Sampling & Density Performance Exam
Revised in November 2017

SD-1
Duration: 45 Minutes

Special Requirements	Test Method	Test Designation	Page
All technicians must certify for these tests	Standard Practice for Sampling Aggregates	AASHTO T2-91 (2015)*/ ASTM D75-14	2
	Reducing field Samples	AASHTO R76-16**	4
	Standard Practice for Sampling Paving Mixtures	AASHTO T168-03 (2016)	5
	Reducing Samples of HMA to Testing Size	AASHTO R47-14	7
	Density & Moisture Content by Nuclear Methods	AASHTO T310-13 (2017)	8
	Method of Test for Relative compaction of Plant mix bituminous Base and Surface Using a Nuclear Density Gauge	Nev T335G	10

*Exempt if qualified in Aggregate Module (doesn't apply for written exam)

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

1st	2nd
Pass	Pass
Fail	Fail

Date:__________________ Participant Name:___________________ Proctor:____________________

STANDARD PRACTICE FOR SAMPLING AGGREGATES (AASHTO T2/ASTM D75)

Select two sampling methods and shipping samples

PROCEDURE

	Sampling from Flowing Aggregate Stream (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 which 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
½”	35
3/4”	55
1”	110
1 ½”	165
2”	220
2 ½”	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 who’s 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?		

Date:___________________ Participant Name:____________________ Proctor:_____________________

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

PROCEDURE

		1st	2nd
Sampling from a Stockpile		1st	2nd
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		1st	2nd
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)		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.	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)		1st	2nd
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:

1st	2nd
Pass	Pass
Fail	Fail

Date:__________________ Participant Name:___________________ Proctor:____________________

REDUCING SAMPLES OF AGGREGATE TO TESTING SIZE (AASHTO R76)

PROCEDURE			
Method A – Splitting		1st	2nd
1.	Material spread uniformly on feeder?		
2.	Rate of feed slow enough so that sample flows freely through chutes?		
3.	Material in one pan re-split until desired weight is obtained?		
Method B Quartering		1st	2nd
1.	Sample placed on clean, hard, and level surface?		
2.	Mixed by turning over three times with shovel or by raising canvas or tarp and pulling over pile?		
3.	Thoroughly mixed conical pile formed?		
4.	Pile flattened to uniform thickness and diameter?		
5.	Diameter about four to eight times thickness?		
6.	Divided into four equal portions with shovel or trowel?		
7.	Two diagonally opposite quarters, including all fine material, removed?		
8.	Cleared space between quarters brushed clean?		
9.	Process continued until desired sample size is obtained?		
Method C – Miniature Stockpile Sampling (Fine Aggregate Only)		1st	2nd
1.	Sample placed on clean, hard, and level surface?		
2.	Material thoroughly mixed by turning over three times?		
3.	Small stockpile formed?		
4.	At least 5 increments of material at random locations taken with sampling thief, small scoop, or spoon?		

COMMENTS:

1st	2nd
Pass	Pass
Fail	Fail

Date:__________________ Participant Name:___________________ Proctor:____________________

SAMPLING BITUMINOUS PAVING MIXTURES (AASHTO T168)

Select three sampling methods **PROCEDURE**			
Sampling		1st	2nd
1.	**Select units to be sampled by an approved random method?**		
a.	**Sampling from conveyor belt:** (1). Conveyor belt stopped?		
	(2). Select at least three areas with approximately equal size?		
	(3). Templates inserted in each location and obtain equal increments of materials, which will form a sample equal or exceeding the min. required?		
b.	**Sampling from Truck Transports:** (1). Randomly select the units to be sampled?		
	(2). Obtain at least three equal increments, avoid the extreme top surface?		
	(3). Combine the units to form a field sample whose quantity equal or exceed the min. required?		
c.	**Sampling from the Roadway Prior to Compaction:** (1). When one sample is to be taken, randomly obtain at least three equal increments and combine the units to form a field sample whose quantity equal or exceed the min. required?		
	(2). When three or more samples are to be taken, randomly select the locations. At each location obtain at least three equal increments and combine the units to form a field sample whose quantity equal or exceed the min. required?		
	(3). All increments are taken from the full depth of the materials?		
d.	**Sampling from a Skip Conveyor Delivering Mixtures:** (1). Randomly select the units to be sampled based on bin's storage capacity?		
	(2). Skip conveyor stopped immediately following pugmill discharge?		
	(3). Dig a furrow 6 inches deep from the top to the bottom of the pile?		
	(4). Obtain approximately three equal increments from top, middle and bottom of the furrow?		
	(5). Combined increments should equal or exceed the min. required?		
e.	**Sampling from a Funnel Device Feeding a Conveyor for Mixture Delivery to Storage:** (1). Randomly select the units based on the bin's max storage capacity?		
	(2). Obtain at least three equal increments of materials from each sample by passing a bucket across the full flow of materials as it drops from funnel device onto the conveyor?		
	(3). Combined portions should form a field sample whose quantity equals or exceeds the min. recommended?		

Guide for Estimating Quantity of Sample

Maximum Size of Aggregate*	Mass of Uncompacted Mixtures, min, kg [lb]
#8	10 [22]
#4	10 [22]
3/8"	16 [35]
½"	20 [45]
¾"	20 [45]
1"	24 [52]
1 ½"	30 [66]
2"	35 [75]

* The maximum size of aggregate is the largest sieve size listed in the applicable specification upon which any material is permitted to be retained.

COMMENTS: **Table not to be memorized**

Date:__________________ Participant Name:___________________ Proctor:____________________

SAMPLING COMPACTED BITUMINOUS MIXTURES FOR LABORATORY TESTING (ASTM D5361)

-CONTINUED-

PROCEDURE			
		1st	2nd
f.	**Samples taken by coring** (1). Randomly select the units?		
	(2). Proper tools (core drill and /or core debonder and /or core lift) are used?		
	(3). Cores have a minimum nominal diameter of 100 mm (4 in) and extended to the full depth of the lift(s) being sampled?		
	(4). Excluded any underlying material when removing the core sample from the hole?		
	(5). Randomly obtain at least three equal samples by coring for the full depth, test each sample and average the results?		
g.	**Samples taken by sawing** (1). Randomly select the units?		
	(2). Proper tools (Saw and/or chisel and /or sharpened tools) are used?		
	(3). Samples have a minimum surface area of 10 000 mm^2 (16 in^2) if it's not sampled only for pavement thickness measurement?		
	(4). Sampled minimum three samples?		
	(5). If test results appear to be erratic or biased in a way attributable to sample size, take larger samples?		
	(6). Transported Samples taken by sawing on a smooth board, top side down?		

COMMENTS:

1st	2nd
Pass	Pass
Fail	Fail

Date:__________________ Participant Name:___________________ Proctor:____________________

REDUCING SAMPLES OF HOT MIX ASPHALT (HMA) TO TESTING SIZE (AASHTO R47)

PROCEDURE			
Mechanical splitter method		1st	2nd
Using Type A Splitter			
1.	Checked the cleanliness and functionality of Type A splitter?		
2.	Applied approved asphalt release agent?		
3.	Positioned sample receptacles properly to prevent loss of material?		
4.	Hopper doors closed and secured?		
5.	Poured sample using a continuous or segmented pour from multiple directions around the hopper?		
6.	Quickly and continuously released the handle?		
7.	Any material retained on the surface?		
8.	If yes, removed and placed into the appropriate receptacles and reported for further evaluation?		

Using Type B Splitter			
1.	Heated splitter at temperature lower than 110 ºC (230°F)?		
2.	If no, cleaned and applied release agent?		
3.	Assembled receptacles under the splitter properly?		
4.	Placed HMA sample carefully and uniformly into the hopper?		
5.	Allowed HMA sample to fall through the chutes and placed retained material into the corresponding receptacles?		

Quartering Method			
1.	Placed HMA sample on a non-stick, clean, and level surface?		
2.	Thoroughly mixed the material by turning it over at least 4 times?		
3.	Flattened the conical pile by pressing on the apex by a flat surface?		
4.	The diameter was at least four to eight time the thickness?		
5.	Pressed quartering template down and separated the material using the straight edge?		
6.	Removed opposite quarters, including the fines?		
7.	Repeated until desired sample is attained?		

Incremental Method			
1.	Spread a heat-resistant paper or sheet over a hard, clean, and level surface?		
2.	Thoroughly mixed the material by turning it over at least 4 times or lifting each corner and pulling it over the sample diagonally?		
3.	Created a conical pile?		
4.	Rolled the material into cylindrical roll (loaf), and flatten the top? During this operation segregation avoided?		
5.	Pulled the paper so at least one-quarter of the length of the loaf is off the edge? Or straight edge used to slice one-quarter of the length of the material?		
6.	Repeated until desired sample is attained?		

COMMENTS:

1st	2nd
Pass	Pass
Fail	Fail

Date:__________________ Participant Name:___________________ Proctor:____________________

IN-PLACE DENSITY AND MOISTURE CONTENT OF SOIL AND SOIL-AGGREGATE BY NUCLEAR METHODS (SHALLOW DEPTH) (AASHTO T310)

PROCEDURE

Standardization		1st	2nd
1.	Performed at start of each day's use?		
2.	Permanent records of data retained?		
3.	Performed with equipment at least 10 m (30 ft) from other radioactive sources, and clear of large masses of water or other items which may affect reference count?		
4.	If recommended by manufacturer, gauge turned on and prior to stabilize prior to use and power left on during the use of the gauge for that day?		
5.	Using reference standard, at least four repetitive readings taken at normal measurement period, and mean obtained?		
6.	Equation 1 used to determined standardization (Refer to AASHTO)?		
Procedure		1st	2nd
1.	Test location selected where gauge will be at least 150 mm (6 in.) away from any vertical mass?		
2.	If test location is closer than 600 mm (24 in.) from any vertical mass, such as a trench, gauge manufacturer correction procedures followed?		
3.	All loose, disturbed and additional material removed as necessary to expose top of material to be tested?		
4.	Horizontal area sufficient in size to accommodate the gauge prepared by scraping the area smooth to obtain maximum contact between gauge and material tested?		
5.	Native fines or fine sand used to fill voids as necessary?		
6.	Surface smoothed with rigid plate or other suitable tool?		
7.	Maximum void beneath gauge without filling does not exceed 3 mm (1/8 in.)?		
8.	Gauge turned on and allowed to stabilize (warm up) according to manufacturer's recommendations?		
Direct Transmission Method (Density Determination)		1st	2nd
1.	Test location selected where gauge will be at least 6 in. away from any vertical mass?		
2.	Hole is made perpendicularly to prepared surface using guide and hole-forming device?		
3.	Hole is at least 50 mm (2 in.) deeper than desired measurement depth?		
4.	Hole aligned that insertion of the probe will not cause the gauge to tilt from plane of prepared area?		
5.	Test area marked to allow placement of instrument over test site and to allow alignment of source rod to the hole? (Follow manufacturer's recommendations if applicable).		
6.	Hole forming device removed carefully to prevent the distortion of the hole, damage to surface, or loose material to fall into the hole?		
7.	Gauge placed on material to be testing, ensuring maximum surface contact?		
8.	Source rod lowered into hole to desired test depth? *Note: A rod containing radioactive sources shall not be extended out of its shielded position prior to placing it in the test hole.*		
9.	Gauge pulled gently in direction that will bring side of probe to face center of gauge so that probe is in intimate contact with the side of the hole in the gamma measurement path?		
10.	All other radioactive sources kept at least 10 m (30 ft.) away from gauge?		
11.	If gauge is so equipped, depth selector set to same depth as probe before recording the automated values (gauge computed densities, moisture contents, and weights)?		
12.	One or more 1 minute readings secured and recorded?		
13.	In-place wet density determined by calibration curve previously established, or gauge read directly if so equipped? *Note: The gauge may be rotated about the axis of the probe to obtain additional readings (when oversize material is present this can be used as a check).*		

COMMENTS:

Date:__________________ Participant Name:___________________ Proctor:____________________

IN-PLACE DENSITY AND MOISTURE CONTENT OF SOIL AND SOIL-AGGREGATE BY NUCLEAR METHODS (SHALLOW DEPTH) (AASHTO T310)

-Continued-

Calculations		1st	2nd
1.	If dry density required, in-place water content determined by using nuclear methods, gravimetric samples and laboratory determination, or other approved instrumentation?		
2.	If water content determined by nuclear methods, moisture subtracted from wet density [both in kg/m^3] and dry density obtained or gauge readings used directly?		
3.	If water content determined by other methods, Equation 2 used?		

COMMENTS:

1st	2nd
Pass	Pass
Fail	Fail

Date:__________________ Participant Name:___________________ Proctor:____________________

Method of Test for Relative Compaction of Plantmix Bituminous Base and Surface Using a Nuclear Density Gauge (Nev. T335G)

PROCEDURE			
Standardization of Nuclear Gauge		1st	2nd
1.	Troxler 4640B and 3450 to be run daily or at the start of each shift?		
2.	Place the standard block on the materials to be tested at least 10 ft away from any large object and 30 ft from any other nuclear gauge?		
3.	Readings recorded after warm-up , standardize the gauge as per manufacturer instructions?		
Testing "Test Section" and Computing Percent Compaction		1st	2nd
1.	Divide the test section into 5 subsections of equal length?		
2.	The station & distance from the edge of the pad where the mat density test will be taken, is determined from the table of random numbers (figure 2 in the test procedure), by multiplying a random number times the length of the subsection and rounded to the nearest 25 ft?		
3.	For the test site station use another random number times the width of the pad rounded to 1 ft for the distance in from the edge?		
4.	Use one column of random numbers for the station and the other for the distance from the edge from any random number block for each test section?		
5.	Take 4 one minute readings, rotating the gauge 90° about its center after each reading. Average the 4 readings?		
6.	Random numbers are always used in series of ten; five from column A and five from column B. Any block can be used as long as a different block is selected for each new "test section"?		
7.	Calculations performed correctly?		
Density Testing – Normal Mode		1st	2nd
1.	Place the gauge on a smooth, flat surface of the plant mix?		
2.	Check for rocking?		
3.	Enter one minute count time and depth of paving into the gauge?		
4.	Place the source rod in the "Measure' position and Press "Start"?		
5.	Record results?		
6.	Procedure repeated for each required count?		
In Place Mat Density Measurements (Oral with demonstration)		1st	2nd
1.	Target density programmed into the gauge?		
2.	Take four one-minute density readings?		
3.	Rotate the gauge 90° about its center after each reading?		
4.	Averaging the 4 readings?		
Correlation with Drilled Cores (ORAL)		1st	2nd
1.	Take cores at the same place where the gauge readings were obtained?		
2.	Density of the cores are determined by NvT336?		
3.	The average of 5 cores and their nuclear density readings will be correlated as follow: a. If the difference between the two averages is not greater than ±1% of the average core density, the nuclear gauge reading shall be used without correction? b. If the difference between the two exceeds ±1%, then the correction factor = average of 5 core densities/average of the 5 nuclear densities?		
Computing Percent Compaction		1st	2nd
1.	Compaction % = (average test site density x correction factor) / target density x 100?		
2.	Mean % Relative Compaction = mean test section density/target density x 100?		
3.	Calculations are performed within 30 minute time limit?		

COMMENTS:

1st	2nd
Pass	Pass
Fail	Fail

Date:__________________ Participant Name:___________________ Proctor:____________________