

### **5.21.03 SEGREGATION CHECK USING THE NUCLEAR DENSITY GAUGE**

#### **OBJECTIVE.**

The objective of these instructions is to give guidance on establishing a density profile behind the laydown machine. This is accomplished by taking multiple readings within a 15 m (50 foot) section. Use the nuclear density gauge results to plot a density profile. Check the profile for a drop in density caused by segregation. Check the roadway profile location for visible segregation. It is important to record the profile location to permit possible future evaluation of the segregated section. It is intended that metric projects use metric values and that English projects use English values.

#### **PROJECT STARTUP.**

At the start of the project, allow the paving unit 300 m (1000 feet) progress with each mix designation before implementing a profile analysis.

#### **SELECTION OF PROFILE LOCATIONS.**

It is intended that visibly identifiable segregated areas be profiled. Two basic types of segregation are encountered on the roadway. They are truck load segregation and longitudinal segregation.

- Truck load segregation (spot, chevron, or gull wing type segregation) has a visible pattern repeated with each truck load. These segregated areas are about the same longitudinal distance apart. This type of segregation will normally occur 3 to 7.5 m (10 to 25 ft) from the screed stop point when trucks dump directly into the paver. The use of a material transfer vehicle (MTV) has been known to extend this further down the paving section.
- Longitudinal segregation (streaking) is normally caused by the paver. This streaking is parallel to the centerline of the project, and may occur continually, or may periodically start and stop.

If the laydown machine continues to progress without any stops, then the engineer will establish profile starting points.

If the laydown machine periodically stops, then use the location where the screed stops as the "zero" point for the profile starting point. The Engineer should use caution on whether to run a profile if the laydown machine has been stopped for more than 10 minutes, due to cooling of the mix.

## **LOCATION OF DENSITY READINGS.**

Take readings approximately every 1.5 m (5 ft.) along the longitudinal direction. The first reading should be located approximately 3 m (10 ft.) behind the screed (zero point). If a segregated location is visible between two locations, then take an additional reading at that location.

- When checking for truck load segregation, the longitudinal distance from centerline may vary, but not the transverse distance (see Figure 1).
- When checking for longitudinal streaking, the longitudinal distance from centerline will vary. This is done so the profile will cross over the longitudinal streaks. Determine the transverse distance from centerline to the longitudinal segregation. Start the profile approximately 0.6 m (2 ft.) farther transversely than the center of the longitudinal streak. End the profile approximately 0.6 m (2 ft.) less transversely than the center of the longitudinal streak. The approximate distance (0.6 m or 2 ft.) from the center of the streak to start and end the profile will be determined by the Engineer (see Figure 1).

Pick a distance from either edge of which you believe will be most likely to detect segregation. That distance shall be more 0.6 m (2 ft.) from either edge of placement. Only one distance is to be used throughout the length of a single profile section for truck load segregation. When testing for longitudinal segregation, each end of the profile will be more than 0.3 m (1 ft.) from the edge of paving.

If there is no visible segregation, then randomly select the location for the profile section.

## **NUCLEAR GAUGE READINGS.**

Use minus 600  $\mu\text{m}$  (No. 30) aggregate from the mix to fill any voids in the surface. Smooth and level the minus 600  $\mu\text{m}$  (No. 30) material with a metal plate or straight edge. The aggregate is not to be used as a thin film between the hot mix and the gauge. Use only enough aggregate to fill the voids. (For this procedure, the aggregate shall be minus 600  $\mu\text{m}$  (No. 30) material from the mix with no more than 20% passing the 150  $\mu\text{m}$  (No. 100) sieve.

In backscatter mode, take 3 one minute readings and average. If one of the readings varies by more than 15  $\text{kg}/\text{m}^3$  ( 1  $\text{lb.}/\text{ft.}^3$ ), then discard and take an additional reading to replace it. It is not necessary for the gauge to be calibrated to the mix.

Take a minimum of 10 locations along the profile section. It is not necessary to maintain a rigid longitudinal spacing of 1.5 m (5 ft.) as stated above. Remember to take additional readings if a segregated location is encountered along the profile.

## **PROFILE EVALUATION.**

Initially perform four segregation checks for each mix. When four consecutive profile evaluations meet the acceptable criteria established in the Contract Documents, the District Materials Engineer may reduce the segregation checks to a frequency deemed appropriate.

The contractor field representative will be provided results of the segregation checks as they are completed. Whenever one of segregation checks fails the acceptable criteria established in the Contract Documents, the contractor will be allowed to make changes to the mix, plant or

roadway operations before the next profile evaluation is made. If any changes are to be made by the contractor, these changes are to be made within the first hour of production following notification of a failing evaluation. Production of the hot mix is to cease whenever two consecutive checks fail. The contractor will make changes to the mix or process before production is restarted. The contractor may produce enough mix to place approximately 600 m (2000 ft.) of pavement one paver width wide. Two segregation checks will be taken within this 600 m (2000 ft.) of production. If both segregation checks meet acceptable criteria, the contractor may resume normal production. If one or both of the segregation checks fail, the contractor will make changes before production is restarted. The contractor may then produce enough mix for an additional 600 m (2000 ft.) of pavement and this production will be evaluated as was the previous 600 m (2000 ft.) of production. This procedure of placing and evaluating 600 m (2000 ft.) sections will be continued until both segregation checks pass. Normal production and segregation checks will resume when both evaluations pass.

The drop in density caused by segregation will be calculated by subtracting the lowest density obtained from the average profile density. The average profile density shall be calculated using all density determinations in the profile section. The density range will be calculated by subtracting the lowest from the highest profile density.

#### **SEGREGATION CHECK FORM.**

The SEGREGATION CHECK USING THE NUCLEAR GAUGE form provides the user a means of recording key information to pinpoint the location of the profile section. It also provides a chart for graphing the average recorded nuclear density readings.

Note the screed location is referred to as the zero point. When the paver is stopped, rollers are prevented from compacting all of the bituminous material that has been laid down. A portion of material has the chance to cool before being compacted. Recording the densities behind the screed provides the gauge operator a complete profile of possible low density locations.

On the right side of the chart is a location to place a different scale in case the left side does not fall in the density region of the material being profiled. If this side is used, cross out values on the left side to help eliminate any confusion.

#### **DENSITY GAUGES AND TEMPERATURE.**

It is recommended to allow the compacted surface to cool for as long as possible prior to using the density gauge. Remove the gauge from the surface immediately after the readings have been taken.

Although the density gauge is designed for high surface temperatures (175°C or 350°F), the ambient temperature inside the gauge is not to exceed 70°C (160°F). If the gauge remains on the surface for any length of time, the surface temperature becomes the ambient temperature inside the gauge. This occurs when the surface temperature penetrates up into the electronics. The electronics can experience temporary malfunction or permanent damage due to excessive heat.

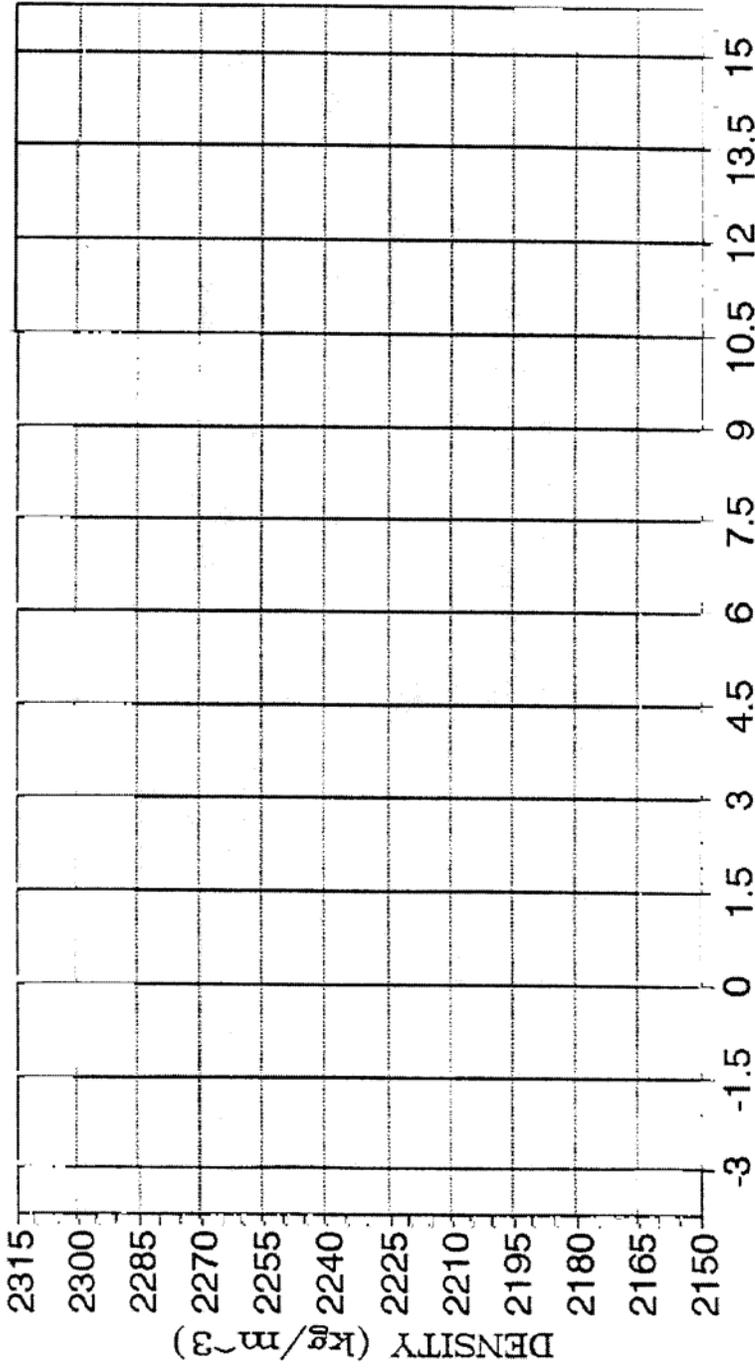
# SEGREGATION CHECK USING THE NUCLEAR DENSITY GAUGE

Rev 08/12/96

Project No. \_\_\_\_\_ Mix Type \_\_\_\_\_ O/L Thickness \_\_\_\_\_ Profile No. \_\_\_\_\_ Dist. \_\_\_\_\_  
 Profile Station No. \_\_\_\_\_ Profile Lift No. \_\_\_\_\_ Visible Segregation (Yes/No) \_\_\_\_\_

Date \_\_\_\_\_ Gauge Serial No. \_\_\_\_\_ Profile Distance From CL \_\_\_\_\_  
 Operator \_\_\_\_\_ Contractor \_\_\_\_\_ Brand and Model of Paver \_\_\_\_\_

Remix Equipment (In or Ahead of Paver): None, Auger Paver, Shuttle Buggy, Pick Up Device, Material Transfer Device, Other \_\_\_\_\_



Revised  
Density  
Scale

SCREEN LOCATION

DISTANCE (m)

Send Copy To Bureau of Materials and Research

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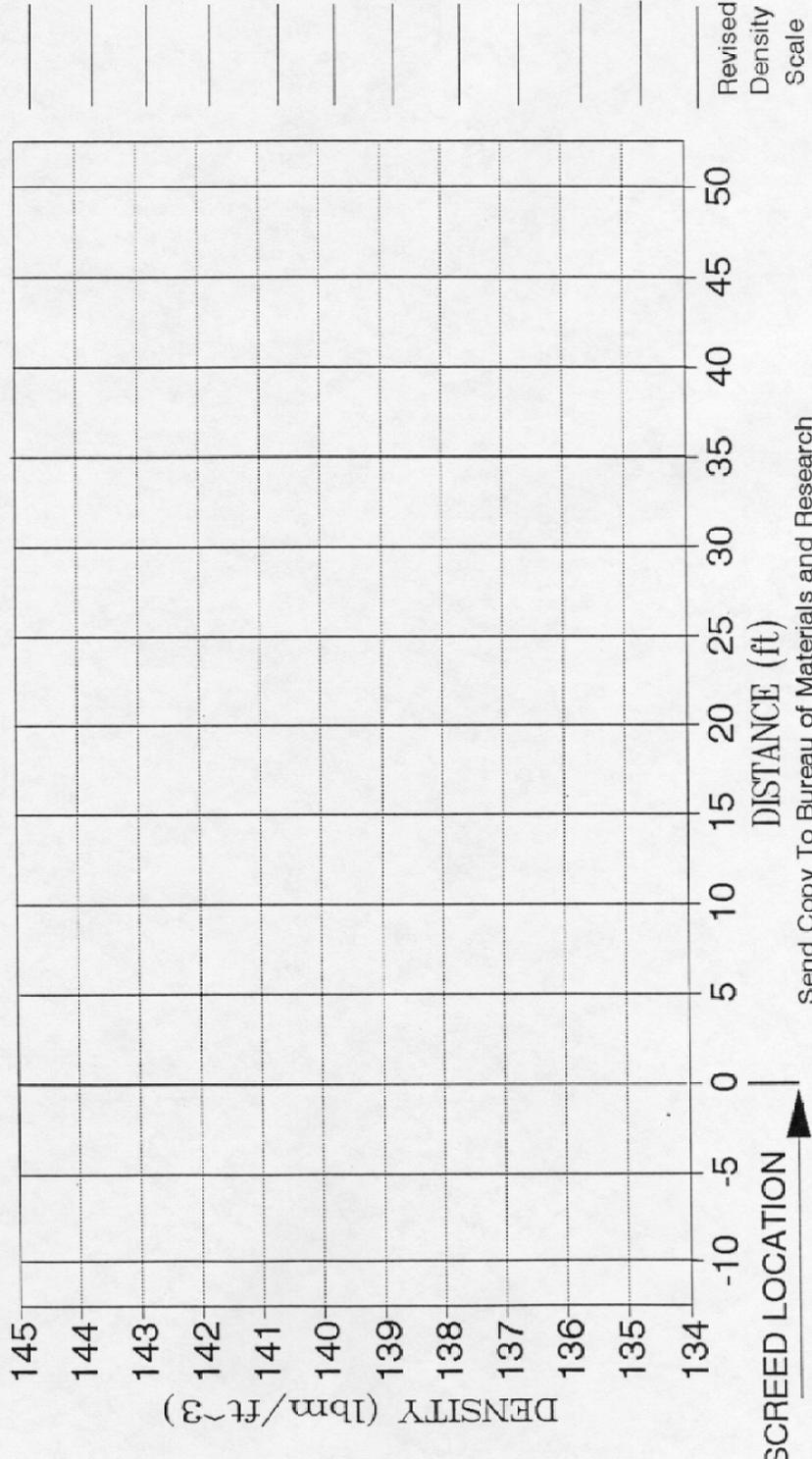


FIGURE 1: SEGREGATION PROFILE LOCATION

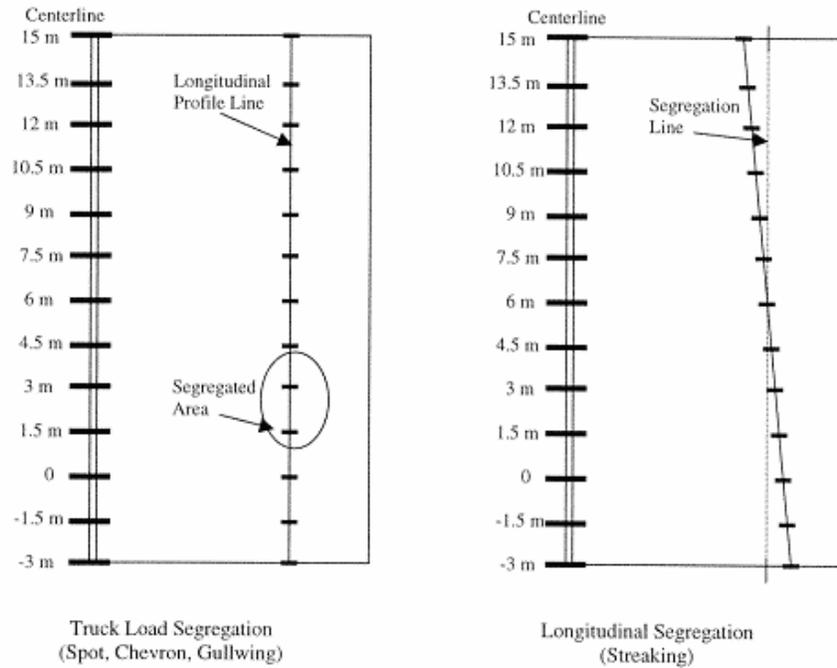
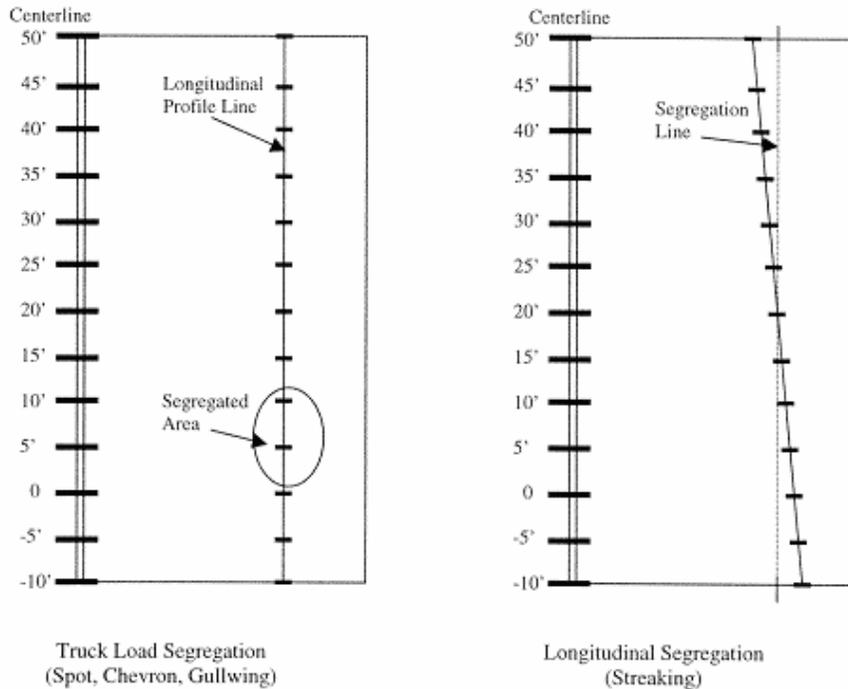


FIGURE 1: SEGREGATION PROFILE LOCATION



Locate profile as follows:

- 1) Mark location where paver stops.
- 2) Determine worst visible segregated area.
- 3) Take profile through area staying at least 0.6 m (2 ft.) from centerline or edge of pavement.

Locate profile as follows:

- 4) Determine worst longitudinal segregated area.
- 5) Take profile at an angle (offset from each end by 0.6 m or 2 ft.)
- 6) Keep ends of profile more than 0.3 m (1 ft.) From edge of paved section.