



**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.

<b>Deleterious Material</b>	<b>Percent by Weight (Mass)</b>
Deleterious Rock	6.0
Shale	1.0
Chert in Limestone	4.0
Other Foreign Material	0.5
Material Passing No. 200 (75 μm) Sieve	
(a) Coarse Fraction, Limestone, Gradation A	1.5 <sup>a</sup>
(b) Fine Fraction, Limestone, Gradation A	2.5 <sup>a</sup>
(c) Limestone, Gradations B, D, & E	2.0 <sup>a</sup>
(d) Limestone, Gradation F	2.5 <sup>a</sup>
(e) Other Aggregates	1.0
Thin or Elongated Pieces	5.0

<sup>a</sup>These limits may be increased 0.5 percent when sampling material at any point after initial stockpiling.

**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. Except as noted herein, rock tested from individual ledges for initial approval shall be in accordance with the criteria below. Source approval and production samples shall also meet the following criteria:

<b>Property</b>	<b>Value</b>
Los Angeles Abrasion, AASHTO T 96, percent loss, max	50
Absorption, AASHTO T 85, percent, max.:	
(a) Portland Cement Concrete Pavement	2.0 <sup>a</sup>
(b) Portland Cement Concrete Masonry	3.5
Soundness, MoDOT Test Method TM 14, percent loss, max.:	
(a) Portland Cement Concrete Pavement	16.0
(b) Portland Cement Concrete Masonry	18.0

<sup>a</sup> If an individual ledge or ledges in a production face constitute 15 percent or less of the total thickness of the production face height used to produce the final product, the absorption for that individual ledge or ledges may exceed the maximum limit specified by 0.5 percentage points.

**1005.2.1.3** Crushed stone for Portland cement concrete pavement, base and approach slabs for bridges from sources required to conform to Gradation F shall be from individual ledges having initial approval, meeting 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.	1.5
Soundness, MoDOT Test Method TM 14, percent loss, max.	10.0
Bulk Specific Gravity, AASHTO T 85, min.	2.58

**1005.2.1.4** 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

**1005.2.1.5** The engineer reserves the right to use additional test methods, such as ASTM C 586, AASHTO T 161, AASHTO T 104 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 and shall be graded to meet Gradation A, Gradation B, or Gradation D, except when Gradation F is required in accordance with [Sec 1005.2.3](#).

Gradation A	Percent by Weight (Mass)
Passing 2-inch (50 mm) sieve	100
Passing 1 1/2-inch (37.5 mm) sieve	95-100
Passing 3/4-inch (19.0 mm) sieve	35-70
Passing 3/8-inch (9.5 mm) sieve	10-30
Passing No. 4 (4.75 mm) sieve	0-5

Gradation B	Percent by Weight (Mass)
Passing 1 1/2-inch (37.5 mm) sieve	100
Passing 1-inch (25.0 mm) sieve	95-100
Passing 1/2-inch (12.5 mm) sieve	25-60
Passing No. 4 (4.75 mm) sieve	0-8

**1005.2.3** 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 be graded to conform to Gradation F:

(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.

<b>Gradation F</b>	<b>Percent by Weight (Mass)</b>
Passing 1/2-inch (12.5 mm) sieve	100
Passing 3/8-inch (9.5 mm) sieve	85-100
Passing No. 4 (4.75 mm) sieve	10-30
Passing No. 8 (2.36 mm) sieve	0-10
Passing No. 16 (1.18 mm) sieve	0-5

**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 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.

<b>Gradation D</b>	<b>Percent by Weight (Mass)</b>
Passing 1-inch (25.0 mm) sieve	100
Passing 3/4-inch (19.0 mm) sieve	90-100
Passing 3/8-inch (9.5 mm) sieve	15-45
Passing No. 4 (4.75 mm) sieve	0-8

<b>Gradation E</b>	<b>Percent by Weight (Mass)</b>
Passing 3/4-inch (19.0 mm) sieve	100
Passing 1/2-inch (12.5 mm) sieve	80-100
Passing 3/8-inch (9.5 mm) sieve	40-70
Passing No. 4 (4.75 mm) sieve	0-10
Passing No. 8 (2.36 mm) sieve	0-4

**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:

<b>Deleterious Material</b>	<b>Percent by Weight (Mass)</b>
Clay Lumps and Shale	0.25
Coal and Lignite	0.25
Total Lightweight (low mass density) Particles, Including Coal and Lignite	0.50
Material Passing No. 200 (75 µm) Sieve	
(a) Natural Sand	2.0
(b) Manufactured Sand	4.0
Other Deleterious Substances	0.10

**1005.3.2** The total lightweight (low mass density) 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 shall meet the following gradation requirements:

<b>Sieve</b>	<b>Percent by Weight (Mass)</b>
Passing 3/8-inch (9.5 mm) sieve	100
Passing No. 4 (4.75 mm) sieve	95-100
Passing No. 8 ( 2.36 mm) sieve	70-100
Passing No. 16 (1.18 mm) sieve	45-90
Passing No. 30 (600 µm) sieve	15-65
Passing No. 50 (300 µm) sieve	5-30
Passing No. 100 (150 µm) sieve	0-10