



SECTION 1005

AGGREGATE FOR CONCRETE

1005.1 Scope. This specification covers aggregate to be used for concrete construction.

1005.2 Coarse Aggregate.

1005.2.1 All coarse aggregate for concrete shall consist of sound, durable rock, free from objectionable coatings and frozen and cemented lumps. The percentage of deleterious substances shall not exceed the following values, and the sum of percentages of all deleterious substances, exclusive of Items 5 and 6, shall not exceed 6.0 percent. For crushed stone, the percentage of wear shall not exceed 50 when tested in accordance with AASHTO T 96.

| Deleterious Material | Percent by Weight |
|---|--------------------------|
| Deleterious Rock | 6.0 |
| Shale | 1.0 |
| Chert in Limestone | 4.0 |
| Other Foreign Material | 0.5 |
| Material Passing No. 200 Sieve Gradations D & E | 2.5 ^a |
| Thin or Elongated | 5.0 |

^a Value may be raised to 3.0 percent, providing the material passing the #200 sieve in the fine aggregate is less than or equal to 1.0 percent.

1005.2.1.1 The above requirements will apply to each size or fraction of aggregate produced.

1005.2.1.2 Crushed stone shall be obtained from rock of uniform quality. Rock tested for initial approval shall be in accordance with the criteria below. Source approval and production samples shall also meet the following criteria:

| Property | Value |
|--|-----------------|
| Los Angeles Abrasion, AASHTO T 96, percent loss, max | 50 |
| Absorption, AASHTO T 85, percent, max.: | |
| (a) Portland Cement Concrete Pavement | -- |
| (b) Portland Cement Concrete Masonry | 3.5 |
| Soundness, MoDOT Test Method TM 14, percent loss, max.: | |
| (a) Portland Cement Concrete Pavement | -- |
| (b) Portland Cement Concrete Masonry | 18.0 |
| Durability Factor, AASHTO T 161 Procedure B, percent, min: | |
| (a) Portland Cement Concrete Pavement | 75 ^a |
| (b) Portland Cement Concrete Masonry | -- |

^a Approval will be based on maximum aggregate size produced that meets durability requirements.

1005.2.1.3 Gravel shall be washed and shall be in accordance with the criteria below for initial approval. Source approval and production samples shall also meet the following criteria:

| Property | Value |
|--|-------|
| Los Angeles Abrasion, AASHTO T 96, percent loss, max. | 45 |
| Absorption, AASHTO T 85, percent, max. | 4.5 |
| Soundness, MoDOT Test Method TM 14, percent loss, max. | 18.0 |

1005.2.1.4 The engineer reserves the right to use additional test methods, such as ASTM C 586, AASHTO T 161 or other appropriate tests, to measure the soundness and durability of aggregate for use in concrete when deemed necessary.

1005.2.2 Coarse aggregate for concrete pavement or base course shall be crushed stone or porphyry.

1005.2.3 Grade F Aggregate. Coarse aggregate for Portland cement concrete pavement, base and approach slabs for bridges that is not produced from the Burlington, Keokuk, Cedar Valley (formerly Callaway) or Warsaw limestone formations, which is obtained from sources in the following areas shall have a maximum top size of ¾ inch:

(a) State of Kansas, Iowa and Nebraska.

(b) Counties of Missouri – Adair, Andrew, Atchison, Bates, Benton, Buchanan, Caldwell, Carroll, Cass, Cedar, Chariton, Clay, Clinton, Daviess, DeKalb, Gentry, Grundy, Harrison, Henry, Holt, Jackson, Johnson, Lafayette, Linn, Livingston, Mercer, Macon, Nodaway, Pettis, Platte, Putnam, Randolph, Ray, St. Clair, Saline, Schuyler, Sullivan, Vernon and Worth.

1005.2.4 Coarse aggregate for concrete for structures, except as specified in [Sec 1005.2.5](#), may be gravel or crushed stone. Coarse aggregate for Class B, B-1, B-2, MB-2 or Seal concrete shall be in accordance with either Gradation D or E. Coarse aggregate for Class A-1 concrete shall be in accordance with Gradation E.

| Gradation D | Percent by Weight |
|----------------------|-------------------|
| Passing 1-inch sieve | 100 |
| Passing ¾-inch sieve | 85-100 |
| Passing ⅜-inch sieve | 15-55 |
| Passing No. 4 sieve | 0-10 |

| Gradation E | Percent by Weight |
|----------------------|-------------------|
| Passing ¾-inch sieve | 100 |
| Passing ½-inch sieve | 70-100 |
| Passing ⅜-inch sieve | 30-70 |
| Passing No. 4 sieve | 0-20 |
| Passing No. 8 sieve | 0-6 |

1005.2.5 Coarse aggregate for ornamental concrete shall be crushed stone in accordance with [Sec 1005.2.4](#), Gradation E. However, the use of coarse aggregate containing more than 2 percent chert will not be permitted.

1005.3 Fine Aggregate.

1005.3.1 Fine aggregate for concrete shall be a fine granular material naturally produced by the disintegration of rock of a siliceous nature, or shall be manufactured from an approved limestone or dolomite source as defined in [Sec 1005.2](#). By specific approval from the engineer, chat sand produced from flint chat in the Joplin area or fines manufactured from

igneous rock or chert gravel may be used. Fine aggregate shall be free from cemented or conglomerated lumps and shall not have any coating of injurious material. The percentage of deleterious substances shall not exceed the following values:

| Deleterious Material | Percent by Weight |
|---|--------------------------|
| Clay Lumps and Shale | 0.25 |
| Coal and Lignite | 0.50 |
| Total Lightweight Particles, Including Coal and Lignite | 0.50 |
| Material Passing No. 200 Sieve | |
| (a) Natural Sand | 2.0 |
| (b) Manufactured Sand | 4.0 |
| Other Deleterious Substances | 0.10 |

1005.3.2 The total lightweight particle requirement will not apply to angular chert sand or manufactured sand.

1005.3.3 Fine aggregate shall produce a mortar having a seven-day compressive strength of at least 90 percent of a control mortar developed at the same proportions, using standard Ottawa sand. Tests shall be performed in accordance with AASHTO T 106. Cement used in the tests shall be Type I, in accordance with [Sec 1019](#). AASHTO T 106 may be waived provided the fine aggregate produces a glass color standard lighter than Organic Platte No. 3, in accordance with AASHTO T 21.

1005.3.4 Fine aggregate for ornamental concrete shall be free from coal and lignite material when tested in accordance with AASHTO T 113.

1005.3.5 All fine aggregate for PCCM shall meet the following gradation requirements:

| Sieve | Percent by Weight |
|------------------------|--------------------------|
| Passing 3/8-inch sieve | 100 |
| Passing No. 4 sieve | 95-100 |
| Passing No. 8 sieve | 70-100 |
| Passing No. 16 sieve | 45-90 |
| Passing No. 30 sieve | 15-65 |
| Passing No. 50 sieve | 5-30 |
| Passing No. 100 sieve | 0-10 |

1005.4 Lightweight Aggregates.

1005.4.1 Lightweight aggregates shall be prepared by expanding, calcining, or sintering argillaceous material such as clay, shales, and slates.

1005.4.2 Grading. The grading shall be uniform and conform to the requirements given in Table I.

1005.4.3 Unit Weight. The unit weight of lightweight aggregates shall not exceed the following:

| Dry, Loose Weight, Max. lb/cu ft | |
|---|----|
| Fine Aggregate | 70 |
| Coarse Aggregate | 55 |

1005.4.3.1 Uniformity of Weight. If the unit weight of any shipment of lightweight aggregate when tested in accordance with AASHTO T 19 is found to vary by more than 10

percent from that of the sample submitted for source approval, the aggregate shipment may be rejected.

1005.4.4 Soundness. When tested in accordance with AASHTO T 104, the loss of lightweight fine or coarse aggregate in 5 cycles of the accelerated soundness test shall not exceed 8 percent if sodium sulfate is used or 10 percent if magnesium sulfate is used.

1005.4.5 Drying Shrinkage. The drying shrinkage of concrete specimens prepared and tested in accordance with AASHTO M 195, shall not exceed 0.07 percent.

1005.4.6 Sampling. Samples of fine and coarse aggregate shall be furnished by the contractor for source approval. Other samples shall be taken from shipments at intervals specified by the engineer.

| Table I Grading Requirements for Lightweight Aggregate | | | | | | | | | | | |
|---|---------------|--------------------------------|--------|--------|--------|--------|--------|-------|--------|--------|---------|
| | | Percent Passing Sieve Sizes | | | | | | | | | |
| Grade | Size | 1 1/2" | 1" | 3/4" | 1/2" | 3/8" | No. 4 | No. 8 | No. 16 | No. 50 | No. 100 |
| Fine Aggregate | | | | | | | | | | | |
| | No. 4 to 0 | --- | --- | --- | --- | 100 | 85-100 | --- | 40-80 | 10-35 | 5-20 |
| Coarse Aggregate | | | | | | | | | | | |
| 1 | 1" to 1/2" | 100 | 90-100 | 20-55 | 0-10 | 0-5 | --- | --- | --- | --- | --- |
| 2 | 1" to No. 4 | 100 | 95-100 | --- | 25-60 | --- | 0-10 | 0-5 | --- | --- | --- |
| 3 | 3/4" to No. 4 | --- | 100 | 90-100 | --- | 20-55 | 0-10 | 0-5 | --- | --- | --- |
| 4 | 1/2" to No. 4 | --- | --- | 100 | 90-100 | 40-70 | 0-15 | 0-5 | --- | --- | --- |
| 5 | 3/8" to No. 8 | --- | --- | --- | 100 | 85-100 | 10-30 | 0-10 | 0-5 | --- | --- |