State of Nevada
Department of Transportation
Materials Division

STANDARD METHODS OF SAMPLING STONE, GRAVEL, SAND AND PAVING MIXTURES FOR USE AS HIGHWAY MATERIALS

SCOPE

This test method is used to obtain a representative sample of stone, gravel, sand and certain paving mixtures for the following purposes:

Preliminary investigation of sources of materials.

Acceptance or rejection of sources of materials.

Inspection of shipments of materials.

Inspection of materials on the site of work.

Some types of materials covered by this method are base aggregates, aggregates for bituminous courses, aggregates for portland cement products, plantmix and roadmix bituminous paving mixtures, and portland cement treated base mixtures.

Representative sample is defined as obtaining material in the same proportion as they will exist or will be used. Good sampling practices must be used throughout the entire sampling and transporting process.

APPARATUS

1. Sample Containers, metal bucket, plastic bucket, 12” cylinders mold, or canvas sample sack of sufficient size to obtain required sample size.

   NOTE: Metal buckets, are used to sample plantmix; 12” cylinder molds, to give a split of a plantmix sample to Materials Division or IA Lab. Plastic containers, are used to sample soils and aggregates. Canvas sample sacks are used to sample for mix designs and source required tests.

2. Shovel or Scoop, square point shovel, bullnose shovel or scoop with a handle long enough to permit proper sampling. Sampling equipment must be clean to prevent contamination of material being sampled.

SECURING SAMPLES

1. All acceptance test samples shall be obtained by or observed by the Engineer or their authorized representative. Samples for informational tests may be submitted by the contractor, seller or owner of the supply.

2. Sampling is as important as the testing procedure. The sampler shall use every precaution to obtain samples that will show the true nature and condition of the materials that they represent.

3. When obtaining any representative sample, it shall be done randomly. This process is based off of the minimum required sample frequencies for project. One of the following methods will be used:

   a. When the testing frequency is based on volume or weight (yd^3 or tons), the location to be sampled shall be determined by the use of the Table of Random Numbers given in Figure 1. This method depends upon the volume or weight of the material the sample represents and the capacity of the delivery vehicle. The vehicle to be sampled from is determined by the following procedure:

      From the table of random numbers, select a number block 1 thru 35. Do not use the same number more than once per day. Multiply the random number by the volume or weight of the material the sample will represent. Then, divide the volume or weight of the material obtained by the capacity of one delivery vehicle. This number will represent the vehicle to be sampled. Use standard practice for rounding, unless the random number selected indicates the unit to be sampled is less than one. Then, the unit to be sampled will be considered to be number one.

      Example: Sampling plantmix from behind the paver using belly dump vehicles for delivery. Using random number block 1, column B, the random number is .482. The sample frequency is one per 1,000 tons. Multiply .482 x 1,000 tons = 482 tons. This belly dump vehicle's capacity is 23 tons. Therefore, 482 tons/23 tons = 20.95 or 21. Samples for this 1,000 ton frequency would be taken from approximately the 21^{st} belly dump load after the paving machine placed the 21^{st} load on the roadway. Document the random number block and random number utilized on the appropriate coversheet under remarks.

      Example: Sampling granular backfill from a jobsite stockpile. The material was delivered to the jobsite in a 10 yd^3 dump truck. Using random number block 1, column B, the random number is .482. The sample frequency is one per 1,000 yd^3. Multiply .482 x 1,000 yd^3 = 482 yd^3. This dump truck's capacity is 10 yd^3. Therefore, 482 yd^3/10 yd^3 = 48.20 or 48. Samples for this 1,000 yd^3 frequency would be taken from approximately the 48^{th} dump truck load. Document the random number block and random number utilized on the appropriate NDOT test report coversheet under remarks.

b. When the testing frequency is based on area (yd^2), the location to be sampled shall be determined by the use of the Table of Random Numbers given in Figure 1. This method depends upon the area of the material the sample represents and is determined by the following procedure:

From the table of random numbers, select a number block 1 thru 35. Do not use the same number more than once per day. The exact station at which the test will be taken is determined from the table of random numbers by multiplying a random number (column A) times the length of the area to be tested. The exact distance in from the edge of the test area where the test will be taken is determined from the table of random numbers (column B) times the width of the test area.

Example: Sampling pulverized base and surface (roadbed modification) from the finished surface area. The sample frequency is one per 7,000 yd^2.

Random Number Block = 15 — Average Width of the entire mat = 13.8 ft
Beginning Station "X" 413 + 03 — Ending Station "X" 407 + 95

Note: One station equals 100 ft

("X" 413 + 03) – ("X" 407 + 95) = 508 ft

Column A	x	Test Area Length	=	Distance for Test Area
.698		508 ft		354.6 ft

("X" 413 + 03) – 354.6 = "X" 409 + 48

Column B	x	Test Area Width	=	Distance in from edge of Test Area
.683		13.8 ft		9.4 ft

Test will be taken at "X" 409 + 48, 9.4 ft in from edge of test area

Document the random number block and random number utilized on the appropriate NDOT test report coversheet under remarks.

c. When the testing frequency is based on length (mile), the location within a given mile to be tested shall be determined by the use of the Table of Random Numbers in Figure 1 and is determined by the following procedure:

From the table of random numbers, select a number block 1 thru 35. Do not use the same number more than once per day. The exact station at which the test will be taken is determined from the table of random numbers by multiplying a random number (column A) times the length of the area to be tested.

Example: Testing retro-reflectivity of pavement striping. The sample frequency is two per lane mile.

Random Number Block = 24
Beginning Station "X" 24 + 73

$$\frac{\text{Column A}}{.673} \times \frac{\text{Test Area Length}}{1 \text{ mile}} = \frac{\text{Distance of Test Area}}{.673 \text{ mile}}$$

Convert miles to ft:

.673 mile x 5,280 ft = 3,553.4

("X" 24 +73) + 3,553.4 = "X" 60 + 26

Two tests will be taken at in the vicinity of "X" 60 + 26

PROCEDURE

Stone from Ledges or Quarries

1. Inspect the ledge or quarry face of the stone to determine any variation in different strata.

2. Obtain separate samples of stone from all strata that appear to vary in color and structure. Include overburden as a separate sample.

3. Each sample should weigh at least 23 kg (50 lbs) and should consist of specimens that are not obviously weathered beyond a degree of usefulness for the purposes intended.

4. When the toughness or compression test is required, include one piece in each sample of not less than 150 mm x 150 mm x 100 mm (6in. x 6in. x 4in.) in size with the bedding plane clearly marked. This piece should be free of seams or fractures.

5. Pieces that have been damaged by blasting shall not be included in the sample.

Field Stone and Boulders

Carefully inspect the deposits of field stone and boulders over the area where the supply is to be obtained. Note and record the various kinds of stone and the condition in the various deposits.

1. Select separate samples of all classes of stone that visual inspection indicates would be considered for use in construction. Individual samples shall weigh at least 23 kg (50 lbs).

2. Estimate and record the percentages of different classes of stone that were sampled, and the percentages of material that can be rejected by visual examination and may therefore have to be handled and rejected.

Deposits of Sand and Gravel

1. If the deposit is worked as an open-face bank or pit, take the sample by channeling the face vertically, top to bottom, to obtain sample from the vertical face, starting from the top and channeling towards the bottom so the sample will be representative of the material to be used.

2. If visual inspection indicates that there is considerable variation in the material, select individual samples to represent the material in each well-defined stratum. Include overburden or disturbed material as a separate sample. Note and record the elevations of the individual strata.

3. Where there is little or no variation in the material, obtain a large sample from each test location and reduce to the proper size by thorough mixing and quartering.

4. If the deposit does not have an exposed face, or if samples are desired in other parts of a proposed deposit; excavate or drill test holes at numerous locations to determine the quality of the material and the extent of the deposit. The number and depth of these test holes will depend on the quantity of the material needed, topography of the area, nature of the deposit, as well as the character of the material and value of the resultant product.

5. Size of the samples shall be such that at least 12 kg (25 lbs) of sand and 34 kg (75 lbs) of gravel are available for tests, if both are present.

6. Estimate the quantity of the different materials that are available in the deposit.

Stockpiles

1. Sample at the top, middle and bottom around the circumference of the stockpile from a minimum of three locations. Do not sample exposed material. Be aware of the segregation that usually occurs when material is stockpiled, with the coarser particles rolling to the outside base of the pile.

2. Insert a board or sign of sufficient size into the pile above the point of sampling to aid in preventing further segregation during sampling.

3. Be sure to remove the top layer of material before sampling.

4. When possible, use power equipment to expose various levels of the stockpile. Ensure material is mixed by the power equipment before a pad is made.

   NOTE: Samples may be tested individually to show the extent of variation existing in the stockpile. Samples may be combined to form a composite sample to demonstrate the overall quality of the stockpile.

Conveyor Belt

Safety Precautions: Notify plant operator that a belt sample needs to be obtained. If the conveyor belt is not equipped with an automatic sampling device the following safety precautions need to be followed.

Conveyor belt shall be stopped and proper lock out tag out procedures followed.

Appropriate access to the conveyor belt shall be given to person(s) obtaining the belt sample. Platform that is MSHA or OSHA approved shall also be provided. If necessary, engineer or their authorized representative can witness sample being taken.

1. Sample aggregate when the plant is in full production and there is a uniform layer of material on the belt. Stop the belt with material on it, before sampling.

2. Sample from the entire width of the belt. Use a metal template, shaped to fit the contour of the belt, to isolate the sample and to prevent segregation during sampling.

3. Use a brush to collect all fines.

4. Sample a minimum of three locations from the belt. Combine portions to form one composite sample.

Storage Bins

1. Sample from the bin as the material is being discharged.

2. Allow sufficient material to flow before sampling to insure normal uniformity.

3. Sample from the complete cross section of flow.

Transport Vehicles

1. Use the following procedure for trucks, railroad cars or any other uncovered vehicle.

2. Make three or more trenches across the width of the load.

    a. The bottom of the trench should be at least one foot below the surface of the aggregate at the sides of the vehicle and approximately one foot wide at the bottom.

    b. The bottom of the trench should be as level as possible.

3. Obtain approximately five equal portions from within the trench; sampling at equally spaced intervals with two portions being sampled near outer sides of transport vehicle.

4. Sample size shall be as outlined in the Table 1.

Processed Windrows

1. Remove the top one-half of the windrow by cutting a trench across the width of the windrow.
    a. Slope the sides of the trench to prevent segregation during sampling.
    b. Remove all disturbed material from the sampling area.
    c. Strike off the ends of the trench vertically with the blade of the shovel.
2. Sample the full length of the trench as prepared above.
    a. Remove material to a depth of at least one and one-half times the maximum size of the particles.
    b. Sample from each end of the trench toward the center.
3. Sample a minimum of three locations from the windrow. Combine portions to create one composite sample.

Paving Machine

1. Sample from the front of paving machine or in front of the auger before spreading and screeding.
2. Collect the sample at intervals to represent an entire truckload of material.
3. Obtain the sample from both sides of the paving machine.

Roadbed, behind laydown machine

1. Take samples from the roadbed behind the laydown machine and prior to compaction.
2. Fill up the metal buckets with material from the auger to fill in the holes from obtaining the composite sample.
3. Take three samples of material deposited from one truckload and combine to form a single composite sample.
    a. Samples shall be taken from the first, middle and last portions of the load.
    b. Samples shall be taken diagonally across the mat at equal portions from the left, center and right segments of the placement and far enough apart to represent one truck load of material.
    c. Using a shovel or scoop remove material in a neat, clean-cut hole to prevent segregation. Remove all loose particles to the full depth of placement, making sure not to get into underlying mat. (If sample is excessively contaminated with underlying material, obtain another sample).

Sampling with Mechanical Device

1. Plants may be equipped with some type of mechanical device for securing samples of the finished product prior to or as the material leaves the conveyor belt.

2. Ensure the device takes all of the material or the device goes all the way through the stream of material to obtain a representative sample.

NUMBER AND SIZE OF SAMPLES

1. The number of samples required depends on the intended use of material, quantity of material involved and variations in the material. A sufficient number of samples must be obtained, as outlined above, to cover all variations in the material. Where multiple samples are taken to show variation, each sample shall conform to sample size as outlined in Table 1.

2. Frequencies and sample locations for sampling processed construction materials in the field are set forth in the State of Nevada Department of Transportation Field Testing Guide, Part 2.

3. The sample sizes set forth below are tentative. Quantities must be based on the type and number of tests to which the material is to be subjected and sufficient material obtained to provide for proper execution of all required tests. The minimum amount depends on maximum size of the particles, as follows:

TABLE 1 – SIZE OF SAMPLE

Nominal Maximum Size of Particles, Passing Sieve	Minimum Weight of Field Sample, Kgs (lbs)
2.00 mm (No. 10)	5 kg (10 lbs)
4.75 mm (No. 4)	5 kg (10 lbs)
9.75 mm (3/8”)	5 kg (10 lbs)
12.50 mm (1/2”)	10 kg (20 lbs)
19.00 mm (3/4”)	15 kg (30 lbs)
25.00 mm (1.0”)	25 kg (50 lbs)
37.00 mm (1-1/2”)	30 kg (70 lbs)
50.00mm (2.0 “)	40 kg (90 lbs)
63.00mm (2-1/2”)	45 kg (100 lbs)
75.00 mm (3.0”)	60 kg (125lbs)
90.00mm (3-1/2”)	65 kg (150 lbs)

4. Field samples of bituminous material and cement treated mixtures taken from the roadbed behind the paver, shall not be less than 1000 cm^2 (144 in^2) of pavement surface area, and shall extend the full depth of the course of material placed.

MARKING AND SHIPPING SAMPLES

1. Immediately upon sampling, samples shall be placed in approved sample sacks or buckets and covered or sealed to prevent contamination or loss of fines. Label each canvas sample sack and bucket at the time of sampling.

2. Each canvas sample sack of material submitted to the Materials lab for testing shall be accompanied by the appropriate NDOT form.

3. In addition to the transmittal form inside the canvas sample sack, label the outside of the canvas sample sack with a brief description of the contents which includes the material type, contract number, date sampled, and if more than one bag of the same material is sampled label it bag 1 of 2 or 2 of 2 etc. Also include a copy of all minimum required tests ran by the construction field lab.

   NOTE: All minimum required tests should have passing results before submitting to the Materials Lab.

TABLE OF
RANDOM NUMBERS

A	B	A	B	A	B	A	B	A	B
1		2		3		4		5	
.576	.730	.430	.754	.271	.870	.732	.721	.998	.239
.892	.948	.858	.025	.935	.114	.153	.508	.749	.291
.669	.726	.501	.402	.231	.305	.009	.420	.517	.858
.609	.482	.809	.140	.396	.025	.937	.310	.253	.761
.971	.824	.902	.470	.997	.392	.892	.957	.640	.463
6		7		8		9		10	
.053	.899	.554	.627	.427	.760	.470	.040	.904	.993
.810	.159	.225	.163	.549	.405	.285	.542	.231	.919
.081	.277	.035	.039	.860	.507	.081	.538	.986	.501
.982	.468	.334	.921	.690	.806	.879	.414	.106	.031
.095	.801	.576	.417	.251	.884	.522	.235	.398	.222
11		12		13		14		15	
.509	.025	.794	.850	.917	.887	.751	.608	.698	.683
.371	.059	.164	.838	.289	.169	.569	.977	.796	.996
.165	.996	.356	.375	.654	.939	.815	.592	.348	.743
.477	.535	.337	.155	.767	.187	.579	.787	.358	.595
.788	.101	.434	.638	.021	.894	.324	.871	.698	.539
16		17		18		19		20	
.566	.815	.622	.548	.947	.169	.317	.472	.864	.466
.901	.342	.873	.964	.942	.985	.123	.086	.335	.212
.470	.682	.412	.064	.150	.962	.925	.355	.909	.019
.068	.242	.667	.356	.195	.313	.396	.460	.740	.247
.874	.420	.127	.284	.448	.215	.833	.652	.601	.326
21		22		23		24		25	
.897	.877	.209	.862	.428	.117	.100	.259	.425	.284
.875	.969	.109	.843	.759	.239	.890	.317	.428	.802
.190	.696	.757	.283	.666	.491	.523	.665	.919	.146
.341	.688	.587	.908	.865	.333	.928	.404	.892	.696
.846	.355	.831	.218	.945	.364	.673	.305	.195	.887
26		27		28		29		30	
.882	.227	.552	.077	.454	.731	.716	.265	.058	.075
.464	.658	.629	.269	.069	.998	.917	.217	.220	.659
.123	.791	.503	.447	.659	.463	.994	.307	.631	.422
.116	.120	.721	.137	.263	.176	.798	.879	.432	.391
.836	.206	.914	.574	.870	.390	.104	.755	.082	.939
31		32		33		34		35	
.636	.195	.614	.486	.629	.663	.619	.007	.296	.456
.630	.673	.665	.666	.399	.592	.441	.649	.270	.612
.804	.112	.331	.606	.551	.928	.830	.841	.602	.183
.360	.193	.181	.399	.564	.772	.890	.062	.919	.875
.183	.651	.157	.150	.800	.875	.205	.446	.648	.685

FIGURE 1