



AGGREGATE Performance Exam
Revised Jan. 5, 2016

Special Requirements	Test Method	Test Designation	Page
Combined ACI Aggregate Base Testing Technician Level 1 certifications will satisfy the requirements for these tests. Must be obtained within one year prior to the performance testing date. <i>(apply for written and performance exam)</i> NOTE: Starting January 2011 the combination of ACI Aggregate Base Testing Technician, ACI Aggregate Testing Technician Level 1 and ACI Aggregate Testing Technician Level 2 will be accepted in Lieu of NAQTC testing for the NAQTC Aggregate Module for the condition that all ACI certifications are obtained within one year prior to the NAQTC performance testing.	Standard Practice for Sampling Aggregates	AASHTO T2*	2
	Minus No. 200 Wash	AASHTO T11 **	4
	Sieve Analysis of Aggregate	AASHTO T27**	5
	Dry Preparation	AASHTO R58	7
	Liquid Limit	AASHTO T89	8
	Plastic Limit	AASHTO T90	9
	Total Moisture Content	AASHTO T255	10
	Specific Gravity of Fine Aggregate	AASHTO T84	11
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		Moisture-Density Relations of Soils using a 4.54 –KG [10-LB] Rammer and 457-MM [18-in] Drop	AASHTO T180
	Or Method of Test for the Determination of Maximum Density and Optimum Moisture Content of Soils Using the Modified Proctor Device	Nev. T108B	14
All technicians must certify for these tests.	Sand Equivalent-shaking by hand is not allowed	AASHTO T176	15
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*Exempt if qualified in Sampling and Density Module (Doesn't apply for written exam)

**Exempt if qualified in Asphalt Module or Asphalt Extended Module (Doesn't apply for written exam)

1 st	2 nd
Pass	Pass
Fail	Fail

Date: _____ Participant Name: _____ Proctor: _____

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STANDARD PRACTICE FOR SAMPLING AGGREGATES (AASHTO T2)

Select two sampling methods and shipping samples		
PROCEDURE		
Sampling from Flowing Aggregate Stream (ORAL)		1st
1.	Select units to be sampled by an approved random method?	
2.	Obtain at least three approximately equal increments, selected at random from the unit being sampled?	
3.	Combine the three to form a field sample whose mass equals or exceeds the minimum requirements (table 1)?	

Table 1

Nominal Maximum Size	Minimum Mass, lb
Fine Aggregate	
#8	22
#4	22
Coarse Aggregate	
3/8"	22
1/2"	35
3/4"	55
1"	110
1 1/2"	165
2"	220
2 1/2"	275
3"	330
3 1/2"	385

Table not to be memorized

		1st	2nd
4.	Take each increment from the entire cross section of the material as it is being discharged?		
5.	A pan of sufficient size to intercept the entire cross-section of the discharge stream and hold the required quantities without overflowing?		

Sampling from the Conveyor Belt (ORAL)		1st	2nd
1.	Select units to be sampled by an approved random method?		
2.	Obtain at least three approximately equal increments, selected at random from the unit being sampled?		
3.	Combine the three to form a field sample whose mass equals or exceeds the minimum requirements (table 1)?		
4.	Stop the conveyor belt while the sample increments are being obtained?		
5.	Use templates that conform to the shape of the belt and insert them such that the materials contained between them will yield an increment of the required weight?		
6.	Carefully scoop all materials between the templates into a suitable container?		
7.	Collect the fines on the belt with a brush and dust pan and add to the container?		

COMMENTS:

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STANDARD PRACTICE FOR SAMPLING AGGREGATES (AASHTO T2)
-Continued-

PROCEDURE

Sampling from a Stockpile		1 st	2 nd
1.	Samples should be made up of at least three increments and taken from the top 1/3, midpoint and bottom 1/3 of the pile?		
2.	For coarse and mixed coarse and fine aggregate, use power equipment to develop a separate small sampling pile composed of material drawn from the main pile?		
3.	If power equipment is not available, use a board shoved vertically into the pile just above the sampling point?		
4.	When sampling fine stockpiles, the outer layer should be removed and sample taken from material beneath?		
5.	Sample tube may be inserted into the pile at random locations to extract a minimum of five increments of fine material to form the sample?		

Sampling from Transportation Units		1 st	2 nd
1.	Excavate three or more trenches across the transportation unit at random points that will represent the entire load?		
2.	Trench should be approximately level and least 1 ft (0.3m) in width and in depth below the surface?		
3.	A minimum of three increments from equally spaced points along each trench will be taken?		
4.	For fine aggregate, sample tube may be used?		

Sampling from Roadway (Bases and Sub-bases) (ORAL)		1 st	2 nd
1.	Select units to be sampled by an approved random method?		
2.	Obtain at least three approximately equal increments, selected at random from the unit being sampled?		
3.	Combine the three to form a field sample whose mass equals or exceeds the minimum requirements (table 1)?		
4.	Take all increments from the roadway for the full depth of the material; take care to exclude any underlying materials?		
5.	Clearly mark the specific areas from which each increment is to be removed?		

Shipping Samples (ORAL)		1 st	2 nd
1.	Transport aggregate in bags or other containers so constructed as to preclude loss, contamination or damage to the contents from mishandling during shipment?		
2.	Shipping containers for the aggregates samples shall have suitable identification?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

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**MATERIAL FINER THAN 75- μ m (No. 200) SIEVE IN MINERAL AGGREGATES BY WASHING
(AASHTO T11)**

PROCEDURE

Method A		1 st	2 nd
1.	Test sample obtained by (T248)		
2.	Test sample mass conforms to following table: <i>If the nominal maximum size of the aggregate to be tested is not listed below, the next larger size listed shall be used to determine sample size.</i>		

Nominal Maximum Size	Minimum Mass, g
No. 4 or finer	300
9.5 mm 3/8 in	1000
19.0 mm 3/4 in	2500
37.5 mm 1 1/2 in	5000

Table not to be memorized

Note: If same sample is to be tested as in T27, minimum mass should conform to requirements of that method.

		1 st	2 nd
3.	Test sample dried to constant mass at 110 \pm 5 $^{\circ}$ C (230 \pm 9 $^{\circ}$ F)?		
4.	Test sample mass determined to 0.1%?		
5.	Placed in container and covered with water?		
6.	Contents of container vigorously agitated?		
7.	Complete separation of coarse and fine particles?		
8.	Wash water poured through sieve nest?		
9.	Wash water free of coarse particles?		
10.	Operation continued until wash water is clear?		
11.	Material on sieves returned to washed sample?		
12.	Excess water decanted from washed sample only through the 75- μ m sieve?		
13.	Washed aggregate dried to constant mass at 110 \pm 5 $^{\circ}$ C (230 \pm 9 $^{\circ}$ F)?		
14.	Washed aggregate mass determined to 0.1%?		
15.	Calculation: % less than 75 μ m = $\frac{\text{Orig. dry mass} - \text{Final dry mass}}{\text{Original dry mass}} \times 100$?		

Method B (ORAL)		1 st	2 nd
1.	Same steps as Method A?		
2.	Wetting agent added?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

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**SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES
(AASHTO T27)**

PROCEDURE

Note to Assessors: Please evaluate procedure(s) and sieving efficiency for both fine and coarse sieve shakers, if applicable.

Coarse Aggregate Gradation OR Mixtures of Coarse and Fine Aggregate Gradation:		1 st	2 nd
Initial mass: _____ Final mass: _____			
1.	Sample obtained by T2, reduced by T248 or whole field sample used?		
2.	Minimum sample mass: 3/8 in. – 1 kg; ½ in. – 2 kg; ¾ in. – 5 kg; 1 in. – 10 kg; 1 ½ in. – 15 kg; 2 in. – 20 kg; 2 ½ in. – 35 kg; 3 in. – 60 kg; 3 ½ in. – 100 kg?		
3.	Sample dried to constant mass at 110±5°C (230±9°F) or sieved surface dry (coarse agg. Only)?		
4.	Mass determined to nearest 0.1%? (unless already determined in T11.		
5.	If hand sieving, particles not forced to pass through openings?		
6.	Sieving continued until not more than 0.5% by mass of the total specimen passes a given sieve during one minute of continuous hand sieving (check by hand with 8-in. diameter sieve)?		
7.	Residue on each sieve weighed to 0.1% of original dry mass?		
8.	Sieves not overloaded?		
(a)	Mass of residue on each sieve [finer than 4.75 mm (No. 4) sieves] does not exceed 7 kg/m ² of sieving surface (200 g for 8 – in. diameter sieve; 469 g for 12 in. diameter sieve)?		
(b)	Mass of residue on each sieve [for 4.75 mm (No. 4) sieves and larger] does not exceed 2.5 * (sieve opening, mm) * (effective sieving area (which is smaller than its nominal diameter) , m ²)		
9.	Total mass of material after sieving agrees with mass before sieving to within 0.3% (If not, do not use for acceptance testing)?		
10.	Percentages calculated to nearest 0.1% and reported to nearest whole number (except 75 - μm (No. 200) – if less than 10%, percentage – 200 reported to nearest 0.1%)?		
11.	Percentage calculations based on Original dry sample mass, including the passing 75-μm fraction if (T11) was used?		

Sieve	Opening (mm)	Mass (g) – 8 in. dia.	Mass (g) – 12 in. dia.
< #4	<4.75	200	469
#4	4.75	338	796
¼ in.	6.3	449	1055
3/8 in.	9.5	677	1592
½ in.	12.5	891	2094
¾ in.	19.0	1354	3183

COMMENTS:

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**SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES
(AASHTO T27)**

-Continued-

Fine Aggregate Gradation (materials primarily passing the No. 4 sieve):		1 st	2 nd
Initial mass: _____ Final mass: _____			
1.	Sample obtained by T2, reduced by T248 or whole field sample used, minimum sample mass 300 g?		
2.	Sample dried to constant mass at 110±5°C (230±9°F)?		
3.	Mass determined to nearest 0.1%? (unless already determined in T11)?		
4.	Sieving continued until not more than 0.5% by mass of the total specimen passes a given sieve during one minute of continuous hand sieving (check by hand with 8-in. diameter sieve)?		
5.	Residue on each sieve weighted to 0.1% of original dry mass?		
6.	Sieves not overloaded?		
(a)	Mass of residue on each sieve [finer than 4.75 mm (No. 4) sieves] does not exceed 7 kg/m ² of sieving surface (200 g for 8 – in. diameter sieve; 469 g for 12 in. diameter sieve)?		
(b)	Mass of residue on each sieve [for 4.75 mm (No. 4) sieves and larger] does not exceed 2.5 * (sieve opening, mm) * (effective sieving area (which is smaller than its nominal diameter), m ²)		
7.	Total mass of material after sieving agrees with mass before sieving to within 0.3% (If not, do not use for acceptance testing)?		
8.	Percentages calculated to nearest 0.1% and reported to nearest whole number (except 75 - μm (No. 200) – if less than 10%, percentage – 200 reported to nearest 0.1%)?		
9.	Percentage calculations based on Original dry sample mass, including the passing 75-μm fraction if (T11) was used?		

Sieve	Opening (mm)	Mass (g) – 8 in. dia.	Mass (g) – 12 in. dia.
< #4	<4.75	200	469
#4	4.75	338	796
¼ in.	6.3	449	1055
3/8 in.	9.5	677	1592
½ in.	12.5	891	2094
¾ in.	19.0	1354	3183

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

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DRY PREPARATION OF DISTURBED SOIL AND SOIL AGGREGATE SAMPLES FOR TEST (AASHTO R58)

PROCEDURE

Initial Preparation		1 st	2 nd
1.	Sample thoroughly dried in air or drying apparatus, not exceeding 60°C (140°F)?		
2.	Sample selected by splitting or quartering?		
3.	Soil pulverized?		
4.	Portion of dried sample selected for particle size analysis weighed and mass recorded as mass of total sample?		

Use A or B (ORAL)		1 st	2 nd
A.	Using a 2.00-mm (No. 10) sieve:		
1.	Sample separated on the 2.00 mm sieve?		
2.	Fraction retained on 2.00-mm sieve pulverized and re-sieved on the 2.00-mm sieve?		
3.	Both portions passing 2.00-mm sieve thoroughly mixed together?		
B.	Using a 4.75 mm (No. 4) and 2.00-mm (No. 10) sieve:		
1.	Sample separated on the 4.75-mm sieve?		
2.	Fraction retained on 4.75-mm sieve pulverized and re-sieved on the 4.75-mm sieve?		
3.	Sample passing 4.75-mm sieve mixed thoroughly and then split or quartered to obtain a representative portion adequate for desired tests?		
4.	That portion weighed and then separated on the 2.00-mm sieve?		
5.	Fraction retained on 2.00-mm sieve pulverized and re-sieved on the 2.00-mm sieve?		
6.	Both portions passing the 2.00-mm sieve thoroughly mixed together?		

Physical Tests T89 and T90		1 st	2 nd
1.	Remaining minus 2.00-mm material separated on 425-µm (No. 40) sieve?		
2.	Fraction retained on 0.425-mm sieve carefully pulverized and re-sieved on 425-µm sieve?		
3.	When repeated pulverizing produces only a small quantity of soil passing the 425 µm sieve, material retained on 425 µm sieve discarded?		
4.	Fraction(s) passing 425-µm sieve thoroughly mixed together for physical tests?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

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**DETERMINING THE LIQUID LIMIT OF SOILS
AASHTO METHOD A PROCEDURE
(AASHTO T89)**

Select one method

Sample Preparation		1 st	2 nd
1.	Sample obtained by T87 or T146?		
2.	Sample consists of about 100g of soil passing 425-µm (No. 40) sieve?		
3.	Soil mixed with 15 to 20 mL of distilled demineralized water in mixing dish (other than brass cup)? <i>Note: Tap water may be used for routine testing if comparative tests indicate no differences in results.</i>		
4.	Mixing done by stirring, kneading and chopping with spatula?		
5.	Additional increments of water added (1 to 3 mL) until mass is uniform and has stiff consistency?		
6.	No additional dry soil added to wet sample once testing has begun?		
7.	If too wet, sample either discarded or mixed to evaporate water?		

Multipoint Method (A) Procedure

Multipoint Procedure		1 st	2 nd
1.	Liquid limit device previously inspected for wear and height of cup drop checked?		
2.	Part of mixture put in cup and spread with spatula until 10 mm deep at maximum thickness?		
3.	As few strokes of spatula as possible used?		
4.	Care taken to avoid entrapment of air bubbles?		
5.	Excess soil returned to mixing dish?		
6.	Unused wet soil in storage dish covered with wet towel (or other means) during test?		
7.	(Using curved grooving tool): Soil in dish divided through centerline of follower with no more than six strokes of curved tool and only last stroke of grooving tool scrapes bottom of cup?		
8.	Tearing along groove and slippage of cake avoided?		
9.	Base of device not held with hand while turning crank?		
10.	Obtain 25 to 35 shocks on first closure?		
11.	Slice of soil, width of spatula, extended across cake at right angles to groove and including portion that flowed together removed from dish and placed in container?		
12.	Water content determined according to T265?		
13.	Soil remaining in cup returned to mixing dish?		
14.	Container and soil weighed to 0.01 g?		
15.	Water content determined according to (T265)?		
16.	Soil remaining in cup returned to mixing dish?		
17.	Cup and grooving tool washed and dried?		
18.	Additional water added to unused material?		
19.	Steps 2 through 18 repeated for closure in 20 to 30 shocks?		
20.	Steps 2 through 18 repeated for closure in 15 to 25 shocks?		
21.	Range of three determinations at least 10 shocks?		
22.	Water content calculated (to nearest whole percent) according to AASHTO? $\% \text{ moisture} = \frac{\text{mass of water}}{\text{Mass of oven dry soil}} \times 100$		
23.	Flow curve plotted and drawn as straight line on semi-logarithmic paper?		
24.	Moisture on linear scale and shocks on log scale?		
25.	Liquid limit equals moisture content at 25 shocks from curve?		
26.	Liquid limit value reported to nearest whole number?		
27.	For referee testing, time schedule of Section 14 used?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

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**DETERMINING THE PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS
(AASHTO T90)**

PROCEDURE

		1 st	2 nd
1.	Sample is either 20g of minus 425-µm (No. 40) material obtained by T87 or T146, or 10g of liquid limit material?		
2.	If 20-g sample of dry material: (a). Mixed with distilled or dematerialized water in mixing dish? (b). Approximately 10-g ball formed?		
3.	A 1.5 to 2-g portion of the 10-g ball selected and formed into ellipsoidal mass?		
4.	Alternate procedure (using plastic limit rolling device): (a). Ellipsoidal mass placed on bottom plate and top plate placed in contact with mass? <i>Note: More than one soil mass can be rolled simultaneously in the device.</i> (b). Simultaneous downward force and back and forth motion applied to top plate so plate comes in contact with side rails within 2 minutes? (c). Soil thread not allowed to contact side rails during rolling?		
5.	Mass rolled between fingers or palm and plate/paper (or between top and bottom plate of rolling device) to form 3-mm diameter thread?		
6.	Rate of rolling between 80 to 90 strokes per minute (counting a stroke as one complete motion of hand forward and back to the starting position)?		
7.	Mass rolled for no more than two minutes to obtain correct thread diameter?		
8.	When thread diameter is 3 mm, thread broken into several pieces?		
9.	Pieces squeezed together between thumbs and fingers into ellipsoidal mass?		
10.	Steps 4 through 9 repeated until thread crumbles and soil can no longer be rolled into a thread? <i>Note: Crumbling may occur when thread diameter is greater than the correct diameter.</i>		
11.	Operator does not attempt to produce failure at exactly 3 mm diameter?		
12.	Crumbled pieces placed in tared container and container immediately covered?		
13.	Steps 3 through 12 repeated until the 10-g specimen is completely tested?		
14.	Mass of specimen and container determined to 0.01g?		
15.	Specimen dried and water content determined according to T265?		
16.	Plastic limit calculated by following equation? $\% \text{ moisture} = \frac{\text{mass of water}}{\text{mass of oven dry soil}} \times 100$		
17.	Plastic limit reported to at least the nearest whole number?		
18.	Plasticity index calculated from: PI = Liquid limit – Plastic limit?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

Date: _____ Participant Name: _____ Proctor: _____

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**TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING
(AASHTO T255)**

PROCEDURE

		1 st	2 nd
1.	Representative test sample obtained?		
2.	Test sample mass conforms to following:		

No. 4	3/8 in.	½ in.	¾ in.	1 in.	1 ½ in.	2 in.	2 ½ in.
.5 kg	1.5 kg	2 kg	3 kg	4 kg	6 kg	8 kg	10 kg

3.	Mass determined to the nearest 0.1%?		
4.	Loss of moisture avoided prior to determining the mass?		
5.	Sample dried by a suitable heat source? Heat source:		
6.	If heated by means other than a controlled temperature oven, is sample stirred to avoid localized overheating? (Stirring optional for microwave use)		
7.	Sample dried to constant mass and mass determined to nearest 0.1%?		
8.	Moisture content calculated by? $\% \text{ moisture} = \frac{\text{original sample mass} - \text{dried sample mass}}{\text{dried sample mass}} \times 100$ <i>Note: If hot plate is used, denatured alcohol may be used to burn off moisture.</i>		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

Date: _____ Participant Name: _____ Proctor: _____

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**SPECIFIC GRAVITY AND ABSORPTION OF FINE AGGREGATE
(AASHTO T84)**

PROCEDURE

Sample Preparation		1 st	2 nd
1.	Sample obtained by T2, and reduced by T248 approximately 1000 g in size?		
2.	Dried to constant mass at 110 ± 5°C (230 ± 9°F)? <i>Note: Oven drying not necessary if naturally moist condition is desired?</i>		
3.	Allowed to cool to comfortable handling temperature?		
4.	Covered with water or at least 6% moisture added?		
5.	Allowed to stand 15-19 hours, or naturally moist?		
6.	Excess water decanted (if necessary) without loss of fines?		
7.	Sample spread on flat, nonabsorbent surface, and uniformly dried by current of warm air?		
8.	Mold placed on flat, nonabsorbent surface and filled to overflowing?		
9.	Tamper allowed to fall freely under gravitational attraction, 25 times with a 5 mm drop? <i>Note: See provisional tests 1-4 for materials that do not readily slump.</i>		
10.	Loose sand removed from around base and mold lifted vertically?		
11.	Sample fails to slump on first test?		
12.	If it does slump on the first test, is water added, sample covered and allowed to stand 30 minutes?		
13.	Drying continued and slump test repeated at frequent intervals until sample slumps slightly?		

Procedure		1 st	2 nd
1.	Pycnometer partially filled with water and 500±10 g sample added and SSD sample mass recorded?		
2.	Pycnometer filled to 90% of total capacity and agitated to eliminate air bubbles?		
3.	Mechanical agitation permitted if performed in a manner that will not degrade the sample and comparison to manual agitation on the same material performed every 6 months, and the two results fall within the Table 1 range?		
4.	Temperature of contents adjusted to 23.0±1.7°C (73.4±3°F)?		
5.	Water level adjusted to calibrated capacity and mass of pycnometer and contents determined?		
6.	Sample removed and dried to constant mass at 110±5°C (230±9°F)?		
7.	Sample cooled in air at room temperature for 1.0±0.5 hour and dry specimen mass determined?		
8.	Empty pycnometer filled to its calibration capacity with water at 23.0±1.7°C (73.4±3°C) and mass determined (pycnometer may be previously calibrated)?		
9.	All masses determined to nearest 0.1 g?		
10.	Bulk specific gravity calculated as follows {Bulk sp gr = A / (B + S - C) } and reported to nearest 0.001 (or reported to nearest 0.01 for fine aggregate meeting M6 requirements)?		
11.	If sample tested in a naturally moist condition, source of the sample and the procedures used to prevent drying prior to testing reported?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

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**SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE
(AASHTO T85)**

PROCEDURE

		1 st	2 nd
1.	Sample obtained by T2 and reduced by T248?		
2.	Screened on 4.75-mm (No. 4 sieve) [or 2.36-mm (No. 8) sieve if sample contains –No. 4 material]?		
3.	Sample mass as follows: ½ in. or less -2 kg; ¾ in. -3 kg; 1 in. -4 kg; 1 ½ in. – 5 kg?		
4.	Washed to clean surfaces of particles?		
5.	Dried to constant mass at 110±5°C (230±9°F) and cooled to room temperature for 1 to 3 hours (for up to 1 ½ in. nominal maximum size, longer for larger sizes)? <i>Note: Oven drying not necessary if naturally moist condition is desired.</i>		
6.	Covered with water for 15 to 19 hours?		
7.	Rolled in cloth to remove visible films of water? (<i>A moving stream of air may be used to assist in the drying operation.</i>)		
8.	Larger particles wiped individually and evaporation avoided?		
9.	SSD sample mass in air determined? All masses determined to nearest 1 g or 0.1% of sample mass (whichever is greater)?		
10.	Sample immediately placed in sample container?		
11.	Entrapped air removed before weighing by shaking container while immersed?		
12.	Mass determined in water at 23.0±1.7°C (73.4±3°F)?		
13.	Dried to constant mass at 110±5°C (230±9°F) and cooled to room temperature for 1 to 3 hours (or until aggregate has cooled to comfortable handling temperature, approximately 50°C)?		
14.	Oven dried sample mass determined?		
15.	Bulk specific gravity calculated using the following formulas and reported to the nearest 0.001 (or nearest 0.01 for coarse aggregate meeting M80 requirements)?		

Note to assessor: M80 specifically applies to coarse aggregates used in concrete applications.

$$\begin{aligned} \text{Bulk specific gravity} &= A / (B - C) \\ \text{Bulk sp gr (by SSD mass)} &= B / (B - C) \\ \text{Apparent specific gravity} &= A / (A - C) \\ \text{Absorption} &= [(B - A) / A] \times 100 \end{aligned}$$

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

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**MOISTURE-DENSITY RELATIONS OF SOILS
(AASHTO T180)**

AASHTO Procedure "Method A Only"

AASHTO T180: 10 lb RAMMER/18 in DROP			
Method	Mold Size	Particle Size	# of Blows
A	4 in	- No 4	25
B	6 in	- No. 4	56
C	4 in	- ¾ in	25
D	6 in	- ¾ in	56

(Not required to be memorized)

Sample Preparation		1 st	2 nd
1.	Temperature not to exceed 140 F mixed with water to approximately 4% below optimum moisture?		
2.	Appropriate equipment selected for testing method:		
3.	10 lb rammer, 18 in. drop, 5 layers – mold size and particle size as in table?		
4.	Layer of soil placed in mold and soil lightly tamped with manual rammer or 2-in. diameter similar device until it is not in a fluffy or loose state (prior to compaction)?		
5.	Mold rests on rigid and stable foundation during compaction?		
6.	Soil compacted with appropriate number layers and blows for method selected (see table and Step 3)?		
7.	Collar, removed and soils trimmed to top of mold with straightedge? <i>Note: The base plate should only be removed if the mold is calibrated without the base plate attached.</i>		
8.	Any holes in top surface filled in with unused or trimmed soil?		
9.	Mold and contents weighed to nearest 1 g (0.005 lb) and wet density calculated?		
10.	Soil removed from mold (using the sample extruder for solid molds), sample sliced vertically through center, moisture sample removed from one cut face (as shown in figure 3), and weighed immediately?		
11.	Steps 4 through 10 repeated for each increment of water until wet unit mass either decreases or stabilizes?		
12.	Water content and oven-dry unit mass calculated for each sample?		
13.	Unit weight plotted on ordinate, water content plotted on abscissa, and points connected with curve?		
14.	Water content at peak of curve taken as optimum water content?		
15.	Dry unit mass at optimum reported as maximum density, to nearest 1 kg/m ³ or 0.1 lb/ft ³ ?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

Date: _____ Participant Name: _____ Proctor: _____

AGGREGATE Performance Exam
Revised Jan. 5, 2016

MOISTURE-DENSITY RELATIONS OF SOILS
(Nev. T108B)

AASHTO Procedure "Method A Only"

AASHTO T180: 10 lb RAMMER/18 in DROP			
Method	Mold Size	Particle Size	# of Blows
A	4 in	- No 4	25
B	6 in	- No. 4	56
C	4 in	- ¾ in	25
D	6 in	- ¾ in	56

(Not required to be memorized)

Sample Preparation		1 st	2 nd
1.	Temperature not to exceed 140 F mixed with water to approximately 4% below optimum moisture?		
2.	Appropriate equipment selected for testing method:		
a.	T180 10 lb rammer, 18 in. drop, 5 layers – mold size and particle size as in table?		
3.	Layer of soil placed in mold and soil lightly tamped with manual rammer or 2-in. diameter similar device until it is not in a fluffy or loose state (prior to compaction)?		
4.	Mold rests on rigid and stable foundation during compaction?		
5.	Soil compacted with appropriate number layers and blows for method selected (see table and Step 2)?		
6.	Collar, removed and soils trimmed to top of mold with straightedge? <i>Note: The base plate should only be removed if the mold is calibrated without the base plate attached.</i>		
7.	Any holes in top surface filled in with unused or trimmed soil?		
8.	Mold and contents weighed to nearest 1g and wet density calculated?		
9.	Soil removed from mold (using the sample extruder for solid molds), sample sliced vertically through center, moisture sample (approx. 200-500g) removed from one cut face (as shown in figure 3), and weighted immediately?		
10.	Steps 4 through 16 repeated for each increment of water until wet unit mass either decreases or stabilizes?		
11.	Water content and oven-dry unit mass calculated for each sample?		
12.	Unit weight plotted on ordinate, water content plotted on abscissa, and points connected with curve?		
13.	Water content at peak of curve taken as optimum water content?		
14.	Dry unit mass at optimum reported as maximum density, to nearest 10 kg/m ³ or 1 lb/ft ³ ?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

Date: _____ Participant Name: _____ Proctor: _____

AGGREGATE Performance Exam
Revised Jan. 5, 2016

**PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY USE OF THE SAND EQUIVALENT TEST
(AASHTO T176)**

Sample Preparation		1 st	2 nd
1.	Sample obtained by T2, pulverized and passed through 4.75mm (No. 4) sieve?		
2.	All fines cleaned from +No. 4 particles and included with –No. 4 material?		
3.	Sample split or quartered to yield slightly more than four 85 mL (3 oz.) tins of No. 4 material? <i>Note: If necessary, material may be dampened before splitting or quartering to avoid segregation or loss of fines.</i>		
Method 1 – Air Dry			
1.	Enough –No. 4 material split or quartered to fill the 85-mL (3 oz) tin slightly rounded above brim?		
2.	While filling, bottom edge of tin tapped on hard surface to consolidate material?		
3.	Tin struck off level full with spatula or straightedge?		
4.	If using referee method (mechanical shaker), sample dried to constant mass at (110 ± 5°C 230 ± 9°F) and cooled to room temperature before testing?		
Method 2 - Pre Wet			
1.	Moisture condition checked by tightly squeezing small portion in palm of hand, forms a cast?		
2.	Sample at proper water content (cast permits careful handling without breaking)?		
a.	If too dry (cast crumbles easily), water added and remixed?		
b.	If too wet (shows free water), sample drained and air dried, mixing frequently?		
3.	If either (a) or (b) above occurred, sample placed in pan, covered with lid or damp cloth (not touching sample), and allowed to stand for at least 15 minutes?		
4.	Sample placed on splitting cloth and mixed by alternately lifting each corner of cloth and pulling it over sample toward diagonally opposite corner, causing material to be rolled?		
5.	When material appears to be homogeneous, mixing finished with sample in a pile near center of cloth?		
6.	Tin measure pushed through base of pile with free hand against pile opposite the measure?		
7.	Material fills tin to overflowing?		
8.	Material compacted into tin with palm of hand?		
9.	Tin struck off level full with spatula or straightedge?		
10.	If using referee method (mechanical shaker), sample dried to constant mass at 110 ± 5°C (230 ± 9°F) and cooled to room temperature before testing?		
Procedure			
1.	101.6±2.5 mm (4±0.1 in.) of working calcium chloride solution siphoned into plastic cylinder?		
2.	Prepared sample poured from measuring tin into cylinder, using funnel to avoid spillage?		
3.	Bottom of cylinder tapped sharply on heel of hand several times to release air bubbles?		
4.	Wetted sample allowed to stand undisturbed for 10±1 minutes?		
5.	Stopper placed in cylinder and material loosened from bottom by shaking?		
6.	Mechanical Shaker Method (Referee Method): (a) Stoppard cylinder placed in mechanical shaker and timer set? (b) Cylinder and contents shaken for 45±1 seconds (127 to 135 cycles during testing period)?		
7.	Following shaking, cylinder set upright on work table and stopper removed?		
8.	Irrigator tube inserted in cylinder and material rinsed from cylinder walls as irrigator is lowered?		
9.	Irrigator forced through material to bottom of cylinder by gentle stabbing and twisting action while solution flows from tip?		
10.	Stabbing and twisting motion applied until cylinder filled to 381-mm (15-in.) mark?		
11.	Irrigator raised slowly without shutting off flow so liquid level is maintained at about 15 in.?		
12.	Final level adjusted to 15 in. before irrigator is removed from cylinder (between top 2 graduations, but not above the 381-mm level)?		
13.	Cylinder and contents allowed to stand undisturbed for 20 minutes ± 15 seconds?		
14.	Timing started immediately after withdrawal of irrigator?		

COMMENTS:

Date: _____ Participant Name: _____ Proctor: _____

AGGREGATE Performance Exam
Revised Jan. 5, 2016

**PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY USE OF THE SAND EQUIVALENT TEST
(AASHTO T176)**

-Continued-

		1 st	2 nd
15.	After sedimentation time, level at top of clay suspension (clay reading) recorded?		
16.	If no clear line of demarcation, sample allowed to stand undisturbed until clay reading can be obtained, and total sedimentation time recorded?		
17.	If sedimentation time exceeds 30 minutes, test rerun using 3 individual samples of same material, and clay reading requiring shortest sedimentation time recorded?		
18.	Weighted foot assembly gently lowered into cylinder, without hitting mouth of cylinder?		
19.	When foot comes to rest on sand, assembly tipped toward cylinder graduations until indicator touches cylinder?		
20.	254 mm (10 in) subtracted from level indicated by extreme top edge of indicator, and this value recorded as sand reading?		
21.	If clay/sand readings fall between 2.5-mm (0.1-in) gradations, is level higher gradation recorded?		
Calculations			
1.	Sand equivalent calculated to 0.1 using following equation:? $\frac{\text{Sand Reading} \times 100}{\text{Clay Reading}}$		
2.	If sand equivalent is not a whole number, reported as next higher whole number?		
3.	If desired to average sand equivalent values, and average is not a whole number, reported as next higher whole number?		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

Date: _____ Participant Name: _____ Proctor: _____

AGGREGATE Performance Exam
Revised Jan. 5, 2016

**DETERMINING THE PERCENTAGE OF FRACTURED PARTICLES IN COARSE AGGREGATE
(ASTM D5821)**

PROCEDURE

Sample Preparation		1 st	2 nd
1.	Sample dried sufficiently to obtain clean separation of fine and coarse material in sieving operation?		
2.	Sample sieved over 4.75-mm (No. 4) sieve?		
3.	Portion retained on sieve reduced to appropriate size for test using a splitter?		
4.	Mass of test sample either of the following, whichever is smaller?		
	a. At least large enough so that largest particle is not more than 1% of sample mass?		
Or	b. At least as large as indicated below?		

Nominal Maximum Size, mm (in)	Minimum Mass, G (approx. lb)
9.5 (3/8)	200 (0.5)
12.5 (1/2)	500 (1)
19.0 (3/4)	1500 (3)
25.0 (1)	3000 (6.5)
37.5 (1 ½)	7500 (16.5)
50.0 (2)	15,000 (33)
63.0 (2 ½)	30,000 (66)
75.0 (3)	60,000 (132)
90.0 (3 ½)	90,000 (198)

(Not required to be memorized)

Procedure		1 st	2 nd
1.	Sample washed over sieve designated for determination of fractured particles and dried to constant mass?		
2.	Mass of test sample, and any subsequent masses, determined to nearest 0.1% of original dry sample mass?		
3.	Dried sample spread on clean flat surface large enough to permit careful inspection of each particle?		
4.	Particle held so that face is viewed directly?		
5.	If the face constitutes at least 1/4 of the maximum cross-sectional area of the particle (and the face has sharp, well-defined edges excluding small nicks), face considered a fractured face?		
6.	Using spatula or similar tool, particles separated into two categories: (1) fractured particles based on whether the particle has the required number of fractured faces, (F), and (2) particles not meeting the specified criteria, (N)?		
7.	If required number of fractured faces is not given to applicable specifications, determination made on basis of a minimum of one fractured face?		
8.	Mass or count of particles in each of the two categories determined?		
9.	Mass (of particles) used to calculate percent fractured particles, unless percentage by particle count is specified?		
10.	If more than one number of fractured faces is specified (for example, 70% with one or more fractured faces and 40% with two or more fractured faces), procedure repeated on the same sample for each requirement?		
Calculation			
1.	Mass percentage or count percentage of particles with specified number(s) of fractured faces reported to nearest 1% in accordance with the following equation?		
	$P = [F / (F + N)] \times 100$		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

Date: _____ Participant Name: _____ Proctor: _____

AGGREGATE Performance Exam
Revised Jan. 5, 2016

**METHOD OF TEST FOR EVALUATING CLEANNES OF COARSE AGGREGATE
(CT 227)**

37.5mm x 19.0mm aggregate size

Sample Preparation		1 st	2 nd
1.	Split or quarter the materials to obtain a test specimen conforming to the weight specified in table 1 for various primary aggregate nominal sizes?		

Primary Aggregate Nominal size	Oven-dry Weight, g	Volume of Wash Water, mL
2 1/2 in. x 1 1/2 in.	20,000 ± 1000	1500 ± 15
1 1/2 in. x 3/4 in.	10,000 ± 500	1250 ± 12
1 in. x No. 4	2500 ± 125	1000 ± 5
1/2 in. Max.	1000 ± 50	500 ± 3

(Table not required to be memorized)

		1 st	2 nd
2.	Dry to constant mass at 230°F ± 9°F temperature?		
3.	Cool to room temperature?		
4.	2 1/2 in. x 1 1/2 in. x 3/4 in. aggregate. Separate the material on the No. 4 box sieve using the following procedure:		
	a. Divide the sample into portions weighing approximately 2500g each?		
	a. Place one portion on the No. 4 box sieve and "rock" the assembly 10 complete cycles in approximately 12s?		
	b. One complete cycle is a back and forth motion with the stops on each end of the rocker assembly bumping the floor before the motion is reversed?		
	c. Repeat the sieving operation on each portion of the test sample?		
	d. Discard material that passes the No. 4 sieve?		
	e. Save material retained on the No. 4 sieve for determining the cleanness value?		

Test Procedures

1.	Measure out the appropriate volume of water for the test specimen according to table 1.		
	a. Place one of the 2500g portions of the test specimen in the wash vessel?		
	b. Add the wash water, clamp the lid in place, and secure the vessel in the agitator?		
	c. At 1 min ± 10s after adding the wash water, start the agitator, and agitate vessel for a period of 1 min. ± 5s?		
	d. Immediately following the agitator period, take the vessel from the agitator and remove the lid?		
	e. Bring the fines into suspension by holding the vessel in an upright position and moving it vigorously in a horizontal circular motion 5 or 6 times to cause the content to swirl inside?		
	f. Immediately pour the contents of the vessel into the No. 8 and No. 200 sieves nested over the collection pot?		
	g. Discard materials retained on the No. 8 sieve?		
	h. Pour the wash water from the collection pot into a graduated cylinder & adjust the volume to 1250 mL ± 12 mL with fresh water?		
	i. Place the second portion of the test specimen in the washing vessel add the same wash water and wash according to the above procedure?		
	j. Repeat this procedure with each of the four portions of the test specimen?		
	k. After washing the last portion and pouring it in the nested sieves, use a small amount of fresh water to rinse the remaining fines from the washing vessel?		
	l. Adjust the volume of water to 1250 mL ± 12mL with fresh water?		
	m. Return wash water to the collection pot taking care to include all water and fines?		

COMMENTS:

Date: _____ Participant Name: _____ Proctor: _____

AGGREGATE Performance Exam
Revised Jan. 5, 2016

**METHOD OF TEST FOR EVALUATING CLEANNES OF COARSE AGGREGATE
(CT 227)**

-Continued-

		1 st	2 nd
2.	Fill the graduated plastic cylinder to the 0.3 in. mark with stock calcium chloride solution & place a funnel on the cylinder.		
3.	Stir the wash water vigorously with one hand until all fines are in suspension?		
4.	Use circular motion allowing the fingers to rub the sides and bottom of the collection pot?		
5.	Immediately fill the graduated plastic cylinder to the 15 in. mark with the turbulent wash water?		
6.	Stopper the cylinder and thoroughly mix the wash water and calcium chloride solution by inverting the cylinder 20 times in approximately 35 s. Allow the air bubble to completely traverse the length of the cylinder each time?		
7.	Immediately place the cylinder on a workbench or table free of vibrations?		
8.	Remove the stopper, and allow the cylinder to stand undisturbed for 20 min ± 15s?		
9.	At the end of the 20 minute period read the top of the sediment column to the nearest 0.1 in. mark?		
	a. If a clearly defined line of demarcation does not form between the sediment and the liquid above it in the specified 20 min. period, allow the cylinder to stand undisturbed until the clear line of demarcation does form, then immediately read the time and height of the column?		
	b. If the liquid immediately above the line of demarcation is still darkly clouded at the end of the 20 minutes, and the line of demarcation although distinct appears to be in the sediment column itself, read and record the level of this line at the end of the 20 minute period?		
Cleanness Value Determination			
1.	Determine the Cleanness Value of individual test specimens?		
2.	When 2 or more primary sizes of coarse aggregate are combined in a mix, determine the weighted-average-cleanness-value for the mix?		
3.	For Portland cement concrete mixes, calculate the weighted-average-cleanness-value using the combination show below regardless of the actual portions to be used on the project? a. 1 ½ in. Maximum Aggregate mix 1 ½ in. x ¾ in. 40% 1 in. x No. 4 60% b. 2 ½ in Maximum aggregate mix 2 ½ in. x 1 ½ in. 30% 1 ½ in. x ¾ in. 30% 1 in. x No. 4 40%		

COMMENTS:

1 st	2 nd
Pass	Pass
Fail	Fail

Date: _____ Participant Name: _____ Proctor: _____