Kentucky Method 64-113-08
Revised 08/06/08
Supersedes KM 64-113-05
Dated 01/31/05

SAMPLING MATERIALS BY RANDOM NUMBER SAMPLING

1. SCOPE: This method provides a procedure and illustrations, in the form of several examples, for selecting samples using a system of random numbers. To accomplish this selection, choose the random sample so that each unit of material (e.g., cubic yard, square yard, ton, etc.) has the same probability of being selected. Divide each material sampled into lots, and establish a frequency of sampling.

2. PROCEDURE:

2.1. Random numbers can be generated by some calculators by planting a seed number such as date, time of day, etc., expressed as a decimal between 0 and 1. Included in this method are two tables of random numbers which may also be used. Enter the table in a random method, such as a blind placement of a pencil. After choosing the first random number in this manner, choose consecutive numbers, following a column (or row), until the entire table has been used. At that time, repeat the initial process of random entry into the table of numbers. This method will reduce the possibility of using a value from the table more than once. All examples are completed using the tables contained in this method.

2.2. Following are examples related to particular phases of highway construction:

2.2.1. EXAMPLE NO. 1

In this example, select station numbers for Lane Density coring of a 0.75-in. nominal-maximum mixture. Specifications require four Lane Density cores for each 1000 tons of mixture placed. The sublot size is 1000 tons with a frequency of four Lane Density cores per sublot. The sublot of mixture in question will be placed on a 12-ft.-wide lane that is 4545 ft. long. The lift thickness of the 0.75-in. nominal-maximum mixture is 3.0 in. The job starts at Station No. 0+00.

Since four Lane Density cores are required for the entire 4545-ft. length, obtain one core for each 1136.25 ft. of pavement. Use the following steps to determine the station number and offset for each Lane Density core:

2.2.1.1. Refer to the random number table (see p. 5 for example).

2.2.1.2. Enter the table at any point. Select four consecutive numbers from the random number table. Use these numbers for finding the station number of the Lane Density core site in each 1136.25-ft. section.

Multiply each random number by 1136.25 to determine the station

number at which to obtain the Lane Density core. After determining the location of the first Lane Density core, for each of the remaining Lane Density cores, add increments of 1136.25 ft., increasing with each Lane Density core, to provide locations throughout the entire sublot length.

SAMPLE NO.	RANDOM NUMBER CALCULATION	STATION NUMBER
1	0.420 x 1136.25 = 477.23 + 0.00 = 477	4 + 77
2	0.859 x 1136.25 = 976.04 + 1136.25* = 2112	21 + 12
3	0.011 x 1136.25 = 12.50 + 2272.50 = 2285	22 + 85
4	0.762 x 1136.25 = 865.82 + 3408.75 = 4275	42 + 75

*1136.25-ft. increments, as determined by the sublot length, provide resultant numbers throughout the entire sublot length.

According to Subsection 402.03.02 of the *Standard Specifications*, obtain Lane Density cores no closer than six inches from the pavement edge or joint. To select the transverse distance from the pavement edge (left or right), select four additional consecutive numbers from the random number table (see p. 5 for example), and multiply each random number by 11.5 (12-ft. lane width minus the 0.25-ft. offset from each side). For this example, calculate the distance from 0.25 ft. inside of the right edge of the pavement.

SAMPLE NO.	RANDOM NO. CALCULATION	OFFSET FROM RIGHT EDGE
1	0.062 x 11.5 + 0.25 =	1.0 ft.
2	0.100 x 11.5 + 0.25 =	1.4 ft.
3	0.409 x 11.5 + 0.25 =	5.0 ft.
4	0.784 x 11.5 + 0.25 =	9.3 ft.

Therefore, from the calculations above, conform to the Lane Density coring schedule given below for this sublot:

SAMPLE NO.	STATION NUMBER	OFFSET FROM RIGHT EDGE
1	4 + 77	1.0 ft.
2	21 + 12	1.4 ft.
3	22 + 85	5.0 ft.
4	42 + 75	9.3 ft.

With respect to this example, in other cases, the paving length and width will vary, but use the same procedure for obtaining random locations.

2.2.2. EXAMPLE NO. 2

In this example, select trucks to sample for running air content, slump, and concrete cylinders on Class AA Concrete for a bridge deck pour.

The pour will consist of 250 cubic yards of concrete. The trucks will be hauling 10 cubic yards each. The testing frequency is one test for each 50 cubic yards; therefore, there will be at least five tests required. Use the following steps to select the trucks to sample:

2.2.2.1. Refer to the random number table (see p. 5 for example).

2.2.2.2. Select five consecutive numbers from the random number table. Use these numbers to determine which trucks to sample. Multiply each number by 50 (a lot size of 50 cubic yards), and divide the answer by 10 (cubic yards per truck) to determine which trucks to sample.

SAMPLE NUMBER	RANDOM NUMBER	CALCULATED VOLUME (cubic yards)	TRUCK SAMPLED
1	0.007	x 50 = 0.35 + 0 = 0.35 ÷10 = 0.04*	1st
2	0.922	x 50 = 46.1 + 50** = 96.1 ÷ 10 = 9.6	10th
3	0.729	x 50 = 36.5 + 100 = 136.5÷ 10 = 13.7	14th
4	0.949	x 50 = 47.5 + 150 = 197.5÷ 10 = 19.8	20th
5	0.606	x 50 = 30.3 + 200 = 230.3÷ 10 = 23.03	24th

*When the answer contains a decimal, always round upward to the next highest whole number to determine the truck number.

**Add increments of 50 cubic yards (lot size), increasing with each sample, in order to provide sampling throughout the full 250 cubic yards.

2.2.3. EXAMPLE NO. 3

In this example, select the accumulated tonnage of Crushed Stone Base for gradation testing. The frequency for gradation testing of aggregate bases is one test per 2000 tons of material. Plan quantities show 10,000 tons of Crushed Stone Base exist on this project. This quantity will require five gradation tests.

Again, select five consecutive random numbers from the random number table (see p. 5 for example). Use these numbers to determine the accumulated tonnage at which to select the sample.

Multiply each number by 2000 to determine the accumulated tonnage for sampling. Add increments of 2000 tons (lot size), increasing with each sample, in order to provide sampling throughout the full 10,000 tons.

SAMPLE NUMBER	RANDOM NUMBER CALCULATION	ACCUMULATED TONNAGE
1	0.658 x 2000 = 1316 + 0 =	1316
2	0.747 x 2000 = 1494 + 2000 =	3494
3	0.270 x 2000 = 540 + 4000 =	4540
4	0.715 x 2000 = 1430 + 6000 =	7430
5	0.418 x 2000 = 836 + 8000 =	8836

Obtain samples as near the above-listed accumulated tonnages as possible.

2.3. The system of selecting random samples can be related to periods of time, number of pieces, tons, etc. The key to randomness, using this method, relies heavily on the manner of entering the table. Do not use the same set of numbers repeatedly.

APPROVED _____

ACTING DIRECTOR
DIVISION OF MATERIALS

DATE 08/06/08

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Attachments km11308.doc

TABLE 1
RANDOM NUMBERS

.600	.504	.248	.230	.996	.462	.422	.054	.224	.121
.116	.227	.802	.349	.241	.956	.079	.632	.126	.677
.098	.726	.507	.607	.963	.410	.572	.777	.237	.851
.147	.867	.802	.416	.370	.377	.775	.256	.348	.148
.644	.067	.001	.158	.702	.148	.667	.217	.421	.149
.310	.531	.520	.560	.888	E.287	.567	.251	.593	.571
.493	.235	.886	.178	.490	X.007	.640	.343	.894	.079
.788	.272	.484	.487	.277	A.922	.435	.716	.924	.304
.652	.523	.317	.601	.705	M.729	.669	.435	.984	.239
.816	.045	.423	.943	.227	#.949	.395	.931	.887	.242
.086	.585	.177	.851	.513	2.606	.911	.253	.669	.328
.689	.755	.027	.183	.024	E.658	.041	.512	.518	.910
.117	.029	.309	.017	.926	X.747	.584	.570	.212	.504
.700	.989	.980	.532	E.640	A.270	.610	.257	.996	.978
.321	.431	.370	.814	X.420	M.715	.548	.148	.953	.450
.515	.775	.759	.438	A.859	#.418	.689	.924	.350	.724
.543	.575	.633	.097	M.011	3.170	.357	.429	.899	.087
.629	.502	.503	.036	#.762	.280	.605	.518	.275	.017
.221	.882	.206	.415	1.776	.548	.520	.417	.253	.808
.751	.446	.189	.776	.465	.936	.970	.467	.371	.077
.553	.160	.464	.309	.298	.304	.613	.512	.816	.270
.384	.778	.284	.435	.246	.319	.078	.695	.152	.637
.969	.740	.102	.093	.055	.155	.225	.782	.226	.250
.085	.125	.750	.900	.991	.887	.993	.183	.096	.542
.667	.355	.784	.803	E.072	.206	.508	.385	.691	.127
.076	.968	.527	.749	X.062	.075	.526	.292	.176	.310
.788	.943	.091	.141	A.100	.040	.750	.870	.249	.345
.165	.422	.601	.095	M.409	.897	.963	.271	.770	.100
.472	.201	.558	.725	#.784	.025	.943	.040	.984	.011
.668	.708	.776	.490	1.270	.868	.658	.954	.916	.955

TABLE 1
RANDOM NUMBERS

.600	.504	.248	.230	.996	.462	.422	.054	.224	.121
.116	.227	.802	.349	.241	.956	.079	.632	.126	.677
.098	.726	.507	.607	.963	.410	.572	.777	.237	.851
.147	.867	.802	.416	.370	.377	.775	.256	.348	.148
.644	.067	.001	.158	.702	.148	.667	.217	.421	.149
.310	.531	.520	.560	.888	.287	.567	.251	.593	.571
.493	.235	.886	.178	.490	.007	.640	.343	.894	.079
.788	.272	.484	.487	.277	.922	.435	.716	.924	.304
.652	.523	.317	.601	.705	.729	.669	.435	.984	.239
.816	.045	.423	.943	.227	.949	.395	.931	.887	.242
.086	.585	.177	.851	.513	.606	.911	.253	.669	.328
.689	.755	.027	.183	.024	.658	.041	.512	.518	.910
.117	.029	.309	.017	.926	.747	.584	.570	.212	.504
.700	.989	.980	.532	.640	.270	.610	.257	.996	.978
.321	.431	.370	.814	.420	.715	.548	.148	.953	.450
.515	.775	.759	.438	.859	.418	.689	.924	.350	.724
.543	.575	.633	.097	.011	.170	.357	.429	.899	.087
.629	.502	.503	.036	.762	.280	.605	.518	.275	.017
.221	.882	.206	.415	.776	.548	.520	.417	.253	.808
.751	.446	.189	.776	.465	.936	.970	.467	.371	.077
.553	.160	.464	.309	.298	.304	.613	.512	.816	.270
.384	.778	.284	.435	.246	.319	.078	.695	.152	.637
.969	.740	.102	.093	.055	.155	.225	.782	.226	.250
.085	.125	.750	.900	.991	.887	.993	.183	.096	.542
.667	.355	.784	.803	.072	.206	.508	.385	.691	.127
.076	.968	.527	.749	.062	.075	.526	.292	.176	.310
.788	.943	.091	.141	.100	.040	.750	.870	.249	.345
.165	.422	.601	.095	.409	.897	.963	.271	.770	.100
.472	.201	.558	.725	.784	.025	.943	.040	.984	.011
.668	.708	.776	.490	.270	.868	.658	.954	.916	.955

TABLE 2
RANDOM NUMBERS

.605	.973	.319	.294	.236	.572	.216	.973	.931	.870
.720	.497	.679	.634	.299	.578	.743	.835	.062	.200
.918	.295	.295	.777	.854	.281	.867	.864	.374	.748
.294	.396	.441	.321	.655	.191	.205	.899	.807	.186
.089	.927	.802	.530	.937	.257	.530	.005	.539	.999
.591	.409	.668	.967	.993	.920	.812	.018	.578	.618
.494	.808	.410	.097	.633	.149	.547	.895	.829	.953
.021	.699	.597	.286	.982	.953	.913	.422	.291	.979
.926	.085	.758	.624	.491	.694	.496	.490	.949	.457
.351	.709	.461	.093	.498	.377	.639	.801	.388	.334
.329	.857	.949	.550	.095	.906	.596	.462	.891	.758
.126	.525	.834	.677	.045	.699	.568	.147	.902	.664
.572	.101	.066	.147	.069	.006	.979	.259	.765	.460
.728	.374	.402	.679	.601	.492	.002	.512	.529	.089
.524	.346	.698	.133	.013	.907	.992	.453	.883	.684
.176	.870	.306	.179	.071	.854	.086	.414	.973	.785
.031	.437	.512	.107	.842	.507	.458	.018	.881	.506
.826	.110	.065	.878	.182	.460	.442	.504	.075	.027
.945	.640	.283	.330	.163	.496	.767	.543	.921	.923
.948	.890	.677	.328	.075	.752	.207	.692	.268	.204
.232	.639	.425	.434	.795	.329	.941	.026	.867	.035
.896	.502	.074	.092	.203	.625	.541	.505	.835	.021
.643	.838	.357	.294	.592	.440	.676	.186	.304	.212
.552	.892	.843	.851	.685	.847	.963	.189	.604	.634
.623	.955	.024	.718	.534	.978	.962	.208	.645	.811
.988	.648	.182	.983	.128	.784	.606	.138	.208	.337
.326	.500	.874	.958	.826	.523	.462	.823	.955	.773
.130	.545	.756	.164	.418	.817	.707	.882	.984	.903
.907	.419	.705	.597	.655	.566	.546	.738	.614	.373
.859	.365	.476	.351	.154	.458	.645	.303	.631	.832