

SPECIFICATIONS FOR AGGREGATE FOR PORTLAND CEMENT CONCRETE

930. 1 SCOPE

These Specifications govern all operations necessary for and pertaining to the production of aggregate for Portland Cement Concrete.

930. 3 MATERIALS

3.1 Source of Supply

The Contractor shall, at least ten days prior to the commencement of production, notify the Engineer as to the sources of aggregate including supplementary granular material.

At the request of the Contractor, the Department will test representative aggregate samples obtained from the sources. Each sample shall contain not less than 45kg and the Contractor shall assume all costs incurred in obtaining and transporting the samples to the Department's Testing Laboratory.

Test results for gradation and physical properties will be provided but will not constitute acceptance of material in the source.

Prior to the production of aggregates, the sources shall be cleared, grubbed and stripped of overburden.

3.2 Aggregate Requirements

Aggregates and supplementary granular material shall consist of sound durable particles of rock, gravel, stone, sand and fines. Deleterious materials, other than those allowed by this Specification, will not be permitted.

Deleterious material is defined as organic impurities, clay lumps, friable particles, chert, shale, ironstone and laminated pieces.

Two types of aggregate will be required; a coarse aggregate and a fine aggregate. A.S.T.M. testing procedures will be used to ensure that the two aggregates meet the gradation and physical requirements of this specification.

The processed aggregate shall be well-graded and shall not vary from maximum to minimum of the specification ranges for consecutive sieve sizes.

930. 3.2.1 Coarse Aggregate

Coarse Aggregate shall meet the following requirements:

| Passing Standard Sieves | Class "A" | | Class "B" | Class "C" |
|-------------------------|--------------------|----------------|-------------------------|----------------------------|
| | Quarried Limestone | Gravel Sources | Quarried Rock or Gravel | Quarried Igneous or Gravel |
| 50mm | | | | 100% |
| 37.5mm | | | | 90 – 100% |
| 25mm | | 100% | | |
| 19mm | 100% | 90 – 100% | 100% | 35 – 70% |
| 12.5mm | | | | 10 – 30% |
| 9.5mm | 20 – 55% | 20 – 55% | 20 – 55% | |
| 4.75mm | 0 – 10% | 0 – 10% | 0 – 10% | 0 – 5% |
| 75µm | 0 – 2% | 0 – 2% | 0 – 2% | 0 – 2% |
| ASTM TESTS | MAXIMUM PERMITTED | | | |
| Los Angeles Abrasion | 28% | 28% | 28% | 28% |
| Water Absorption | 2.25% | 2.25% | 2.25% | 2.25% |
| Deleterious Materials | 1.5% | 1.5% | *1.5% | 1.5% |

* The Shale content shall not exceed 0.5%

This Table gives the Contractor an option for producing coarse aggregate from different sources, however each Class may only be used as follows:

- Class "A" for use on other than bridge work.
- Class "B" for use on bridges in walls, slabs of 300mm thickness or less, columns, deck slabs, approach slabs, rigid frames, diaphragms, end newel posts, curbs, sidewalks and medians.
- Class "C" for use on other bridge work not covered by Class "B"

Class "A" coarse aggregate, produced from a gravel source having a Limestone content exceeding 65%, shall have a maximum size of 19mm.

The Los Angeles Abrasion Loss shall not exceed 28 percent, by weight, of any handpicked portion of a sample containing a minimum of 12 percent by weight of the original sample.

3.2.2 Fine Aggregate

Fine Aggregate shall meet the following requirements;

| Standard Sieves | Percent Passing |
|----------------------|-----------------|
| 12.5mm | 100% |
| 9.5mm | 96 – 100% |
| 4.75mm | 90 – 100% |
| 1.18mm | 50 – 80% |
| 600µm | 25 – 60% |
| 300µm | 10 – 30% |
| 75µm | 0 – 3% |
| ASTM TESTS | |
| Fineness Modulus | 2.3 – 3.5 |
| Deleterious Material | 2% Maximum |

Not more than 45%, by weight, shall be retained between any two consecutive sieves.

930. 3.2.3 General Requirements

The percentage passing the 75µm sieve in both coarse and fine aggregate will be determined by washing and sieving.

3.2.4 Blended Concrete Aggregates

The gradation of Blended Concrete Aggregate shall be as follows:

| Standard Sieves | % Retained | |
|-----------------------|--------------------------|----------------|
| | Quarried Limestone | Gravel Sources |
| 25mm | 0% | 0% |
| 20mm | 0% | 0-16% |
| 12.5mm | 4-20% | 4-20% |
| 9.5mm | 4-20% | 4-20% |
| 4.75mm | 4-20% | 4-20% |
| 2.36mm | 0-12% | 0-12% |
| 1.18mm | 0-12% | 0-12% |
| 600µm | 4-20% | 4-20% |
| 300µm | 4-20% | 4-20% |
| 150µm | 0-10% | 0-10% |
| 75µm | 0-2% | 0-2% |
| ASTM TESTS | MAXIMUM PERMITTED | |
| Los Angeles Abrasion | 28% | 28% |
| Water Absorption | 2.25% | 2.25% |
| Deleterious Materials | 1.50% | 1.50% |

Note: The percent retained refers to the percent retained on each individual sieve.

- If limestone is to be used, the maximum permitting aggregate size is 20mm; for crushed gravel, the maximum permitting aggregate size is 25mm;
- The sum of the percent retained on the 2.36mm, 1.18mm and 600µm sieves must be greater than 15%;
- The sum of the percent retained on the 600µm – 75µm sieves must fall within 24-34%;
- The percent passing the 75µm sieve shall not exceed 2%.

930. 5 PRODUCTION METHODS

5.1 General

Concrete course and fine aggregate shall be produced by crushing or screening.

5.2 Supplementary Granular Material

Supplementary granular material is material added during the production of course and fine aggregate but before final processing and testing.

930. 5.2 Supplementary Granular Material (Continued)

The addition of supplementary granular material during crushing or screening operations shall be controlled to ensure the final product is uniform and within the gradation requirements of this Specification.

Supplementary granular material for use in concrete coarse or fine aggregate shall be stockpiled separately and fed by belt uniformly along with the pit material immediately prior to entering the crusher or screener.

Where supplementary granular material is too coarse to be fed by belt, it shall be added to the pit material in such a manner that the processed aggregate is within the specified gradation. Mixing supplementary granular material with the pit material may be necessary to ensure uniformity.

The supply and addition of supplementary granular material will be considered as incidental to the unit price for concrete paving or concrete curbing.

5.3 Multiple Product Aggregate

A multiple product coarse or fine aggregate may be produced by combining two or more processed materials which have been tested and stockpiled separately. Multiple product aggregates may be combined using one of the following methods:

- a) Combining material in the concrete batching plant providing the plant is equipped with a separate controllable aggregate storage bin for each of the products required in the mix; or
- b) Using controllable bins and belts to produce coarse or fine aggregate stockpiles meeting the applicable gradation requirements. The Contractor shall adjust his operation to facilitate testing of the final product by the Engineer.

5.4 Stockpiling Aggregate

Stockpiling of coarse and fine aggregate shall be in accordance with the Specification for Stockpiling Aggregates, with the following modifications:

- a) Quarried Limestone Course Aggregate Stockpiles

No equipment will be permitted on the stockpile during its construction or during removal of aggregate. The stockpile height shall not exceed 3 metres. The depth of layers is waived.

- b) Other Course Aggregate Stockpiles

Track-type equipment will not be permitted on the stockpile during its construction or during removal of the aggregate. The stockpile height shall not exceed 3 metres. The depth of layers is waived.

All aggregates obtained from below water level, and all washed aggregates, shall be stockpiled for at least twelve hours prior to being used in the mix.

930. 5.5 Testing Aggregate

5.5.1 During Production

Concrete aggregates will be subject to testing by the Engineer at the time the material is being produced and at the plant site. Rejected material shall be either immediately moved to the vicinity of the feed end of the crusher for reprocessing or to an area completely removed from any approved aggregate.

5.5.2 Previously Prepared

The Contractor may use concrete aggregates that were prepared and stockpiled not under the terms of the contract. The Contractor shall, unless otherwise permitted, pass the material uniformly over a conveyor belt to provide representative samples for testing. On the basis of the tests, the Engineer may allow the aggregate to be used on the project providing it continues to meet the Specifications as may be confirmed by further testing of aggregates during concrete mixing.