1224 Procedure for Determining the Amount of Bituminous, Concrete, Masonry Block, Glass, Brick and other Objectionable Material in a Recycled Aggregate

1224.1 Scope

This test procedure is performed on aggregates to determine the percentage of natural rock and bituminous materials, crushed concrete, masonry block, brick, glass, shale, and other objectionable materials in a recycled aggregate sample.

The main purpose of this procedure is to measure the percentage of concrete in order to determine the governing gradation table in Specification 3138, however shale, glass or other objectionable materials may also be picked. One need only review and count the particles, which appear to not be incompliance, i.e. if only the concrete amount appears to be out of specification, then only pick for concrete, etc.

Perform the procedure on the material retained on the #4 sieves. If the material is less than 65% concrete, and the material passing the #4 sieve does not appear to be composed of >75% concrete fines, then report the percentage based only on the + #4 material. If the material retained on the #4 sieve is 65% concrete or greater, and/or the material passing the #4 sieve appears to be composed of >75% concrete fines, perform and report the percentage based on the + #40 material.

The Engineer may choose to run the sample on the + #40 material, regardless is what the results for the + #4 material.

1224.2 Apparatus

A. Balances - Shall conform to AASHTO M 231 (Classes G2 & G5) with readability & sensitivity 0.1 grams, accuracy 0.1 grams or 0.1%.
B. Small Hammer, Steel Plate and Safety Glasses
C. Paper Containers - Approximately 75mm (3") in diameter
D. Magnifying Lens (5 plus power with integrated light is preferred).

1224.3 Test Sample

The test sample, prepared in accordance with MnDOT Laboratory Manual: Section 1201.4G, shall be shall be divided by sieving the +4 material into the various sizes required for testing (See Section 1201, Table 1 – Lithological Count, for sample weights.)
A typical sample would be comprised of five fractions: +1”, 1” - ½”, ½” - #4, #4 - #10 and #10 - #40. The separate fractions shall be washed (Observe washing restrictions in Section 1201.4G1c) and then dried to a constant weight at a temperature of 140 ± 10° F.

Classify each fraction of material. For the purposes of visually identifying percentages of crushed concrete, masonry block, glass, shale, and deleterious materials, material passing the #40 sieve is omitted from the procedure.

1224.4 Limitations

The test sample being assessed comprises that portion of the overall sample retained on the +40 sieves.

1224.5 Procedure

Examine and classify each rock piece individually as being derived from natural rock and bituminous materials, crushed concrete, masonry block, brick, glass, shale and other objectionable deleterious material. Some particles may need to be cracked open to identify or determine the identifying properties of the particle.

The following general guidelines are for informational purposes:

- Pick the easy particles first
- Don't be concerned about questionable particles unless they will change the sample classification.
- Generally, one questionable particle should not change a sample classification.
- Seek help on questionable particles; contact the Maplewood Materials Lab, Grading and Base Unit or Geology Unit for assistance.

After each +4 particle piece has been categorized, it should be placed in a container with the particle type clearly labeled. When all the pieces within the particular sample have been classified and grouped weigh each group to the nearest 0.1 gram and record the value. Material not classified as being derived from crushed concrete, masonry block, brick, glass, shale, and objectionable material should be listed as natural rock and bituminous materials.

1224.6 Definitions of Materials and Terms (Rock Types)

The definitions in this section are brief and general descriptions intended to provide a guideline in approximating base aggregate composition classification. The exact classification of some of the particles may only be made by a geologist/petrographer.

- *Natural Rock Product and Recycled Bituminous* – Naturally occurring mineral material and particles of "Natural Rock" and sand surrounded by bitumen.
- *Crushed Concrete* – Particles of "Natural Rock" and sand surrounded by cementitious material, typically a light gray color (some concrete is dyed allowing for cement to be another color).
- *Masonry Block* – Particles derived from a concrete masonry unit (CMU) – also called concrete brick, concrete block, cement block, or cinder block predominately composed of cement and sand.
- *Brick* – a fire or sun dried clay material used as a building material often red or beige in color.
- *Glass* – Solid particles that are often transparent. It typically has a hard and brittle characteristic.
- *Shale* – As per the MnDOT Laboratory Manual section 1209.5: A sedimentary rock composed of thinly laminated (fissile) clay and silt-sized particles with a low specific gravity (1.8 or less) and very high absorption. Due to its high absorbency, dry shale will cling when touched to the moistened lip. It is easily scratched with the fingernail and is typically light gray in color. Because of its light weight and tendency to break

- into flat, platy pieces, shale will cause many more spalls per weight than any other deleterious aggregate.
- *Objectionable Material* – Including, but not limited to wood, plant matter, plastic, plaster and fabric.

1224.7 Calculations

1. Calculate the percent retained (rock type) for each sieve sizes (1"+, 1" - ½", ½" - #4, #4 - #10, #10 - #40) using the following formula:

$$\textbf{\% (Rock Type)} = \frac{\text{Dry Weight of Rock Type}}{\text{Dry Weight of Sample Size}} \textbf{ x } 100$$

Record to the nearest 0.01 percent.

2. From your (#4 - #10) sample weight out 4-6 grams (approximately 100 particles) and perform a count of each rock type.

3. From your (#10 - #40) sample weight out 0.15 - 0.25 grams (approximately 100 particles) and perform a count of each rock type.

4. Calculate the percent retained (rock type) for each size (#4 - #10, #10 - #40) using the following formula:

$$\textbf{\% (Rock Type)} = \frac{\text{Count of each Rock Type}}{\text{Total count of Particles Reviewed}} \textbf{ x } 100$$

Record to the nearest 0.01 percent.

5. Determine the weighted average (WA) on the rock type using the following formulas:

WA% (Rock Type when testing + #4) =

Rock Type Weight % (1"+) x wt. retained (1"+) ÷ total wt. from (+1 - #4) +

Rock Type Weight % (1" - ½") x wt. retained (1" - ½") ÷ total wt. from (+1 - #4) +

Rock Type Weight % (½"- #4) x wt. retained (½" - #4) ÷ total wt. from (+1 - #4)

Report to the nearest 0.1 percent.

WA% (Rock Type when testing + #40) =

Rock Type Weight % (1"+) x wt. retained (1"+) ÷ total wt. from (+1 - #40) +

Rock Type Weight % (1" - ½") x wt. retained (1" - ½") ÷ total wt. from (+1 - #40) +

Rock Type Weight % (½"- #4) x wt. retained (½" - #4) ÷ total wt. from (+1 - #40) +

Rock Type Count % (#4 - #10) x wt. retained (#4 - #10) ÷ total wt. from (+1 - #40) +

Rock Type Count % (#10 - #40) x wt. retained (#10 - #40) ÷ total wt. from (+1 - #40)

Report to the nearest 0.1 percent.