

NEBRASKA DEPARTMENT OF ROADS  
NDR STANDARD METHOD T 504

**DETERMINATION OF CLAY LUMPS,  
SHALE AND SOFT PARTICLES IN  
COARSE AGGREGATE AND CRUSHED ROCK,  
AND OF CLAY LUMPS IN FINE AGGREGATE  
AND SAND GRAVEL AGGREGATE**

**SCOPE**

- 1.1 This method of test covers the procedure for determining the percent of clay lumps, shale and soft particles in coarse aggregate and crushed rock, and the percent of clay lumps in fine aggregate and sand gravel aggregate.

**APPARATUS**

- 2.1 **Balance** - The balance shall conform to the requirements of AASHTO M 231, "Weighing Devices Used in the Testing of Materials", for the class of general purpose balance required for the principal sample mass of the sample being tested.
- 2.2 **Sample Container** - The sample containers shall be watertight metal pans, approximately 12 inches by 17 inches, and 2 ½ inches in depth.
- 2.3 **Drying Equipment** - An oven capable of maintaining a uniform temperature of 110±5 C. Other drying equipment capable of drying materials to substantially constant mass without injury to the material may be used if drying ovens are not available.
- 2.4 **Sieves** - The sieves shall conform to AASHTO M 92, "Wire-Cloth Sieves for Testing Purposes".

**DEFINITIONS**

- 3.1 **Clay** - Any material which can be broken with the fingers into finely divided particles when dry, or, after the initial rinsing of the material, is found to be soft, and can be extruded between the fingers when squeezed and feels greasy to the touch, or is found to be in this condition after the two hour soaking period as specified for coarse aggregate in Paragraph 5.1, shall be classified as clay.
- 3.2 **Shale** - Laminated material which can be broken with the fingers when dry, or after the initial rinsing of the material, is found to be separating or slacking off into layers, or is found to be in this condition after the two hour soaking period shall be called shale. This material generally is soft when wet and when squeezed may extrude between the fingers. Some pieces of shale, however, cannot be identified until completion of the 24±2 hour soaking period. These cannot usually be squeezed or extruded between the fingers, but can be broken easily. These are generally dark gray in color and have a slick or greasy surface.

- 3.3 **Soft Particles** - Soft particles shall be identified as such, if, after soaking for 24±2 hours they can be broken with the fingers. This material can readily be identified as not being clay or shale due to its structure, which is generally sandy or chalk-like and loosely bonded.

### COARSE AGGREGATE AND CRUSHED ROCK

- 4.1 **Sample** - A representative portion of air dried material of sufficient size to yield approximately 2000 grams of material after sieving over a No. 4 sieve shall be selected from the sample submitted for test by quartering or by use of a sample splitter. The material retained on the No. 4 sieve shall be considered the test sample, and the material passing the No. 4 sieve shall be discarded.

### PROCEDURE

- 5.1 The test sample shall first be rinsed free of surface dust and examined for soft lumps of clay or shale. At this time, any materials identified as clay or shale shall be removed from the test sample and retained in separate portions. After this preliminary examination, the sample shall be covered with water and allowed to soak for approximately 2 hours to soften the harder lumps of clay and softer lumps of shale. At the completion of the 2 hour soaking period, free water shall be poured off the sample and the sample hand picked for clay and shale, retaining them in their respective portions. After picking, the sample is again covered with water and allowed to soak for an additional 22±2 hours. At the completion of this soaking period, free water is poured off the sample and the sample is again hand picked for harder lumps of shale and soft particles of stone. When this last separation is complete, the test sample and separate portions of clay, shale and soft particles shall be dried to substantially constant mass using an oven or other suitable drying equipment.

**NOTE:** *When drying a sample using equipment other than a thermostatically-controlled drying oven, extreme care must be taken to not overheat the sample. Overheating may remove material other than moisture, causing erroneous results.*

### CALCULATIONS

- 6.1 The percent of clay, shale, and soft particles shall be calculated to the nearest 0.1 percent in accordance with the following formula:

$$X = \frac{R}{W} \times 100$$

where:

X = Percent of Clay, or Shale, or Soft Particles

R = Mass of Clay, or Shale, or Soft Particles

W = Total Dry Mass of Plus No. 4 Test Sample, Including Masses of Clay, Shale & Soft Particles

## FINE AGGREGATE & SAND GRAVEL AGGREGATE

- 7.1 **Sample** - A representative portion of air dried material of sufficient size to yield approximately 1000 grams of material after sieving over a No. 10 sieve shall be selected from the sample submitted for test by quartering or by use of a sample splitter. The material retained on the No. 10 sieve shall be considered the test sample, and the material passing the No. 10 sieve shall be discarded.

### PROCEDURE

- 8.1 The test sample shall be spread in a flat pan and examined for lumps of clay. Any material identified as clay lumps shall be removed from the test sample and retained as a separate portion. When separation of clay lumps from aggregate is complete, the test sample and the separate portion of clay lumps shall be dried to substantially constant mass using an oven or other suitable drying equipment.

**NOTE:** *When drying a sample using equipment other than a thermostatically-controlled drying oven, extreme care must be taken to not overheat the sample. Overheating may remove material other than moisture, causing erroneous results.*

### CALCULATIONS

- 9.1 The percent of clay lumps shall be calculated to the nearest 0.1 percent in accordance with the following formula:

$$X = \frac{R}{W} \times 100$$

*where:*

X = Percent of Clay Lumps

R = Mass of Clay Lumps

W = Total Dry Mass of Plus No. 10 Test Sample, Including Mass of Clay Lumps