODOT Form Number	*Description*
734-4101	Pavement Marking Retroreflectivity Testing – General
734-4102	Pavement Marking Retroreflectivity Testing – Longitudinal Markings
734-4103	Pavement Marking Retroreflectivity Testing – Transverse Markings
734-4104	Pavement Marking Additional Testing Required - Longitudinal Lines
734-4105	Pavement Marking Additional Testing Required - Transverse Markings
Miscellaneous	
ODOT Form Number	*Description*
734-1972	Random Sample Locations by Station Random Units Table
734-4000	Sample Data Sheet
734-4000 NFTM	Sample Data Sheet for Non-Field Tested Materials
734-4040	QA/QC Testing Investigation
734-5072	Random Number Table
734-5189	Resin Bonded Anchor Pull Test
734-5292	Mechanical Anchor Pull Test

Note: These forms may be photocopied for your use. They are also available in Microsoft Excel file format on the Construction Section webpage at the following address:

https://www.oregon.gov/odot/Construction/Pages/Forms.aspx

To copy or move sheets within or between workbooks use the following procedure:

- Save desired forms from the address above and open all files intended for the workbook.
- Right click the work sheet tab to be moved or copied.
- From the pop-up window, left click "**Move or Copy…**"
- From the pop-up window, left click drop down button from the "**To Book:**" box.
- Select desired workbook or (new book).
- Select location in workbook to copy or move sheet in the "**Before sheet**" box.
- To keep a copy in the original book and move select "**Create copy**", otherwise leave blank.
- Click **OK**.

NUCLEAR COMPACTION TEST REPORT

E English (**E**) or Metric(**M**)

PROJECT NAME (SECTION)			CONTRACT NUMBER
CONTRACTOR OR SUPPLIER	PROJECT MANAGER		BID ITEM NUMBER
TEST LOCATION (STATION)	OFFSET (DISTANCE FROM CENTERLINE)		SOURCE POSITION
TEST NUMBER / DISTANCE BELOW GRADE	LIFT	LIFT THICKNESS	DATE

CODES FOR ROLLER TYPES
SDV-SINGLE DRUM VIBRATORY — SF- SHEEP FOOT
DDV-DOUBLE DRUM VIBRATORY — GR - GRID ROLLER

ROLLER TYPE AND DESCRIPTION (MANUFACTURE, WEIGHT, ETC)

REPRESENTS MATERIAL / AREA INCORPORATED

FROM: STATION ____ **OFFSET** ____ **DIST. BELOW GRADE** ____

TO: STATION ____ **OFFSET** ____ **DIST. BELOW GRADE** ____

CHECK BOX
☐ **DEFLECTION OBSERVED UNDER LOADED EQUIP.** ☐ **NO DEFLECTION OBSERVED UNDER LOADED EQUIP.**
☐ **MOISTURE IS NOT WITHIN SPECIFICATION** ☐ **MOISTURE IS WITHIN SPECIFICATION**

AASHTO T 310	Wet Density lb/ft³	Moisture lb/ft³	**Dry Density**	**Percent Moisture**
Shot 1			WD - M	(M / DD) X 100
Shot 2				
Average	**WD** (shots within 2 lb/ft³)	**M**	**DD**	**%M** %

(Pc)

AASHTO T 99						
A	№4	COARSE		FINE		**% Coarse**
D	¾	COARSE		FINE		**% Coarse**

MASS OF MOLD AND MATERIALS	MASS OF MOLD	MASS OF WET MATERIAL **(M)**	WET DENSITY lb/ft³ **(A)**	SPEEDY MOISTURE % WET **(B)**	SPEEDY MOISTURE % DRY **(C)**	AASHTO T 255 / T 265 MOISTURE % WET **(a)**	DRY **(b)**	% M **(C)**	DRY DENSITY lb/ft³ **(D)**
UNSCREENED COMBINED IN-PLACE MOISTURE →									

WD (A) = (M) X (MF)MOLD FACTOR

MOLD FACTOR **(MF)** ____

4 inch MOLD (WD) = (M) x 0.06614

6 inch MOLD (WD) = (M) x 0.02939

SPEEDY MOISTURE %
$$(C) = \frac{(B)}{100 - (B)} \times 100$$

T 255 / T 265 MOISTURE %
$$(C) = \frac{(a) - (b)}{(b)} \times 100$$

DRY DENSITY
$$(D) = \frac{(A)}{(C) + 100} \times 100$$

Pc (from A or D above)	**Pf** (Pf = 100 - Pc)	**CURVE NO.**	DRY DENSITY ρ_f	OPTIMUM MOISTURE **MCf**	**k** (Gsb x 62.4)	**MCc**

COMBINED IN-PLACE MOISTURE
(C) = unaltered one-point moisture

$$W = ((C)P_f + MC_cP_c) / 100$$

(____ ____ + ____ ____) /100

Within 1% of T 310 % Moisture?
(If not Correct T 310 DD)

W= ____

COMBINED OPTIMUM MOISTURE (MCT)
(Based on Curve Info.)

$$MC_T = (MC_fP_f + MC_cP_c) / 100$$

(____ ____ + ____ ____) /100

MC_T= ____

RELATIVE MAXIMUM DRY DENSITY lb/ft³

$$\rho_d = \frac{100}{\frac{P_f}{\rho_f} + \frac{P_c}{k}}$$

$$\rho_d = \frac{100}{\frac{\_\_}{\_\_} + \frac{\_\_}{\_\_}}$$

CORRECTED DRY DENSITY

DD = WD / (1+(**W**/100))

DD ____ = **WD** ____ / **1+(W/100)** ____

PERCENT COMPACTION

Original or Corrected (DD / Dd) x 100

Percent Required ____ PERCENT OBTAINED ____

REMARKS

☐ QUALITY CONTROL ☐ VERIFICATION **TYPE GAUGE-SERIAL NUMBER:**

CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE

NUCLEAR COMPACTION TEST REPORT

E — English (E) or Metric(M)

PROJECT NAME (SECTION): Forms Example				CONTRACT NUMBER: 12345
CONTRACTOR OR SUPPLIER: ODOT Forms		PROJECT MANAGER: Sean Parker		BID ITEM NUMBER: 123
TEST LOCATION (STATION): 65+15		OFFSET (DISTANCE FROM CENTERLINE): 15' Rt.		SOURCE POSITION: 8"
TEST NUMBER: 1-1	DISTANCE BELOW GRADE: Subgrade	LIFT: N/A	LIFT THICKNESS: N/A	DATE: 10/9/20

CODES FOR ROLLER TYPES: SDV-SINGLE DRUM VIBRATORY; SF- SHEEP FOOT; DDV-DOUBLE DRUM VIBRATORY; GR - GRID ROLLER

ROLLER TYPE AND DESCRIPTION (MANUFACTURE, WEIGHT, ETC): CAT CF 560 SDV

REPRESENTS MATERIAL / AREA INCORPORATED

	STATION	OFFSET	DIST. BELOW GRADE
FROM:	62+00	CL	Subgrade
TO:	75+00	20' Rt.	Subgrade

CHECK BOX
- [ ] DEFLECTION OBSERVED UNDER LOADED EQUIP.
- [x] NO DEFLECTION OBSERVED UNDER LOADED EQUIP.
- [ ] MOISTURE IS NOT WITHIN SPECIFICATION
- [x] MOISTURE IS WITHIN SPECIFICATION

AASHTO T 310

	Wet Density lb/ft³	Moisture lb/ft³	Dry Density	Percent Moisture
Shot 1	150.2	10.1	WD - M	(M / DD) X 100
Shot 2	150.9	10.3		
Average	WD 150.6	M 10.2	DD 140.4	%M 7.3 %

(shots within 2 lb/ft³)

AASHTO T 99

		COARSE	FINE	% Coarse (Pc)
A	№4	4582.0	5939.0	44
D	¾	845.0	9691.0	8

MASS OF MOLD AND MATERIALS	MASS OF MOLD	MASS OF WET MATERIAL (M)	WET DENSITY lb/ft³ (A)	SPEEDY MOISTURE % WET (B)	SPEEDY MOISTURE % DRY (C)	AASHTO T 255 / T 265 MOISTURE % WET (a)	DRY (b)	% M (C)	DRY DENSITY lb/ft³ (D)
UNSCREENED COMBINED IN-PLACE MOISTURE →						2005.2	1850.1	8.4	
10317.0	5655.5	4661.5	137.0			1097.7	1065.3	3.0	133
10491.8	5655.5	4836.3	142.1			1044.7	991.1	5.4	134.8

WD (A) = (M) X (MF)MOLD FACTOR

MOLD FACTOR (MF): 0.02939

4 inch MOLD (WD) = (M) x 0.06614

6 inch MOLD (WD) = (M) x 0.02939

SPEEDY MOISTURE %: $(C) = \frac{(B)}{100 - (B)} \times 100$

T 255 / T 265 MOISTURE %: $(C) = \frac{(a) - (b)}{(b)} \times 100$

DRY DENSITY: $(D) = \frac{(A)}{(C) + 100} \times 100$

Pc (from A or D above)	Pf (Pf = 100 - Pc)	CURVE NO.	DRY DENSITY ρ_f	OPTIMUM MOISTURE MCf	k (Gsb x 62.4)	MCc
8	92	Exit 99-03	139.0	8.5	165	2.2

COMBINED IN-PLACE MOISTURE

(C) = unaltered one-point moisture

$W = ((C)P_f + MC_cP_c) / 100$

Within 1% of T 310 % Moisture?
(If not Correct T 310 DD)

W= 8.4

COMBINED OPTIMUM MOISTURE (MCT)

(Based on Curve Info.)

$MC_T = (MC_fP_f + MC_cP_c) / 100$

MC_T= 8.5

RELATIVE MAXIMUM DRY DENSITY lb/ft³

$$\rho_d = \frac{100}{\frac{Pf}{\rho_f} + \frac{Pc}{k}}$$

ρ_d = 139.0

CORRECTED DRY DENSITY

DD = WD / (1+(**W**/100))

DD		WD		1+(W/100)
138.9	=	150.6	/	1.084

PERCENT COMPACTION

Original or Corrected (DD / Dd) x 100

Percent Required: **95** PERCENT OBTAINED: **100**

REMARKS

- [ ] QUALITY CONTROL
- [x] VERIFICATION

TYPE GAUGE-SERIAL NUMBER: **Troxler 3430 #11111**

CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Scott Aker	#43048		10/9/2020

NUCLEAR COMPACTION TEST REPORT

E English (**E**) or Metric(**M**)

PROJECT NAME (SECTION): Forms Example			CONTRACT NUMBER: 12345
CONTRACTOR OR SUPPLIER: ODOT Forms	PROJECT MANAGER: Sean Parker		BID ITEM NUMBER: 123
TEST LOCATION (STATION): 117+17	OFFSET (DISTANCE FROM CENTERLINE): 16' Lt.		SOURCE POSITION: 8"
TEST NUMBER: 1-1 / DISTANCE BELOW GRADE: 7 ft.	LIFT: 3 rd	LIFT THICKNESS: 12"	DATE: 10/9/20

CODES FOR ROLLER TYPES
SDV-SINGLE DRUM VIBRATORY — SF- SHEEP FOOT
DDV-DOUBLE DRUM VIBRATORY — GR - GRID ROLLER

ROLLER TYPE AND DESCRIPTION (MANUFACTURE, WEIGHT, ETC): CAT CF 460 SF

REPRESENTS MATERIAL / AREA INCORPORATED

	STATION	OFFSET	DIST. BELOW GRADE
FROM:	**115+25**	**15' Lt.**	**8'**
TO:	**200+25**	**20' Rt.**	**7'**

CHECK BOX
- [ ] **DEFLECTION OBSERVED UNDER LOADED EQUIP.**
- [x] **NO DEFLECTION OBSERVED UNDER LOADED EQUIP.**
- [ ] **MOISTURE IS NOT WITHIN SPECIFICATION**
- [x] **MOISTURE IS WITHIN SPECIFICATION**

AASHTO T 310

	Wet Density lb/ft³	Moisture lb/ft³	Dry Density	Percent Moisture
Shot 1	131.0	9.4	WD - M	(M / DD) X 100
Shot 2	131.1	9.4		
Average	**WD** 131.1	**M** 9.4	**DD 121.7**	**%M 7.7 %**

(shots within 2 lb/ft³)

AASHTO T 99

			COARSE	FINE		**(Pc)**
A	№4	COARSE	8946.8	12948.7	**% Coarse**	**41**
D	¾	COARSE	5425.2	16470.3	**% Coarse**	**25**

MASS OF MOLD AND MATERIALS	MASS OF MOLD	MASS OF WET MATERIAL (M)	WET DENSITY lb/ft³ (A)	SPEEDY MOISTURE % WET (B)	SPEEDY MOISTURE % DRY (C)	AASHTO T 255 / T 265 MOISTURE % WET (a)	DRY (b)	% M (C)	DRY DENSITY lb/ft³ (D)
UNSCREENED COMBINED IN-PLACE MOISTURE →									
9815.3	5645.5	4169.8	122.6			4158.9	3718.5	11.8	109.7

WD (A) = (M) X (MF)MOLD FACTOR

MOLD FACTOR **(MF)**: **0.02939**

4 inch MOLD (WD) = (M) x 0.06614

6 inch MOLD (WD) = (M) x 0.02939

SPEEDY MOISTURE %: $(C) = \frac{(B)}{100 - (B)} \times 100$

T 255 / T 265 MOISTURE %: $(C) = \frac{(a) - (b)}{(b)} \times 100$

DRY DENSITY: $(D) = \frac{(A)}{(C) + 100} \times 100$

Pc (from A or D above)	Pf (Pf = 100 - Pc)	CURVE NO.	DRY DENSITY ρ_f	OPTIMUM MOISTURE MCf	k (Gsb x 62.4)	MCc
25	**75**	Exit 19-1	112.8	15.4	166.6	1.5

COMBINED IN-PLACE MOISTURE
(C) = unaltered one-point moisture

W = ((C)Pf + MCcPc) / 100

11.8 × 75 + 1.5 × 25 /100

W= 9.2

Within 1% of T 310 % Moisture?
(If not Correct T 310 DD)

COMBINED OPTIMUM MOISTURE (MCT)
(Based on Curve Info.)

MCT = (MCfPf + MCcPc) / 100

15.4 × 75 + 1.5 × 25 /100

MCT= 11.9

RELATIVE MAXIMUM DRY DENSITY $\rho_d = \frac{100}{\frac{Pf}{\rho_f} + \frac{Pc}{k}}$ lb/ft³

ρ_d = **122.7** = $\frac{100}{\frac{75}{112.8} + \frac{25}{166.6}}$

CORRECTED DRY DENSITY

DD = WD / (1+(**W**/100))

DD		**WD**		**1+(W/100)**
120.1	=	131.1	/	1.092

PERCENT COMPACTION

Original or Corrected (DD / Dd) x 100

Percent Required: **95**

PERCENT OBTAINED: **98**

REMARKS

- [ ] QUALITY CONTROL
- [x] VERIFICATION

TYPE GAUGE-SERIAL NUMBER: **Troxler 3430 #11111**

CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Scott Aker #43048	ODOT		10/9/2020

ACP INCINERATOR OVEN CALIBRATION WORKSHEET

PROJECT NAME (SECTION)	PROJECT MANAGER	CONTRACT NUMBER	ASPHALT SUPPLIER	ODOT MIX DESIGN NO.
C0NTRACTOR OR SUPPLIER	MATERIAL TYPE	PERCENT RAP	ASPHALT GRADE	CONTRACTOR DESIGN #

INCINERATOR MAKE		SERIAL NUMBER		BURN METHOD (A OR B)	

BLANK				RAP				Incinerator Sample #				Incinerator Sample #			
PAN TARE				BASKET TARE	T			BASKET TARE	T			BASKET TARE	T		
WET MASS & PAN				MIX MASS & BASKET	A			MIX MASS & BASKET	A			MIX MASS & BASKET	A		
DRY MASS & PAN				AGG MASS & BASKET	B			AGG MASS & BASKET	B			AGG MASS & BASKET	B		
				COOL AGG & BASKET				COOL AGG & BASKET				COOL AGG & BASKET			
				TEMP A		Mi (A-T)		TEMP A		Mi (A-T)		TEMP A		Mi (A-T)	
				TEMP B		Mf (B-T)		TEMP B		Mf (B-T)		TEMP B		Mf (B-T)	
				%I = [(Mi -Mf) / (Mi)] x 100				%I = [(Mi -Mf) / (Mi)] x 100				%I = [(Mi -Mf) / (Mi)] x 100			
Sieve	Mass	% Ret	%Pass	Sieve	Mass	% Ret	%Pass	Sieve	Mass	% Ret	%Pass	Sieve	Mass	% Ret	%Pass
PAN		Initial Mass		PAN		Initial Mass		PAN		Initial Mass		PAN		Initial Mass	
AFTER WASH DRY MASS				AFTER WASH DRY MASS				AFTER WASH DRY MASS				AFTER WASH DRY MASS			
MASS AFTER SIEVE				MASS AFTER SIEVE				MASS AFTER SIEVE				MASS AFTER SIEVE			
Sieve loss				Sieve loss				Sieve loss				Sieve loss			

SIEVE	TARGET	BLANK/RAP	MIX # 1	MIX # 2	AVE 1 & 2	Diff TARGET-BLANK	FACTOR

	MIX # 1	MIX # 2
% LOSS (%I)		
% Pb BATCHED		
CORRECTION		

(Cf)

CERTIFIED TECHNICAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE	QUALITY CONTROL VERIFICATION INDEPENDENT ASSURANCE

ACP INCINERATOR OVEN CALIBRATION WORKSHEET

PROJECT NAME (SECTION)	PROJECT MANAGER	CONTRACT NUMBER	ASPHALT SUPPLIER	ODOT MIX DESIGN NO.
ODOT Forms	Sean Parker	12345	Paramount	20-MD0001
CONTRACTOR OR SUPPLIER	**MATERIAL TYPE**	**PERCENT RAP**	**ASPHALT GRADE**	**CONTRACTOR DESIGN #**
Best Paving Company	Level 3 1/2" Dense	25	PG 70-22	BPC-001

INCINERATOR MAKE	SERIAL NUMBER	BURN METHOD (A OR B)
Troxler	160	B

BLANK				RAP				Incinerator Sample # 3				Incinerator Sample # 7			
PAN TARE			1311.8	BASKET TARE		T	4461.7	BASKET TARE		T	4504.2	BASKET TARE		T	4543.2
WET MASS & PAN			2403.3	MIX MASS & BASKET		A	4812.8	MIX MASS & BASKET		A	6033.8	MIX MASS & BASKET		A	6073.0
DRY MASS & PAN			2403.3	AGG MASS & BASKET		B	4812.8	AGG MASS & BASKET		B	5930.8	AGG MASS & BASKET		B	5970.9
				COOL AGG & BASKET			4812.8	COOL AGG & BASKET			5930.8	COOL AGG & BASKET			5970.9
				TEMP A	70.0	Mi (A-T)	351.1	TEMP A	71.0	Mi (A-T)	1529.6	TEMP A	71.0	Mi (A-T)	1529.8
				TEMP B	72.0	Mf (B-T)	351.1	TEMP B	75.0	Mf (B-T)	1426.6	TEMP B	73.0	Mf (B-T)	1427.7
				%I = [(Mi -Mf) / (Mi)] x 100			0.00	%I = [(Mi -Mf) / (Mi)] x 100			6.73	%I = [(Mi -Mf) / (Mi)] x 100			6.67
Sieve	Mass	% Ret	%Pass	Sieve	Mass	% Ret	%Pass	Sieve	Mass	% Ret	%Pass	Sieve	Mass	% Ret	%Pass
1	0.0	0.0	100.0	1	0.0	0.0	100.0	1	0.0	0.0	100.0	1	0.0	0.0	100.0
3/4	0.0	0.0	100.0	3/4	0.0	0.0	100.0	3/4	0.0	0.0	100.0	3/4	0.0	0.0	100.0
1/2	52.0	4.8	95.2	1/2	30.7	8.7	91.3	1/2	53.3	3.7	96.3	1/2	32.3	2.3	97.7
3/8	181.5	16.6	78.6	3/8	8.2	2.3	89.0	3/8	209.4	14.7	81.6	3/8	233.2	16.3	81.4
1/4	228.9	21.0	57.6	1/4	48.4	13.8	75.2	1/4	241.4	16.9	64.7	1/4	236.8	16.6	64.8
4	202.0	18.5	39.1	4	35.8	10.2	65.0	4	237.0	16.6	48.1	4	238.2	16.7	48.1
6	106.0	9.7	29.4	6	37.0	10.5	54.5	6	128.4	9.0	39.1	6	137.0	9.6	38.5
8	58.7	5.4	24.0	8	30.7	8.7	45.8	8	93.1	6.5	32.6	8	86.8	6.1	32.4
16	72.1	6.6	17.4	16	38.4	10.9	34.9	16	100.0	7.0	25.6	16	100.0	7.0	25.4
30	72.2	6.6	10.8	30	38.5	11.0	23.9	30	135.7	9.5	16.1	30	133.9	9.4	16.0
50	28.2	2.6	8.2	50	19.0	5.4	18.5	50	50.0	3.5	12.6	50	50.0	3.5	12.5
100	28.2	2.6	5.6	100	19.1	5.4	13.1	100	50.0	3.5	9.1	100	50.0	3.5	9.0
200	28.4	2.6	3.0	200	19.1	5.4	7.7	200	57.5	4.0	5.1	200	57.9	4.1	4.9
PAN	4.0	Initial Mass	1091.5	PAN	4.7	Initial Mass	351.1	PAN	6.4	Initial Mass	1426.6	PAN	9.3	Initial Mass	1427.7
AFTER WASH DRY MASS			1062.2	AFTER WASH DRY MASS			329.7	AFTER WASH DRY MASS			1362.0	AFTER WASH DRY MASS			1365.7
MASS AFTER SIEVE			1062.2	MASS AFTER SIEVE			329.6	MASS AFTER SIEVE			1362.2	MASS AFTER SIEVE			1365.4
Sieve loss			0.0%	Sieve loss			0.0%	Sieve loss			0.0%	Sieve loss			0.0%

SIEVE	TARGET	BLANK/RAP	MIX # 1	MIX # 2	AVE 1 & 2	Diff TARGET-BLANK	FACTOR	
1	100	100.0	100.0	100.0	100.0	0.0	0.0	1
3/4	100	100.0	100.0	100.0	100.0	0.0	0.0	3/4
1/2	96	94.3	96.3	97.7	97.0	1.7	-2.7	1/2
3/8	81	81.2	81.6	81.4	81.5	-0.2	-0.3	3/8
1/4	65	62.0	64.7	64.8	64.8	3.0	-2.8	1/4
4	47	45.5	48.1	48.1	48.1	1.5	-2.6	4
6	39	35.6	39.1	38.5	38.8	3.4	-3.2	6
8	32	29.4	32.6	32.4	32.5	2.6	-3.1	8
16	25	21.7	25.6	25.4	25.5	3.3	-3.8	16
30	16	14.0	16.1	16.0	16.1	2.0	-2.1	30
50	12	10.7	12.6	12.5	12.6	1.3	-1.9	50
100	9	7.4	9.1	9.0	9.1	1.6	-1.7	100
200	5.1	4.1	5.1	4.9	5.0	1.0	-0.9	200

	MIX # 1	MIX # 2
% LOSS (%I)	6.73	6.67
% Pb BATCHED	5.71	5.71
CORRECTION	1.02	0.96

0.99 **(Cf)**

CERTIFIED TECHNICAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE	
Scott Aker #43048	ODOT		10/10/2020	X QUALITY CONTROL ☐ VERIFICATION ☐ INDEPENDENT ASSURANCE

MAXIMUM DENSITY OF CONSTRUCTION MATERIALS

E English (E) or Metric (M)

PROJECT NAME (SECTION)						CONTRACT NUMBER
CONTRACTOR OR SUPPLIER				PROJECT MANAGER		BID ITEM NUMBER
SOURCE NAME				SOURCE NUMBER		MATERIAL SIZE
TEST NO.	DATE	TIME	SAMPLED AT	MATERIAL DESCRIPTION	TO BE USED IN	

lb/ft³					
lb/ft³					
lb/ft³					
lb/ft³					
lb/ft³					
%	%	%	%	%	%

TEST METHOD

T 99 ☐ T 180 ☐

A or D ☐

SAMPLE

+ №4	
- №4	
Total	
Pc	%
+ ¾	
- ¾	
Total	
Pc	%

MAX DRY DENSITY OF THE FINES

ρ_f ______ lb/ft³

OPTIMUM MOISTURE OF THE FINES

MCf ______ %

TEST NO.	MASS OF MOLD AND MATERIALS (GRAMS)	MASS OF MOLD (GRAMS)	(M) MASS OF WET MATERIAL	WET DENSITY WD = (M)x(MF) lb/ft³	OVEN MOISTURE % AASHTO T255 / 265 Pan Tare (t)	WET(a)	DRY(b)	% M (m)	(D) DRY DENSITY lb/ft³
1									
2									
3									
4									
5									
6									
7									
8									

MOLD FACTOR (MF)

4 in MOLD = 0.06614
101.6mm MOLD = 1.060
6 in MOLD = 0.02939
152.4mm = 0.471

OVEN MOISTURE %

$(m) = \frac{(a) - (b)}{(b) - (t)} X100$

$(D) = \frac{(WD)}{(m)+100} X100$

AASHTO T85 SPECIFIC GRAVITY OF COARSE AGGREGATE	Oven Dry Mass (A)	SSD Mass (B)	Weight in Water (C)	**Gsb** (A) / [(B)-(C)]	**Gsb SSD** (B) / [(B)-(C)]	**Gsa** (A) / [(A)-(C)]	**ABSORPTION** [[(B)-(A)]/(A)]X100

COMMENTS

☐ **QUALITY CONTROL** ☐ **INDEPENDENT ASSURANCE**

CERTIFIED TECHNICAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE

MAXIMUM DENSITY OF CONSTRUCTION MATERIALS

PROJECT NAME (SECTION)						CONTRACT NUMBER
CONTRACTOR OR SUPPLIER				PROJECT MANAGER		BID ITEM NUMBER
SOURCE NAME				SOURCE NUMBER		MATERIAL SIZE
TEST NO.	DATE	TIME	SAMPLED AT	MATERIAL DESCRIPTION	TO BE USED IN	

AASHTO T 99 COARSE PARTICLE CORRECTION

RELATIVE MAXIMUM DRY DENSITY

100 / (Pf / ρf)+(Pc / k) = ρ_d

COMBINED OPTIMUM MOISTURE

(MCf x Pf + MCc x Pc) / 100 = MCT

Pf = 100 - Pc k = Gsb x 62.4

MCc = ABSORPTION OR MOISTURE

COARSE PARTICLES	RELATIVE MAXIMUM DRY DENSITY	COMBINED OPTIMUM MOISTURE	COARSE PARTICLES
0-9%			0-9%
10%			10%
11%			11%
12%			12%
13%			13%
14%			14%
15%			15%
16%			16%
17%			17%
18%			18%
19%			19%
20%			20%
21%			21%
22%			22%
23%			23%
24%			24%
25%			25%
26%			26%
27%			27%
28%			28%
29%			29%
30%			30%
31%			31%
32%			32%
33%			33%
34%			34%
35%			35%
36%			36%
37%			37%
38%			38%
39%			39%
40%			40%

TEST METHOD

T 99 ☐ T 180 ☐

A or D ☐

CURVE COARSE PARTICLES

+ №4 ☐ %

+ ¾ ☐ %

SOILS

MAX DRY DENSITY OF THE FINES

ρ_f ☐ lb/ft³

OPTIMUM MOISTURE % THE FINES

MCf ☐ %

MAX DRY DENSITY OF THE COURSE

k ☐ lb/ft³

OPTIMUM MOISTURE % THE COURSE

MCc ☐ %

☐ QUALITY CONTROL ☐ VERIFICATION

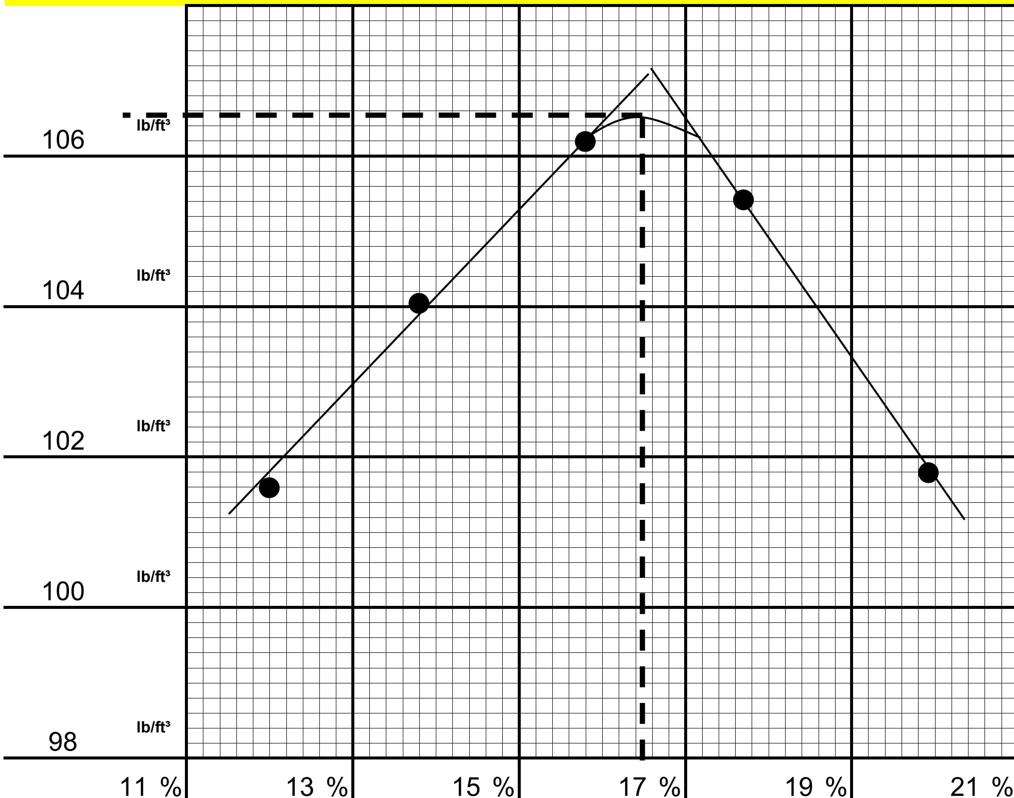
CERTIFIED TECHNICAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE

MAXIMUM DENSITY OF CONSTRUCTION MATERIALS

E — English (E) or Metric (M)

PROJECT NAME (SECTION)		CONTRACT NUMBER
Forms Example		12345
CONTRACTOR OR SUPPLIER: ODOT Forms	PROJECT MANAGER: Sean Parker	BID ITEM NUMBER: 123
SOURCE NAME: Native	SOURCE NUMBER: n/a	MATERIAL SIZE: 1"-0

TEST NO.	DATE	TIME	SAMPLED AT	MATERIAL DESCRIPTION	TO BE USED IN
1	10/9/2020	8:00am	15+45	Lt Brown Silty Clay	Embankment



TEST METHOD

T 99 [X] T 180 [ ]

A or D [A]

SAMPLE

+ №4	4098.1
- №4	9231.6
Total	13329.7
Pc	**31 %**
+ ¾	1533.4
- ¾	11796.3
Total	13329.7
Pc	**12 %**

MAX DRY DENSITY OF THE FINES

ρ_f **106.5** lb/ft³

OPTIMUM MOISTURE OF THE FINES

MCf **16.5** %

TEST NO.	MASS OF MOLD AND MATERIALS (GRAMS)	MASS OF MOLD (GRAMS)	(M) MASS OF WET MATERIAL	WET DENSITY WD = (M)x(MF) lb/ft³	OVEN MOISTURE % AASHTO T255 / 265 Pan Tare (t)	WET(a)	DRY(b)	% M (m)	(D) DRY DENSITY lb/ft³
1	5964.80	4244.1	1720.70	113.8	130.2	358.4	334.0	**12.0**	**101.6**
2	6032.50	4244.1	1788.40	118.3	127.9	361.8	333.4	**13.8**	**104**
3	6104.20	4244.1	1860.10	123	128.5	382.0	347.4	**15.8**	**106.2**
4	6118.70	4244.1	1874.60	124	128.2	376.7	339.4	**17.7**	**105.4**
5	6090.50	4244.1	1846.40	122.1	129.5	372.2	331.9	**19.9**	**101.8**
6									
7									
8									

MOLD FACTOR (MF)

0.06614

4 in MOLD = 0.06614
101.6mm MOLD = 1.060
6 in MOLD = 0.02939
152.4mm = 0.471

OVEN MOISTURE %

$$(m) = \frac{(a) - (b)}{(b) - (t)} \times 100$$

$$(D) = \frac{(WD)}{(m)+100} \times 100$$

AASHTO T85 SPECIFIC GRAVITY OF COARSE AGGREGATE	Oven Dry Mass (A)	SSD Mass (B)	Weight in Water (C)	**Gsb** (A) / [(B)-(C)]	**Gsb SSD** (B) / [(B)-(C)]	**Gsa** (A) / [(A)-(C)]	**ABSORPTION** [[(B)-(A)]/(A)]X100
	4001.7	4073.1	2498.4	2.541	2.587	2.662	1.8

COMMENTS

[X] **QUALITY CONTROL** [ ] **INDEPENDENT ASSURANCE**

CERTIFIED TECHNICAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Scott Aker #43048	ODOT	Scott Aker	10/9/20

MAXIMUM DENSITY OF CONSTRUCTION MATERIALS

PROJECT NAME (SECTION)						CONTRACT NUMBER
Forms Example						12345
CONTRACTOR OR SUPPLIER: ODOT Forms				PROJECT MANAGER: Sean Parker		BID ITEM NUMBER: 123
SOURCE NAME: Native				SOURCE NUMBER: n/a		MATERIAL SIZE: 1"-0
TEST NO.: 1	DATE: 10/9/2020	TIME: 8:00am	SAMPLED AT: 15+45	MATERIAL DESCRIPTION: Lt Brown Silty Clay	TO BE USED IN: Embankment	

AASHTO T 99 COARSE PARTICLE CORRECTION

RELATIVE MAXIMUM DRY DENSITY

$100 \;/\; (P_f / \rho_f) + (P_c / k) = \rho_d$

COMBINED OPTIMUM MOISTURE

$(MC_f \times P_f + MC_c \times P_c) / 100 = MCT$

$P_f = 100 - P_c$ $k = G_{sb} \times 62.4$

MC_c = ABSORPTION OR MOISTURE

COARSE PARTICLES	RELATIVE MAXIMUM DRY DENSITY	COMBINED OPTIMUM MOISTURE	COARSE PARTICLES
0-9%	106.5	16.5	0-9%
10%	110.1	15.0	10%
11%	110.5	14.9	11%
12%	110.9	14.7	12%
13%	111.3	14.6	13%
14%	111.6	14.4	14%
15%	112	14.3	15%
16%	112.4	14.1	16%
17%	112.8	14.0	17%
18%	113.2	13.9	18%
19%	113.6	13.7	19%
20%	114	13.6	20%
21%	114.4	13.4	21%
22%	114.8	13.3	22%
23%	115.2	13.1	23%
24%	115.6	13.0	24%
25%	116	12.8	25%
26%	116.4	12.7	26%
27%	116.9	12.5	27%
28%	117.3	12.4	28%
29%	117.7	12.2	29%
30%	118.1	12.1	30%
31%	118.6	11.9	31%
32%	119	11.8	32%
33%	119.4	11.6	33%
34%	119.9	11.5	34%
35%	120.3	11.4	35%
36%	120.8	11.2	36%
37%	121.2	11.1	37%
38%	121.7	10.9	38%
39%	122.1	10.8	39%
40%	122.6	10.6	40%

TEST METHOD

T 99 [X] T 180 [ ]

A or D [A]

CURVE COARSE PARTICLES

+ №4 [31] %

+ ¾ [12] %

SOILS

MAX DRY DENSITY OF THE FINES

ρ_f [106.5] lb/ft³

OPTIMUM MOISTURE % THE FINES

MCf [16.5] %

MAX DRY DENSITY OF THE COURSE

k [158.6] lb/ft³

OPTIMUM MOISTURE % THE COURSE

MCc [1.8] %

[X] QUALITY CONTROL [ ] VERIFICATION

CERTIFIED TECHNICAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Scott Aker #43048	ODOT	Aker	10/9/20

734-3468 (10-2020)

MAXIMUM DENSITY OF AGGREGATE BASE MATERIALS

E — English (E) or Metric (M)

PROJECT NAME (SECTION)			CONTRACT NUMBER
CONTRACTOR OR SUPPLIER	PROJECT MANAGER		BID ITEM NUMBER
SOURCE NAME	SOURCE NUMBER		MATERIAL SIZE

TEST NO.	DATE	TIME	SAMPLED AT	MATERIAL DESCRIPTION	TO BE USED IN

lb/ft³
lb/ft³
lb/ft³
lb/ft³
lb/ft³

% % % % % %

TEST METHOD
ODOT TM 223
FOR AASHTO T 99 METHOD A

SAMPLE
MAX DRY DENSITY OF THE FINES
ρ_f ____ lb/ft³
OPTIMUM MOISTURE % THE FINES
MC_f ____ %

BASE AGG STOCKPILE
STATSPEC MEAN #4 (4.75mm)
Pc ____ %

COMBINED
RELATIVE MAX DRY DENSITY
ρ_d ____ lb/ft³
OPTIMUM MOISTURE %
MC_T ____ %

TEST NO.	MASS OF MOLD AND MATERIALS (grams)	MASS OF MOLD (grams)	(M) MASS OF WET MATERIAL	(WD) WET DENSITY lb/ft³	OVEN MOISTURE % AASHTO T255 / 265 Pan Tare (t)	WET(a)	DRY(b)	% M (m)	(D) DRY DENSITY lb/ft³
1									
2									
3									
4									
5									
6									
7									
8									

MOLD FACTOR

4" MOLD = 0.06614
101.6mm MOLD = 1.060
WD = (M) x MOLD FACTOR

OVEN MOISTURE %

$$(m) = \frac{(a) - (b)}{(b) - (t)} \times 100$$

$$(D) = \frac{(WD)}{(m)+100} \times 100$$

AASHTO T85
SPECIFIC GRAVITY OF COARSE AGGREGATE

Oven Dry Mass (A)	SSD Mass (B)	Weight in Water (C)	Gsb (A) / [(B)-(C)]	Gsb SSD (B) / [(B)-(C)]	Gsa (A) / [(A)-(C)]	ABSORPTION [((B)-(A))/(A)]X100

ODOT TM 223
COARSE PARTICLE CORRECTION

$P_f = 100 - P_c$ $k = Gsb \times 62.4$ MC_c = ABSORPTION OR MOISTURE

$$100 / ((Pf/\rho_f) + (Pc / (k \times 0.9))) = \rho_d$$

$$((MCf \times Pf) + (MCc \times Pc)) / 100 = MC_T$$

100 /((____ / ____)+(____ / ____))= ρ_d ((____ x ____)+(____ x ____))/ 100 = MC_T

100 /((____)+(____))= ____ ((____)+(____))/ 100 = ____

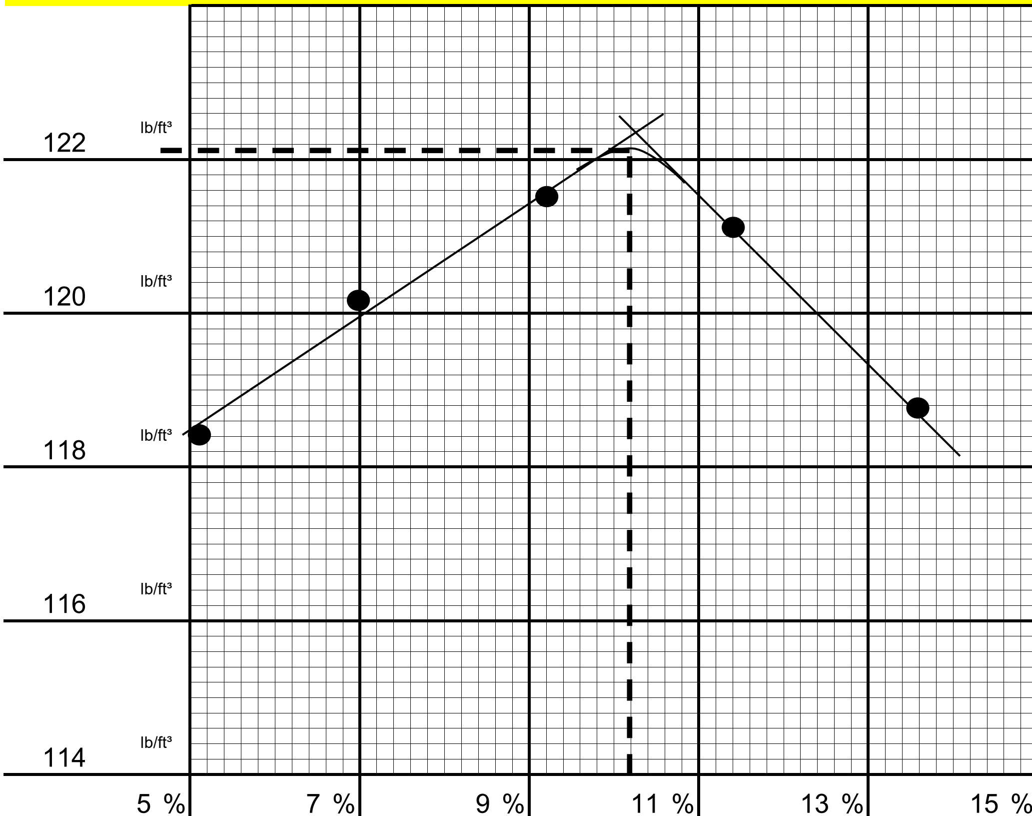
☐ QUALITY CONTROL ☐ INDEPENDENT ASSURANCE

CERTIFIED TECHNICAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE

MAXIMUM DENSITY OF AGGREGATE BASE MATERIALS **E** English (E) or Metric (M)

PROJECT NAME (SECTION)		CONTRACT NUMBER
Forms Example		12345
CONTRACTOR OR SUPPLIER: ODOT Forms	PROJECT MANAGER: Sean Parker	BID ITEM NUMBER: 123
SOURCE NAME: Best Rock Quarry	SOURCE NUMBER: 10-123-3	MATERIAL SIZE: 1"-0

TEST NO.	DATE	TIME	SAMPLED AT	MATERIAL DESCRIPTION	TO BE USED IN
1	10/9/2020	8:00am	Final Belt	Crushed Aggregate	Aggregate Base



TEST METHOD
ODOT TM 223
FOR AASHTO T 99 METHOD A

SAMPLE
MAX DRY DENSITY OF THE FINES ρ_f 122.1 lb/ft³
OPTIMUM MOISTURE % THE FINES MC_f 10.2 %

BASE AGG STOCKPILE
STATSPEC MEAN #4 (4.75mm)
Pc 57 %

COMBINED
RELATIVE MAX DRY DENSITY
ρ_d **135.4** lb/ft³
OPTIMUM MOISTURE %
MC_T **6.2** %

TEST NO.	MASS OF MOLD AND MATERIALS (grams)	MASS OF MOLD (grams)	(M) MASS OF WET MATERIAL	(WD) WET DENSITY lb/ft³	OVEN MOISTURE % AASHTO T255 / 265 Pan Tare (t)	WET(a)	DRY(b)	% M (m)	(D) DRY DENSITY lb/ft³
1	6125.2	4244.1	1881.1	124.4	100.1	638.2	612.1	5.1	118.4
2	6188.4	4244.1	1944.3	128.6	99.9	660.2	623.5	7.0	120.2
3	6250.5	4244.1	2006.4	132.7	100.3	736.0	682.4	9.2	121.5
4	6284.3	4244.1	2040.2	134.9	100.5	668.0	609.9	11.4	121.1
5	6284.2	4244.1	2040.1	134.9	100.2	686.0	615.9	13.6	118.8
6									
7									
8									

MOLD FACTOR
0.06614

4" MOLD = 0.06614
101.6mm MOLD = 1.060
WD = (M) x MOLD FACTOR

OVEN MOISTURE %

$$(m) = \frac{(a) - (b)}{(b) - (t)} \times 100$$

$$(D) = \frac{(WD)}{(m) + 100} \times 100$$

AASHTO T85
SPECIFIC GRAVITY OF COARSE AGGREGATE

Oven Dry Mass (A)	SSD Mass (B)	Weight in Water (C)	Gsb (A) / [(B)-(C)]	Gsb SSD (B) / [(B)-(C)]	Gsa (A) / [(A)-(C)]	ABSORPTION [[(B)-(A)]/(A)]X100
4562.3	4701.9	2964.3	2.626	2.706	2.855	3.1

ODOT TM 223
COARSE PARTICLE CORRECTION $P_f = 100 - P_c$ k = Gsb x 62.4 MC_c = ABSORPTION OR MOISTURE

100 / ((Pf /ρ_f) + (Pc / (k x 0.9))) = ρ_d

100 /((43 / 122.1)+(57 / 147.5))= ρ_d

100 /((0.35217)+(0.38644))= **135.4**

((MCf x Pf) + (MCc x Pc)) / 100 = MC_T

((10.2 x 43)+(3.1 x 57))/ 100 = MC_T

((438.6)+(176.7))/ 100 = **6.2**

X QUALITY CONTROL ☐ INDEPENDENT ASSURANCE

CERTIFIED TECHNICAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Scott Aker #43048	ODOT	Scott Aker	10/9/2020

734-3468 B (10-2020)

MECHANICAL ANCHOR PULL TEST

PROJECT NAME (SECTION)							CONTRACT NUMBER
C0NTRACTOR OR SUPPLIER			PROJECT MANAGER			BID ITEM NUMBER	TEST DATE
ANCHOR TYPE	ANCHOR SIZE	ANCHOR GRADE	STRUCTURE NUMBER	BRIDGE ELEMENT		PRODUCT NAME	LOT NO.

TEST NO.	TEST TYPE	INSTALLATION POSITION	EMBEDMENT DEPTH (in)	MIN. PULL-OUT FORCE (Lbs)	MEAS. PULL-OUT FORCE (Lbs)	VISUAL DISPLACEMENT	RESULTS
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

REMARKS:

CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE

734-5292 (10-2020)

MECHANICAL ANCHOR PULL TEST

PROJECT NAME (SECTION)						CONTRACT NUMBER
Demo Example						C 12345
C0NTRACTOR OR SUPPLIER			PROJECT MANAGER		BID ITEM NUMBER	TEST DATE
Contractor X			PM X		00534	7/6/20
ANCHOR TYPE	ANCHOR SIZE	ANCHOR GRADE	STRUCTURE NUMBER	BRIDGE ELEMENT	PRODUCT NAME	LOT NO.
Screw	5	60	ABC123	Rail	HIT - RE 500	Lot # 125

TEST NO.	TEST TYPE	INSTALLATION POSITION	EMBEDMENT DEPTH (in)	MIN. PULL-OUT FORCE (Lbs)	MEAS. PULL-OUT FORCE (Lbs)	VISUAL DISPLACEMENT	RESULTS
1	DEMO	VERTICAL	6.00	22,300	21,000	YES	FAIL
2	DEMO	VERTICAL	6.00	22,300	22,500	NO	PASS
3	DEMO	VERTICAL	6.00	22,300	22,600	NO	PASS
4				Avg.	22,033		FAIL
5							
6							
7							
8							
9							
10							

REMARKS:

DEMO Test No. 1-3 (3Anchors) failed due to visible deflection and not achieving min. pull out force. Average pull out force = 22, 033 lbs. Since 22,033>0.95 x 22, 300, anchor system may be retested.

CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Joe Bond	Contractor X		
CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Bob Force	Agency		

INSERT TAB

SECTION 4(D)
Field Tested Materials
Guide

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)): Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00330 - EARTHWORK									
Establishing Maximum Density (for Compaction)	*Density Curve*			*T 99*	*3468*	*1/Soil type*		*1/Project*	
	Bulk Specific Gravity			*T 85*	*3468*				
	Family of Curves			*R 75*	*3468FC*				
Compaction	*Deflection Testing*	*TM 158*			*1793S*	*1 test per 3 ft. in depth*		*1 test per 10 QC Tests per Table 00330-1*	
	Nuclear Gauge *Coarse Particle Correction*			*T 310* *T 99*	*1793S*	*See Table 00330-1 Below*			
	Deflection Testing	*TM 158*			*1793S*				

TABLE 00330-1 Frequency of Quality Control Testing (English)

Individual Areas	Under 3500 yd² or yd³	Over 3500 yd² or yd³
Existing Ground Surface	1 test per 1000 yd²	1 test per 3000 yd²
Embankments	1 test per 500 yd³	1 test per 3000 yd³
Excavations and Finished Subgrade	1 test per 1000 yd²	1 test per 3000 yd²

MATERIAL AND OPERATION	DESCRIPTION OF TEST	ODOT	WAQTC	AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
Stone Embankment Material (See Sec. 330.16(a))	*Gradation*						*Visual See Section 00330.16(b)*		
Compaction	*Deflection Testing*	*TM 158*			*1793S*	*1 per Layer*			

Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.

MATERIAL AND OPERATION	DESCRIPTION OF TEST	ODOT	WAQTC	AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
Imported Topsoil (See Section 01040.14(b))	*Compliance*				*4000*	*See Section 4C* *1/Source & 1/Type of Soil*	*Submit to Lab*		

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Same Frequency for all Tests (Minimums)			
						QUALITY ASSURANCE			
						Contractor Quality Control	Independent Assurance/Verification		
		ODOT	WAQTC	AASHTO			Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00331 - SUBGRADE STABILIZATION									
Aggregate backfill	*Material must meet the requirements of Section 00331.10*						*Visual*		
Water	*Material must meet the requirements of Section 00340*								
Compaction	*Material must meet the requirements of Section 00331*						*Visual*		
SECTION 00332 - SURFACING STABILIZATION									
Aggregate Base	*Material must meet the requirements of Section 00332.10*						*Visual*		
Compaction	*Material must meet the requirements of Section 00332*						*Visual*		
SECTION 00333 - AGGREGATE DITCH LINING									
Aggregate	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*1792*	*1/Project or 1/Source*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE

(Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00344 -TREATED SUBGRADE									
Granular Quicklime	*Sieve Analysis* *Calcium Hydroxide Content in lime*			*T 27* *T 219*	*4000*	*1/Project or 1/Source*	*Submit to Lab*		*1/Project or 1/Source*
Hydrated Lime Calcium Chloride Sodium Chloride	*Materials must meet the requirements of Section 00344.10 and Test Results Certificate provided according to Section 00165.35(a)*								
Portland Cement	*Material must meet the requirements of Section 02010*								
Water	*Material must meet the requirements of Section 00340*								
Establishing Maximum Density	*Density Curve* *Maximum Specific Gravity*			*T 99*	*3468*	*See Table 00344-1 Below for Testing Frequency*		*1/Project and 1 Test per 10 QC tests per Table 00344-1*	
Compaction	*Deflection Testing*	*TM 158*			*1793S*				
	Deflection Testing *Nuclear Gauge* *Coarse Particle Correction*	*TM 158*		*T 310* *T 99*	*1793S*				

TABLE 00344-1 Frequency of Quality Control Testing

Individual Areas	Under 3500 yd²	Over 3500 yd²
Finished Subgrade	1 test per 1000 yd²	1 test per 3000 yd²

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)): Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00360 - Drainage Blankets									
						A sublot equals 1000 Tons			
Granular Drainage Blanket	*Sampling*			*R 90*		*1/sublot minimum 1/Source per Project*			
	Reducing			*R 76*					
	Sieve Analysis			*T 27/T 11*	*1792*				
Sand Drainage Blanket	*Sampling*			*R 90*					
	Reducing			*R 76*					
	Sieve Analysis			*T 27/T 11*	*1792*				
Establishing Maximum Density	*Density Curve*			*T 99*	*3468*	*1/Source and Type*		*1/Project*	
	Bulk Specific Gravity			*T 85*	*3468*				
Compaction	*Deflection Testing*	*TM 158*			*1793S*	*1 test per 3 ft. in depth*			
	Deflection Testing	*TM 158*			*1793S*	*See Table 00360-1 Below*		*1 Test per 10 QC Tests per Table 00360-1*	
	Nuclear Gauge			*T 310*					
	Coarse Particle Correction			*T 99*	*1793S*				

TABLE 00360-1 Frequency of Quality Control Testing

Individual Areas	Under 3500 yd²	Over 3500 yd²
Existing Ground Surface	1 test per 1000 yd²	1 test per 3000 yd²
Finished Surfaces	1 test per 1000 yd²	1 test per 3000 yd²

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00390 - RIPRAP PROTECTION									
Fill Material & Riprap									
Gradation *See 00390.11(c-1)*							*Visual*		
	Degradation	*TM 208*							
	Soundness			*T 104*	*4000*	*See Section 4(A)*	*Submit to Lab*		*See Section 4(A)*
	Apparent Specific Gravity & Absorption			*T 85*	*1825*				
Filter Blanket									
Gradation *See 00390.13*							*Visual*		
Grouted Riprap									
Sand	*Sampling*			*R 90*		*1/Project*			
	Reducing			*R 76*					
	Sieve Analysis			*T 27/T 11*	*1792*				
	Soundness			*T 104*	*4000*	*See Section 4(A)*	*Submit to Lab*		*See Section 4(A)*
	Lightweight Pieces			*T 113*					
Portland Cement	*Material must meet the requirements of Section 02010*								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) – QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00396 -SHOTCRETE SLOPE STABILIZATION									
Aggregate Production and Mixture						A Sublot equals 1000 Tons			
[1] *QAE may waive after 5 sublots/shifts*	*Sampling*			*R 90*					
	Reducing			*R 76*					
[2] *Coarse Aggregate (See Section 02690.20)*	[2][3] *Sieve Analysis*			*T 27/T 11*	*1792*	*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	[3] *Fineness Modulus*			*T 27/T 11*					
	[1][2] *Wood Particles*	*TM 225*							
	[3] *Sand Equivalent*			*T 176*					
[3] *Fine Aggregate (See Section 02690.30)*	*Soundness*			*T 104*	*4000*	*See Section 4A*	*Submit to Central Lab*		*See Section 4(A)*
	Abrasion			*T 96*					
	Degradation	*TM 208*							
	Lightweight Pieces			*T 113*					
	Organics			*T 21*					
	[2] *Dry Rodded Unit Weight*			*T 19*	*1825* *1825C*	*Start of*			
	[2][3] *Bulk Specific Gravity & Absorption*			*T 84 & T 85*	*1825*	*production and*			
Portland Cement	*Material must meet the requirements of Section 02010*								
Admixtures	*Material must meet the requirements of Section 02040*								
Mixing Water	*Material must meet the requirements of Section 02020*								
Production Testing (See Section 00396.14)	[S] *Test Panel*					*Two Test Panels per Mix Design & Two Panels per days Production See Section 00396.14(a)2*			
[S] 3 Cores minimum per Panel									
Compression Test Cores	*Strength*			*T 22*	*4000C*	*1/Set Cores per Test panel*	*Submit to Central Lab*		

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	**DESCRIPTION OF TEST**	**TEST METHOD**			**FORM 734-**	**QUALITY ASSURANCE**			
		ODOT	**WAQTC**	**AASHTO**		**Contractor Quality Control**	**Independent Assurance/Verification**		
							Project Manager	**Region Quality Assurance**	**Materials Laboratory**
SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL									
TRENCH FOUNDATION (Excavation Below Grade Only)									
Selected general backfill	*Material must meet the requirements of Section 00330.13*						*Visual*		
Selected granular backfill	*Material must meet the requirements of Section 00330.14*						*Visual*		
Selected stone backfill	*Material must meet the requirements of Section 00330.15*						*Visual*		
Other approved material	*Material must meet the requirements of Section 00405.11*						*Visual*		
Establishing Maximum Density	*Density Curve*			*T 99*	*3468*	*1/Soil Type or Aggregate Gradation*			
	Bulk Specific Gravity			*T 85*	*3468*				
	Family of Curves			*R 75*	*3468FC*				
Compaction	*Nuclear Gauge* *Coarse Particle Correction*			*T 310* *T 99*	*1793S*	*1test per 300 ft. of Trench*			
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Same Frequency for all Tests (Minimums)			
						QUALITY ASSURANCE			
						Contractor Quality Control	Independent Assurance/Verification		
		ODOT	WAQTC	AASHTO			Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL (CONTINUED)									
Bedding 3/8" - 0 PCC fine aggregate (See Section 02690.30(h))	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*1792*	*1/Source or Aggregate Gradation*			
Commercial 3/4" - 0 Aggregate							*Visual*		
No. 10 - 0 Sand drainage blanket material (See Section 00360.10)	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*1792*	*1/Source or Aggregate Gradation*			
Reasonably well graded sand, maximum 3/8" to dust							*Visual*		
Commercial available 3/8"-0 or No.10 - 0 sand							*Visual*		
Continuous cradle of Commercial Grade Concrete	*Material must meet the requirements of Section 00440*						*Visual*		

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL (CONTINUED)									
Pipe Zone Material Flexible Pipe	*Use the Listed Material requirements under Bedding*								
Rigid Pipe: Aggregate Base 1" - 0 or 3/4" - 0 Aggregate (See Section 02630.10)	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27*	*1792*	*1/Source or Gradation*			
Rigid Pipe: Commercial 1"- 0 or 3/4" - 0 Aggregate							*Visual*		
Establishing Maximum Density [1] Method "A" & ODOT TM 223 for Dense Graded Base Aggregate	*Density Curve* *Bulk Specific Gravity* *Coarse Particle Correction*			[1] *T 99* *T 85* *T 99*	*3468* *3468*	*1/Source or Aggregate Gradation*			
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1 Test per 300 ft. of Trench and every 1.5 ft. of Fill*			
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL (CONTINUED)									
Trench Backfill									
Class A Backfill - Native or common Material	*Material must meet the requirements of Section 00330.43*								
Class B Backfill - 1"-0 or 3/4"-0 Granular Material	*Material must meet the requirements of Section 00641*								
Class C Backfill - Clean sand with 100% minus 1/4" material							*Visual*		
Class D Backfill - Pit run or bar run material with 3" maximum dimension and well graded from coarse to fine							*Visual*		
Class E Backfill - Controlled Low Strength Material (CLSM)	*Material must meet the requirements of Section 00442*								
Establishing Maximum Density (1) Method "A" & ODOT TM 223 for Dense Graded Base Aggregate	*Density Curve* *Bulk Specific Gravity* *Family of Curves*			*(1) T 99* *T 85* *R 75*	*3468* *3468* *3468FC*	*1/Soil Type or Aggregate Gradation*			
Compaction (C) Density testing is based on cumulative lineal feet of pipe placement.	*Nuclear Gauge* *Coarse Particle Correction*			*T 310* *T 99*	*1793S or 1793B*	*(C) 1 test per 300 ft. of Trench and every 1.5 ft. of Fill*			

Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE		(Revised November 2020)				Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00430 - SUBSURFACE DRAINS									
Granular Drain Backfill Material						A Sublot equals 1000 Tons			
	Sampling *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27*	*1792*	1/Sublot (Minimum 1/ Project)			
	Abrasion *Degradation*	*TM 208*		*T 96*	*4000*	See Section 4A	Submit To Lab		See Section 4A
Special Filter Material See Section 00430.46(a)	*Compaction*	See section 405 for compaction requirements							
SECTION 00440 - COMMERCIAL GRADE CONCRETE									
Mixture	*Sampling* *Air Content* *Density (Unit Weight)* *Yield* *Slump* *Concrete Temperature*		*TM 2*	*T 152* *T 121* *T121* *T 119* *T 309*	*3573WS or 4000 C*	*(S) 1 per each set of cylinders*			
Modifiers	*Material must meet the requirements of Section 02030*								
Admixtures	*Material must meet the requirements of Section 02040*								
Portland Cement	*Material must meet the requirements of Section 02010*								
Structural Items	*Strength*			*T 22 & T 23*	*4000C*	*(M)(S) 1 Set / Day Minimum*			
Except Visual Acceptance Items (See section 00440.14(a))	*Strength*			*T 22 & T 23*	*4000C*	*(M) (S) 1 Set/20 yd^3 Cumulative (Maximum 1 Set/day)*			
(S) 1 Set Represents a minimum of 3 Cylinders (M) Per Mix Design & Source									

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)): Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00442 - CONTROLLED LOW STRENGTH MATERIALS (CLSM)									
CLSM Mixture	*Mix Proportions* *Trial Batch* *Strength*			*T 22 & T 23*	*4000C*	1/Project or Source			
Modifiers	*Material must meet the requirements of Section 02030*								
Admixtures	*Material must meet the requirements of Section 02040*								
Portland Cement	*Material must meet the requirements of Section 02010*								
SECTION 00445 - SANITARY, STORM, CULVERT, SIPHON, AND IRRIGATION PIPE - INCLUDED WITH SECTION 00405									
Trench Work									
Excavation, bedding, pipe zone and trench backfill	See Section 00405 for pipes less than 72"								
Excavation, bedding, pipe zone and trench backfill	See Section 00510 for pipes greater than 72"								
Concrete Blocks	Material must meet the requirements of Section 00440								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE			
SECTION 00450 - STRUCTURAL PLATE SHAPED STRUCTURES									
Commercial Grade Concrete in appurtenances	*Material must meet the requirements of Section 00440*								
Trench Work									
Excavation and Backfill	*Operations must meet the requirements of Section 00510*								
Trenches in Unstable Areas									
Granular Structural Backfill	*Material must meet the requirements of Section 00510*								
Establishing Maximum Density [(1)] *Method "A"*	*Density Curve* *Bulk Specific Gravity Coarse Particle Correction*	*TM 223*		[(1)] *T 99* *T 85*	*3468 B*	*1/Aggregate Gradation and Source*			
Compaction	*Nuclear Gauge*			*T 310*	*1793 B*	*1 Test per 100 ft. and 1 ft. of fill*			
Structure Backfill (Section 00450.46)	*Material and Operation must meet the requirements of Section 00510.48(d)*								
SECTION 00459 - CAST IN PLACE CONCRETE PIPE									
Concrete	*Material must meet the requirements of Section 00540, with acceptance in accordance with Section 00540.17*								
Backfill Material	*Material must meet the requirements of Section 00405.14 and be incorporated into the project in accordance with Section 00405.46*								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00460 - PAVED CULVERT END SLOPES									
Commercial Grade Concrete	*Material must meet the requirements of Section 00440*								
SECTION 00470 - MANHOLES, CATCH BASINS AND INLETS									
Commercial Grade Concrete	*Material must meet the requirements of Section 00440*								
Base Drain Backfill	*Material must meet the requirements of Section 00470.17*								
Excavation, Backfill and Foundation Stabilization	*Material must meet the requirements of Section 00405*								
SECTION 00480 - DRAINAGE CURBS									
Commercial Grade Concrete	*Material must meet the requirements of Section 00440*								
Dense Graded ACP Mixture Level 2, (1/2")	*Material must meet the requirements of Section 00744*								

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00490 - WORK ON EXISTING SEWERS AND STRUCTURES									
Commercial Grade Concrete	*Material must meet the requirements of Section 00440*								
High Early Strength Concrete	*Material must meet the requirements of Section 00440, but cement contents adjusted according to 00490.11*								
Backfill Operations	*Backfill Excavations according to section 405*								
Filling Abandoned Pipes, Manholes and Catch Basins (See section 00490.44)									
Backfill Operations (Roadway)	*Material must meet the requirements of Section 2630*								
Establishing Maximum Density	*Density Curve*			*(1) T 99*					
(1) Method "A"	*Bulk Specific Gravity Coarse Particle Correction*	*TM 223*		*T 85*	*3468 B*	*1/Aggregate Gradation and Source*			
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1 Test per 100 ft. and every 1.5' of Fill*			
Backfill Operations Landscaped or Unimproved Roadways	*Material must meet the requirements of Section 00330.13*								
Top 1.0' of Backfill Region	*Material must meet the requirements of Section 00330.11*								
SECTION 00495 - TRENCH RESURFACING									
Resurfacing Materials	*See Section 00495.40 for Material Requirements*								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00510 - STRUCTURE EXCAVATION AND BACKFILL									
Soils, Soil/Aggregate Mixtures and Graded Aggregates						A Sublot equals 1,000 Tons			
Granular Structure Backfill (See Section 02630.10) [(1)] *Perform a minimum of 3 tests QL's required*	*Sampling* *Reducing* [(1)] *Sieve Analysis* *Fracture (Method 1)* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 335* *T 176*	*1792*	*1/Sublot (Minimum 1/Project)*			
Product Compliance	*Abrasion* *Degradation* *Plasticity Index* *Sieve Analysis*	*TM 208*		*T 96* *T 90* *T 11*	*4000*	*See Section 4C 1/Source*	*Submit to Lab*		*Minimum 1/Project or 1/Source*
Establishing Maximum Density [(2)] Method "A" & ODOT TM 223 for Dense Graded Base Aggregate	*Density Curve* *Bulk Specific Gravity* *Coarse Particle Correction*			[(2)] *T 99* *T 85* *T 99*	*3468* *3468*	*1/Soil type or Aggregate Gradation*			
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1/100 yd^3 minimum 1/project*			
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00510 - STRUCTURE EXCAVATION AND BACKFILL (CONTINUED)									
Soils, Soil/Aggregate Mixtures and Graded Aggregates						A Sublot equals 1,000 Tons			
Granular Wall Backfill (See Section 02630.11) (1) *Perform a minimum of 3 tests QL's required*	*Sampling* *Reducing* (1) *Sieve Analysis* *Fracture (Method 2)*			*R 90* *R 76* *T 27* *T 335*	*1792*	*1/Sublot (Minimum 1/Project)*			
Product Compliance	*Abrasion* *Degradation*	*TM 208*		*T 96*	*4000*	*See Section 4C 1/Source*	*Submit to Lab*		*Minimum 1/Project or 1/Source*
(2) Compaction **Note: Compaction must meet the requirements of section 00330.43c**	(2) *Deflection Testing*	*TM 158*			*1793B*	*1/Sublot (Minimum 1/Project)*			
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.								

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Same Frequency for all Tests (Minimums)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00512 - DRILLED SHAFTS									
Aggregate Production						A Sublot equals 1,000 Tons			
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
	(2)(3)(4) Sieve Analysis			*T 27/T 11*	*1792*				
(2) Perform a minimum of 3 tests, QL's required	*(4) Fineness Modulus*			*T 27/T 11*					
	(1)(3) Wood Particles	*TM 225*							
	(4) Sand Equivalent			*T 176*	*1792*				
(3) Coarse Aggregate (See Section 02690.20)	*Soundness*			*T 104*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4(A)*
	Abrasion			*T 96*					
	Degradation	*TM 208*							
(4) Fine Aggregate (See Section 02690.30)	*Lightweight Pieces*			*T 113*					
	Organics			*T 21*	*4000*				
	(3) Dry Rodded Unit Weight			*T 19*	*1825 1825C*	*Start of production and when changes in aggregate occurs*			
	(3)(4) Bulk Specific Gravity & Absorption			*T 84 & T 85*	*1825*				
Portland Cement Modifiers Admixtures	*Materials must meet the requirements of Section 02001.10*								
Drilling Slurry	*Slurry material must meet the requirements of Section 00512.14 & 00512.43(g)*								
Grout	*Material must meet the requirements of Section 02080*								
Mixing Water	*Material must meet the requirements of Section 02020*								

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00512 - DRILLED SHAFTS (CONTINUED)									
Portland Cement Concrete							*QA Testing*		
	Sampling		TM 2			(M) (S) *1 per Shaft and Test at minimum frequencies according to table 00512-1. Review specs.*	***Projects under 100 yd³ all classes*** 1/Project representing all classes of PCC ***Projects over 100 yd³ all classes*** 1/500 yd³ per class minimum 1/class		
	Slump			*T 119*	3573WS or 4000C				
	Concrete Temperature			*T 309*					
	Density (Unit Weight)			*T 121*					
	Yield			*T121*					
	Water/Cement Ratio			*T 121*					
	Strength			*T22/23*	*4000C*				

(S) *1 Set Represents a minimum of 3 Cylinders*

(M) *Per Mix Design & Source*

TABLE 00512-1 Frequency of Quality Control Testing

Minimum frequencies per Class of concrete based on daily production records.

Production	**Frequencies**
0 to 100 yd³ on a single day	1 Set each day
Quantity Over 100 yd³	
100 to 600 yd³ on a single day	1 Set per each 100 yd³ or portion thereof
over 600 yd³ on a single day	1 Set per each 200 yd³ or portion thereof after reaching 600 yd³

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD ASTM	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00535 - POST-INSTALLED ANCHOR SYSTEMS									
Resin Bonded Anchor System						A Sublot equals 50 Anchors			
Anchor Bolts, reinforcing steel and resin (Polyester, vinyl ester or epoxy)	*Materials must meet the requirements of Section 00535.10(a)*								
Anchor Installation									
Demonstration Testing (See Section 00535.45(a))	*Strength of Anchors in Concrete Elements*		*E 488*		*5189*	*One demonstration Test includes 3 anchors (Resin shall be from same lot)*	*Visual*		
Production Testing (See Section 00535.45(b))	*Strength of Anchors in Concrete Elements*		*E 488*		*5189*	*[A] 1 Anchor/Sublot or portion thereof (Minimum 1/Shift)*	*Visual per Sublot*		

[A] ***Anchor testing is required per critical element identified in the Special Provisions or Plan Drawings.***

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD ASTM	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00535 - POST-INSTALLED ANCHOR SYSTEMS (continued)									
Mechanical Anchor System						A Sublot equals 50 Anchors			
Mechanical Anchors	*Materials must meet the requirements of Section 00535.10(b)*								
Anchor Installation									
Demonstration Testing (See Section 00535.45(a))	*Strength of Anchors in Concrete Elements*		*E 488*		*5292*	*One demonstration Test includes 3 anchors*	*Visual*		
Production Testing (See Section 00535.45(b))	*Strength of Anchors in Concrete Elements*		*E 488*		*5292*	*(A) 1 Anchor/Sublot or portion thereof (Minimum 1/Shift)*	*Visual per Sublot*		

(A) ***Anchor testing is required per critical element identified in the Special Provisions or Plan Drawings.***

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00540 - STRUCTURAL CONCRETE									
Aggregate Production						A Sublot equals 1,000 Tons			
	Sampling			*R 90*					
(1) *QAE may waive after 5 sublots/shifts*	*Reducing*			*R 76*					
	(2)(3)(4) *Sieve Analysis*			*T 27/T 11*	*1792*	*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	(4) *Fineness Modulus*			*T 27/T 11*					
(2) *Perform a minimum of 3 tests, QL's required*	(1)(3) *Wood Particles*	*TM 225*							
	(4) *Sand Equivalent*			*T 176*	*1792*				
(3) *Coarse Aggregate (See Section 02690.20)*	*Soundness*			*T 104*	*4000*	*See Section 4A*	*Submit To Lab*		*See Section 4A*
	Abrasion			*T 96*					
(4) *Fine Aggregate (See Section 02690.30)*	*Degradation*	*TM 208*							
	Lightweight Pieces			*T 113*					
	Organics			*T 21*	*4000*				
	(3) *Dry Rodded Unit Weight*			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*			
	(3)(4) *Bulk Specific Gravity & Absorption*			*T 84 & T 85*	*1825*				
Portland Cement Modifiers Admixtures	*Materials must meet the requirements of Section 02001.10*								
Mixing Water	*Material must meet the requirements of Section 02020*								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00540 - STRUCTURAL CONCRETE (CONTINUED)									
Portland Cement Concrete							*QA Testing*		
	Sampling		*TM 2*						
	Air Content			*T 152*	*3573WS or 4000C*	$^{(M)}$ $^{(S)}$ *Test at minimum frequencies according to table 00540-1. Review specs.*	***Projects under 100 yd³ all classes*** 1/Project representing all classes of PCC ***Projects over 100 yd³ all classes*** 1/500 yd³ per class minimum 1/class		
	Slump			*T 119*					
	Concrete Temperature			*T 309*					
	Density (Unit Weight)			*T 121*					
	Yield			*T 121*					
	Water/Cement Ratio			*T 121*					
	Strength			*T 22 & T 23*	*4000C*				
$^{(S)}$ *1 Set Represents a minimum of 3 Cylinders*									
$^{(M)}$ *Per Mix Design & Source*									

TABLE 00540-1 Frequency of Quality Control Testing

Minimum frequencies per Class of concrete based on daily production records.

Production	**Frequencies**
0 to 100 yd³ on a single day	1 Set each day
Quantity Over 100 yd³	
100 to 600 yd³ on a single day	1 Set per each 100 yd³ or portion thereof
over 600 yd³ on a single day	1 Set per each 200 yd³ or portion thereof after reaching 600 yd³

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00556 - MULTI-LAYER POLYMER CONCRETE OVERLAY									
Aggregate Production									
	Moisture Content			*T 255/265*	*1792*	*At time of mixing the polymer resin. See 00556.10-b*			
Polymer Resin	*Material must meet the requirements of section 00556.10*								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00557 - PREMIXED POLYMER CONCRETE OVERLAYS									
Resin Primer	*Material must meet the requirements of section 00557.10*								
Polyester Resin Binder Including (Initiator, Accelerators & Inhibitors)	*Material must meet the requirements of section 00557.12 (a-c)*								
Aggregate Production									
Product Compliance (Submitt 2- 50 lb. samples of blended aggregate (00557.02)during the trial overlay)	*Bulk Specific Gravity & Absorption Moisture Content Fracture (Method 1)*			*T 84 & T 85 T 255/265 T 335*	*4000*	1/Project or Source	*Submit to Lab*		*See Section 00557.12(d)*
[(1)] *Maybe required during Production*	*Moisture Content*			*T 255/265*	*1792*	[(1)] *During the Trial Overlay Strip*			
Surface Texture Sand (see section 00557.12(e))	Sieve Analysis			T 27/11	*1792*	*1/Project or Source*			
Premixed Polymer Concrete									
	Density			*T 121*	*3573WS*	[(B)] *1/Batch*			
	Modulus of Elasticity	*TM 759*			*4000C*	[(M)] *Minimum 1 set/batch*			
[(M)] *1 set Represents a minimum of 3 (4"x8") cylinders cast per 00557.44(e)*						*1 set per 10 batches placed or minimum 1 set/day*	*Submit to Lab*		See section 00557.44(e)
[(B)] *Batch is defined "Per Mixer or Portion placed".*									

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00559 - STRUCTURAL CONCRETE OVERLAYS									
Aggregate Production						A Sublot equals 500 Tons. A minimum one per shift, whichever results in the greatest sampling frequency. (For preproduced aggregates, 1 shift shall mean 500 Tons.)			
(1) QAE may waive after 5 sublots/shifts	Sampling			R 90		1/Sublot & Start of Production		1 per 10 Sublots	
	Reducing			R 76					
(2) Perform a minimum of 3 tests, QL's required	(2)(3)(4) Sieve Analysis			T 27/T 11	1792				
	(4) Fineness Modulus			T 27/T 11					
	(4) Sand Equivalent			T 176	1792				
(3) Coarse Aggregate (See Section 02690.20)	(1)(3) Elongated Pieces	TM 229			1792	1/5 Sublots & Start of Production			
	(1)(3) Wood Particles	TM 225							
(4) Fine Aggregate (See Section 02690.30)	Abrasion			T 96	4000	See Section 4(A)	Submit to Central Lab		See Section 4(A)
	Degradation	TM 208							
	Soundness			T 104					
	Lightweight Pieces			T 113					
	Organics			T 21	4000				
	(3) Dry Rodded Unit Weight			T 19	1825 1825C	Start of production and when changes in aggregate occurs			
	(3)(4) Bulk Specific Gravity & Absorption			T 84 & T 85	1825				
Portland Cement Modifiers Admixtures	Materials must meet the requirements of Section 02001.10								
Mixing Water	Material must meet the requirements of Section 02020								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00559 - STRUCTURAL CONCRETE OVERLAYS (CONTINUED)									
Portland Cement Concrete						*A sublot equals 1 set of tests per 50 yd3*			
	Sampling		*TM 2*						
	Air Content			*T 152*	*3573WS or 4000 C*	*1 / Sublot or Minimum 1 per Shift*		*1 per 10 Sublots*	
	Slump			*T 119*					
	Concrete Temperature			*T 309*					
	Density (Unit Weight)			*T 121*					
	Yield			*T 121*					
	W/C Ratio			*T 121*					
	Strength			*T 22 & T 23*	*4000C*	*(M) (S) 1 Set Cylinders per 50yd³ Minimum 1 set/shift*		*1 Set per 500 yd³*	
(M) Per Mix Design & Source									
(S) 1 Set Represents a minimum of 3 Cylinders									
SECTION 00590 - POLYMER MEMBRANE									
Broadcast Aggregate									
	Moisture Content			*T 255/265*	*1792*	*Test at time of packaging and shipment. See Section 00590.10-c*			
	Moisture Content			*T 255/265*	*1792*	*Field Test at time of Mixing Polymer Resin. See Section 00590.10-c*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)) Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00596A - MECHANICALLY STABILIZED EARTH RETAINING WALLS									
Aggregate Production									
Gravel Leveling Pads Backfill *(See Section 02630.10)*	*Abrasion* *Degradation*	*TM 208*		*T96*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
					A Sublot equals 1,000 Tons Minimum 1/Project				
	Sampling *Reducing* *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Sublot*			
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*			
					Testing Frequency for Product Compliance per Source 1/5,000 Tons Minimum 1/Project				
(3) Modular Block Core and Drainage Backfill *(Product Compliance)*	*Soundness* *Abrasion* *Degradation* *Lightweight Pieces*	*TM 208*		*T 104* *T 96* *T 113*	*4000* *4000*	*See Section 4C & 02690*	*Submit To Lab*		*See Section 4C*
(3) (See Section 2690.20(a) thru 2690.20(d) & 2690.20(f)									
					A Sublot equals 1,000 Tons				
(3) Modular Block Core and Drainage Backfill *(1) QAE may waive after 5 sublots/shifts* *(2) Perform a minimum of 3 tests, QL's required*	*Sampling* *Reducing* *(2) Sieve Analysis* *(1) Wood Particles* *Fracture (Method 2)* *Elongated Pieces*	*TM 225* *TM 229*		*R 90* *R 76* *T 27/T 11* *T 335*	*1792* *1792*	*1/Sublot*			
Pipe Drain Backfill *(Product Compliance)* *(See Section 00430.11)*	*Abrasion* *Degradation*	*TM 208*		*T 96*	*4000*	*See Section 4C*	*Submit To Lab*		*See Section 4C*
	Sieve Analysis			*T27*	*4000*	*1/Sublot*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00596A - MECHANICALLY STABILIZED EARTH RETAINING WALLS									
Aggregate Production					Testing Frequency for Product Compliance per Source 1/5,000 Tons Minimum 1/Project				
Gabion Basket Fill *(Product Compliance)* *(See Section 00390.11(b))*	*Degradation*	*TM 208*			*4000*	*See Section 4C*	*Submit to Lab*		*See Section 4C*
	Soundness			*T 104*					
	Apparent Specific Gravity & Absorption			*T 85*	*1825*				
	Gradation						*Visual*		

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00596A - MSE RETAINING WALLS									
Aggregate Production					Testing Frequency for Product Compliance per Source 1/5,000 Tons Minimum 1/Project				
MSE Granular Wall Backfill *(Product Compliance)* *(Also reference 02630.10)*	*Abrasion* *Degradation* *Sieve Analysis* *Plasticity Index* *pH* *Resistivity* *Organic Content*	*TM 208*		*T96* *T 11* *T 90* *T 289* *T 288* *T 267*	*4000* *4000*	*See Section 4C*	*Submit to Central Lab*		*See Section 4C*
					A Sublot Equals 2,000 Tons				
MSE Granular Wall Backfill [(1)] *Perform a minimum of 3 tests, QL's required*	*Sampling* *Reducing* [(1)] *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Sublot*			
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*			
Placement Establishing Maximum Density [(1)] *Method A*	*Density Curve* *Bulk Specific Gravity* *Coarse Particle Correction*	*TM 223*		[(1)] *T 99* *T 85*	*3468* *3468*	*1/Aggregate Gradation/Per Source*			
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1/ 100 yd3 (Minimum 1/day)*			
	Deflection Testing	*TM 158*			*1793B*	*1 per layer*	Visual See section 00596A.47(c-5)		
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00596B - PREFABRICATED MODULAR RETAINING WALLS									
Aggregate Production									
Gravel Leveling Pads Backfill (See Section 02630.10)	*Abrasion* *Degradation*	*TM 208*		*T96*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
					A Sublot equals 1,000 Tons Minimum 1/Project				
	Sampling *Reducing* *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Sublot*			
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*			
					Testing Frequency for Product Compliance per Source 1/5,000 Tons Minimum 1/Project				
(3) Modular Block Core and Drainage Backfill (Product Compliance)	*Soundness* *Abrasion* *Degradation* *Lightweight Pieces*	*TM 208*		*T 104* *T 96* *T 113*	*4000* *4000*	*See Section 4C & 02690*	*Submit To Lab*		*See Section 4C*
(3) (See Section 2690.20(a) thru 2690.20(d) & 2690.20(f)					A Sublot equals 1,000 Tons				
(3) Modular Block Core and Drainage Drainage Backfill *(1) QAE may waive after 5 sublots/shifts* *(2) Perform a minimum of 3 tests, QL's required*	*Sampling* *Reducing* *(2) Sieve Analysis* *(1) Wood Particles* *Fracture (Method 2)* *Elongated Pieces*	*TM 225* *TM 229*		*R 90* *R 76* *T 27/T 11* *T 335*	*1792* *1792*	*1/Sublot*			
Pipe Drain Backfill (Product Compliance) (See Section 00430.11)	*Abrasion* *Degradation*	*TM 208*		*T 96*	*4000*	*See Section 4C*	*Submit To Lab*		*See Section 4C*
	Sieve Analysis			*T27*	*4000*	*1/Sublot*			

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
						Same Frequency for all Tests (Minimums)			
SECTION 00596B - PREFABRICATED MODULAR RETAINING WALLS									
Aggregate Production					Testing Frequency for Product Compliance per Source 1/5,000 Tons Minimum 1/Project				
Gabion Basket Fill (Product Compliance) (See Section 00390.11(b))	*Degradation*	*TM 208*			*4000*	*See Section 4C*	*Submit to Lab*		*See Section 4C*
	Soundness			*T 104*					
	Apparent Specific Gravity & Absorption			*T 85*	*1825*				
	Gradation						*Visual*		

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				(Revised November 2020)		Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00596B - PREFABRICATED MODULAR RETAINING WALLS									
Aggregate Production						Testing Frequency for Product Compliance per Source 1/5,000 Tons Minimum 1/Project			
Retaining Wall Granular Backfill (Product Compliance) (Also reference 02630.10)	*Abrasion*			*T96*	*4000*	*See Section 4C*	*Submit to Central Lab*		*See Section 4C*
	Degradation	*TM 208*							
	Sieve Analysis			*T 11*					
	Plasticity Index			*T 90*	*4000*				
						A Sublot Equals 2,000 Tons			
Retaining Wall Granular Backfill	*Sampling*			*R 90*					
	Reducing			*R 76*					
(1) Perform a minimum of 3 tests, QL's required	*(1) Sieve Analysis*			*T 27*	*1792*	*1/Sublot*			
	Sand Equivalent			*T 176*					
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*			
Placement									
Establishing Maximum Density	*Density Curve*			*(1) T 99*	*3468*	*1/Aggregate Gradation/Per Source*			
(1) Method A	*Bulk Specific Gravity*			*T 85*					
	Coarse Particle Correction	*TM 223*			*3468*				
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1/ 100 yd3 (Minimum 1/day)*			
	Deflection Testing	*TM 158*			*1793B*	*1 per layer*	Visual See section 00596B.47(b-6)		
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00596C - CAST-IN-PLACE CONCRETE RETAINING WALLS									
Aggregate Production									
Pipe Drain Backfill (Product Compliance) (See Section 00430.11)	*Abrasion Degradation*	*TM 208*		*T 96*	*4000*	*See Section 4C*	*Submit To Lab*		*See Section 4C*
	Sampling Reducing Sieve Analysis			*R 90 R 76 T27*	*4000*	*1/Sublot*			
Retaining Wall Granular Backfill					Testing Frequency for Product Compliance per Source 1/5,000 Tons Minimum 1/Project				
Retaining Wall Granular Backfill (Product Compliance) (Also reference 02630.10)	*Abrasion Degradation Sieve Analysis Plasticity Index*	*TM 208*		*T96 T 11 T 90*	*4000 4000*	*See Section 4C*	*Submit to Central Lab*		*See Section 4C*
					A Sublot Equals 2,000 Tons				
Retaining Wall Granular Backfill *(1) Perform a minimum of 3 tests, QL's required*	*Sampling Reducing (1) Sieve Analysis*			*R 90 R 76 T 27*	*1792*	*1/Sublot*			
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE		(Revised November 2020)				Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00596C - CAST-IN-PLACE CONCRETE RETAINING WALLS									
Placement									
Retaining Wall Granular Backfill									
Establishing Maximum Density	*Density Curve*			(1) *T 99*	*3468*	*1/Aggregate Gradation/Per Source*			
(1) *Method A*	*Bulk Specific Gravity*			*T 85*					
	Coarse Particle Correction	*TM 223*			*3468*				
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1/ 100 yd3 (Minimum 1/day)*			
	Deflection Testing	*TM 158*			*1793B*	*1 per layer*	Visual See section 00596C.42(f)		
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				(Revised November 2020)		Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00635 - GRID-ROLLED AGGREGATE SUBBASE									
Aggregate Subbase					*A Sublot equals 1000 Tons*				
Grading *(See 00635.10)*	*Abrasion*			*T 96*	*4000*	*1/Source*	*Submit To Central Lab*		*See Section 4(A)*
	Sampling *Reducing* *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Sublot & Start of Production*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00641 - AGGREGATE SUBBASE, BASE, AND SHOULDERS									
Aggregate Production Aggregate Subbase	*Abrasion*			*T 96*	*4000*	*See Sec. 4A*	*Submit To Central Lab*		*See Section 4(A)*
Grading *(See 00641.10(b))*	*Sampling* *Reducing* *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Project or 1/Source*	*Visual*		
Aggregate Base and Shoulders	*Abrasion* *Degradation*	*TM 208*		*T96*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
					A Sublot equals 2000 Tons				
Grading *Aggregate Base (See 02630)* *Aggregate Shoulder (See 02640)* *Open Graded Aggregate Base* *(See 02630.11)* (1) *Perform at least 3 tests* (2) *May be waived by QAE*	*Sampling* *Reducing* (1) *Sieve Analysis* (2) *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots & Start of Production*			
Placement Aggregate Base					*A Sublot equals 2000 Tons*				
Plant Mix Applications Only *Aggregate (Mixture)*	*Sampling* *Reducing* *Moisture*			*R 90* *R 76* *T 255 &* *T 265*	*1792*	*1/Sublot or minimum 1/Day*		*1 per 10 Sublots*	
Establishing Maximum Density & Optimum Moisture (Mix Design) (3) *Method A*	*Density Curve* *Coarse Particle Correction* *Bulk Specific Gravity*	*TM 223*		(3) *T 99* *T 85*	*3468 B* *3468 B*	*Each Size per Source*		*1/Project*	
Compaction	*Deflection Testing*	*TM 158*			*1793B*	*1 per Sublot*			
(D) **(Individual tests must meet Specification)**	*Nuclear Gauge*			*T310*	*1793B*	(D) *5 Tests Per Sublot*		(D) *1 (5 Tests) per 10 Sublots*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				**(Revised November 2020)**		**Same Frequency for all Tests (Minimums)**			
MATERIAL AND OPERATION	**DESCRIPTION OF TEST**	**TEST METHOD**			**FORM 734-**	**QUALITY ASSURANCE**			
						Contractor Quality Control	**Independent Assurance/Verification**		
		ODOT	**WAQTC**	**AASHTO**			**Project Manager**	**Region Quality Assurance**	**Materials Laboratory**
SECTION 00641 - AGGREGATE SUBBASE, BASE, AND SHOULDERS (Continued)									
Placement Aggregate Subbase									
Compaction	*Deflection Testing*	*TM 158*			*1793 B*	*1 per Layer*	*Visual*		

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)): Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00680 - STOCKPILED AGGREGATES									
Aggregate Base and Shoulders *(See Section 00641)*	*Abrasion*			*T 96*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
	Degradation	*TM 208*							
					A Sublot equals 2,000 Tons				
(1) Perform at least 3 tests, QL's required	*Sampling*			*R 90*	*1792*	*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
	(1) *Sieve Analysis*			*T 27*					
	(2) *Sand Equivalent*			*T 176*	*1792*				
(2) May be waived by QAE	*Fracture (Method 1)*			*T 335*	*1792*	*1/5 Sublots & Start of Production*			
Aggregate (Sanding Aggregate)									
					A Sublot equals 1000 Tons				
	Sampling			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
	Sieve Analysis			*T 27*	*1792*				
(1) May be waived by QAE	(1) *Cleanness Value*	*TM 227*							
	Abrasion			*T 96*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
	Degradation	*TM 208*							
	Lightweight Pieces			*T 113*	*4000*				
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots & Start of Production*		*1 per 10 Sublots*	
	Elongated Pieces	*TM 229*							
	Wood Particles	*TM 225*			*1792*				

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00680 - STOCKPILED AGGREGATES (CONTINUED)									
Emulsified AC Aggregate									
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*			
(See Sections 00705, 00706, 00710, 00711, 00712 and 00715)	*Abrasion*			*T 96*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
	Degradation	*TM 208*							
(1) QAE may waive after 5 sublots/shifts	*Soundness*			*T 104*					
	Lightweight Pieces			*T 113*					
	Dry Rodded Unit Weight			*T 19*	*4000*				
	Sampling			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture (Method 1)*			*T 335*	*1792*				
	(1) Wood Particles	*TM 225*							
	(1)(4) Elongated Pieces	*TM 229*							
	(2) Sieve Analysis			*T27/T 11*					
	(3) Cleanness Value	*TM 227*			*1792*				
(3) May be waived by QAE									
	Dry Rodded Unit Weight			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*			
(4) Not required for Dry Key Material									
(5) 1/5 Sublots & Start of Production									
Aggregate (Other)		*Use sampling and testing frequencies required for proposed end product use*							

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	WAQTC	AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00705 - EMULSIFIED ASPHALT PRIME COAT and EMULSIFIED ASPHALT FOG COAT									
Aggregate Production						*A sublot equals 1000 Tons. A minimum 1 per shift*			
Aggregate Cover Material	*Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27*	*1792*	*1/Sublot & Start of Production*		*1 per 10 Sublots*	
Asphalt Prime and Fog Coat *Asphalt Cement (Emulsion)*	*Compliance*			*R 66*	*4000*	*See Section 4C 1/50 Tons (Submit All)*	*Submit to Central Lab*		*1/5 QC Samples (Random)*
SECTION 00706 - EMULSIFIED ASPHALT SLURRY SEAL SURFACING									
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift whichever results in the greatest sampling frequency*			
(1) Perform at least 3 tests, QL's required	*Sampling* *Reducing* *(1) Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*1792*	*1/Sublot & Start of Production*			
Emulsified Asphalt Cement *Emulsified Asphalt* *Polymer Modified Emulsion*	*Compliance*				*4000*	*See Section 4C 1/50 Tons (Submit All)*	*Submit to Central Lab*		*1/5 QC Samples (Random)*
Additives *Mineral Filler*	*Material must meet the requirements of Section 00706.13*								
Mixture	*Material must meet the requirements of Section 00706.16*								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00710 - SINGLE APPLICATION EMULSIFIED ASPHALT SURFACE TREATMENT									
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*			
	Abrasion			*T 96*	*4000*	*See Section 4A*	*Submit to Central Lab*		*See Section 4A*
	Degradation	*TM 208*							
	Soundness			*T 104*					
	Lightweight Pieces			*T 113*					
	Dry Rodded Unit Weight			*T 19*	*4000*				
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture (Method 1)*			*T 335*	*1792*				
	(1) Wood Particles	*TM 225*							
	(1)(4) Elongated Pieces	*TM 229*							
	(2) Sieve Analysis			*T27/T 11*					
	(3) Cleanness Value	*TM 227*			*1792*				
(3) May be waived by QAE	*Dry Rodded Unit Weight*			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*			
(4) Not required for Dry Key Material *(5) 1/5 Sublots & Start of Production*									
Asphalt Cement (Emulsion)	*Compliance*			*R 66*	*4000*	*1/50 Tons Submit All*	*Submit to Lab*		*1/5 QC Samples (Random)*

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00710.10 and 710.15, Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00710.10 and 710.15 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 2500 Tons".
b. One Per sublot means "One Set of Tests Per 500 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00711 - PRE-COATED AGGREGATE ASPHALT SURFACE TREATMENT									
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift whichever results in the greatest sampling frequency*			
	Abrasion			*T 96*	*4000*	*See Section 4A*	*Submit to Central Lab*		*See Section 4A*
	Degradation	*TM 208*							
	Soundness			*T 104*					
	Lightweight Pieces			*T 113*					
	Dry Rodded Unit Weight			*T 19*	*4000*				
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture (Method 1)*			*T 335*	*1792*				
	(1) Wood Particles	*TM 225*							
	(1)(4) Elongated Pieces	*TM 229*							
	(2) Sieve Analysis			*T27/T 11*					
	(3) Cleanness Value	*TM 227*			*1792*				
(3) May be waived by QAE	*Dry Rodded Unit Weight*			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*			
(4) Not required for Dry Key Material *(5) 1/5 Sublots & Start of Production*									
Asphalt Cement	*Compliance*			*R 66*	*4000*	*1/50 Tons Submit All*	*Submit to Lab*		*1/5 QC Samples (Random)*

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00711.10 and 711.15, Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00711.10 and 711.15 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 2500 Tons".
b. One Per sublot means "One Set of Tests Per 500 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00711 - PRE-COATED AGGREGATE ASPHALT SURFACE TREATMENT (CONTINUED)									
Mixture Acceptance						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*			
Meter Method	*Readings backed by Tank Measure & Production Records*	*TM 321* [(1)] *TM 322*			*2277*	*1/Sublot or Min. 1/Day*			
	Daily				*2043 & 2401*	*Daily Production*			
[(1)] ***Required at start of production and if meters fail to meet specification***	*Cold Feed Moisture*			T 255/265	*2277*	*1/Sublot or Min. 1/Day*			
Plant Discharge Moisture	*Asphalt Mix Moist.*			*T 329*	*2277*	*1/Sublot*			
Asphalt Cement	*Compliance*			*R 66*	*4000*	*1/50 Tons Submit All*	*Submit to Lab*		*1/5 QC Samples (Random)*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
						Same Frequency for all Tests (Minimums)			
SECTION 00712 - DRY KEY EMULSIFIED ASPHALT SURFACE TREATMENT									
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*			
	Abrasion			*T 96*	*4000*	*See Section 4A*	*Submit to Central Lab*		*See Section 4A*
	Degradation	*TM 208*							
	Soundness			*T 104*					
	Lightweight Pieces			*T 113*					
	Dry Rodded Unit Weight			*T 19*	*4000*				
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture (Method 1)*			*T 335*	*1792*				
	(1) Wood Particles	*TM 225*							
	(1)(4) Elongated Pieces	*TM 229*							
	(2) Sieve Analysis			*T 27/T 11*					
	(3) Cleanness Value	*TM 227*			*1792*				
(3) May be waived by QAE	*Dry Rodded Unit Weight*			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*			
(4) Not required for Dry Key Material									
(5) 1/5 Sublots & Start of Production									
Asphalt Cement (Emulsion)	*Compliance*			*R 66*	*4000*		*Submit to Lab*		*1/5 QC Samples (Random)*

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00712.10 and 712.15, Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00712.10 and 712.15 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 2500 Tons".
b. One Per sublot means "One Set of Tests Per 500 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00715 - MULTIPLE APPLICATION EMULSIFIED ASPHALT SURFACE TREATMENT						Same Frequency for all Tests (Minimums)			
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*			
	Abrasion			*T 96*	*4000*	*See Section 4A*	*Submit to Central Lab*		*See Section 4A*
	Degradation	*TM 208*							
	Soundness			*T 104*					
	Lightweight Pieces			*T 113*					
	Dry Rodded Unit Weight			*T 19*	*4000*				
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture (Method 1)*			*T 335*	*1792*				
	(1) Wood Particles	*TM 225*							
	(1)(4) Elongated Pieces	*TM 229*							
	(2) Sieve Analysis			*T 27/T 11*					
	(3) Cleanness Value	*TM 227*			*1792*				
(3) May be waived by QAE	*Dry Rodded Unit Weight*			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*			
(4) Not required for Dry Key Material *(5) 1/5 Sublots & Start of Production*									
Asphalt Cement (Emulsion)	*Compliance*			*R 66*	*4000*	*1/50 Tons Submit All*	*Submit to Lab*		*1/5 QC Samples (Random)*

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00715.10 and 715.15, Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00715.10 and 715.15 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 2500 Tons".
b. One Per sublot means "One Set of Tests Per 500 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
						Contractor Quality Control	Independent Assurance/Verification		
		ODOT	WAQTC	AASHTO			Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00720 - COLD IN-PLACE RECYCLED ASPHALT CONCRETE PAVEMENT (CIR)									
SECTION 00721 - COLD RECYCLED EMULSIFIED ASPHALT CONCRETE PAVEMENT (CRP)									
Asphalt Cement (Emulsified Recycling Agent)	*Compliance*			*R 66*	*4000* *4000*	*See Section 4C 1/50 Tons (Submit All)*	*Submit to Central Lab*		*1/5 QC Samples (Random)*
Water	*Compliance*					*See Sec.00340.10*			
					A Sublot equals 1000 Tons				
Aggregate Production Choke Aggregate (See 00705)	*Sampling Reducing Sieve Analysis*			*R 90 R 76 T 27*	*1792*	*1/Sublot & Start of Production*		*Minimum 1/Project*	
SECTION 00725 - HOT IN-PLACE RECYCLED (HIR) ASPHALT CONCRETE PAVEMENT									
	The type of recycling agent will be listed in the Special Provisions								
Recycling Agent (See 00745.11)	*Compliance*			*R 66*	*4000*	*See Section 4C*	*Submit to Lab*		*1/5 QC Samples (Random)*
Recycling Agent	*Compliance*			*R 66*	*4000*	*1/50 Tons*	*Submit to Lab*		
Asphalt Concrete Mixture	*New Asphalt Concrete mixture will meet the requirements of Section 00744*								
SECTION 00730 - ASPHALT TACK COAT									
Tack	*Compliance*			*R 66*	*4000*	*See Section 4C 1/50 Tons*	*Submit to Lab*		*1/50 Tons or All QC Samples*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)): Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00735 - EMULSIFIED ASPHALT CONCRETE PAVEMENT									
Aggregate production									
	Abrasion			*T 96*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
	Degradation	*TM 208*							
	Soundness			*T 104*					
	Lightweight Pieces			*T 113*	*4000*				
					A Sublot equals 1000 Tons. A minimum one per shift, whichever results in the greatest sampling frequency. (For preproduced aggregates, 1 shift shall mean 1000 Tons				
(1) Perform at least 3 tests, QL's required	*Sampling*			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing			*R 76*					
	(1) Sieve Analysis			*T 27/T 11*	*1792*				
(2) May be waived by QAE	*(2) Cleanness Value*	*TM 227*							
	Fracture (Method 1 & 2)			*T 335*					
(3) QAE may waive after 5 sublots/shifts	*(3) Elongated Pieces*	*TM 229*							
	(3) Wood Particles	*TM 225*			*1792*				
Choke Aggregate	*Sieve Analysis*			*T 27*	*1792*	*1/Sublot*		*1/Project*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00735 - EMULSIFIED ASPHALT CONCRETE PAVEMENT (CONTINUED)									
Mixture Acceptance									
					A Sublot equals 1000 Tons of Mixture				
	Sampling *Reducing* *Sieve Analysis* *Moisture Content*			*R 90* *R 76* *T 27/T 11* *T 255*	 *2277* *2277*	*1/Sublot*		*1 per 10 Sublots*	
% Emulsified Asphalt [(1)] ***Required at start of production and if meters fail to meet specification***	*Meter Backed by Tank Measure Daily*	*TM 321* [(1)] *TM 322*			*2401 & 2043*	*Daily Production*			
Emulsified Asphalt Cement	*Compliance*			*R 66*	*4000*	*See Section 4C 1/Sublot (Submit All)*	*Submit to Lab*	*1 per 10 Sublots*	*1/5 QC Samples (Random)*
SECTION 00740 - COMMERCIAL ASPHALT CONCRETE PAVEMENT (CACP)									
	See Specifications when Testing is Required by Agency								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00743 - POROUS ASPHALT CONCRETE (PAC)									
Aggregate Production									
	Soundness			*T 104*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
	Abrasion			*T 96*					
	Degradation	*TM 208*							
	Lightweight Pieces			*T 113*					
	Plasticity Index			*T 90*	*4000*				
(1) QAE may waive after 5 sublots/shifts						*A Sublot equals 1000 Tons. A minimum one per shift whichever results in the greatest sampling frequency*			
(2) Not required for ATPB Mix	*Sampling*			*R 90*		*1/Sublot & Start of Production*			
(3) Coarse Agg (+ No. 4)	*Reducing*			*R 76*					
	(3)(4) Sieve Analysis			*T 27/T 11*	*1792*				
(4) Fine Agg (- No. 4)	*(1)(4) Sand Equivalent*			*T 176*					
	(1)(2)(3) Elongated Pieces	*TM 229*				*1/5 Sublots & Start of Production*			
	(3)(4) Fracture (Method 2)			*T 335*	*1792*				
	(1)(2)(3) Wood Particles	*TM 225*							

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00743.10 Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00743.10 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 5000 Tons".
b. One Per sublot means "One Set of Tests Per 1000 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00743 - POROUS ASPHALT CONCRETE (PAC) (CONTINUED)									
Mixture Acceptance - PAC with RAP									
Gradation				*A Sublot equals 1000 Tons*					
Ignition method	[1] *Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*			
Ignition method	*Sampling* *Reducing*			*R 97* *R 47*		*1/Sublot or Min. 1/Day*			
(Residual aggregate from AASHTO T 308)	*Sieve analysis*			*T 30*	*2277*	*1/Sublot or Min. 1/day*			
[1] *Submit Samples a minimum of 2 Days Prior to ACP Production*									
Asphalt Content				*A Sublot equals 1000 Tons*					
Ignition Method	[1] *Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*			
Ignition Method	*Sampling* *Reducing*			*R 97* *R 47*		*1/Sublot or Min. 1/day*			
	Asphalt Content			*T 308*	*2277*				
Meter Method	*Readings backed by Tank measure*	*TM 321* [2] *TM 322*			*2277*	*1/Sublot or Min. 1/day*			
[2] ***Required at start of production and if meters fail to meet specification***	*& Production Records Daily*				*2043 & 2401*	*Daily Production*			
Meter Method is required for PAC even when acceptance is by Ignition Method									

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)) Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00743 - POROUS ASPHALT CONCRETE (PAC) (CONTINUED)									
Mixture Acceptance - PAC without RAP									
Gradation				*A Sublot equals 1000 Tons*					
Cold Feed Method	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*2277*	*1/Sublot or Min. 1/Day*			
Ignition method	*(1) Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*			
Ignition method **(1) *Not required if Asphalt Content Accepted by Meter Method***	*Sampling* *Reducing*			*R 97* *R 47*		*1/Sublot or Min. 1/Day*			
(Residual aggregate from AASHTO T 308) *(1) Submit Samples a minimum of 2 Days Prior to ACP Production*	*Sieve analysis*			*T 30*	*2277*	*1/Sublot or Min. 1/day*			
Asphalt Content				*A Sublot equals 1000 Tons*					
Ignition Method	*(1) Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*			
Ignition Method **(2) *Required at start of production and if meters fail to meet specification***	*Sampling* *Reducing* *Asphalt Content*			*R 97* *R 47* *T 308*	*2277*	*1/Sublot or Min. 1/day*			
Meter Method	*Readings backed by Tank measure*	*TM 321* *(2) TM 322*			*2277*	*1/Sublot or Min. 1/day*			
Meter Method is required for PAC even when acceptance is by Ignition Method	*& Production Records Daily*				*2043 and 2401*	*Daily Production*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)) Contractor Quality Control	Independent Assurance/Verification Project Manager	Independent Assurance/Verification Region Quality Assurance	Independent Assurance/Verification Materials Laboratory
SECTION 00743 - POROUS ASPHALT CONCRETE (PAC) (CONTINUED)									
Mixture Acceptance - PAC with and without RAP									
Mix Design Verification Testing				*A Sublot equals 1000 Tons*					
	Cold Feed Moisture			*T255/T265*	*2277*	*1/Sublot or Min. 1/Day*			
Plant Discharge Moisture	*Asphalt Mix Moist.*			*T 329*	*2277*	*1/Sublot or Min. 1/Day*			
(1) RAP Percentage *(1) If applicable*	*(1) RAP Moisture*			*T 329*	*2277*	*1/Sublot or Min. 1/Day*			
	Readings backed by Tank measure & Production Records Daily	*TM321* *(2) TM 322*			*2401 & 2043*	*Daily Production*			
Asphalt Cement	*Compliance*			*R 66*	*4000*	*1/Sublot - See section 4C*	*Submit to Lab*		*1/5 QC Samples (Random)*

(2) Required at start of production and if meters fail to meet specification

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00744 - ASPHALT CONCRETE PAVEMENT									
Aggregate Production		*See Specifications when Aggregate Testing is Required by the Agency*							
Mixture Acceptance									
Gradation				*A Sublot equals 1000 Tons*					
Ignition method	*[1] Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*			
Ignition method	*Sampling* *Reducing*			*R 97* *R 47*		*1/Sublot or Min. 1/Day*			
(Residual aggregate from AASHTO T 308)	*Sieve analysis*			*T 30*	*2277*	*1/Sublot or Min. 1/Day*			
[1] Submit Samples a minimum of 2 Days Prior to ACP Production									
Asphalt Content				*A Sublot equals 1000 Tons*					
Ignition Method	*[1] Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*			
Ignition Method	*Sampling* *Reducing* *Asphalt Content*			*R 97* *R 47* *T 308*	*2277*	*1/Sublot or Min. 1/day*			
Mix Design Verification Testing				*A Sublot equals 1000 Tons*					
Plant Discharge Moisture	*Asphalt Mix Moist.*			*T 329*	*2277*	*1/Sublot*			
Maximum Density Test G_{mm}	*Max. Specific Gravity* *MAMD*	*TM 305*		*T 209*	*2050*	1st Sublot Daily or Min. 1/Day			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00744 - ASPHALT CONCRETE PAVEMENT (CONTINUED)									
Compaction	*Nuclear Density*			*T 355*	*1793A*	*(D) Average 10 tests per Sublot or Min. 10/Day, See Section 00744.49*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums)			
						QUALITY ASSURANCE	**Independent Assurance/Verification**		
SECTION 00745 - ASPHALT CONCRETE PAVEMENT - STATISTICAL ACCEPTANCE									
Aggregate Production	*Soundness*			*T 104*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4A*
	Abrasion			*T 96*					
	Degradation	*TM 208*							
(1) QAE may waive after 5 sublots/shifts	*Lightweight Pieces*			*T 113*					
	Plasticity Index			*T 90*	*4000*				
(2) Perform a minimum of 3 tests QL's required						*A Sublot equals 1000 Tons. A minimum one per shift whichever results in the greatest sampling frequency*			
	Sampling			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
(3) Coarse Agg (+ No. 4)	*Reducing*			*R 76*					
	(2)(3)(4) Sieve Analysis			*T 27/T 11*	*1792*				
(4) Fine Agg (- No. 4)	*(1)(4) Sand Equivalent*			*T 176*					
	(1)(3) Elongated Pieces	*TM 229*				*1/5 Sublots & Start of Production*			
Note: Sample Aggregate before Lime Treatment	*(3)(4) Fracture (Method 2)*			*T 335*	*1792*				
	(1)(3) Wood Particles	*TM 225*							
	Sieve Analysis			*T 27*	*4000*	*1 / 500 Tons*	Submit to Lab		
RAS Production	*Deleterious Materials*	*TM 335*							
(Reclaimed Asphalt Shingles)									
	Sampling			*R 90*		*1 / 50 Tons*			
	Reducing			*R 76*					
	Sieve Analysis			*T 27*	*1792*				
	Deleterious Materials	*TM 335*							

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00745.10 Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00745.10 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 5000 Tons".
b. One Per sublot means "One Set of Tests Per 1000 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	QUALITY ASSURANCE (Same Frequency for all Tests (Minimums)): Contractor Quality Control	Independent Assurance/Verification: Project Manager	Independent Assurance/Verification: Region Quality Assurance	Independent Assurance/Verification: Materials Laboratory
SECTION 00745 - ASPHALT CONCRETE PAVEMENT - STATISTICAL ACCEPTANCE (CONTINUED)									
Mixture Acceptance - ACP " With and Without RAP"				A Sublot equals 1000 Tons					
Gradation									
Ignition method	(1) Calibrate Incinerator	TM 323			2327IC	1/JMF & Each Calendar Year.		1/JMF & Each Calendar Year.	
Ignition method (Residual aggregate from AASHTO T 308)	Sampling Reducing Sieve analysis			R 97 R 47 T 30	2277	1/Sublot		1 per 10 Sublots	
(1) Submit Samples a minimum of 2 Days Prior to ACP Production									
Asphalt Content				A Sublot equals 1000 Tons					
Ignition Method	(1) Calibrate Incinerator	TM 323			2327IC	1/JMF & Each Calendar Year.		1/JMF & Each Calendar Year.	
Ignition Method	Sampling Reducing Asphalt Content			R 97 R 47 T 308	2277	1/Sublot or Min. 1/day		1 per 10 Sublots	
(2) RAP Percentage (2) If Applicable **(3) Required at start of production and if meters fail to meet specification**	Meter Method (2) RAP Moisture Cold Feed Moisture	TM 321 (3) TM 322		T 329 T255/T265	2277 2277	1/Sublot or Minimum 1/Day		1 per 10 Sublots	
<u>Meter Method is required for ACP even when acceptance is by Ignition Method</u>	Readings backed by Tank measure & Production Records Daily	TM 321 (3) TM 322			2401 ACP	Daily Production			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00745 - ASPHALT CONCRETE PAVEMENT - STATISTICAL ACCEPTANCE (CONTINUED)									
Mixture Acceptance - ACP "With and Without RAP"				*A Sublot equals 1000 Tons*					
Mix Design Verification Testing									
Fabrication	*Gyratory Specimen*	*TM 326*			*2050GV*				
Maximum Density Test	*Max. Specific Gravity*			*T 209*	*2050* **5068* **2560*	*1/Sublot & according to Section 00745.16 (b)-1-d*		*1 per 10 Sublots*	
Determination of G_{mb}	*Bulk Specific Gravity*			*T 166*	**5069*				
Stripping Susceptibility	*Tensile Strength Ratio*			*T 283*	*2050tsr*	*1/JMF See Section 00745.16 (b)-1-f*			
**Cat-II complete & submit as required, See Section 745.16(b)*									
Plant Discharge Moisture	*Asphalt Mix Moist.*			*T 329*	*2277*	*1/Sublot*			
Maximum Density Test G_{mm}	*Max. Specific Gravity*			*T 209*	*2050*	*1st Sublot Daily or Min. 1/Day*			
	MAMD	*TM 305*							
Performing Control Strip	*Control Strip*	*TM 306*			*2084* **5069*	*Develop Rolling Pattern See Specs.*			
Compaction	*Nuclear Density*			*T 355*	*1793A*	*(D) Average 5 tests per Sublot or Min. 1/Day, See Section 00745.49 (b)-2*		*(D) 1 per 10 Sublots*	
Asphalt Cement	*Compliance*			*R 66*	*4000*	*1/Sublot See Section 4C*	*Submit to Lab*	*1 per 10 Sublots*	*1/5 QC Samples (Random)*
(D) See T 355 Yellowsheet for Density Test Locations									

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00745 - ASPHALT CONCRETE PAVEMENT - STATISTICAL ACCEPTANCE (CONTINUED)									
Mixture Acceptance - ACP "With and Without RAP"				A Sublot equals 1000 Tons					
Mix Design Verification Testing									
Lime	*Material must meet the requirements of Section 2090*								
Latex	*See Special Provisions for Latex Requirements*								
Lime or Latex Treatment of Aggregate (Stockpile or Mixture Production)	[(1)] *% Hydrated Lime*	*TM 321* [(2)] *TM 322*			*2277* *2277*	*1/Sublot*		*1 per 10 Sublots*	
[(2)] ***Required at start of production and if meters fail to meet specification***	*Readings backed by Tank Measure & Production Records Daily*				*2401 ACP*	*Daily Production*			
[(1)] *If Applicable*									
[(1)] *See JMF for Details*									
Smoothness									
Certification of Profiler Equipment *Determining Profile Index* *Determining International Roughness Index*		*TM 769* *TM 770* *TM 772*				*See Special Provisions*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00754 - PLAIN CONCRETE PAVEMENT REPAIR **SECTION 00755 - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT** **SECTION 00756 - PLAIN CONCRETE PAVEMENT** **SECTION 00758 - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT REPAIR**									
Aggregate Production					*A Sublot equals 1000 Tons*				
	Sampling			*R 90*					
(1) *QAE may waive after 5 sublots/shifts*	*Reducing*			*R 76*					
	(2)(3)(4) *Sieve Analysis*			*T 27/T 11*	*1792*	*1/Sublot & Start of Production*		*1 per 10 Sublots*	
(2) *Perform a minimum of 3 tests, QL's required*	(4) *Fineness Modulus*								
	(4) *Sand Equivalent*			*T 176*	*1792*				
(3) *Coarse Aggregate (See Section 02690.20)*	(1)(3) *Wood Particles*	*TM 225*			*1792*	*1/5 Sublots & Start of Production*			
	(3) *Fracture (Method 2)*			*T 335*					
	(1)(3) *Elongated Pieces*	*TM 229*			*1792*				
(4) *Fine Aggregate (See Section 02690.30)*	*Abrasion*			*T 96*	*4000*	*See Section 4A & 02690*	*Submit to Central Lab*		*See Section 4A*
	Degradation	*TM 208*							
	Soundness			*T 104*					
	Lightweight Pieces			*T 113*					
	Organics			*T 21*	*4000*				
	(3) *Dry Rodded Unit Weight*			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*			
	(3)(4) *Bulk Specific Gravity & Absorption*			*T 84 & T 85*	*1825*				

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Contractor Quality Control	Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE	Independent Assurance/Verification		
SECTION 00754 - PLAIN CONCRETE PAVEMENT REPAIR **SECTION 00755 - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT** **SECTION 00756 - PLAIN CONCRETE PAVEMENT** **SECTION 00758 - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT REPAIR** **(CONTINUED)**									
Portland Cement Concrete						*A Sublot equals 1000 lane feet of slip formed pavement or 100 yd^3 of non-slip formed PCC*			
Portland Cement *Modifiers* *Admixtures*	*Materials must meet the requirements of Section 02001.10*								
Curing Compounds	*Material must meet the requirements of Section 02050*								
Mixing Water	*Material must meet the requirements of Section 02020*								
(S) 1 Set Represents a minimum of 3 Cylinders	*Sampling* *Air Content* *Slump* *Density (Unit Weight)* *Yield* *Concrete Temperature* *Water/Cement Ratio* *Batching*		*TM 2* .	 *T 152* *T 119* *T 121* *T 121* *T 309* *T 121*	*3573WS or 4000C*	*1/ sublot or Minimum 1 per Day*		*1 per 10 Sublots*	
(M) Per Mix Design & Source	*Strength*			*T 22 & T 23*	*4000C*	*(M) (S) 1 Set of Cylinders per Sublot or Minimum 1 set per Day*		*1 per 10 Sublots*	
Smoothness									
Certification of Profiler Equipment		*TM 769*				*See Special Provisions*			
Determining IRI with an Inertial Laser Profiler		*TM 772*							
Thickness of Pavement	*Sticking Measure*	*TM 775*				*See Specs*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00850 - COMMON PROVISIONS FOR PAVEMENT MARKINGS									
Placement Evaluation "Retroreflectivity"									
In-Place *Procedure evaluates Durable and High Performance Pavement Markings*	*Evaluation of Retroreflectivity Using Hand-Operated Instrument*	*TM 777*			*4101 thru 4105*	*See Special Provisions and Test Procedure for Testing Frequency*			

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Contractor Quality Control	Independent Assurance/Verification: Project Manager	Region Quality Assurance	Materials Laboratory
						Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE			
SECTION 00921 - MAJOR SIGN SUPPORT DRILLED SHAFTS									
Aggregate Production						A Sublot equals 1,000 Tons			
[1] *QAE may waive after 5 sublots/shifts*	*Sampling*			*R 90*					
	Reducing			*R 76*					
[2] *Perform a minimum of 3 tests, QL's required*	[2][3][4] *Sieve Analysis*			*T 27/T 11*	*1792*	*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	[4] *Fineness Modulus*			*T 27/T 11*					
	[1][3] *Wood Particles*	*TM 225*							
	[4] *Sand Equivalent*			*T 176*	*1792*				
[3] *Coarse Aggregate (See Section 02690.20)*	*Soundness*			*T 104*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4(A)*
	Abrasion			*T 96*					
[4] *Fine Aggregate (See Section 02690.30)*	*Degradation*	*TM 208*							
	Lightweight Pieces			*T 113*					
	Organics			*T 21*	*4000*				
	[3] *Dry Rodded Unit Weight*			*T 19*	*1825* / *1825C*	*Start of production and when changes in aggregate occurs*			
	[3][4] *Bulk Specific Gravity & Absorption*			*T 84 & T 85*	*1825*				
Portland Cement Modifiers Admixtures	*Materials must meet the requirements of Section 02001.10*								
Drilling Slurry	*Slurry material must meet the requirements of Section 00921.14 & 00921.43(g)*								
Grout	*Material must meet the requirements of Section 02080*								
Mixing Water	*Material must meet the requirements of Section 02020*								

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — QUALITY ASSURANCE: Contractor Quality Control	Independent Assurance/Verification: Project Manager / Region Quality Assurance / Materials Laboratory
SECTION 00921 - MAJOR SIGN SUPPORT DRILLED SHAFTS							
Portland Cement Concrete							***QA Testing***
	Sampling *Slump* *Concrete Temperature* *Density (Unit Weight)* *Yield* *Water/Cement Ratio*		*TM 2*	*T 119* *T 309* *T 121* *T 121* *T 121*	*3573WS or 4000C*	(M) (S) *1 per Shaft and Test at minimum frequencies according to table 00512-1. Review specs.*	***Projects under 100 yd³ all classes*** 1/Project representing all classes of PCC ***Projects over 100 yd³ all classes*** 1/500 yd³ per class minimum 1/class
	Strength			*T 22 & T 23*	*4000C*		
(S) *1 Set Represents a minimum of 3 Cylinders* (M) *Per Mix Design & Source*							

TABLE 00512-1 Frequency of Quality Control Testing

Minimum frequencies per Class of concrete based on daily production records.

Production	**Frequencies**
0 to 100 yd³ on a single day	1 Set each day
Quantity Over 100 yd³	
100 to 600 yd³ on a single day	1 Set per each 100 yd³ or portion thereof
over 600 yd³ on a single day	1 Set per each 200 yd³ or portion thereof after reaching 600 yd³

INSERT TAB

SECTION 5
Field Tested Materials
Guide (Type D&E Projects)

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00330-EARTHWORK								
(See Sec. 330.16(a)) Soil and Soil/Aggregate Mixtures	*Gradation*					*Contractor Furnished Testing*	***Requires Signed and Notarized Statement of Compliance From Contractor For All Items Under Section 00300***	*Review Documentation for Acceptance*
Establishing Maximum Density (for Compaction)	*Density Curve*			*T 99*	*3468*	*1/Soil type*		
	Bulk Specific Gravity			*T 85*	*3468*			
	Family of Curves			*R 75*	*3468FC*		*Visual*	
Compaction	*Deflection Testing*	*TM 158*			*1793S*	*1 Test per 3 ft. in depth*		
	Nuclear Gauge			*T 310*	*1793S*	*See Table 00330-1 Below*		*Review Documentation for Acceptance*
	Coarse Particle Correction			*T 99*				
	Deflection Testing	*TM 158*			*1793S*		*Visual*	

TABLE 00330-1 Frequency of Quality Control Testing

Individual Areas	Under 3500 yd^2 or yd^3	Over 3500 yd^2 or yd^3
Existing Ground Surface	1 test per 1000 yd^2	1 test per 3000 yd^2
Embankments	1 test per 500 yd^3	1 test per 3000 yd^3
Excavations and Finished Subgrade	1 test per 1000 yd^2	1 test per 3000 yd^2

MATERIAL AND OPERATION	DESCRIPTION OF TEST	ODOT	WAQTC	AASHTO	FORM 734-	Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
Stone Embankment Material (See Sec. 330.16(a))	*Gradation*					*Contractor Furnished Testing*	*Visual*	*Review Documentation for Acceptance*
Compaction	*Deflection Testing*	*TM 158*			*1793S*	*1 per Layer*		
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.							
Imported Topsoil (See Section 01040.14(b))	*Compliance*				*4000*	*Contractor Testing 1/Source & 1/Soil type*	*Visual*	*Review Documentation for Acceptance*

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00331 - SUBGRADE STABILIZATION								*Review Documentation for Acceptance*
Aggregate backfill	*Material must meet the requirements of Section 00331.10*					*Contractor Testing*	*Visual*	
Water	*Material must meet the requirements of Section 00340*					*Contractor Testing*		
Compaction	*Material must meet the requirements of Section 00331*					*Visual*		
SECTION 00332 - SURFACING STABILIZATION								
Aggregate Base	*Material must meet the requirements of Section 00332.10*					*Visual*	*Visual*	
Compaction	*Material must meet the requirements of Section 00332*							
SECTION 00333 - AGGREGATE DITCH LINING								
Aggregate	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*1792*	*1/Project or 1/Source*	*Visual*	*Review Documentation for Acceptance*

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00344 -TREATED SUBGRADE								
Granular Quicklime	*Sieve Analysis* *Calcium Hydroxide Content in lime*			*T 27* *T 219*	*4000*	*Contractor Testing 1/Source*	*Manufacture Compliance Statement*	*Review Documentation for Acceptance*
Hydrated Lime Calcium Chloride Sodium Chloride	*Materials must meet the requirements of Section 00344.10 and Test Results Certificate provided according to Section 00165.35(a)*						*Manufacture Compliance Statement*	
Portland Cement	*Material must meet the requirements of Section 02010*							
Water	*Material must meet the requirements of Section 00340*							
Establishing Maximum Density (for Compaction)	*Density Curve* *Maximum Specific Gravity*				*3468*	*See Special Provisions and Table 00344-1 Below*	*Visual*	
Compaction	*Deflection Testing*	*TM 158*			*1793S*			
	Deflection Testing *Nuclear Gauge* *Coarse Particle Correction*	*TM 158*		*T 310* *T 99*	*1793S*			*Review Documentation for Acceptance*

Same Frequency for all Tests (Minimums)

TABLE 00344-1 Frequency of Quality Control Testing

Individual Areas	Under 3500 yd^2	Over 3500 yd^2
Finished Subgrade	1 test per 1000 yd^2	1 test per 3000 yd^2

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00360 - Drainage Blankets								
						A sublot equals 1000 Tons		
Granular Drainage Blanket	*Sampling*			*R 90*		*1/sublot minimum 1/Source per Project*	*Visual*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
	Gradation			*T 27/T 11*	*1792*			
Sand Drainage Blanket	*Sampling*			*R 90*				
	Reducing			*R 76*				
	Gradation			*T 27/T 11*	*1792*			
Establishing Maximum Density (for Compaction)	*Density Curve*			*T 99*	*3468*	*1/Source and Type*		
	Bulk Specific Gravity			*T 85*	*3468*			
Compaction	*Deflection Testing*	*TM 158*			*1793S*	*1 Test per 3 ft. in depth*		
	Deflection Testing	*TM 158*			*1793S*	*See Table 00360-1 Below*	*Visual*	*Review Documentation for Acceptance*
	Nuclear Gauge			*T 310*				
	Coarse Particle Correction			*T 99*	*1793S*			

TABLE 00360-1 Frequency of Quality Control Testing

Individual Areas	Under 3500 yd²	Over 3500 yd²
Existing Ground Surface	1 test per 1000 yd²	1 test per 3000 yd²
Finished Surfaces	1 test per 1000 yd²	1 test per 3000 yd²

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				(Revised November 2020)		Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00390 - RIPRAP PROTECTION								
Fill Material & Riprap	*Gradation* *See 00390.11(c)1*					*Contractor Furnished Testing*	*Visual*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Soundness			*T 104*	*4000*	*Contractor Furnished Testing*	*Provide History of Passing Tests*	
	Apparent Specific Gravity & Absorption			*T 85*	*1825*			
Filter Blanket	*Gradation* *See 00390.13*					*Contractor Testing When Required*	*Visual*	
Grouted Riprap								
Sand	*Sampling*			*R 90*		*1/Project*	*Visual*	
	Reducing			*R 76*				
	Sieve Analysis			*T 27/T 11*	*1792*			
	Soundness *Lightweight Pieces*			*T 104* *T 113*	*4000*	*Contractor Furnished Testing*	*Provide History of Passing Tests*	
Portland Cement	*Material must meet the requirements of Section 02010*							*Review Documentation for Acceptance*

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00396 -SHOTCRETE SLOPE STABILIZATION								
Aggregate Production and Mixture						*A Sublot equals 1000 Tons*		
[1] QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1/Sublot & Start of Production*	*Provide History of Passing Tests*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
	[2][3] Sieve Analysis			*T 27/T 11*	*1792*			
	[3] Fineness Modulus			*T 27/T 11*				
[2] Coarse Aggregate (See Section 02690.20)	*[1][2] Wood Particles*	*TM 225*						
	[3] Sand Equivalent			*T 176*				
[3] Fine Aggregate (See Section 02690.30)	*Soundness*			*T 104*	*4000*	*Contractor Furnished Testing*	*Provide History of Passing Tests*	
	Abrasion			*T 96*				
	Degradation	*TM 208*						
	Lightweight Pieces			*T 113*				
	Organics			*T 21*				
	[2] Dry Rodded Unit Weight			*T 19*		*Start of production and when changes in aggregate occurs*	*Start of production and when changes in aggregate occurs*	
	[2][3] Bulk Specific Gravity & Absorption			*T 84 & T 85*				
Portland Cement	*Material must meet the requirements of Section 02010*							
Admixtures	*Material must meet the requirements of Section 02040*							
Mixing Water	*Material must meet the requirements of Section 02020*							
Production Testing (See Section 00396.14) [S] 3 Cores minimum per Panel	*[S] Test Panel*					*Two Test Panels per Mix Design & Two Panels per days Production See Section 00396.14(a)2*	*Two Test Panels per Mix Design & Two Panels per days Production See Section 00396.14(a)2*	
Compression Test Cores	*Strength*			*T 22*	*4000C*	*1/Set Cores per Test panel*	*1/Set Cores per Test panel*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

<table>
<tr><th colspan="6">FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)</th><th colspan="3">Same Frequency for all Tests (Minimums)</th></tr>
<tr><th rowspan="2">MATERIAL AND OPERATION</th><th rowspan="2">DESCRIPTION OF TEST</th><th colspan="3">TEST METHOD</th><th rowspan="2">FORM 734-</th><th colspan="2">Quality Control</th><th>Quality Assurance</th></tr>
<tr><th>ODOT</th><th>WAQTC</th><th>AASHTO</th><th>Contractor Quality Control Type D</th><th>Contractor Quality Control Type E</th><th>Project Manager Type D & E</th></tr>
<tr><td colspan="6">SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL</td><td></td><td rowspan="5">Requires Signed and Notarized Statement of Compliance From Contractor For All Items Under Section 00400</td><td rowspan="6">Review Documentation for Acceptance</td></tr>
<tr><td>TRENCH FOUNDATION (Excavation Below Grade Only)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Selected general backfill</td><td colspan="5">Material must meet the requirements of Section 00330.13</td><td rowspan="4">Contractor Furnished Testing</td></tr>
<tr><td>Selected granular backfill</td><td colspan="5">Material must meet the requirements of Section 00330.14</td></tr>
<tr><td>Selected stone backfill</td><td colspan="5">Material must meet the requirements of Section 00330.15</td></tr>
<tr><td>Other approved material</td><td colspan="5">Material must meet the requirements of Section 00405.11</td><td>Visual</td></tr>
<tr><td>Establishing Maximum Density</td><td>Density Curve</td><td></td><td></td><td>T 99</td><td>3468</td><td rowspan="2">1/Soil Type or Aggregate Gradation</td><td rowspan="2">Visual</td><td rowspan="4">Review Documentation for Acceptance</td></tr>
<tr><td></td><td>Bulk Specific Gravity</td><td></td><td></td><td>T 85</td><td>3468</td></tr>
<tr><td></td><td>Family of Curves</td><td></td><td></td><td>R 75</td><td>3468FC</td><td></td><td></td></tr>
<tr><td>Compaction</td><td>Nuclear Gauge
Coarse Particle Correction</td><td></td><td></td><td>T 310
T 99</td><td>1793S</td><td>1 Test per 300 ft. of Trench</td><td>Visual</td></tr>
</table>

Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL (CONTINUED)								
Bedding 3/8" - 0 PCC fine aggregate (See Section 02690.30(h))	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*1792*	*Contractor Provided Testing*	*Visual*	*Review Documentation for Acceptance*
Commercial 3/4" - 0 Aggregate						*Contractor Provided Testing*	*Visual*	
No. 10 - 0 Sand drainage blanket material (See Section 00360.10)	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*1792*	*Contractor Provided Testing*	*Visual*	
Reasonably well graded sand, maximum 3/8" to dust						*Contractor Provided Testing*	*Visual*	
Commercial available 3/8"-0 or No.10 - 0 sand						*1 per Sublot*	*Visual*	
Continuous cradle of Commercial Grade Concrete	*Material must meet the requirements of Section 00440*					*Contractor Provided Testing*	*Visual*	*Review Documentation for Acceptance*

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL (CONTINUED)								
Pipe Zone Material Flexible Pipe	*Use the Listed Material requirements under Bedding*							
Rigid Pipe: Aggregate Base 1" - 0 or 3/4" - 0 Aggregate (See Section 02630.10)	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27*	*1792*	*Contractor Provided Testing*	Visual	*Review Documentation for Acceptance*
Rigid Pipe: Commercial 1"- 0 or 3/4" - 0 Aggregate						*Contractor Provided Testing*	*Visual*	
Establishing Maximum Density (1) Method "A" & ODOT TM 223 for Dense Graded Base Aggregate	*Density Curve* *Bulk Specific Gravity* *Coarse Particle Correction*			(1) *T 99* *T 85* *T 99*	*3468* *3468*	*1/Source or Aggregate Gradation*	*Visual*	
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1 test per 100 ft. of Trench and every 2.0 ft. of Fill*	*Visual*	*Review Documentation for Acceptance*

Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)		
						Quality Control		Quality Assurance
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	WAQTC	AASHTO	FORM 734-	Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL (CONTINUED)								
Trench Backfill								
Class A Backfill - Native or common Material	*Material must meet the requirements of Section 00330.43*					*Contractor Provided Testing*	*Visual*	*Review Documentation for Acceptance*
Class B Backfill - 1"-0 or 3/4"-0 Granular Material	*Material must meet the requirements of Section 00641*							
Class C Backfill - Clean sand with 100% minus 1/4" material								
Class D Backfill - Pit run or bar run material with 3" maximum dimension and well graded from coarse to fine								
Class E Backfill - Controlled Low Strength Material (CLSM)	*Material must meet the requirements of Section 00442*					*Contractor Provided Testing*	*Visual*	
Establishing Maximum Density (1) Method "A" & ODOT TM 223 for Dense Graded Base Aggregate	*Density Curve* *Bulk Specific Gravity* *Family of Curves*			*(1) T 99* *T 85* *R 75*	*3468* *3468* *3468FC*	*1/Soil Type or Aggregate Gradation*		
Compaction (C) Density testing is based on cumulative lineal meters or feet of pipe placement.	*Nuclear Gauge* *Coarse Particle Correction*			*T 310* *T 99*	*1793S or 1793B*	*(C) 1 test per 100 ft. of Trench and every 2.0 ft. of Fill*	*Visual*	*Review Documentation for Acceptance*
	Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.							

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00430 - SUBSURFACE DRAINS								
						A Sublot equals 1000 Tons		
Granular Drain Backfill Material	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27*	*1792*	*Contractor Provided Testing*	*Visual*	Review Documentation for Acceptance
	Abrasion *Degradation*	*TM 208*		*T 96*	*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	
Special Filter Material See Section 00430.46(a)	*Compaction*	See section 405 for compaction requirements						
SECTION 00440 - COMMERCIAL GRADE CONCRETE								
Mixture	*Sampling* *Air Content* *Density (Unit Weight)* *Slump* *Concrete Temperature*		*TM 2*	*T 152* *T 121* *T 119* *T 309*	*3573WS or 4000C*	^(S)^ *1 per each set of cylinders*	*Contractor Provided Testing*	
Modifiers	*Material must meet the requirements of Section 02030*						*Manufacture Compliance Statement*	
Admixtures	*Material must meet the requirements of Section 02040*							
Portland Cement	*Material must meet the requirements of Section 02010*							
Structural Items	*Strength*			*T 22 & T 23*	*4000C*	^(M) (S)^ *1 Set / Day Minimum*	*Contractor Provided Testing*	
Except Visual Acceptance Items (See section 00440.14(a))	*Strength*			*T 22 & T 23*	*4000C*	^(M) (S)^ *1 Set/20 yd³* *Cumulative* *(Maximum 1 Set/day)*	*Contractor Provided Testing*	Review Documentation for Acceptance
^(S)^ 1 Set Represents a minimum of 3 Cylinders								
^(M)^ Per Mix Design & Source								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				(Revised November 2020)		Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	**DESCRIPTION OF TEST**	**TEST METHOD**			**FORM 734-**	**Quality Control**		**Quality Assurance**
		ODOT	**WAQTC**	**AASHTO**		**Contractor Quality Control Type D**	**Contractor Quality Control Type E**	**Project Manager Type D & E**
SECTION 00442 - CONTROLLED LOW STRENGTH MATERIALS (CLSM)								
CLSM Mixture	*Mix Proportions* *Trial Batch* *Strength*			*T 22 & T 23*	*4000C*	1/Project or Source	*Contractor Provided Testing*	Review Documentation for Acceptance
Modifiers	*Material must meet the requirements of Section 02030*						*Manufacture Compliance Statement*	Review Documentation for Acceptance
Admixtures	*Material must meet the requirements of Section 02040*							
Portland Cement	*Material must meet the requirements of Section 02010*							
SECTION 00445 - SANITARY, STORM, CULVERT, SIPHON, AND IRRIGATION PIPE - INCLUDED WITH SECTION 00405								
Trench Work								
Excavation, bedding, pipe zone and trench backfill	See Section 00405 for pipes less than 72"					*Contractor Provided Testing*	*Contractor Provided Testing*	Review Documentation for Acceptance
Excavation, bedding, pipe zone and trench backfill	See Section 00510 for pipes greater than 72"							
Concrete Blocks	Material must meet the requirements of Section 00440							

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00450 - STRUCTURAL PLATE PIPE, PIPE ARCH AND ARCH								
Commercial Grade Concrete in appurtenances	*Material must meet the requirements of Section 00440*					*Contractor Provided Testing*	*Contractor Provided Testing*	Review Documentation for Acceptance
Trench Work								
Excavation and Backfill	*Operations must meet the requirements of Section 00510*							
Trenches in Unstable Areas								
Granular Structural Backfill	*Material must meet the requirements of Section 00510*						*Visual*	
Establishing Maximum Density [1] *Method "A"*	*Density Curve* *Bulk Specific Gravity Coarse Particle Correction*	*TM 223*		[1] *T 99* *T 85*	*3468 B*	*Contractor Provided Testing*	*Visual*	
Compaction	*Nuclear Gauge*			*T 310*	*1793 B*	*Contractor Provided Testing*	*Visual*	Review Documentation for Acceptance
Structure Backfill (Section 00450.46)	*Material and Operation must meet the requirements of Section 00510.48(d)*							
SECTION 00459 - CAST IN PLACE CONCRETE PIPE								
Concrete	*Material must meet the requirements of Section 00540, with acceptance in accordance with Section 00540.17*					*Contractor Provided Testing*	*Contractor Provided Testing*	Review Documentation for Acceptance
Backfill Material	*Material must meet the requirements of Section 00405.14 and be incorporated into the project in accordance with Section 00405.46*					*Contractor Provided Testing*	*Visual*	

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Same Frequency for all Tests (Minimums): Quality Control – Contractor Quality Control Type D	Quality Control – Contractor Quality Control Type E	Quality Assurance – Project Manager Type D & E
SECTION 00460 - PAVED CULVERT END SLOPES								
Commercial Grade Concrete	*Material must meet the requirements of Section 00440*					*Contractor Provided Testing*	*Contractor Provided Testing*	Review Documentation for Acceptance
SECTION 00470 - MANHOLES, CATCH BASINS AND INLETS								
Commercial Grade Concrete	*Material must meet the requirements of Section 00440*					*Contractor Provided Testing*	*Visual*	Review Documentation for Acceptance
Base Drain Backfill	*Material must meet the requirements of Section 00470.17*							
Excavation, Backfill and Foundation Stabilization	*Material must meet the requirements of Section 00405*							
SECTION 00480 - DRAINAGE CURBS								
Commercial Grade Concrete	*Material must meet the requirements of Section 00440*					*Contractor Provided Testing*	*Visual*	Review Documentation for Acceptance
Dense Graded HMAC Mixture Level 2, (1/2")	*Material must meet the requirements of Section 00744*							

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Same Frequency for all Tests (Minimums)		
						Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00490 - WORK ON EXISTING SEWERS AND STRUCTURES								
Commercial Grade Concrete	*Material must meet the requirements of Section 00440*					*Contractor Provided Testing*	*Visual*	Review Documentation for Acceptance
High Early Strength Concrete	*Material must meet the requirements of Section 00440, but cement contents adjusted according to 00490.11*							
Backfill Operations	*Backfill Excavations according to section 405*							
Filling Abandoned Pipes, Manholes and Catch Basins (See section 00490.44)								
Backfill Operations (Roadway)	*Material must meet the requirements of Section 2630*					*Contractor Provided Testing*	*Visual*	Review Documentation for Acceptance
Establishing Maximum Density	*Density Curve*			(1) *T 99*				
(1) *Method "A"*	*Bulk Specific Gravity Coarse Particle Correction*	*TM 223*		*T 85*	*3468 B*			
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1 Test per 100 ft. and every 1.5' of Fill*	*Visual*	
Backfill Operations Landscaped or Unimproved Roadways	*Material must meet the requirements of Section 00330.13*					Contractor Provided Testing	*Visual*	Review Documentation for Acceptance
Top 1.0' of Backfill Region	*Material must meet the requirements of Section 00330.11*							
SECTION 00495 - TRENCH RESURFACING								
Resurfacing Materials	*See Section 00495.40 for Material Requirements*					Contractor Provided Testing	*Visual*	Review Documentation for Acceptance

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00510 - STRUCTURE EXCAVATION AND BACKFILL								
Soils, Soil/Aggregate Mixtures and Graded Aggregates								
					A Sublot equals 1000 Tons			
Granular Structure Backfill (See Section 02630.10)	*Sampling*			*R 90*		*1/Sublot (Minimum 1/Project)*	***Requires Signed and Notarized Statement of Compliance From Contractor For All Items Under Section 00500***	*Review Documentation for Acceptance*
	Reducing			*R 76*				
[(1)] *Perform a minimum of 3 tests QL's required*	[(1)] *Sieve Analysis*			*T 27*	*1792*			
	Fracture (Method 1)			*T 335*				
	Sand Equivalent			*T 176*				
Product Compliance	*Abrasion*			*T 96*	*4000*	*Contractor Provided Testing*	*Minimum 1 per Project*	
	Degradation	*TM 208*						
	Plasticity Index			*T 90*				
	Sieve Analysis			*T 11*				
Establishing Maximum Density	*Density Curve*			[(2)] *T 99*	*3468*	*1/Soil type or Aggregate Gradation*	*Visual*	
[(2)] Method "A" & ODOT TM 223 for Dense Graded Base Aggregate	*Bulk Specific Gravity*			*T 85*				
	Coarse Particle Correction			*T 99*	*3468*			
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*Min of 1 per lift*	*Visual*	*Review Documentation for Acceptance*

Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00510 - STRUCTURE EXCAVATION AND BACKFILL (CONTINUED)								
Soils, Soil/Aggregate Mixtures and Graded Aggregates						A Sublot equals 1,000 Tons		
Granular Wall Backfill (See Section 02630.11)	*Sampling*			*R 90*				
	Reducing			*R 76*				
(1) *Perform a minimum of 3 tests QL's required*	(1) *Sieve Analysis*			*T 27*	*1792*	*1/Sublot (Minimum 1/Project)*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
	Fracture (Method 2)			*T 335*				
Product Compliance	*Abrasion*			*T 96*	*4000*	*Contractor Provided Testing*	*Minimum 1 per Project*	
	Degradation	*TM 208*						
(2) Compaction	(2) *Deflection Testing*	*TM 158*			*1793B*	*1/Sublot (Minimum 1/Project)*	*Visual*	*Review Documentation for Acceptance*
Note: Compaction must meet the requirements of section 00330.43c	***Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.***							

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00512 - DRILLED SHAFTS								
Aggregate Production						A Sublot equals 1000 Mg or 1000 Tons		
[1] QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*				*Review Documentation for Acceptance*
	Reducing			*R 76*				
[2] Perform a minimum of 3 tests QL's required	[2][3][4] *Sieve Analysis*			*T 27/T 11*	*1792*	*Contractor Provided Testing*	*Contractor Provided Testing*	
	[4] *Fineness Modulus*			*T 27/T 11*				
	[1][3] *Wood Particles*	*TM 225*						
	[4] *Sand Equivalent*			*T 176*				
[3] *Coarse Aggregate (See Section 02690.20)*	*Soundness*			*T 104*	*4000*	*Contractor Provided Testing*	*Contractor Provided Testing*	
	Abrasion			*T 96*				
	Degradation	*TM 208*						
[4] *Fine Aggregate (See Section 02690.30)*	*Lightweight Pieces*			*T 113*				
	Organics			*T 21*	*4000*			
	[3] *Dry Rodded Unit Weight*			*T 19*	*1825 1825C*	*Minimum of 1 per Project*	*Minimum of 1 per Project*	
	[3][4] *Bulk Specific Gravity & Absorption*			*T 84 & T 85*	*1825*			
Portland Cement Modifiers Admixtures	*Materials must meet the requirements of Section 02001.10*						*Manufacture Compliance Statement*	
Drilling Slurry	*Slurry material must meet the requirements of Section 00512.14 & 00512.43(g)*						*Contractor Provided Testing*	
Grout	*Material must meet the requirements of Section 02080*						*Manufacture Compliance Statement*	*Review Documentation for Acceptance*
Mixing Water	*Material must meet the requirements of Section 02020*							

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) – Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00512 - DRILLED SHAFTS (CONTINUED)								
Portland Cement Concrete								
	Sampling *Slump* *Concrete Temperature* *Density (Unit Weight)* *Yield* *Water/Cement Ratio*		*TM 2*	*T 119* *T 309* *T 121* *T 121* *T 121*	*3573WS or 4000C*	(M) (S) *1 per Shaft and Test at minimum frequencies according to table 00512-1. Review specs.*	(M) (S) *1 per Shaft and Test at minimum frequencies according to table 00512-1. Review specs.*	*Review Documentation for Acceptance*
	Strength			T 22 & T 23	*4000C*			

(S) 1 Set Represents a minimum of 3 Cylinders

(M) Per Mix Design & Source

TABLE 00512-1 Frequency of Quality Control Testing

Minimum frequencies per Class of concrete based on daily production records.

Production	**Frequencies**
0 to 100 yd^3 on a single day	1 Set each day
Quantity Over 100 yd^3	
100 to 600 yd^3 on a single day	1 Set per each 100 yd^3 or portion thereof
over 600 yd^3 on a single day	1 Set per each 200 yd^3 or portion thereof after reaching 600 yd^3

FIELD TESTED MATERIALS ACCEPTANCE GUIDE		(Revised November 2020)				Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	ASTM	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00535 - POST-INSTALLED ANCHOR SYSTEMS								
Resin Bonded Anchor System						A Sublot equals 50 Anchors		
Anchor Bolts, reinforcing steel and resin (Polyester, vinyl ester or epoxy)	*Materials must meet the requirements of Section 00535.10*							
Anchor Installation								
Demonstration Testing (See Section 00535.45(a))	*Strength of Anchors in Concrete Elements*		*E 488*		*5189*	*One demonstration Test includes 3 anchors (Resin shall be from same lot)*		*Visual*
Production Testing (See Section 00535.45(b))	*Strength of Anchors in Concrete Elements*		*E 488*		*5189*	*(A) 1 Anchor/Sublot or portion thereof (Minimum 1/Shift)*		*Visual per Sublot*

(A) ***Anchor testing is required per critical element identified in the Special Provisions or Plan Drawings.***

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Same Frequency for all Tests (Minimums)		
						Quality Control		Quality Assurance
		ODOT	ASTM	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00535 - POST-INSTALLED ANCHOR SYSTEMS (continued)								
Mechanical Anchor System								
						A Sublot equals 50 Anchors		
Mechanical Anchors	*Materials must meet the requirements of Section 00535.10(b)*							
Anchor Installation								
Demonstration Testing (See Section 00535.45(a))	*Strength of Anchors in Concrete Elements*		*E 488*		*5292*	*One demonstration Test includes 3 anchors*		*Visual*
Production Testing (See Section 00535.45(b))	*Strength of Anchors in Concrete Elements*		*E 488*		*5292*	*[A] 1 Anchor/Sublot or portion thereof (Minimum 1/Shift)*		*Visual per Sublot*

[A] ***Anchor testing is required per critical element identified in the Special Provisions or Plan Drawings.***

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00540 - CONCRETE BRIDGES								
Aggregate Production						A Sublot equals 1000 Mg or 1000 Tons		
[1] QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*				*Review Documentation for Acceptance*
	Reducing			*R 76*				
	[2][3][4] *Sieve Analysis*			*T 27/T 11*	*1792*	*Contractor Provided Testing*	*Contractor Provided Testing*	
	[4] *Fineness Modulus*			*T 27/T 11*				
[2] *Perform a minimum of 3 tests*	[1][3] *Wood Particles*	*TM 225*						
	[4] *Sand Equivalent*			*T 176*				
[3] *Coarse Aggregate (See Section 02690.20)*	*Soundness*			*T 104*	*4000*	*Minimum 1 per Project*	*Minimum 1 per Project*	
	Abrasion			*T 96*				
[4] *Fine Aggregate (See Section 02690.30)*	*Degradation*	*TM 208*						
	Lightweight Pieces			*T 113*				
	Organics			*T 21*				
	[3] *Dry Rodded Unit Weight*			*T 19*	*1825* *1825C*	*Contractor Provided Testing Minimum 1 per Project*	*Contractor Provided Testing Minimum 1 per Project*	
	[3][4] *Bulk Specific Gravity & Absorption*			*T 84 & T 85*	*1825*			
Portland Cement *Modifiers* *Admixtures*	*Materials must meet the requirements of Section 02001.10*						*Manufacture Compliance Statement*	
Mixing Water	*Material must meet the requirements of Section 02020*							*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00540 - CONCRETE BRIDGES (CONTINUED)								
Portland Cement Concrete								
	Sampling		*TM 2*					
	Air Content *Slump* *Concrete Temperature* *Density (Unit Weight)* *Yield* *Water/Cement Ratio*			*T 152* *T 119* *T 309* *T 121* *T 121* *T 121*	*3573WS or 4000C*	⁽ᴹ⁾		
	Strength			*T 22 & T 23*	*4000C*			

Same Frequency for all Tests (Minimums): Contractor Quality Control Type D and Type E — *(M) (S) Test at minimum frequencies according to table 00540-1. Review specs.* Quality Assurance — *Review Documentation for Acceptance*

(S) 1 Set Represents a minimum of 3 Cylinders

(M) Per Mix Design & Source

TABLE 00540-1 Frequency of Quality Control Testing

Minimum frequencies per Class of concrete based on daily production records.

Production	**Frequencies**
0 to 100 yd³ on a single day	1 Set each day
Quantity Over 100 yd³	
100 to 600 yd³ on a single day	1 Set per each 100 yd³ or portion thereof
over 600 yd³ on a single day	1 Set per each 200 yd³ or portion thereof after reaching 600 yd³

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				(Revised November 2020)		Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00556 - MULTI-LAYER POLYMER CONCRETE OVERLAY								
Aggregate Production								
	Moisture Content			*T 255/265*	*1792*	*At time of mixing the polymer resin. See 00556.10-b.*		
						Contractor Provided Testing	*Contractor Provided Testing*	*Review Documentation for Acceptance*
Polymer Resin	*Material must meet the requirements of section 00556.10*							*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00557 - PREMIXED POLYMER CONCRETE OVERLAYS								
Resin Primer	*Material must meet the requirements of section 00557.10*					*Contractor Provided Testing*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
Polyester Resin Binder Including (Initiator, Accelerators & Inhibitors)	*Material must meet the requirements of section 00557.12 (a-c)*							
Aggregate Production								
Product Compliance (Submitt 2- 50 lb. samples of blended aggregate (00557.02)during the trial overlay). See Section 00557.12(d)	*Bulk Specific Gravity & Absorption* *Moisture Content* *Fracture (Method 1)*			*T 84 & T 85* *T 255/265* *T 335*	*4000*	*1/Project or Source*	*1/Project or Source*	
[(1)] *Maybe required during Production*	*Moisture Content*			*T 255/265*	*1792*	[(1)] *During the Trial Overlay Strip*	[(1)] *During the Trial Overlay Strip*	*Review Documentation for Acceptance*
Surface Texture Sand (see section 00557.12(e))	Sieve Analysis			T 27/11	1792	*Contractor Provided Testing*	*Contractor Provided Testing*	
Premixed Polymer Concrete	*Density*			*T 121*	*3573WS*	[(B)] *1/Batch*	[(B)] *1/Batch*	
	Modulus of Elasticity	*TM 759*			*4000C*	[(M)] *Minimum 1 set/batch*	[(M)] *Minimum 1 set/batch*	
[(M)] *1 set Represents a minimum of 3 (4"x8") cylinders cast per 00557.44(e).* [(2)] *Submit to ODOT - CML* [(B)] *Batch is defined "Per Mixer or Portion placed".*						[(2)] *1 set per 10 batches placed or minimum 1 set/day*	[(2)] *1 set per 10 batches placed or minimum 1 set/day*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00559 - STRUCTURAL CONCRETE OVERLAYS								
Aggregate Production						*A Sublot equals 500 Tons. A minimum one per shift, whichever results in the greatest sampling frequency. (For preproduced aggregates, 1 shift shall mean 500 Tons.)*		
[1] QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*Contractor Provided Testing*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
[2] Perform a minimum of 3 tests, QL's required	*[2][3][4] Sieve Analysis*			*T 27/T 11*	*1792*			
	[4] Fineness Modulus			*T 27/T 11*				
	[4] Sand Equivalent			*T 176*	*1792*			
[3] Coarse Aggregate (See Section 02690.20)	*[1][3] Elongated Pieces*	*TM 229*			*1792*			
	[1][3] Wood Particles	*TM 225*						
[4] Fine Aggregate (See Section 02690.30)	*Abrasion*			*T 96*	*4000*	*Minimum 1 Per Project*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Soundness			*T 104*				
	Lightweight Pieces			*T 113*				
	Organics			*T 21*	*4000*			
	[3] Dry Rodded Unit Weight			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*	*Start of production and when changes in aggregate occurs*	
	[3][4] Bulk Specific Gravity & Absorption			*T 84 & T 85*	*1825*			
Portland Cement *Modifiers* *Admixtures*	*Materials must meet the requirements of Section 02001.10*						*Manufacture Compliance Statement*	*Review Documentation for Acceptance*
Mixing Water	*Material must meet the requirements of Section 02020*							

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00559 - STRUCTURAL CONCRETE OVERLAYS (CONTINUED)								
Portland Cement Concrete						*A sublot equals 1 set of tests per 50 yd3*		
	Sampling *Air Content* *Slump* *Concrete Temperature* *Density (Unit Weight)* *Yield* *W/C Ratio*		*TM 2*	*T 152* *T 119* *T 309* *T 121* *T 121* *T 121*	*3573WS or 4000 C*	*1 / Sublot or Minimum 1 per Shift*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
Latex Modified Concrete	*Fine Aggregate Moisture*			*T 255 / T 265*	*1792*	*Contractor Provided Testing*	*Contractor Provided Testing*	
(M) Per Mix Design & Source	*Mixer Calibration*							
	Strength			*T 22 & T 23*	*4000C*	*(M) (S) 1 Set Cylinders per 50yd³ Minimum 1 set/shift*	*(M) (S) 1 Set Cylinders per 50yd³ Minimum 1 set/shift*	*Review Documentation for Acceptance*
(S) 1 Set Represents a minimum of 3 Cylinders								
SECTION 00590 - POLYMER MEMBRANE								
Broadcast Aggregate								
	Moisture Content			*T 255/265*	*1792*	*Test at time of packaging and shipment. See Section 00590.10-c*	*Test at time of packaging and shipment. See Section 00590.10-c*	*Review Documentation for Acceptance*
	Moisture Content			*T 255/265*	*1792*	*Field Test at time of Mixing Polymer Resin. See Section 00590.10-c*	*Field Test at time of Mixing Polymer Resin. See Section 00590.10-c*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00596A - MECHANICALLY STABILIZED EARTH RETAINING WALLS								
Aggregate Production								
Gravel Leveling Pads Backfill *(See Section 02630.10)*	*Abrasion* *Degradation*	*TM 208*		*T96*	*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
					A Sublot equals 1,000 Tons Minimum 1/Project			
	Sampling *Reducing* *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Sublot*	*Visual*	*Review Documentation for Acceptance*
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*		
					Testing Frequency for Product Compliance per Source 1/5,000 Tons Minimum 1/Project			
(3) Modular Block Core and Drainage Backfill (Product Compliance)	*Soundness* *Abrasion* *Degradation* *Lightweight Pieces*	*TM 208*		*T 104* *T 96* *T 113*	*4000* *4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
(3) (See Section 2690.20(a) thru 2690.20(d) & 2690.20(f)								
					A Sublot equals 1,000 Tons			
(3) Modular Block Core and Drainage Backfill *(1) QAE may waive after 5 sublots/shifts* *(2) Perform a minimum of 3 tests, QL's required*	*Sampling* *Reducing* *(2) Sieve Analysis* *(1) Wood Particles* *Fracture (Method 2)* *Elongated Pieces*	*TM 225* *TM 229*		*R 90* *R 76* *T 27/T 11* *T 335*	*1792* *1792*	*1/Sublot or Minimum 1 Per Project*	*Visual*	*Review Documentation for Acceptance*
Pipe Drain Backfill (Product Compliance) (See Section 00430.11)	*Abrasion* *Degradation*	*TM 208*		*T 96*	*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
	Sieve Analysis			*T27*	*4000*	*1/Sublot*	*Visual*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00596A - MECHANICALLY STABILIZED EARTH RETAINING WALLS								
Aggregate Production					Testing Frequency for Product Compliance per Source 1/5000 Tons Minimum 1/Project			
Gabion Basket Fill *(Product Compliance)* *(See Section 00390.11(b))*	*Degradation* *Soundness* *Apparent Specific Gravity & Absorption*	*TM 208*		*T 104* *T 85*	*4000* *1825*	*Contractor Provided Testing*	*Minimum 1 per Project*	*Review Documentation for Acceptance*
	Gradation					*1/Sublot (Minimum 1/Project)*	*Visual*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00596A - MSE RETAINING WALLS								
Aggregate Production					Testing Frequency for Product Compliance per Source 1/5000 Tons Minimum 1/Project			
MSE Granular Wall Backfill *(Product Compliance)* *(Also reference 02630.10)*	*Abrasion* *Degradation* *Sieve Analysis* *Plasticity Index* *pH* *Resistivity* *Organic Content*	*TM 208*		*T96* *T 11* *T 90* *T 289* *T 288* *T 267*	*4000* *4000*	*Contractor Provided Testing*	*Minimum 1 per Project*	*Review Documentation for Acceptance*
					A Sublot Equals or 2000 Tons			
MSE Granular Wall Backfill [(1)] *Perform a minimum of 3 tests, QL's required*	*Sampling* *Reducing* [(1)] *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Sublot (Minimum 1/Project)*	*Visual*	*Review Documentation for Acceptance*
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*	*Visual*	
Placement Establishing Maximum Density [(2)] Method A	*Density Curve* *Bulk Specific Gravity* *Coarse Particle Correction*	*TM 223*		[(2)] *T 99* *T 85*	*3468* *3468*	*1/Aggregate Gradation/Per Source*	*Visual*	
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1/100 yd^3 (Minimum 1/day)*	*Visual*	*Review Documentation for Acceptance*
	Deflection Testing	*TM 158*			*1793B*	*1 per layer*	*Visual*	

Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				(Revised November 2020)		Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00596B - PREFABRICATED MODULAR RETAINING WALLS								
Aggregate Production								
Gravel Leveling Pads Backfill *(See Section 02630.10)*	*Abrasion* *Degradation*	*TM 208*		*T96*	*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
					A Sublot equals 1000 Tons Minimum 1/Project			
	Sampling *Reducing* *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*1/Sublot*	*Visual*	*Review Documentation for Acceptance*
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*	*Visual*	
					Testing Frequency for Product Compliance per Source 1/5000 Tons Minimum 1/Project			
[3] Modular Block Core and Drainage Backfill (Product Compliance) *[3] (See Section 2690.20(a) thru 2690.20(d) & 2690.20(f)*	*Soundness* *Abrasion* *Degradation* *Lightweight Pieces*	*TM 208*		*T 104* *T 96* *T 113*	*4000* *4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
					A Sublot equals 1000 Tons			
[3] Modular Block Core and Drainage Backfill *[1] QAE may waive after 5 sublots/shifts* *[2] Perform a minimum of 3 tests, QL's required*	*Sampling* *Reducing* *[2] Sieve Analysis* *[1] Wood Particles* *Fracture (Method 2)* *Elongated Pieces*	*TM 225* *TM 229*		*R 90* *R 76* *T 27/T 11* *T 335*	*1792* *1792*	*1/Sublot (Minimum 1 Per Project)*	*Visual*	*Review Documentation for Acceptance*
Pipe Drain Backfill (Product Compliance) (See Section 00430.11)	*Abrasion* *Degradation*	*TM 208*		*T 96*	*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
	Sieve Analysis			*T27*	*4000*	*1/Sublot*	*Visual*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				(Revised November 2020)		Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00596B - PREFABRICATED MODULAR RETAINING WALLS								
Aggregate Production					Testing Frequency for Product Compliance per Source 1/5000 Tons Minimum 1/Project			
Gabion Basket Fill *(Product Compliance)* *(See Section 00390.11(b))*	*Degradation*	*TM 208*			*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
	Soundness			*T 104*				
	Apparent Specific Gravity & Absorption			*T 85*	*1825*			
	Gradation					*1/Sublot*	*Visual*	

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00596B - PREFABRICATED MODULAR RETAINING WALLS								
Aggregate Production					Testing Frequency for Product Compliance per Source 1/5000 Tons Minimum 1/Project			
Retaining Wall Granular Backfill *(Product Compliance)* *(Also reference 02630.10)*	*Abrasion*			*T96*	*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Sieve Analysis			*T 11*				
	Plasticity Index			*T 90*	*4000*			
					A Sublot Equals 2000 Tons			
Retaining Wall Granular Backfill	*Sampling*			*R 90*		1/Sublot (Min. 1 Per Project)	*Visual*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
(1) Perform a minimum of 3 tests, QL's required	*(1) Sieve Analysis*			*T 27*	*1792*			
	Sand Equivalent			*T 176*				
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*	*Visual*	
Placement								
Establishing Maximum Density	*Density Curve*			*(2) T 99*	*3468*	*1/Aggregate Gradation/Per Source*	*Visual*	*Review Documentation for Acceptance*
(2) Method A	*Bulk Specific Gravity*			*T 85*				
	Coarse Particle Correction	*TM 223*			*3468*			
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1/100 yd^3 (Minimum 1/day)*	*Visual*	
	Deflection Testing	*TM 158*			*1793B*	*1 per layer*	*Visual*	

Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00596C - CAST-IN-PLACE CONCRETE RETAINING WALLS								
Aggregate Production								
Pipe Drain Backfill (Product Compliance) (See Section 00430.11)	*Abrasion Degradation*	*TM 208*		*T 96*	*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
	Sieve Analysis			*T27*	*4000*	*1/Sublot*	*Visual*	
Retaining Wall Granular Backfill					Testing Frequency for Product Compliance per Source 1/5000 Tons Minimum 1/Project			
Retaining Wall Granular Backfill *(Product Compliance) (Also reference 02630.10)*	*Abrasion*			*T96*	*4000*	*Contractor Provided Testing*	*Minimum 1 Per Project*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Sieve Analysis			*T 11*				
	Plasticity Index			*T 90*	*4000*			
					A Sublot Equals 2000 Tons			
Retaining Wall Granular Backfill	*Sampling*			*R 90*		*1/Sublot*	*Visual*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
[(1)] *Perform a minimum of 3 tests, QL's required*	[(1)] *Sieve Analysis*			*T 27*	*1792*			
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*	*Visual*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE		(Revised November 2020)				Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00596C - CAST-IN-PLACE CONCRETE RETAINING WALLS								
Placement								
Retaining Wall Granular Backfill								
Establishing Maximum Density	*Density Curve*			*(1) T 99*	*3468*	*1/Aggregate Gradation/Per Source*	*Visual*	*Review Documentation for Acceptance*
(1) Method A	*Bulk Specific Gravity*			*T 85*				
	Coarse Particle Correction	*TM 223*			*3468*			
Compaction	*Nuclear Gauge*			*T 310*	*1793B*	*1/100 yd^3 (Minimum 1/day)*	*Visual*	
	Deflection Testing	*TM 158*			*1793B*	*1 per layer*	*Visual*	*Review Documentation for Acceptance*

Contractor must demonstrate, by compaction testing or acceptable visual means, that the material, equipment, and process used for compaction achieves the specification requirements. If the material, equipment, or process changes, or if other conditions indicate a non-specification product, the Contractor must re-demonstrate that specification requirements are being achieved.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE		(Revised November 2020)				Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00635 - GRID-ROLLED AGGREGATE SUBBASE								
Aggregate Subbase Grading *(See 00635.10)*	Abrasion			*T 96*	*4000*	*Contractor Provided Testing*	***Requires Signed and Notarized Statement of Compliance From Contractor For All Items Under Section 00600***	*Review Documentation for Acceptance*
	Sampling *Reducing* *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*Contractor Provided Testing*		*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Same Frequency for all Tests (Minimums): Quality Control – Contractor Quality Control Type D	Quality Control – Contractor Quality Control Type E	Quality Assurance – Project Manager Type D & E
SECTION 00641 - AGGREGATE SUBBASE, BASE, AND SHOULDERS								*Review Documentation for Acceptance*
Aggregate Production	*Abrasion*			*T 96*	*4000*	*Contractor Provided Testing*	Submit Required Documentation	
Aggregate Subbase *Grading* *(See 00641.10(b))*	*Sampling* *Reducing* *Sieve Analysis* *Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*Contractor Provided Testing*	Submit Required Documentation	*Review Documentation for Acceptance*
Aggregate Base and Shoulders	*Abrasion* *Degradation*	*TM 208*			*4000*	*Minimum 1 per Project*	Submit Required Documentation	*Review Documentation for Acceptance*
					A Sublot equals 2000 Tons			
Grading *Aggregate Base (See 02630)* *Aggregate Shoulder (See 02640)* *Open Graded Aggregate Base* *(See 02630.11)* *(1) Perform at least 3 tests* *(2) May be waived by QAE*	*Sampling* *Reducing* *(1) Sieve Analysis* *(2) Sand Equivalent*			*R 90* *R 76* *T 27* *T 176*	*1792*	*Contractor Provided Testing*	Submit Required Documentation	*Review Documentation for Acceptance*
	Fracture (Method 1)			*T 335*	*1792*	*Contractor Provided Testing*		*Review Documentation for Acceptance*
PLACEMENT								
Aggregate Base					*A Sublot equals 2000 Tons*			
Plant Mix Applications Only *Aggregate (Mixture)*	*Sampling* *Reducing* *Moisture*			*R 90* *R 76* *T 255 &* *T 265*	*1792*	*1/Sublot or minimum 1per day*	*Visual*	*Review Documentation for Acceptance*
Establishing Maximum Density & Optimum Moisture (Mix Design) (3) Method A	*Density Curve* *Coarse Particle Correction* *Bulk Specific Gravity*	*TM 223*		*(3) T 99* *T 85*	*3468*	*Each Size Per Source*	*Visual*	
Compaction							*Visual*	*Review Documentation for Acceptance*
(D) (Individual tests must meet Specification)	*Deflection Testing*	*TM 158*			*1793B*	*1 per Sublot*	*Visual*	*Review Documentation for Acceptance*
	Nuclear Gauge			*T310*	*1793B*	*(D) 5 Tests Per Sublot*	*Visual*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00641 - AGGREGATE SUBBASE, BASE, AND SHOULDERS (Continued)								
Placement								
Aggregate Subbase								
Compaction	*Deflection Testing*	*TM 158*			*1793 B*	*1 per Layer*	*Visual*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00680 - STOCKPILED AGGREGATES								
Aggregate Base and Shoulders *(See Section 00641)*	*Abrasion*			*T 96*	*4000*	*Minimum 1 per Source/Project*	*Visual*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
					A Sublot equals 2,000 Tons			
	Sampling					*Contractor Provided Testing*	*Visual*	*Review Documentation for Acceptance*
[(1)] Perform at least 3 tests	*Reducing*			*R 76*				
[(2)] *May be waived by QAE*	[(1)] *Sieve Analysis*			*T 27*	*1792*			
	[(2)] *Sand Equivalent*			*T 176*				
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots*	Visual	
Aggregate (Sanding Aggregate)								
					A Sublot equals 1000 Tons			
	Sampling			*R 90*		*Contractor Provided Testing*	*Visual*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
	Sieve Analysis			*T 27*	*1792*			
[(3)] *May be waived by QAE*	[(3)] *Cleanness Value*	*TM 227*						
	Abrasion			*T 96*	*4000*	*Minimum 1 per Source/Project*	Visual	
	Degradation	*TM 208*						
	Lightweight Pieces			*T 113*	*4000*			
	Fracture (Method 1)			*T 335*	*1792*	*1/5 Sublots & Start of Production*	Visual	*Review Documentation for Acceptance*
	Elongated Pieces	*TM 229*						
	Wood Particles	*TM 225*			*1792*			

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00680 - STOCKPILED AGGREGATES (CONTINUED)								
Emulsified AC Aggregate								
Aggregate Production					A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency			
(See Sections 00705, 00706, 00710, 00711, 00712 and 00715)	*Abrasion*			*T 96*	*4000*	*Minimum 1 per Source/Project*	Visual	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Soundness			*T 104*				
	Lightweight Pieces			*T 113*				
(1) QAE may waive after 5 sublots/shifts	*Dry Rodded Unit Weight*			*T 19*	*4000*			
	Sampling			*R 90*		*Contractor Provided Testing*	Visual	
	Reducing			*R 76*				
(2) QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture*			*T 335*	*1792*			
	(1) Wood Particles	*TM 225*						
	(1)(4) Elongated Pieces	*TM 229*						
	(2) Sieve Analysis			*T27/T 11*				
(3) May be waived by QAE	*(3) Cleanness Value*	*TM 227*			*1792*			
(4) Not required for Dry Key Material *(5) 1/5 Sublots & Start of Production*	*Dry Rodded Unit Weight*			*T 19*	1825 1825C	*Start of production and when changes in aggregate occurs*	Visual	*Review Documentation for Acceptance*
Aggregate (Other)		*Use sampling and testing frequencies required for proposed end product use*						

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00705 - ASPHALT PRIME COAT and EMULSIFIED ASPHALT FOG COAT								
Aggregate Production						*A sublot equals 1000 Tons. A minimum 1 per shift*		
Aggregate Cover Material	Sampling Reducing *Sieve Analysis*			*R 90* *R 76* *T 27*	*1792*	*Provide Process Control*	***Requires Signed and Notarized Statement of Compliance From Contractor For All Items Under Section 00700***	*Review Documentation for Acceptance*
Asphalt Prime and Fog Coat Asphalt Cement *(Emulsion)*	*Compliance*			*R 66*	*4000*	*Provide Suppliers Certificate of Compliance*		*Review Documentation for Acceptance*
SECTION 00706 - EMULSIFIED ASPHALT SLURRY SEAL SURFACING								
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*		
	Sampling *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*1792*	*Provide Process Control*	*Visual*	*Review Documentation for Acceptance*
Emulsified Asphalt Cement *Emulsified Asphalt* *Polymer Modified Emulsion*	*Compliance*				*4000*	*Provide Suppliers Certificate of Compliance*	*Visual*	
Additives *Mineral Filler*	*Material must meet the requirements of Section 00706.13*						*Visual*	
Mixture	*Material must meet the requirements of Section 00706.16*						*Visual*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00710 - SINGLE APPLICATION EMULSIFIED ASPHALT SURFACE TREATMENT						Same Frequency for all Tests (Minimums)		
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*		
	Abrasion			*T 96*	*4000*	*Contractor Provided Testing*	*Contractor Provided Testing Minimum 1 per Project*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Soundness			*T 104*				
	Lightweight Pieces			*T 113*				
	Dry Rodded Unit Weight			*T 19*	*4000*			
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1 per Sublot*	*Visual*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture*			*T 335*	*1792*			
	(1) Wood Particles	*TM 225*						
	(1)(4) Elongated Pieces	*TM 229*						
	(2) Sieve Analysis			*T27/T 11*				
(3) May be waived by QAE	*(3) Cleanness Value*	*TM 227*			*1792*			
	Dry Rodded Unit Weight			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*	*Visual*	
(4) Not required for Dry Key Material								
(5) 1/5 Sublots & Start of Production								
Asphalt Cement *(Emulsion)*	*Compliance*			*R 66*	*4000*	*Provide Suppliers Certificate of Compliance*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00710.10 and 710.15, Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00710.10 and 710.15 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 2500 Tons".
b. One Per sublot means "One Set of Tests Per 500 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00711 - PRE-COATED AGGREGATE ASPHALT SURFACE TREATMENT								
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*		
	Abrasion			*T 96*	*4000*	*Contractor Provided Testing*	*Contractor Provided Testing Minimum 1 per Project*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Soundness			*T 104*				
	Lightweight Pieces			*T 113*				
	Dry Rodded Unit Weight			*T 19*	*4000*			
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1 per Sublot*	*Visual*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture*			*T 335*	*1792*			
	(1) Wood Particles	*TM 225*						
	(1)(4) Elongated Pieces	*TM 229*						
	(2) Sieve Analysis			*T 27/T 11*				
(3) May be waived by QAE	*(3) Cleanness Value*	*TM 227*			*1792*			
	Dry Rodded Unit Weight			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*	*Visual*	
(4) Not required for Dry Key Material								
(5) 1/5 Sublots & Start of Production								
Asphalt Cement *(Emulsion)*	*Compliance*			*R 66*	*4000*	*Provide Suppliers Certificate of Compliance*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00711.10 and 711.15, Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00711.10 and 711.15 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 2500 Tons".
b. One Per sublot means "One Set of Tests Per 500 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	**DESCRIPTION OF TEST**	**TEST METHOD**			**FORM 734-**	**Quality Control**		**Quality Assurance**
		ODOT	**WAQTC**	**AASHTO**		**Contractor Quality Control Type D**	**Contractor Quality Control Type E**	**Project Manager Type D & E**
SECTION 00711 - PRE-COATED AGGREGATE ASPHALT SURFACE TREATMENT (CONTINUED)								
Mixture Acceptance						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*		
Meter Method	*Readings backed by Tank Measure & Production Records Daily*	*TM 321* *(1) TM 322*			*2277*	*1/Sublot or Min. 1/Day*	*Production Control Testing*	*Review Documentation for Acceptance*
					2043 and 2401	*Daily Production*	*Production Control Testing*	
(1) Required at start of production and if meters fail to meet specification	*Cold Feed Moisture*			T 255/265	*2277*	*1/Sublot or Min. 1/Day*	*Production Control Testing*	
Plant Discharge Moisture	*Asphalt Mix Moist.*			*T 329*	*2277*	*1/Sublot*	*Production Control Testing*	
Asphalt Cement	*Compliance*			*R 66*	*4000*	*1/50 Tons Submit All*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00712 - DRY KEY EMULSIFIED ASPHALT SURFACE TREATMENT						Same Frequency for all Tests (Minimums)		
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*		
	Abrasion			*T 96*	*4000*	*Contractor Provided Testing*	*Contractor Provided Testing Minimum 1 per Project*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Soundness			*T 104*				
	Lightweight Pieces			*T 113*				
	Dry Rodded Unit Weight			*T 19*	*4000*			
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*		*1 per Sublot*	*Visual*	*Review Documentation for Acceptance*
	Reducing			*R 76*				
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture*			*T 335*	*1792*			
	(1) Wood Particles	*TM 225*						
	(1)(4) Elongated Pieces	*TM 229*						
	(2) Sieve Analysis			*T 27/T 11*				
(3) May be waived by QAE	*(3) Cleanness Value*	*TM 227*			*1792*			
	Dry Rodded Unit Weight			*T 19*	*1825* *1825C*	*Start of production and when changes in aggregate occurs*	Visual	
(4) Not required for Dry Key Material								
(5) 1/5 Sublots & Start of Production								
Asphalt Cement *(Emulsion)*	*Compliance*			*R 66*	*4000*	*Provide Suppliers Certificate of Compliance*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00712.10 and 712.15, Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00712.10 and 712.15 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 2500 Tons".
b. One Per sublot means "One Set of Tests Per 500 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00715 - MULTIPLE APPLICATION EMULSIFIED ASPHALT SURFACE TREATMENT								
Aggregate Production						*A sublot equals 500 Tons. A minimum 1 per shift, whichever results in the greatest sampling frequency*		
	Abrasion			*T 96*	4000	*Contractor Provided Testing*	*Contractor Provided Testing Minimum 1 per Project*	*Review Documentation for Acceptance*
	Degradation	*TM 208*						
	Soundness			*T 104*				
	Lightweight Pieces			*T 113*				
	Dry Rodded Unit Weight			*T 19*	4000			
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*				
	Reducing			*R 76*				
(2) Perform at least 3 tests (QL's required), QAE may waive wet sieve after 5 sublots/shifts if a correlation to dry sieve can be demonstrated	*(5) Fracture*			*T 335*	1792	*1 per Sublot*	*Visual*	
	(1) Wood Particles	*TM 225*						
	(1)(4) Elongated Pieces	*TM 229*						
	(2) Sieve Analysis			*T27/T 11*				
(3) May be waived by QAE	*(3) Cleanness Value*	*TM 227*			1792			
	Dry Rodded Unit Weight			*T 19*	1825 1825C	*Start of production and when changes in aggregate occurs*	Visual	*Review Documentation for Acceptance*
(4) Not required for Dry Key Material *(5) 1/5 Sublots & Start of Production*								
Asphalt Cement *(Emulsion)*	*Compliance*			*R 66*	4000	*Provide Suppliers Certificate of Compliance*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00715.10 and 715.15, Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00715.10 and 715.15 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 2500 Tons".
b. One Per sublot means "One Set of Tests Per 500 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00720 - COLD IN-PLACE RECYCLED ASPHALT CONCRETE PAVEMENT (CIR)								
SECTION 00721 - COLD RECYCLED EMULSIFIED ASPHALT CONCRETE PAVEMENT (CRP)								
Asphalt Cement (Emulsified Recycling Agent)	*Compliance*			*R 66*	*4000*	*Provide Suppliers Certificate of Compliance*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*
Water	*Material must meet the requirements of Section 00340.10*						*Visual*	*Review Documentation for Acceptance*
						A Sublot equals 1000 Tons		
Aggregate Production Choke Aggregate *(See 00705)*	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27*	*1792*	*Provide Process Control*	*Visual*	*Review Documentation for Acceptance*
SECTION 00725 - HOT IN-PLACE RECYCLED (HIR) ASPHALT CONCRETE PAVEMENT								
	The type of recycling agent will be listed in the Special Provisions							
Recycling Agent *(See 00745.11)*	*Compliance*			*R 66*	*4000*	*Provide Suppliers Certificate of Compliance*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*
Recycling Agent	*Compliance*			*R 66*	*4000*			
Asphalt Concrete Mixture	*New Asphalt Concrete mixture will meet the requirements of Section 00744*							
SECTION 00730 - ASPHALT TACK COAT								
Tack	*Compliance*			*R 66*	*4000*	*Provide Suppliers Certificate of Compliance*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00735 - EMULSIFIED ASPHALT CONCRETE PAVEMENT								
Aggregate production								
	Abrasion *Degradation* *Soundness* *Lightweight Pieces*	 *TM 208*		*T 96* *T 104* *T 113*	*4000* *4000*	*Contractor Provided Testing Minimum 1 per Project*	*Contractor Provided Testing Minimum 1 per Project*	*Review Documentation for Acceptance*
						A Sublot equals 1000 Tons. A minimum one per shift, whichever results in the greatest sampling frequency. (For preproduced aggregates, 1 shift shall mean 1000 Tons)		
(1) *May be waived by QAE* (2) *QAE may waive after 5 sublots/shifts*	*Sampling* *Reducing* *Sieve Analysis* (1) *Cleanness Value* *Fracture* (2) *Elongated Pieces* (2) *Wood Particles*	 *TM 227* *TM 229* *TM 225*		*R 90* *R 76* *T 27/T 11* *T 335*	 *1792* *1792*	*1/Sublot & Start of Production*	*Visual*	*Review Documentation for Acceptance*
Choke Aggregate	*Sieve Analysis*			*T 27*	*1792*	*Provide Process Control*	*Visual*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00735 - EMULSIFIED ASPHALT CONCRETE PAVEMENT (CONTINUED)								
Mixture Acceptance						*A Sublot equals 1000 Tons of Mixture*		
	Sampling *Reducing* *Sieve Analysis* *Moisture Content*			*R 90* *R 76* *T 27/T 11* *T 255*	 *2277* *2277*	*Provide Process Control*	*Visual*	*Review Documentation for Acceptance*
% Emulsified Asphalt [(1)] *Required at start of production and if meters fail to meet specification*	*Meter Backed by Tank Measure Daily*	*TM 321* [(1)] *TM 322*			*2401 & 2043*	*Daily Production*	*Visual*	
Emulsified Asphalt Cement	*Compliance*			*R 66*	*4000*	*Provide Suppliers Certificate of Compliance*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*
SECTION 00740 - COMMERCIAL ASPHALT CONCRETE PAVEMENT (CACP)								
	See Specifications when Testing is Required by Agency					*Provide Process Control*	*Visual*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00743 - POROUS ASPHALT CONCRETE (PAC)								
Aggregate Production								
	Soundness *Abrasion* *Degradation* *Lightweight Pieces* *Plasticity Index*	*TM 208* (Degradation)		*T 104* *T 96* *T 113* *T 90*	*4000* (Soundness) *4000* (Plasticity Index)	*Contractor Provided Testing Minimum 1 per Project*	*Contractor Provided Testing Minimum 1 per Project*	*Review Documentation for Acceptance*
(1) QAE may waive after 5 sublots/shifts						*A Sublot equals 1000 Tons. A minimum one per shift whichever results in the greatest sampling frequency*		
(2) Not required for ATPB Mix *(3) Coarse Agg (+ No. 4)* *(4) Fine Agg (- No. 4)*	*Sampling* *Reducing* *(3)(4) Sieve Analysis* *(1)(4) Sand Equivalent*			*R 90* *R 76* *T 27/T 11* *T 176*	*1792*	*1/Sublot & Start of Production*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
	(1)(2)(3) Elongated Pieces *(3)(4) Fracture (Method 2)* *(1)(2)(3) Wood Particles*	*TM 229* *TM 225*		*T 335*	*1792*	*1/5 Sublots & Start of Production*	*Contractor Provided Testing*	*Review Documentation for Acceptance*

Same Frequency for all Tests (Minimums)

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00743.10 Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00743.10 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 5000 Tons".
b. One Per sublot means "One Set of Tests Per 1000 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00743 - POROUS ASPHALT CONCRETE (PAC) (CONTINUED)								
Mixture Acceptance - PAC with RAP								
Gradation				*A Sublot equals 1000 Tons*				
Ignition method	*[1] Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*	*Production Control Testing*	*Review Documentation for Acceptance*
Ignition method	*Sampling Reducing*			*R 97 R 47*		*1/Sublot or Min. 1/Day*		
(Residual aggregate from AASHTO T 308)	*Sieve analysis*			*T 30*	*2277*	*1/Sublot or Min. 1/day*		
[1] Submit Samples a minimum of 2 Days Prior to ACP Production								
Asphalt Content				*A Sublot equals 1000 Tons*				
Ignition Method	*[1] Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*	*Production Control Testing*	*Review Documentation for Acceptance*
Ignition Method	*Sampling Reducing*			*R 97 R 47*		*1/Sublot or Min. 1/day*		
	Asphalt Content			*T 308*	*2277*			
Meter Method	*Readings backed by Tank measure & Production Records Daily*	*TM 321 [2] TM 322*			*2277*	*1/Sublot or Min. 1/day*		
[2] Required at start of production and if meters fail to meet specification					*2043 and 2401*	*Daily Production*	*Production Control Testing*	
Meter Method is required for PAC even when acceptance is by Ignition Method								

Same Frequency for all Tests (Minimums)

FIELD TESTED MATERIALS ACCEPTANCE GUIDE

(Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00743 - POROUS ASPHALT CONCRETE (PAC) (CONTINUED)								
Mixture Acceptance - PAC without RAP								
Gradation				A Sublot equals 1000 Tons				
Cold Feed Method	*Sampling* *Reducing* *Sieve Analysis*			*R 90* *R 76* *T 27/T 11*	*2277*	*1/Sublot or Min. 1/Day*	*Production Control Testing*	*Review Documentation for Acceptance*
Ignition method	[(1)] *Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*	*Production Control Testing*	
Ignition method [(1)] ***Not required if Asphalt Content Accepted by Meter Method***	*Sampling* *Reducing*			*R 97* *R 47*		*1/Sublot or Min. 1/Day*	*Production Control Testing*	
(Residual aggregate from AASHTO T 308) [(1)] *Submit Samples a minimum of 2 Days Prior to ACP Production*	*Sieve analysis*			*T 30*	*2277*	*1/Sublot or Min. 1/day*	*Production Control Testing*	*Review Documentation for Acceptance*
Asphalt Content				A Sublot equals 1000 Tons				
Ignition Method	[(1)] *Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*	*Production Control Testing*	*Review Documentation for Acceptance*
Ignition Method [(2)] ***Required at start of production and if meters fail to meet specification***	*Sampling* *Reducing* *Asphalt Content*			*R 97* *R 47* *T 308*	*2277*	*1/Sublot or Min. 1/day*	*Production Control Testing*	
Meter Method	*Readings backed by Tank measure*	*TM 321* [(2)] *TM 322*			*2277*	*1/Sublot or Min. 1/day*	*Production Control Testing*	
Meter Method is required for PAC even when acceptance is by Ignition Method	*& Production Records Daily*				*2043 and 2401*	*Daily Production*	*Production Control Testing*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00743 - POROUS ASPHALT CONCRETE (PAC) (CONTINUED)								
Mixture Acceptance - PAC with and without RAP								
Mix Design Verification Testing				A Sublot equals 1000 Tons				
	Cold Feed Moisture			*T255/T265*	*2277*	*1/Sublot or Min. 1/Day*	*Production Control Testing*	*Review Documentation for Acceptance*
Plant Discharge Moisture	*Asphalt Mix Moist.*			*T 329*	*2277*	*1/Sublot or Min. 1/Day*	*Production Control Testing*	
[1] RAP Percentage	*[1] RAP Moisture*			*T 329*	*2277*	*1/Sublot or Min. 1/Day*	*Production Control Testing*	*Review Documentation for Acceptance*
[1] If applicable	*Readings backed by Tank measure & Production Records Daily*	*TM321 [2] TM 322*			*2401 & 2043*	*Daily Production*	*Production Control Testing*	
Asphalt Cement	*Compliance*			*R 66*	*4000*	*1/Sublot See Section 4C*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*
[2] Required at start of production and if meters fail to meet specification								

Same Frequency for all Tests (Minimums)

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00744 - ASPHALT CONCRETE PAVEMENT								
Aggregate Production	*See Specifications when Aggregate Testing is Required by Agency*					*Provide Process Control*	*Visual*	*Review Documentation for Acceptance*
Mixture Acceptance								
Gradation				*A Sublot equals 1000 Tons*				
Ignition method	*[1] Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*	*Production Control Testing*	*Review Documentation for Acceptance*
Ignition method	*Sampling Reducing*			*R 97 R 47*		*1/Sublot or Min. 1/Day*	*Production Control Testing*	
(Residual aggregate from AASHTO T 308)	*Sieve analysis*			*T 30*	*2277*	*1/Sublot or Min. 1/Day*	*Production Control Testing*	*Review Documentation for Acceptance*
[1] Submit Samples a minimum of 2 Days Prior to ACP Production								
Asphalt Content				*A Sublot equals 1000 Tons*				
Ignition Method	*[1] Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*	*Production Control Testing*	*Review Documentation for Acceptance*
Ignition Method	*Sampling Reducing*			*R 97 R 47*		*1/Sublot or Min. 1/day*	*Production Control Testing*	
	Asphalt Content			*T 308*	*2277*			
Mix Design Verification Testing				*A Sublot equals 1000 Tons*				
Plant Discharge Moisture	*Asphalt Mix Moist.*			*T 329*	*2277*	*1/Sublot*	*Production Control Testing*	*Review Documentation for Acceptance*
Maximum Density Test G_{mm}	*Max. Specific Gravity MAMD*	*TM 305*		*T 209*	*2050*	1st Sublot Daily or Min. 1/Day		

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)						Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00744 - ASPHALT CONCRETE PAVEMENT (CONTINUED)								
Compaction	*Nuclear Density*			*T 355*	*1793A*	[(D)] *Average 10 tests per Sublot or Min. 10/Day, See Section 00744.49*	*Production Control Testing*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00745 - ASPHALT CONCRETE PAVEMENT - STATISTICAL ACCEPTANCE						Same Frequency for all Tests (Minimums)		
Aggregate Production	*Soundness*			*T 104*	*4000*	*Contractor Provided Testing Minimum 1 per Project*	*Contractor Provided Testing Minimum 1 per Project*	*Review Documentation for Acceptance*
	Abrasion			*T 96*				
	Degradation	*TM 208*						
(1) QAE may waive after 5 sublots/shifts	*Lightweight Pieces*			*T 113*				
	Plasticity Index			*T 90*	*4000*			
(2) Perform a minimum of 3 tests QL's required						*A Sublot equals 1000 Tons. A minimum one per shift whichever results in the greatest sampling frequency*		
	Sampling			*R 90*		*1/Sublot & Start of Production*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
(3) Coarse Agg (+ No. 4)	*Reducing*			*R 76*				
	(2)(3)(4) Sieve Analysis			*T 27/T 11*	*1792*			
(4) Fine Agg (- No. 4)	*(1)(4) Sand Equivalent*			*T 176*				
	(1)(3) Elongated Pieces	*TM 229*			*1792*	*1/5 Sublots & Start of Production*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
Note: Sample Aggregate before Lime Treatment	*(3)(4) Fracture (Method 2)*			*T 335*				
	(1)(3) Wood Particles	*TM 225*						
	Sieve Analysis			*T 27*	*4000*	*Contractor Provided Testing 1/500 Tons*	Contractor Provided Testing	*Review Documentation for Acceptance*
RAS Production *(Reclaimed Asphalt Shingles)*	*Deleterious Materials*	*TM 335*						
	Sampling			*R 90*		*1 / 50 Tons*		
	Reducing			*R 76*				
	Sieve Analysis			*T 27*	*1792*			
	Deleterious Materials	*TM 335*						

Preproduced Aggregate

Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this contract will be determined by the following:

1. Continuing production records meeting the above requirements of Section 00745.10 Aggregate Production.
2. Furnish records of testing for the entire stockpile according to Section 00745.10 Aggregate Production except change the sampling frequency to the following:

a. One Per 5 sublots means "One Set of Tests Per 5000 Tons".
b. One Per sublot means "One Set of Tests Per 1000 Tons" with a minimum of 3 sets of Sieve Analysis tests per project.
c. Provide one stockpile sample for each set of tests required above.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE (Revised November 2020)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00745 - ASPHALT CONCRETE PAVEMENT - STATISTICAL ACCEPTANCE (CONTINUED)								
Mixture Acceptance - ACP "With and Without RAP"				*A Sublot equals 1000 Tons*				
Gradation								
Ignition method	*(1) Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*	*Production Control Testing*	*Review Documentation for Acceptance*
Ignition method	*Sampling* *Reducing*			*R 97* *R 47*		*1/Sublot*		
(Residual aggregate from AASHTO T 308)	*Sieve analysis*			*T 30*	*2277*			
(1) Submit Samples a minimum of 2 Days Prior to ACP Production								
Asphalt Content				*A Sublot equals 1000 Tons*				
Ignition Method	*(1) Calibrate Incinerator*	*TM 323*			*2327IC*	*1/JMF & Each Calendar Year.*	*Production Control Testing*	*Review Documentation for Acceptance*
Ignition Method	*Sampling* *Reducing* *Asphalt Content*			*R 97* *R 47* *T 308*	*2277*	*1/Sublot or Min. 1/day*		
(2) RAP Percentage (2) If Applicable	*Meter Method*	*TM 321* *(3) TM 322*			*2277*	*1/Sublot or Minimum 1/Day*	*Production Control Testing*	*Review Documentation for Acceptance*
(3) Required at start of production and if meters fail to meet specification	*(2) RAP Moisture* *Cold Feed Moisture*			*T 329* *T255/T265*	*2277*			
Meter Method is required for ACP even when acceptance is by Ignition Method	*Readings backed by Tank measure & Production Records Daily*	*TM 321* *(3) TM 322*			*2401 ACP*	*Daily Production*	*Production Control Testing*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE	(Revised November 2020)					Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	**DESCRIPTION OF TEST**	**TEST METHOD**			**FORM 734-**	**Quality Control**		**Quality Assurance**
		ODOT	**WAQTC**	**AASHTO**		**Contractor Quality Control Type D**	**Contractor Quality Control Type E**	**Project Manager Type D & E**
SECTION 00745 - ASPHALT CONCRETE PAVEMENT - STATISTICAL ACCEPTANCE (CONTINUED)								
Mixture Acceptance - ACP "With and Without RAP"				*A Sublot equals 1000 Tons*				
Mix Design Verification Testing								
Fabrication	*Gyratory Specimen*	*TM 326*			*2050GV*	*1/Sublot & according to Section 00745.16 (b)-1-d*	*Production Control Testing*	*Review Documentation for Acceptance*
Maximum Density Test	*Max. Specific Gravity*			*T 209*	*2050* **5068* **2560*			
Determination of G_{mb}	*Bulk Specific Gravity*			*T 166*	**5069*			
Stripping Susceptibility	*Tensile Strength Ratio*			*T 283*	*2050tsr*	*1/JMF See Section 00745.16 (b)-1-f*	*Production Control Testing*	*Review Documentation for Acceptance*
**Cat-II complete & submit as required, See Section 745.16(b)*								
Plant Discharge Moisture	*Asphalt Mix Moist.*			*T 329*	*2277*	*1/Sublot*	*Production Control Testing*	*Review Documentation for Acceptance*
Maximum Density Test G_{mm}	*Max. Specific Gravity* *MAMD*	*TM 305*		*T 209*	*2050*	*1st Sublot Daily or Min. 1/Day*		
Performing Control Strip	*Control Strip*	*TM 306*			*2084* **5069*	*Develop Rolling Pattern See Specs.*	*Production Control Testing*	*Review Documentation for Acceptance*
Compaction	*Nuclear Density*			*T 355*	*1793A*	*(D) Average 5 tests per Sublot or Min. 1/Day, See Section 00745.49 (b)-2*		
Asphalt Cement	*Compliance*			*R 66*	*4000*	*1/Sublot See Section 4C*	*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*
(D) See T 355 Yellowsheet for Density Test Locations								

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
						Same Frequency for all Tests (Minimums)		
SECTION 00745 - ASPHALT CONCRETE PAVEMENT - STATISTICAL ACCEPTANCE (CONTINUED)								
Mixture Acceptance - ACP "With and Without RAP"						*A Sublot equals 1000 Tons*		
Mix Design Verification Testing								
Lime	*Material must meet the requirements of Section 2090*						*Production Control Testing*	*Review Documentation for Acceptance*
Latex	*See Special Provisions for Latex Requirements*							
Lime or Latex Treatment of Aggregate (Stockpile OR Mixture Production)	*(1) % Hydrated Lime*	*TM 321* *(2) TM 322*			*2277* *2277*	*1/Sublot*	*Production Control Testing*	*Review Documentation for Acceptance*
(2) ***Required at start of production and if meters fail to meet specification***	*Readings backed by Tank Measure & Production Records Daily*				*2401 ACP*	*Daily Production*	*Production Control Testing*	*Review Documentation for Acceptance*
(1) If Applicable								
(1) See JMF for Details								
Smoothness								
Certification of Profiler Equipment *Determining Profile Index* *Determining International Roughness Index*		*TM 769* *TM 770* *TM 772*				*See Special Provisions*	*Production Control Testing*	*Review Documentation for Acceptance*

FIELD TESTED MATERIALS ACCEPTANCE GUIDE

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Same Frequency for all Tests (Minimums): Quality Control – Contractor Quality Control Type D	Quality Control – Contractor Quality Control Type E	Quality Assurance – Project Manager Type D & E
SECTION 00754 - PLAIN CONCRETE PAVEMENT REPAIR **SECTION 00755 - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT** **SECTION 00756 - PLAIN CONCRETE PAVEMENT** **SECTION 00758 - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT REPAIR**								
Aggregate Production					*A Sublot equals 1000 Tons*			
[1] QAE may waive after 5 sublots/shifts *[2] Perform a minimum of 3 tests, QL's required*	*Sampling* *Reducing* *[2][3][4] Sieve Analysis* *[4] Fineness Modulus* *[4] Sand Equivalent*			*R 90* *R 76* *T 27/T 11* *T 176*	*1792* *1792*	*Contractor Provided Testing*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
[3] Coarse Aggregate (See Section 02690.20)	*[1][3] Wood Particles* *[3] Fracture (Method 2)* *[1][3] Elongated Pieces*	*TM 225* *TM 229*		 *T 335*	*1792* *1792*	*Contractor Provided Testing 1/5 Sublots & Start of Production*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
[4] Fine Aggregate (See Section 02690.30)	*Abrasion* *Degradation* *Soundness* *Lightweight Pieces* *Organics*	 *TM 208*		*T 96* *T 104* *T 113* *T 21*	*4000* *4000*	*Minimum 1 per Project*	*Contractor Provided Testing*	*Review Documentation for Acceptance*
	[3] Dry Rodded Unit Weight *[3][4] Bulk Specific Gravity & Absorption*			*T 19* *T 84 & T 85*	*1825* *1825C* *1825*	*Start of production and when changes in aggregate occurs*	*Contractor Provided Testing*	*Review Documentation for Acceptance*

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00754 - PLAIN CONCRETE PAVEMENT REPAIR **SECTION 00755 - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT** **SECTION 00756 - PLAIN CONCRETE PAVEMENT** **SECTION 00758 - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT REPAIR** **(CONTINUED)**						Same Frequency for all Tests (Minimums)		
Portland Cement Concrete						*A Sublot equals 1000 lane feet of slip formed pavement or 100 yd^3 of non-slip formed PCC*		
Portland Cement *Modifiers* *Admixtures*	*Materials must meet the requirements of Section 02001.10*						*Provide Suppliers Certificate of Compliance*	*Review Documentation for Acceptance*
Curing Compounds	*Material must meet the requirements of Section 02050*							
Mixing Water	*Material must meet the requirements of Section 02020*							
Mixture	*Sampling* *Air Content* *Slump* *Density (Unit Weight)* *Yield* *Concrete Temperature* *Water/Cement Ratio* *Batching*		*TM 2* .	 *T 152* *T 119* *T 121* *T 121* *T 309* *T 121*	*3573WS or 4000C*	*Contractor Provided Testing - 1/sublot or Minimum 1 per Day*	*Visual*	*Review Documentation for Acceptance*
(S) 1 Set Represents a minimum of 3 Cylinders (M) Per Mix Design & Source	*Strength*			*T 22 & T 23*	*4000C*	(M) (S) 1 Set of Cylinders per sublot or Minimum 1 set per Day	*Visual*	*Review Documentation for Acceptance*
Smoothness								
Certification of Profiler Equipment *Determining IRI with an Inertial Laser Profiler*		*TM 769* *TM 772*				*See Special Provisions*	*Production Control Testing*	
Thickness of Pavement	*Sitcking Measure*	*TM 775*				*See Specs*	*Visual*	

FIELD TESTED MATERIALS ACCEPTANCE GUIDE				(Revised November 2020)		Same Frequency for all Tests (Minimums)		
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Quality Control		Quality Assurance
		ODOT	WAQTC	AASHTO		Contractor Quality Control Type D	Contractor Quality Control Type E	Project Manager Type D & E
SECTION 00850 - COMMON PROVISIONS FOR PAVEMENT MARKINGS								
Placement Evaluation "Retroreflectivity"								
In-Place *Procedure evaluates Durable and High Performance Pavement Markings*	*Evaluation of Retroreflectivity Using Hand-Operated Instrument*	*TM 777*			*4101 thru 4105*	*See Special Provisions and Test Procedure for Testing Frequency*	*Visual*	*Review Documentation for Acceptance*

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD: ODOT	TEST METHOD: WAQTC	TEST METHOD: AASHTO	FORM 734-	Same Frequency for all Tests (Minimums) — Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00921 - MAJOR SIGN SUPPORT DRILLED SHAFTS								
Aggregate Production						A Sublot equals 1,000 Tons		
(1) QAE may waive after 5 sublots/shifts	*Sampling*			*R 90*				*Review Documentation for Acceptance*
	Reducing			*R 76*				
(2) Perform a minimum of 3 tests, QL's required	*(2)(3)(4) Sieve Analysis*			*T 27/T 11*	*1792*	*Contractor Provided Testing*	*Contractor Provided Testing*	
	(4) Fineness Modulus			*T 27/T 11*				
	(1)(3) Wood Particles	*TM 225*						
	(4) Sand Equivalent			*T 176*	*1792*			
(3) Coarse Aggregate (See Section 02690.20)	*Soundness*			*T 104*	*4000*	*Contractor Provided Testing*	*Contractor Provided Testing*	
	Abrasion			*T 96*				
	Degradation	*TM 208*						
(4) Fine Aggregate (See Section 02690.30)	*Lightweight Pieces*			*T 113*				
	Organics			*T 21*	*4000*			
	(3) Dry Rodded Unit Weight			*T 19*	*1825* *1825C*	*Minimum of 1 per Project*	*Minimum of 1 per Project*	
	(3)(4) Bulk Specific Gravity & Absorption			*T 84 & T 85*	*1825*			
Portland Cement Modifiers Admixtures	*Materials must meet the requirements of Section 02001.10*						*Manufacture Compliance Statement*	
Drilling Slurry	*Slurry material must meet the requirements of Section 00921.14 & 00921.43(g)*						*Contractor Provided Testing*	
Grout	*Material must meet the requirements of Section 02080*						*Manufacture Compliance Statement*	
Mixing Water	*Material must meet the requirements of Section 02020*							*Review Documentation for Acceptance*

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MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD ODOT	TEST METHOD WAQTC	TEST METHOD AASHTO	FORM 734-	Quality Control: Contractor Quality Control Type D	Quality Control: Contractor Quality Control Type E	Quality Assurance: Project Manager Type D & E
SECTION 00921 - MAJOR SIGN SUPPORT DRILLED SHAFTS								
Portland Cement Concrete								
	Sampling		*TM 2*		*3573WS or 4000C*	*(M) (S) 1 per Shaft and Test at minimum frequencies according to table 00512-1. Review specs.*	*(M) (S) 1 per Shaft and Test at minimum frequencies according to table 00512-1. Review specs.*	*Review Documentation for Acceptance*
	Slump			*T 119*				
	Concrete Temperature			*T 309*				
	Density (Unit Weight)			*T 121*				
	Yield			*T 121*				
	Water/Cement Ratio			*T 121*				
	Strength			*T22/23*	*4000C*			

Same Frequency for all Tests (Minimums)

(S) 1 Set Represents a minimum of 3 Cylinders

(M) Per Mix Design & Source

TABLE 00512-1 Frequency of Quality Control Testing

Minimum frequencies per Class of concrete based on daily production records.

Production	**Frequencies**
0 to 100 yd³ on a single day	1 Set each day
Quantity Over 100 yd³	
100 to 600 yd³ on a single day	1 Set per each 100 yd³ or portion thereof
over 600 yd³ on a single day	1 Set per each 200 yd³ or portion thereof after reaching 600 yd³

INSERT TAB

Yellow Sheets

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October 31, 2020

To: All Holders of the Manual of Field Test Procedures

Section: **Test Procedure AASHTO T 30**

The Oregon Department of Transportation has specified method(s) for this Test Procedure. Please observe the following for our projects:

- **Under Mass Verification Section – Delete the second and third sentence.**
- **Under Procedure step 2 – Dispersing agents or wetting solutions are optional.**
- **Under Procedure step 7 – delete this step**
- **Under Procedure step 11 - Shaking time will be a minimum of 10 minutes.**
- **Under Procedure step 15 – Aggregate Correction Factors are at the option of the Engineer.**
- **Under Reporting section, 3rd bullet - Aggregate Correction Factors are at the option of the Engineer.**

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To: All Holders of the Manual of Field Test Procedures

Section: **Test Procedure AASHTO T 152**

The Oregon Department of Transportation has specified method(s) for this Test Procedure. Please observe the following for our projects:

- **Under Annex A "Standardization of Air Meter Gauge", delete the second paragraph and replace with the following: Standardization shall be performed at a minimum of once every three months or whenever test results are suspect. Record the date of the standardization, the standardization results, and the name of the technician performing the standardization in the log book kept with each air meter.**
- **Under Sampling, step 1, second sentence, delete 1 ½" and replace with 2". Add the following sentence: If any aggregate is retained on the 2" sieve, wet sieve a sufficient amount of sample over the 1 ½" sieve according to the Wet Sieving portion of the FOP for WAQTC TM 2.**
- **An Aggregate Correction Factor is not required for Air Content Determination.**

Test Procedure AASHTO T 209 Continued

- **Under Section "Mixtures Containing Uncoated Porous Aggregates" or "Dryback" procedure observe the following:**

a) Perform the "Dryback" procedure at the beginning of ACP production and after any JMF target adjustment.

b) The "Dryback Trigger" is based on a 2 test average. By computing the percent difference between, Mass of Sample in air (A) to Mass of saturated surface-dry sample in air (A_{ssd}) according to the following formula:

$$\frac{A_{ssd} - A}{A_{ssd}} \times 100 = \%\ \text{Diff.}$$ (Compute to nearest 0.01%)

c) If the calculated difference of startup results or the average of the 2 results after a JMF target adjustment exceeds 0.17%, then the "Dryback" procedure will be required for subsequent testing. Use the results of the "Dryback" procedure on all MDV and MAMD calculations.

d) If the calculated results are 0.17% or less, then subsequent testing may be performed without the "Dryback" procedure.

Procedure – Mixtures Containing Uncoated Porous Aggregate

Delete steps 1 thru 3 and replace with the following

1. **Within 5 minutes of completing 'Procedure – General', carefully drain water from the sample over a #40 or smaller opening sieve to prevent loss of material.**

2. **Dry the sample by spreading it out in a container that has sides high enough to prevent material loss when stirred and is large enough to allow the sample to be in a layer no thicker than ¾ inch. Direct an electric fan so that it is blowing directly on the sample.**

3. **After a minimum of 1 hour of continuous exposure to the fan, determine the mass of the sample. Stir the sample and spread out as in step 2. Continue to step 4.**

- **Under the calculation section, Theoretical Maximum Density, Delete the second sentence and replace with the following: The density of water at (77ºF) is 62.4.**

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To: All Holders of the Manual of Field Test Procedures

Section: **Test Procedure AASHTO T 209**

The Oregon Department of Transportation has specified method(s) for this Test Procedure. Please observe the following for our projects:

- **Under apparatus delete Bleeder valve and replace with, inline bleeder valve capable of regulating the vacuum between 25 & 30mm of mercury.**
- **Under the Standardization Section, delete the second sentence and add the following: The container shall be standardized annually and when the calibration value is in question.**
- **Use the flask method.**
- **Under Test Sample Preparation Section add the following: The test sample will be cured for a minimum of 1 hr. and a maximum of 3 hrs. according to the placement temperature range shown on the Mix Design. If the total time of storage and haul is less than 1 hour as determined by the Region QAC, Contractor CAT II and Project Manager then the test sample shall not be cured.**
- **Under the Procedure- (Pycnometer or Volumetric Flask) Delete step 12B, 13B and Note 2 and replace with the following: Fill the flask with (77.0°F +- 2°F) water and allow to stand for 10 ±1 minutes.**
- **Under Procedure – (Pycnometer or Volumetric Flask) Delete step 14B and replace with the following: The water temperature upon finishing filling the flask shall be at (77.0°F +- 2°F). Place the cover or a glass plate on the flask, and eliminate all air from the flask.**

(See Next Page)

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To: All Holders of the Manual of Field Test Procedures

Section: **Test Procedure AASHTO R 47**

The Oregon Department of Transportation has specified method(s) for this Test Procedure. Please observe the following for our projects:

- **Under Procedure, Mechanical Splitter Type B (Riffle) Method is not allowed.**
- **Under Procedure, Incremental Method, is not allowed, use the Quartering Method or a combination of the Full Quarter and the Apex Method may be utilized.**

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To: All Holders of the Manual of Field Test Procedures

Section: **Test Procedure AASHTO R 67**

The Oregon Department of Transportation has specified method(s) for this Test Procedure. Please observe the following for our projects:

Under the Apparatus Section 4, change or modify as follows:

- **Section 4.2, Core Drill Bit, the core barrel shall have an inside diameter of (6 ± 0.25 in.).**
- **Section 4.3, Separation Equipment, delete and replace with the following:**

  Cores lift shall be separated with a saw that provides a clean smooth plane representing the layer to be measured.
- **Section 4.4, Retrieval Device – Removal with a screw driver(s) or similar device shall not be allowed.**

Under Procedure, Step 5.8, delete and replace with the following:

The Hole created from the coring operation shall be filled with fast setting non-shrink grout from the QPL (Qualified Products List). Set time shall be less than 20 minutes. Ensure the final surface is flush with the surrounding surface.

Under the Layer Separation Section 7, delete 7.1 and replace with the following:

Separate the layer of HMAC to be tested from the remainder of each core with a saw. If a clean separation of the desired layer thickness occurs during core removal, sawing of specimen is not necessary. During separation the layer to be tested may be damaged, so use caution during this process.

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To: All Holders of the Manual of Field Test Procedures

Section: **Test Procedure AASHTO R 90**

The Oregon Department of Transportation has specified method(s) for this Test Procedure. Please observe the following for our projects:

For all produced aggregates the definition of "Nominal Maximum Size" shall be as follows:

"One sieve larger than the first sieve that retains more than 10% of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size."