3138
Aggregate for Surface and Base Courses

3138.1 SCOPE

This Specification covers the quality of aggregates used in construction of aggregate surfaced roads, shoulders and dense graded base courses.

3138.2 REQUIREMENTS

A Aggregate Composition

The source of supply and quality of the material is subject to approval by the Engineer in accordance with 1601.

A1 Virgin Aggregate Composition

Classes 1, 2, 3, 4, 5 and 6 shall meet the following requirements:

All aggregate sources (pits and quarries) from which surface and/or base course aggregates are produced shall be stripped to uncover suitable materials for use. In quarries, all weathered rock will be removed prior to production of the face.

The mixture shall consist of 100 percent virgin aggregates (unless noted otherwise), and shall consist of sound durable particles or fragments of gravel and sand, crushed quarry or mine rock, crushed gravel or stone or any combination thereof; except that, Class 2 aggregates shall consist of 100 percent crushed quarry or mine rock.

The Engineer may allow aggregates containing a limited quantity of binder soil; however, the aggregates shall not contain sod, roots, plants, other organic matter, or other objectionable material. All materials shall be free from lumps or balls of clay.

A2 Salvaged/Recycled Aggregate Mixtures

Class 7

Salvaged/recycled aggregate materials may be used or blended with a combination of virgin and salvaged/recycled aggregates or 100% salvaged/recycled aggregate materials as permitted in accordance with the following requirements. These composite mixtures/ blends shall be designated as Class 7.

The composite mixture/blend shall meet the following requirements:

(a) A salvage/recycled mixture shall have a minimum of 10 percent by mass (**weight**) salvage/recycle aggregate material incorporated into the mixture to be considered a salvage/recycled mixture.

(b) Virgin aggregates that are incorporated into the mixture shall meet the requirements in Sections 3138.2A1, 3138.2D, and 3138.2E.

(c) The salvaged/recycled aggregate portion of the mixture shall consist of sound durable particles produced by crushing, screening and grading to the required sizes from materials which were salvaged from the following sources: Portland cement concrete

pavement removal and/or other concrete structural elements, bituminous pavement removal, aggregate bases underlying bituminous and concrete pavements. Incorporation of recycled glass into the aggregate mixture during production will be permitted. The composite mixture may be produced from any combination of these salvaged/recycled aggregate materials (including glass), unless otherwise specifically modified or prohibited in the plans and/or special provisions.

(d) The Engineer may allow aggregate containing a limited quantity of binder soil. However, the composite aggregate mixture/blend shall not contain sod, roots, plants, building rubble, building brick, wood, plaster, reinforcing steel or other similar objectionable or deleterious materials and shall be free of lumps or balls of clay.

(e) The requirements of 3138 A2(a), Salvaged Bituminous Aggregate Mixtures; 3138 A2(b), Salvaged Crushed Concrete Aggregate; and 3138 A2(c), Reclaimed Glass.

(f) Blending of the various types of aggregates (virgin and recycle/salvage aggregates), shall be done during production. The final product shall consist of a uniform blend of all the composite materials.

Class 7 may be substituted for Classes 1, 3, 4, 5 and 6 unless otherwise specifically modified or prohibited in the plans and/or Special Provisions.

A2a Salvaged Bituminous Aggregate Mixtures

Salvaged bituminous aggregate mixtures may be used in accordance with the following applications and requirements:

(a) Aggregate base course.

Salvaged bituminous mixture may be used either alone or in combination with other aggregate materials (virgin and/or salvaged/recycled) in the production of the base course mixture.

However, the bitumen content of the composite mixture shall not exceed 3.0 percent by mass (by weight). Nonconforming materials shall be subject to the provisions of Table 2211-D.

(b) Surfacing aggregate (travel lanes and/or shoulders).

All aggregates used for surfacing shall have 100% passing the 19 mm (¾ **inch**) sieve. The aggregates may contain up to 100 percent salvaged bituminous materials. (No limit on bitumen content).

A2b Salvaged Crushed Concrete Aggregate

Crushed concrete aggregate may be used singularly or blended with virgin and/or other permitted salvaged/recycled aggregate materials in accordance with the following applications and requirements:

3138.2

(1) Aggregate base course applications.

(a) Where drainage layers and/or perforated drainage pipes are not installed or will not be installed:

i. Crushed concrete may be used in the production of aggregate base course mixtures provided that the final product meets all other requirements of this specification.

(b) Where drainage layers and/or perforated drainage pipes are installed or will be installed. One of the following requirements must be met:

i. Crushed concrete, blended with other permitted aggregates (virgin and/or recycled), may be used on any type of subgrade soil provided that at least 95% of the crushed concrete aggregate particles are retained on the 4.75 mm (**# 4**) sieve. The blended aggregate base must meet the gradation requirements of this specification.

ii. Crushed concrete aggregates may be used singularly or blended with other permitted aggregate materials when placed over material meeting the requirements of 3149.2B2, Select Granular, provided that the amount crushed concrete aggregate does not exceed the equivalent of 75 mm (**3 inches**) of 100 percent crushed concrete; such as, 150 mm (**6 inches**) of a 50/50 blend of crushed concrete and permitted aggregate material. If crushed concrete aggregate is used (singularly or blended) for the base course and for stabilizing the subgrade at the same location, the total equivalent application rate shall not exceed a 75 mm (**3 inches**) thickness (approximately 160 kg/m^2 (**300 pounds per square yard**) of surface area)).

iii. Crushed concrete may be used up to 100% in construction of the filter/separation layer under a permeable aggregate base drainage layer (i.e. OGAB, PASB, PCSB) in accordance with the applicable drainage specifications.

(2) Other Applications.

With and without drainage layer and/or perforated pipe installation, crushed concrete may be used for:

i. Surfacing and base course(s) in the shoulder area.

ii Surfacing aggregate-surfaced roads (including shoulders).

A2c Reclaimed Glass

Unless otherwise specifically modified or prohibited in the Plans and/or Special Provisions, up to 10 percent by mass **(weight)** reclaimed glass may be mixed/blended with virgin and/or salvaged/recycled aggregate materials during the crushing operation in the production of the aggregate base course mixture in accordance with the following:

1. Sources

   Reclaimed glass shall consist of eligible secondary glass available from any source willing and able to certify their supply sources and composition of glass as required in paragraph 7, below.

2. Composition

   Reclaimed glass shall consist only of the following eligible types of glass products: a. container glass used for consumer food and beverages; b. beverage drinking glasses; c. plain ceramic or china dinnerware; d. building window glass free of any framing material; and e. other types of glass that can be certified and approved by Mn/DOT's Office of Environmental Services on an individual source basis.

   Reclaimed glass or other salvaged aggregates shall not consist of the following prohibited types of materials: a. any hazardous waste as defined in MPCA Rules 7045; b. hazardous substance in regulated quantities listed in 40 CFR, Table 302.4; c. automobile windshields or other glass from automobiles; d. light bulbs of any type; e. porcelain products; f. laboratory glass; and g. television, computer or other cathode ray monitor tubes.

3. Debris Content

   The reclaimed glass shall not contain more than 5 percent debris, by visual inspection. Debris includes any non-glass material such as: paper, foil, plastics, metal, corks, wood debris, food residue, or other deleterious materials. The percentage of debris shall be estimated using the American Geophysical Institute Visual Method. (AGI Data Sheet 15.1 and 15.2 Comparison Chart for Estimating Percent Composition, 1982.)

4. Storage

   Interim storage of reclaimed glass stockpiles shall be on locations with: a. minimum of 1.2 m (**4 feet**) depth of suitable soils separating groundwater; b. a minimum of 50 m (**150 feet**) away from any surface water body; and

c. a maximum slope for four percent (4%) if sloped to any surface water body.

5. Ratio of Reclaimed Glass
   Up to 10 percent by mass **(weight)** reclaimed glass may be mixed virgin and/or other salvaged/recycled aggregate materials during the crushing operation in the production of the aggregate mixture.
6. Applications
   Reclaimed glass blended with other aggregates may be used for aggregate base course mixtures. Reclaimed glass shall not be used in aggregate surfacing applications including shoulder surfacing.
7. Certification
   a. The contractor shall provide documentation certifying that the reclaimed glass: (i) is only from sources that have given the contractor the certification required in paragraph b) below, sub-item (ii), is comprised of only eligible types of reclaimed glass; (iii) does not contain any prohibited materials; (iv) meets debris content requirements; (v) meets the blending ratio requirements; and (vi) is or will be stored according to storage requirements described in paragraph 4 above.
   b. Documentation shall include, at a minimum: (i) written certification from sources of reclaimed glass, such as recycling centers, that a good faith effort of public education was used to inform resident and business of the eligible and prohibited types of glass to be included for recycling, (ii) written certification by recycling centers that their independent sources of reclaimed glass, such as private recyclables haulers, have been notified in writing of these composition and public education requirements and have agreed in writing to comply with them; and (iii) description of the reclaimed glass blending methods used to assure required blending ratios.

A3 Limestone and/or Dolostone

The following provisions shall apply in these listed counties:

Anoka - 02	Ramsey - 62
Carver - 10	Scott - 70
Dakota - 19	Washington - 82
Hennepin - 27	

All counties in Mn/DOT's District 6

(a) If crushed carbonate (limestone or dolostone) quarry/bedrock is used in total or in part for base or shoulder applications, unless exempted below, the portion passing the 75 µm (**# 200**) sieve of the carbonate aggregate insoluble residue shall not exceed 10 percent.

(b) An exemption to this 10 percent insoluble residue Specification will be made for carbonate rock to be used as temporary by-passes and parking lots. Use on other specific non-exempted applications must be approved by the Engineer. For these exempted applications, the portion passing the 75 µm (**# 200**) sieve of the carbonate aggregate insoluble residue test shall not exceed 16 percent.

B Gradation ..... TABLES 3138-1 and 2

In the event that it is necessary to add a portion of the overburden or binder soil from an outside source, the materials shall be introduced into the aggregate producing plant at a uniform rate by a separate conveyor simultaneously with the base aggregate. The binder soils or overburden shall meet 3146.

If Class 7 is substituted for Classes 1, 3, 4, 5, or 6, it shall meet the gradation requirements of the substituted class (Table 3138-1); except that, for Class 5 and 6, up to 5.0 percent by mass **(weight)** of the total composite mixture may exceed the 25.0 mm (**1 inch**) sieve but 100 percent must pass the 37.5 mm (**1.5 inches**) sieve. Surfacing aggregate mixtures containing salvaged materials shall meet the gradation requirements of the materials specified in the Plan. All gradations will be run on the composite mixture before extraction of the bituminous material.

If Class 7 is substituted for Classes 5 or 6, and with the approval of the Engineer, the Contractor may produce Class 7 base material meeting the gradation requirements in Table 3138-2. The final product shall meet all other requirements of this specification.

When the use of salvaged aggregates is specified and/or shown in the plans as Class 7 the gradation requirements shall be as shown in Table 3138-1, Class 6, or Table 3138-2. The final product shall meet all other requirements of this specification.

3138.2

TABLE 3138-1
BASE AND SURFACING AGGREGATE
Total Percent Passing

Sieve Size	Class 1 **(A)**	Class 2	Class 3 **(A)**	Class 4 **(A)**	Class 5 **(A) (B)**	Class 6 **(A) (B)**
75 mm (**3 inches**)	--	--	--	--	--	--
50 mm (**2 inches**)	--	--	100	100	--	--
37.5 mm (1½ **inches**)	--	--	--	--	--	--
25.0 mm (**1 inch**)	--	--	--	--	100	100
19.0 mm (¾ **inch**)	100	100	--	--	90-100	90-100
9.5 mm (**3/8 inch**)	65-95.	65-90	--	--	50-90	50-85
4.75 mm (**# 4**)	40-85.	35-70	35-100	35-100	35-80	35-70
2.00 mm (**# 10**)	25-70	25-45	20-100	20-100	20-650	20-55
425 µm (**# 40**)	10-45	12-30	5-50	5-35	10-35	10-30
75 µm (**# 200**)	8.0-15.0	5.0-13.0	5.0-10.0	4.0-10.0	3.0-10.0	3.0-7.0

(A) When salvaged materials are substituted for another class of aggregate, it shall meet the gradation requirements of the class being replaced except as amended in 3138.2 B.

(B) The gradation requirements for aggregates containing 60% or more crushed quarry rock may be amended with the concurrence of the Project Engineer and the Grading and Base Engineer.

TABLE 3138-2
OPTIONAL Class 7 BASE AGGREGATE
Total Percent Passing

Total Percent Passing Sieve Size	Class 7
75 mm (**3 inches**)	--
50 mm (**2 inches**)	100
37.5 mm (**1½ inches**)	95-100
25.0 mm (**1 inch**)	65-95
19.0 mm (**¾ inch**)	45-85
9.5 mm (**3/8 inch**)	35-70
4.75 mm (**# 4**)	15-45
2.00 mm (**# 10**)	10-30
425 µm (**# 40**)	5-25
75 µm (**# 200**)	<12.0

In the production of Class 7 aggregate materials, the different aggregate types shall be blended at uniform proportions/rates.

At the time of testing, aggregate mixtures containing salvaged materials shall be further identified as to the type of recycle/salvage
aggregate materials that are incorporated into the final product by the following designations:

B - Bituminous Mixture .....7(B)
C - Concrete .....7(C)
BC - Bituminous and Concrete ..... 7(BC)
G - Glass .....7(G)
BG ..... 7(BG)
CG..... 7(CG)
BCG ..... 7(BCG)
M - Misc. - must be specified in Special Provisions

C Crushing

Crushing will be required for Class 5 and 6 aggregates. For these classes of aggregate, crushing will be required of all stones larger than the maximum size permitted by the gradation requirements and that will pass a grizzly or bar grate having parallel bars spaced 200 mm (**8 inches**) apart. However, the Engineer may allow rejection of oversize material when excessive crushing results in an unsatisfactory gradation.

Class 6 aggregates shall contain at least 15 percent crushed material. Class 5 aggregates shall contain at least 10 percent crushed material. The percentage of crushing shall be determined by the procedures described in the Grading and Base Manual. A tolerance of 2 percent will be allowed on each individual test, but the average of all material tested for the project shall meet the specification requirements. It may be necessary to add stones or crushed rock from another source to meet the crushing requirements.

D Los Angeles Rattler Loss

The Los Angeles Rattler Loss requirements shall apply only to the crushed quarry or mine rock portion of the aggregate.

Class of Aggregates	**Los Angeles Rattler Loss**
1, 2, 3, 4, 5, 7	40% maximum
6,	35% maximum

The LAR maximum loss shown for Class 7 shall be determined on the virgin aggregate portion of the mixture prior to the incorporation of the salvage/recycle materials into the final composite mixture.

E Shale

Class 3, 4, and 5 aggregate shall contain not more than 10.0 percent shale in the total sample; except that, when the part passing a 75 µm (**# 200**) sieve exceeds 7.0 percent, the percentage of shale in the total sample shall not exceed 7.0 percent.

Class 6 aggregate shall contain not more than 7.0 percent shale in the total sample.

The virgin aggregate portion of the Class 7 mixture shall not contain more shale than allowed for the Class of aggregate that the substitution is being made. Testing for compliance shall be performed prior to the incorporation of the salvage/recycled materials into the final composite mixture.

3138.3 SAMPLING AND TESTING

Samples for testing to determine compliance with the aggregate gradation specifications for base and shoulder surfacing will be obtained from the roadway at a time when the material is ready for compaction. The samples may be obtained from the windrow or after blending and spreading of the material on the roadway. However, Classes 1, 2 and 7 shoulder surfacing aggregates may be sampled from a stockpile, tested, and accepted before roadway placement, provided that:

(a) No more than 25 percent of the stockpile samples fail to meet gradation requirements.

(b) The average of all stockpile tests meet requirements.

(c) The contractor mixes the material during placement to the satisfaction of the Engineer.

The stockpile shall be sampled at the rate of one field gradation test per metric tons (**tons)** of aggregate used on the project.

If calcium chloride is incorporated in a central mixing plant, the aggregate will be sampled before such materials are added.

A Sampling, Sieve Analysis, Shale, and Crushing Test .... Mn/DOT Grading and Base Manual

B Los Angeles Rattler Loss..... .....Mn/DOT Laboratory Manual Method 1210

C Sampling and Shale Tests .... Mn/DOT Laboratory Manual

D Bitumen Content: .....Mn/DOT Laboratory Manual a) By Extraction.....Method 1852

E Insoluble Residue..... Mn/DOT Laboratory Manual .....Method 1221

F Reclaimed Glass ..... American Geophysical Institute Visual Method (AGI Data sheet 15.1 and 15.2, Comparison chart for Estimating Percent Composition 1982)