Standard Method of Test for

Random Method of Sampling Highway Construction Materials

SCDOT Designation: SC-T-100 (9/08)

1. SCOPE

1.1. This test method outlines the procedure for randomly sampling highway construction materials at the production plant, in a truck bed, and on the roadway. A table of random numbers is used to pre-determine the sampling time and location. This method may be used in any situation requiring random selection procedures.

2. SIGNIFICANCE AND USE

2.1. The purpose of this procedure is to obtain random material samples that are representative of the material being produced. This procedure is used in determining sample times and sample locations that are necessary for obtaining random samples that are used for acceptability of materials according to SCDOT specifications.

3. PROCEDURE

3.1. Determine Sampling Times:

3.2. Sampling Frequency: Determine the number of samples of the material that are to be obtained. Sampling frequency varies with application; information regarding the number and timing of samples can generally be found in the Specifications or Construction Manual.

3.3. Randomization:

3.3.1. At the beginning of each day of sampling, divide the anticipated volume of production to be tested into the required number of equal intervals.

3.3.2. Select a series of consecutive random numbers from Figure SC-T-100A.

3.3.3. If random sampling times during the day are needed, multiply the first random number in the series by the number of minutes in the first time interval and add the product to the clock time at the beginning of the interval. Take the random sample at the first opportunity following the computed sampling time.

3.3.4. Repeat the operation, using the other random numbers in the same order as they appear in the Figure SC-T-100A, to determine the sampling times for the remaining time intervals. In each interval, the product of the random number and the number of minutes in that interval is added to that interval's beginning clock time to determine the sampling time.

0.576	0.730	0.430	0.754	0.271	0.870	0.732	0.721	0.998	0.239
0.892	0.948	0.858	0.025	0.935	0.114	0.153	0.508	0.749	0.291
0.669	0.726	0.501	0.402	0.231	0.505	0.009	0.420	0.517	0.858
0.609	0.482	0.809	0.140	0.396	0.025	0.937	0.310	0.253	0.761
0.971	0.824	0.902	0.470	0.997	0.392	0.892	0.957	0.640	0.463
0.053	0.899	0.554	0.627	0.427	0.760	0.470	0.040	0.904	0.993
0.810	0.159	0.225	0.163	0.549	0.405	0.285	0.542	0.231	0.919
0.081	0.277	0.035	0.039	0.860	0.507	0.081	0.538	0.986	0.501
0.982	0.468	0.334	0.921	0.690	0.806	0.879	0.414	0.106	0.031
0.095	0.801	0.576	0.417	0.251	0.884	0.522	0.235	0.398	0.222
0.509	0.025	0.794	0.850	0.917	0.887	0.751	0.608	0.698	0.683
0.371	0.059	0.164	0.838	0.289	0.169	0.569	0.977	0.796	0.996
0.165	0.996	0.355	0.375	0.654	0.979	0.815	0.592	0.348	0.743
0.477	0.535	0.137	0.155	0.767	0.187	0.579	0.787	0.358	0.595
0.788	0.101	0.434	0.638	0.021	0.894	0.324	0.871	0.698	0.539
0.566	0.815	0.622	0.548	0.947	0.169	0.817	0.472	0.864	0.466
0.901	0.342	0.873	0.964	0.942	0.985	0.123	0.086	0.335	0.212
0.470	0.682	0.412	0.064	0.150	0.962	0.925	0.355	0.909	0.019
0.068	0.242	0.667	0.356	0.195	0.313	0.396	0.460	0.740	0.247
0.874	0.420	0.127	0.284	0.448	0.215	0.833	0.652	0.601	0.326
0.897	0.877	0.209	0.862	0.428	0.117	0.100	0.259	0.425	0.284
0.875	0.969	0.109	0.843	0.759	0.239	0.890	0.317	0.428	0.802
0.190	0.696	0.757	0.283	0.666	0.491	0.523	0.665	0.919	0.146
0.341	0.688	0.587	0.908	0.865	0.333	0.928	0.404	0.892	0.696
0.846	0.355	0.831	0.218	0.945	0.364	0.673	0.305	0.195	0.887
0.882	0.227	0.552	0.077	0.454	0.731	0.716	0.265	0.058	0.075
0.464	0.648	0.629	0.269	0.069	0.998	0.917	0.217	0.220	0.659
0.123	0.791	0.503	0.447	0.659	0.463	0.994	0.307	0.631	0.422
0.116	0.120	0.721	0.137	0.263	0.176	0.798	0.879	0.432	0.391
0.836	0.206	0.914	0.574	0.870	0.390	0.104	0.755	0.082	0.939
0.636	0.195	0.614	0.486	0.629	0.663	0.619	0.007	0.296	0.456
0.630	0.673	0.665	0.666	0.399	0.592	0.441	0.649	0.270	0.612
0.804	0.112	0.331	0.606	0.551	0.928	0.830	0.841	0.602	0.183
0.360	0.193	0.181	0.399	0.564	0.772	0.890	0.062	0.919	0.875
0.183	0.651	0.157	0.150	0.800	0.875	0.205	0.446	0.648	0.685

TABLE OF RANDOM NUMBERS
Figure SC-T-100A

3.3.5. Example of Calculating the Random Sampling Times:

3.3.5.1 Assume production is expected to begin at 7:00 a.m. and continue for ten hours, creating four lots. A random sampling time is needed during each of the four periods.

3.3.5.2 Divide the operating period into four intervals as follows:

$$I = \frac{60H}{S} = \frac{(60)(10)}{4} = 150 \text{ minutes}$$

where: I = the interval (minutes)
H = number of hours the plant operates
S = number of samples to be obtained

3.3.5.3 Select a series of random numbers from the random number table.

0.354 0.949 0.24 0.826

3.3.5.4 Compute Sampling Times:

0.354 x 150 = 53 minutes
0.949 x 150 = 142 minutes
0.241 x 150 = 36 minutes
0.826 x 150 = 124 minutes

Interval 1 = 7:00 a.m.
Interval 2 = 7:00 a.m. + 150 minutes = 9:30 a.m.
Interval 3 = 9:30 a.m. + 150 minutes = 12:00 noon
Interval 4 = 12:00 noon + 150 minutes = 2:30 p.m.

Sampling Times:

Interval 1 = 7:00 a.m. + 53 minutes = 7:53 a.m.
Interval 2 = 9:30 a.m. + 142 minutes = 11:52 a.m.
Interval 3 = 12:00 noon + 36 minutes = 12:36 p.m.
Interval 4 = 2:30 p.m. + 124 minutes = 4:34 p.m.

3.3.6. Delay of production due to plant breakdown, weather or other cause:

When it is not possible to obtain a scheduled sample because of breakdown, weather or other cause, disregard the sample and proceed to obtain the next scheduled sample. If operations are resumed before the completion of a specific interval, then a sample is to be taken as soon as it is feasible to do so before completion of that interval.

3.3.7. Examples of a Delay in Production:

Example 1: Suppose a breakdown occurs at 10:30 a.m. and operations do not resume until 12:05 p.m. No sample would be obtained during Interval 2 because no production occurred between 11:52 a.m., the sampling time and 12:00 noon, the end of Interval 2. Interval 3 would be sampled as scheduled.

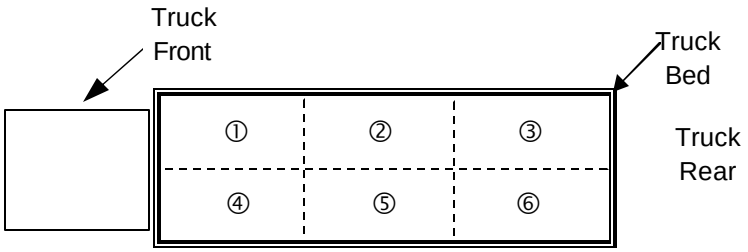
Example 2: Suppose a breakdown occurs at 7:30 a.m. and operations do not resume until 8:30 a.m., then a sample would be required from Interval 1 as soon as it is feasible to obtain one.

3.4. Sampling from a Truck Bed:

3.4.1. Determining Sampling Locations on the Truck:

3.4.1.1 Divide the truck into 6 imaginary locations as shown in Figure SC-T-100B:

These locations are to remain constant and cannot be reversed.



TRUCK SAMPLING LOCAT IONS
Figure SC-T-100B

3.4.1.2 Select a set of random numbers from Figure SC-T-100A. Because there are 6 imaginary locations on the truck, multiply each random number by 6. The sample locations are determined by the magnitude of the product (see Figure SC-T-100C):

PRODUCT	SAMPLE LOCATION
0.00-1.00	1
1.01-2.00	2
2.01-3.00	3
3.01-4.00	4
4.01-5.00	5
5.01-6.00	6

SAMPLE LOCATIONS
Figure SC-T-100C

3.4.1.3 Example of Computing Sampling Locations on Truck (see Figure SC-T-100D):

SAMPLE NO.	RANDOM NO.	PRODUCT (Random No. x 6)	TRUCK LOCATION
1	0.509	3.05	4
2	0.834	5.00	5
3	0.165	0.99	1

COMPUTING SAMPLING LOCATIONS
Figure SC-T-100D

3.5. Random Roadway Sampling of In-Place Highway Materials:

3.5.1. Divide the length of the day's run into the required number of equal subsections. Determine the beginning station number of each subsection.

3.5.2. Randomly select a column of random numbers from Figure SC-T-100A, which are the random number table to be used to determine the longitudinal distance from each beginning subsection station number.

3.5.3. Randomly select another column of random numbers from Figure SC-T-100A, which are to be used to determine the transverse distance from the right edge of the roadway to the sample location.

3.5.4. For the first sample, multiply the first random number of the first set by the number of feet in the subsection. Add this value to the beginning station number of that subsection. This will yield the station number of the sample location. To determine the transverse distance from the right edge of the roadway to the sample location, multiply the width of the lane available (available = width of lane - 2 ft.) by the random number from the second set and add one foot.

3.5.5. Continue this procedure for each sample location.

3.5.6. Example of Locating Samples of In-Place Highway Materials:

3.5.6.1 Suppose a day's run was 5000 feet. Determine the subsection lengths:

5000 feet = 1000 feet per subsection (5 subsections)

Recall the beginning station number for the day. Add 1000 feet to the station number to obtain the beginning station number of the next subsection. Do this for all 5 subsections.

3.5.6.2 Assume that the roadway is 12 feet wide; therefore, the available roadway width is:

12 feet - 2 feet = 10 feet

3.5.6.3 Randomly select 2 sets of random numbers from Figure SC-T-100A:

0.629	0.399	0.551	0.564	0.800
0.663	0.592	0.928	0.772	0.875

3.5.6.4 Using the first number in the first set of random numbers, calculate the longitudinal distance to the first sample in subsection 1:

(1000 feet subsection) (0.629) = 629 feet

Add this value to the beginning station number of the subsection to obtain the station number of the sample in subsection 1:

STA 0+00 + 629 feet = STA 6+29

Using the first number in the second set of random numbers, calculate the transverse distance from the right edge to the sample location:

(0.663) (10 feet) + 1 feet = 7.6 feet from right edge

Therefore, the first sample location is at STA 6+29 and is located 7.6 feet from the right edge.

3.5.6.5 Repeat Step 3.5.6.4. for each subsection, as shown in Figure SC-T-100E.

SUBSECTION	RANDOM NO.	FEET TO SAMPLE	SAMPLE LOCATION
1	0.629 0.663	(0.629)(1000 ft.) = 629 ft. (0.663)(10 ft.) + 1 = 7.6 ft.	STA 0+00 + 629 = STA 6+29 8 ft. from right edge
2	0.399 0.592	(0.399)(1000 ft.) = 399 ft. (0.592)(10 ft.) + 1 = 6.9 ft.	STA 10+00 + 399 = STA 13+99 7 ft. from right edge
3	0.511 0.928	(0.511)(1000 ft.) = 511 ft. (0.928)(10 ft.) + 1 = 10.3 ft.	STA 20+00 + 511 = STA 25+11 10 ft. from right edge
4	0.564 0.772	(0.564)(1000 ft.) = 546 ft. (0.772)(10 ft.) + 1 = 8.8 ft.	STA 30+00 + 546 = STA 35+46 9 ft. from right edge
5	0.800 0.875	(0.800)(1000 ft.) = 800 ft. (0.875)(10 ft.) + 1 = 9.8 ft.	STA 40+00 + 800 = STA 48+00 10 ft. from right edge

LOCATING SAMPLES OF IN-PLACE HIGHWAY MATERIALS
Figure SC-T-100E

4. CALCULATIONS

4.1. Calculations for this test are listed in the procedure section.

5. REPORT

5.1. Record what times the samples should be taken, where in the truck bed the samples are to be obtained and where the samples are to be taken from the roadway.