

## Colorado Procedure 75-08

*Standard Practice for*

### Stratified Random Sampling of Materials

#### 1. SCOPE

1.1 This practice covers the random selection of materials to be sampled and tested.

1.2 This Standard may involve hazardous materials, operations, and equipment. This Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this Standard to establish appropriate safety and health practices prior to use.

#### 2. REFERENCED DOCUMENTS

##### 2.1 *ASTM Standard:*

D 3665 Standard Practice for Random Sampling of Construction Materials.

#### 3. SIGNIFICANCE AND USE

3.1 The sampling and testing procedures to be followed are specified in the procedures of the tests required.

3.2 The sampling of materials is one of the most critical steps in materials testing. If the material to be tested to determine conformity to specifications is not chosen randomly, the tests will not reflect the true characteristics of the material being evaluated. Most specifications require samples to be taken using a stratified random process. Stratified random requires that one random sample is selected from each subplot or the quantity represented by the minimum sampling frequency. Stratified random sampling ensures that samples are selected uniformly throughout the entire production process.

3.3 Random sampling ensures that all produced material will have an equal chance of being selected for testing. No material is excluded from the chance of being selected unless it is specified in the test specification.

3.4 It is the nature of random testing that some of the samples will represent below average

material, just as they will sometimes represent above average material.

3.5 Random number schedules should be predetermined using an established random process. CDOT has developed a random schedule program that can be used for sampling all construction materials. The *Random Schedule* program is included in the Asphalt03 and Voids03 computer programs. Random number schedules used for sampling should not be shared with the supplier before the sample is taken. Contractors can generate their own random number schedules as needed using the computer program. Extra samples may be taken for the contractor's use at the time of sampling.

3.6 Stratified random sampling is called for in most of CDOT's specifications. However, some specifications have a minimum sampling frequency of one per day. Regardless of the quantity produced that day one sample is still required. A predetermined random sampling schedule has no way of knowing what the daily production will be. It is the responsibility of the tester to ensure that the minimum sampling frequency is met in these cases. Other specifications require that a minimum number of samples to be taken regardless of the produced quantity. In these cases the planned quantity is divided by the number of required samples to determine the sampling frequency. A stratified random schedule should be generated using the new sampling frequency.

#### 4. CDOT's RANDOM SCHEDULE PROGRAM

4.1 CDOT's random schedule program is contained in both the Asphalt03 and Voids03 computer programs, found under Tools. It is written in Microsoft Excel and can be used to generate a random sampling schedule for all materials.

#### 5. GENERATING A RANDOM SCHEDULE

5.1 Open the *Random Schedule* program. Enable the macros when asked. Instructions for using the program are included in the Instructions

worksheet. Read through the instructions before using the program. The program requires that Excel's Analysis ToolPak - VBA be installed before the macros will run properly. Follow the instructions on the Instructions worksheet to do this.

5.2 Move to the "Rand Nos" worksheet. Enter the project information into the green shaded cells. Click the "Clear No's" button to clear the worksheet. Click the "Generate Random Numbers" button to generate a set of random numbers. Click the "Print" button to print the random number schedule.

5.2.1 The random schedule program has the option of generating offset random numbers. Offset numbers are used to find a random transverse location. For example, the correct random location for a mat density test is the combination to two random numbers, the longitudinal (along the length of the pavement) and transverse (across the width of the pavement). The generation of transverse numbers can be turned off by changing the cell for generating offset numbers to "No". The "Transverse\_Convert"

worksheet contains a table that can help you convert the transverse random number into feet and inches based on the width of the pavement.

5.2.2 The random schedule program can only generate up to 70 numbers at one time. To generate numbers in excess of 70 follow the instructions in the "Instructions" worksheet.

5.3 Repeat the steps in Subsection 5.2 to generate a random schedule for all materials and test elements for the project.

## **6. COMPLETING THE RANDOM SCHEDULE FORM**

6.1 On the project, sample as close as possible to the values represented on the sampling schedule. Fill in the "Taken At" column of the random schedule form as samples are being selected. Major deviations from the sampling schedule should be noted and explained on the form or on additional pages as needed.