# SECTION M2

# AGGREGATES AND RELATED MATERIALS

## M2.01.0 Crushed Stone.

Crushed stone shall consist of one or the other of the following materials:

1. Durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered natural rock, and free from a detrimental quantity of thin, flat, elongated* or other objectionable pieces.

A detrimental quantity will be considered as any amount in excess of 15% of the total mass.

2. Durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone with a minimum diameter before crushing of 200 millimeters.

*Thin or elongated pieces are defined as follows. Thin stones shall be considered to be such stones whose average width exceeds four (4) times their average thickness. Elongated stones shall be considered to be such stones whose average length exceeds four (4) times their average width.

The crushed stone shall be reasonably free from clay, loam or deleterious material and not more than 1.0% of satisfactory material passing a 75 micrometer sieve will be allowed to adhere to the crushed stone. Where crushed stone is to be used for surfacing, this requirement shall be not more than 0.5% of satisfactory material passing a 75 µm sieve.

The crushed stone shall have a maximum percentage of wear as determined by the Los Angeles Abrasion Test (AASHTO T 96) as follows:

1. For Class I Bituminous Concrete 30% **
2. For Cement Concrete Aggregate 45% ***
3. Crushed Stone for Subbase 45%
4. Special Borrow Ledge 45%

**Crushed stone for this use shall consist of crushed or shattered natural rock only. Crushed gravel stone will not be permitted.

***Except for 35 megaPascals or greater cement concrete and prestressed concrete which shall be 30%.

The crushed stone shall be uniformly blended according to the grading requirements for the respective stone sizes shown in Table 1.

**TABLE 1**

**Tabulation of Stone Sizes (Percent by Mass Passing Through)**

| Sieve Opening | M2.01.1/M2.01.2 | M2.01.3 | M2.01.4 | M2.01.5 | M2.01.6 |
|---|---|---|---|---|---|
| | 37.5 mm | 31.5 mm | 19.0 mm | 12.5 mm | 9.5 mm |
| 63 mm | | | | | |
| 50 mm | 100 | | | | |
| 37.5 mm | 95 - 100 | 100 | | | |
| 31.5 mm | | 85 - 100 | | | |
| 25.0 mm | 35 - 70 | | 100 | | |
| 19.0 mm | 0 - 25 | 10 - 40 | 90 - 100 | | |
| 16.0 mm | | | | 100 | |
| 12.5 mm | | 0-8 | 10 - 50 | 85 - 100 | 100 |
| 9.5 mm | | | 0 - 20 | 15 - 45 | 85 - 100 |
| 4.75 mm | | | 0 - 5 | 0 - 15 | 20-50 |
| 2.36 mm | | | | 0 - 5 | 0 - 15 |

| | |
|---|---|
| 1.18 mm | 0 - 5 |

**M2.01.1 to M201.6** (See Table 1 for grading requirements)

**M2.01.7 Dense Graded Crushed Stone for Sub-base.**

This specification covers the quality and gradation requirements for a sub-base material combining crusher-run coarse aggregates of crushed stone (trap only, meeting M2.01.0,1) and fine aggregates of natural sand or stone screenings uniformly premixed with a predetermined quantity of water.

Coarse aggregate shall consist of hard, durable particles of fragments of stone. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used.

Coarse aggregate shall have a percentage of wear, by the Los Angeles test, of not more than 45.

Fine aggregate shall consist of natural or crushed sand.

The composite material shall be free from clay, loam or other plastic material, and shall conform to the following grading requirements:

| Sieve Designation | Percentage by Mass Passing Square Mesh Sieves |
|---|---|
| 50 mm | 100 |
| 37.5 mm | 70 - 100 |
| 19.0 mm | 50 - 85 |
| 4.75 mm | 30 - 55 |
| 300 µm | 8 - 24 |
| 75 µm | 3 - 10 |

Sampling and testing shall be in accordance with the following standard AASHTO methods:

| | |
|---|---|
| Sieve Analysis | T 27 |
| Passing 75 µm | T 11 |

The use of Processed Glass Aggregate (PGA) meeting the requirements of M2.01.8 will be allowed at a maximum addition rate of 10% by mass, providing the blended material is homogeneous and the physical requirements of dense graded crushed stone are maintained.

**M2.01.8 Processed Glass Aggregate (PGA).**

Processed Glass Aggregate (PGA) shall be manufactured from an approved supplier of crushed cullet. The material shall consist of recycled glass food or beverage containers free of debris such as paper, metals, fabrics, toxins, clay, loam, or other materials that would be associated with the glass recycling process. A maximum of 5% mass of the material may be produced from china dishes, ceramics, plate glass or other glass products. The material will have a nominal aggregate size of 10 millimeters and meet the following gradation requirements:

| Sieve Designation | Percentage by Mass Passing Square Mesh Sieves |
|---|---|
| 9.5 mm | 100 |
| 4.75 mm | 70 - 100 |
| 2.36 mm | 35 - 88 |
| 1.18 mm | 15 - 40 |
| 300 µm | 4 - 12 |
| 75 µm | 0 - 5 |

The percent wear as determined by the Los Angeles Abrasion Test, Class C or D will be a maximum of 40%.

**M2.02.0 Riprap.**

Riprap shall be sound, durable rock which is angular in shape. Rounded stones, boulders, sandstone or similar soft stone or relatively thin slabs will not be acceptable. Each stone shall have a mass of not less than 25 kilograms and at least 75% of the volume shall consist of stones with a mass of not less than 225 kilograms each. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.

**M2.02.1 Rockfill.**

Stone for rockfill shall be sound, angular in shape, free from structural defects and comparatively free of chemical decay. From 50% to 70% of the stones shall have a mass of not less than 225 kilograms each and the remainder shall have a mass of not less than 25 kilograms each.

**M2.02.2 Dumped Riprap.**

Stone used for dumped riprap shall be hard, durable, angular in shape, resistant to weathering and shall meet the gradation requirement specified. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone or boulders will not be accepted unless authorized by special provisions.

Stone shall be free from overburden, spoil, shale, and organic material and shall meet the following gradation requirement specified:

| Size of Stone | Maximum Percent of Total Mass Smaller Than Given Size |
|---|---|
| 180 kg | 100 |
| 135 kg | 80 |
| 90 kg | 50 |
| *10 kg | 10 |

*No more than 5% by mass shall pass a 50 micrometer sieve.

Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified. Stones smaller than the specified 10% size and spalls will not be permitted in an amount exceeding 10% by mass of each load.

Control of gradation will be by visual inspection. The Contractor shall provide at the locations specified a mass of rock of at least 5 metric tons meeting the gradation for the class specified. The sample at the construction site may be a part of the finished riprap covering. At the quarry, an additional sample shall be provided. These samples shall be used as a frequent reference for judging the gradation of the riprap supplied. Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truck loads of stone. Mechanical equipment, a sorting site and labor needed to assist in checking gradation shall be provided by the Contractor at no additional cost to the Department.

**M2.02.3 Stone for Pipe Ends.**

Stone for pipe ends shall be sound, durable rock which is angular in shape. Rounded stones, boulders,

sandstone or similar stone or relatively thin slabs will not be acceptable. Each stone shall have a mass of not less than 25 kilograms not more than 55 kilograms and at least 75% of the volume shall consist of stones having a mass of not less than 35 kilograms each. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.

**M2.02.4 Modified Rockfill.**

Modified rockfill shall consist of hard, durable angular shaped stones which are the product of the primary crushing of a stone crusher. Rounded stone, boulders, sandstone and similar soft stone or relatively thin slabs will not be acceptable.

Stone shall be free from overburden, spoil, shale, organic material and meet the following gradation requirements:

| Size of Stone | Passing Percentages |
|---|---|
| 200 mm | 95 - 100 |
| 100 mm | 0 - 25 |
| 63 mm | 0 - 5 |

**M2.03.0 Granite Rubble Block.**

Rubble pavement blocks shall be granite, basically light grey in color, free from seams and other structural imperfections or flaws which would impair its structural integrity, and of a smooth splitting appearance. Natural color variations characteristic of the deposit from which the paving blocks are obtained will be permitted.

Rubble pavement blocks shall be not less than 100 millimeters nor more than 300 millimeters in length, not less than 90 millimeters nor more than 115 millimeters in width and depth. Rubble blocks shall be rectangular in shape with one good face.

Opposite faces of rubble blocks shall be approximately parallel and adjoining faces shall be approximately at right angles to each other. Blocks shall be dressed so that they may be laid with 25 millimeter to 38 millimeter joints.

**M2.04.0 Aggregate for Sand Blasting.**

Aggregate to be used for sand blasting shall be an approved material currently used in the industry. It shall be graded to produce the profile requirements of the material being cleaned and shall meet the applicable requirements of OSHA, EPA, and DEP.

**M2.05.0 Stone Screenings.**

Stone Screenings shall be that product from a stone crusher that completely passes a 4.75 millimeter sieve and not less than 40% passes a 2.36 millimeter sieve.

**M2.06.0 Slope Paving.**

Stone for slope paving shall be sound, angular in shape and free from structural defects. Each stone shall have one reasonably flat face and a thickness perpendicular to the face of not less than 150 millimeters, which shall be the least dimension of the stone.

Approximately 60% of the stones shall vary from 0.06 to 0.08 cubic meters each in volume and the remainder of the stones shall each be from 0.03 to 0.06 cubic meters in volume.

**M2.06.1 Special Slope Paving Under Bridge (Quarry Stone).**

Quarry stone shall consist of granite or other similar durable stone. The exposed surface of the stones shall range from roughly square to rectangular shape, with split or quarry face finish and uniform in color. The stones shall be from 300 millimeters to 700 millimeters long, 250 millimeters to 350 millimeters wide and from 75 millimeters to 150 millimeters thick.

**M2.06.2 Channel Paving.**

Stones for Channel Paving and Grouted Channel Paving shall be sound, approved quality angular blocks, as nearly rectangular or cubical as practicable. Rounded stones or relatively thin slabs will not be acceptable. At least 75% of the volume shall consist of stones having a mass of at least 90 kilograms each. The remainder of the stones shall be so graded that when placed with the larger stones a compact mass will result.