

# DIVISION III MATERIALS

## AGGREGATES

### SECTION 901 COARSE AGGREGATE

#### 901-1 General.

**901-1.1 Composition:** Coarse aggregate shall consist of naturally occurring materials such as gravel, or resulting from the crushing of parent rock, to include natural rock, slags, expanded clays and shales (lightweight aggregates) and other approved inert materials with similar characteristics, having hard, strong, durable particles, conforming to the specific requirements of this Section.

Materials substantially retained on the No. 4 sieve, shall be classified as coarse aggregate.

Approval of mineral aggregate sources shall be in accordance with 6-2.3.

**901-1.2 Deleterious Substances:** All coarse aggregates shall be reasonably free of clay lumps, soft and friable particles, salt, alkali, organic matter, adherent coatings, and other substances not defined which may possess undesirable characteristics. The weight of deleterious substances shall not exceed the following percentages:

Coal and lignite (AASHTO T-113) .....	1.00
Soft and friable particles (AASHTO T-112)*.....	2.00
Clay lumps (AASHTO T-112)* .....	2.00
Plant root matter (visual inspection in AASHTO T-27)**** .....	0.005
Wood and wood matter (visual inspection in AASHTO T-27)**** .....	0.005
Cinders and clinkers.....	0.50
Free shell** .....	1.00
Total Material passing the No. 200 sieve (FM 1-T011) At Source with Los Angeles Abrasion less than or equal to 30 .....	2.50
At Source with Los Angeles Abrasion greater than 30.....	1.75
At Point of Use.....	3.75
Fine-Grained Organic Matter (AASHTO 194).....	0.03
Chert (less than 2.40 specific gravity SSD) (AASHTO T-113)*** .....	3.00

\* The maximum percent by weight of soft and friable particles and clay lumps together shall not exceed 3.00.

\*\* Aggregates to be used in asphalt concrete may contain up to 5% free shell. Free shell is defined as that portion of the coarse aggregate retained on the No. 4 sieve consisting of loose, whole, or broken shell, or the external skeletal remains of other marine life, having a ratio of the maximum length of the particle to the shell wall thickness exceeding five to one. Coral,

molds, or casts of other shells, and crushed clam and oyster shell indigenous to the formation will not be considered as free shell.

\*\*\* This limitation applies only to coarse aggregates in which chert appears as an impurity. It is not applicable to aggregates which are predominantly chert.

\*\*\*\* Plant root matter, and wood and wood matter shall be considered deleterious when any piece exceeds two inches in length or 1/2 inch in width.

The weights of deleterious substances for reclaimed Portland cement concrete aggregate shall not exceed the following percentages:

Bituminous Concrete .....	1.00
Bricks .....	1.00
Wood and other organic substances (by weight)***** .....	0.1
Reinforcing Steel and Welded Wire Reinforcement.....	0.1
Plaster and gypsum board .....	0.1
Joint Fillers .....	0.1

\*\*\*\*\* Supersedes requirement for other coarse aggregate

**901-1.3 Physical Properties:** Coarse aggregates shall meet the following physical property requirements, except as noted herein:

Los Angeles Abrasion (FM 1-T096).....maximum loss 45%

Soundness (Sodium Sulfate) AASHTO T104 .....

.....maximum loss 12%\*

Flat or elongated pieces\*\*..... maximum 10%

\* For source approval - aggregates exceeding soundness loss limitations will be rejected unless performance history shows that the material will not be detrimental for portland cement concrete or other intended usages.

\*\* A flat or elongated particle is defined as one having a ratio between the maximum and the minimum dimensions of a circumscribing prism exceeding five to one.

**901-1.4 Gradation:** Coarse aggregates shall conform to the gradation requirements of Table 1, when the stone size is specified. However, Table 1 is waived for those aggregates intended for usage in bituminous mixtures, provided the material is graded on sieves specified in production requirements contained in 6-2.3, and meets uniformity and bituminous design requirements.

TABLE 1 Standard Sizes of Coarse Aggregate								
Amounts Finer than Each Laboratory Sieve (Square Openings), weight percent								
Size No.	Nominal Size Square Openings	4 inches	3 1/2 inches	3 inches	2 1/2 inches	2 inches	1 1/2 inches	1 inch
1	3 1/2 to 1 1/2 inches	100	90 to 100	-	25 to 60	-	0 to 15	-
2	2 1/2 inches to 1 1/2 inches	-	-	100	90 to 100	35 to 70	0 to 15	-
24	2 1/2 inches to 3/4 inch	-	-	100	90 to 100	-	25 to 60	-
3	2 inches to 1 inch	-	-	-	100	90 to 100	35 to 70	0 to 15

TABLE 1 Standard Sizes of Coarse Aggregate								
Amounts Finer than Each Laboratory Sieve (Square Openings), weight percent								
Size No.	Nominal Size Square Openings	4 inches	3 1/2 inches	3 inches	2 1/2 inches	2 inches	1 1/2 inches	1 inch
357	2 inches to No. 4	-	-	-	100	95 to 100	-	35 to 70
4	1 1/2 inches to 3/4 inch	-	-	-	-	100	90 to 100	20 to 55
467	1 1/2 inches to No. 4	-	-	-	-	100	95 to 100	-
5	1 inch to 1/2 inch	-	-	-	-	-	100	90 to 100
56	1 inch to 3/8 inch	-	-	-	-	-	100	90 to 100
57	1 inch to No. 4	-	-	-	-	-	100	95 to 100
6	3/4 inch to 3/8 inch	-	-	-	-	-	-	100
67	3/4 inch to No. 4	-	-	-	-	-	-	100
68	3/4 inch to No. 8	-	-	-	-	-	-	-
7	1/2 inch to No. 4	-	-	-	-	-	-	-
78	1/2 inch to No. 8	-	-	-	-	-	-	-
8	3/8 inch to No. 8	-	-	-	-	-	-	-
89	3/8 inch to No. 16	-	-	-	-	-	-	-
9	No. 4 to No. 16	-	-	-	-	-	-	-
10	No. 4 to 0	-	-	-	-	-	-	-

TABLE 1 (Continued) Standard Sizes of Coarse Aggregate								
Amounts Finer than Each Laboratory Sieve (Square Openings), weight percent								
Size No.	Nominal Size Square Openings	3/4 inch	1/2 inch	3/8 inch	No. 4	No. 8	No. 16	No. 50
1	3 1/2 inches to 1 1/2 inches	0 to 5						
2	2 1/2 inches to 1 1/2 inches	0 to 5						
24	2 1/2 inches to 3/4 inch	0 to 10	0 to 5					
3	2 inches to 1 inch	-	0 to 5					
357	2 inches to No. 4	-	10 to 30	-	0 to 5			
4	1 1/2 inches to	0 to 15	-	0 to 5				

TABLE 1 (Continued)  
Standard Sizes of Coarse Aggregate

Amounts Finer than Each Laboratory Sieve (Square Openings), weight percent								
Size No.	Nominal Size Square Openings	3/4 inch	1/2 inch	3/8 inch	No. 4	No. 8	No. 16	No. 50
	3/4 inch							
467	1 1/2 inches to No. 4	35 to 70	-	10 to 30	0 to 5			
5	1 inch to 1/2 inch	20 to 55	0 to 10	0 to 5				
56	1 inch to 3/8 inch	40 to 85	10 to 40	0 to 15	0 to 5			
57	1 inch to No. 4	-	25 to 60	-	0 to 10	0 to 5		
6	3/4 inch to 3/8 inch	90 to 100	20 to 55	0 to 15	0 to 5			
67	3/4 inch to No. 4	90 to 100	-	20 to 55	0 to 10	0 to 5		
68	3/4 inch to No. 8	90 to 100	-	30 to 65	5 to 25	0 to 10	0 to 5	
7	1/2 inch to No. 4	100	90 to 100	40 to 70	0 to 15	0 to 5		
78	1/2 inch to No. 8	100	90 to 100	40 to 75	5 to 25	0 to 10	0 to 5	
8	3/8 inch to No. 8	-	100	85 to 100	10 to 30	0 to 10	0 to 5	
89	3/8 inch to No. 16	-	100	90 to 100	20 to 55	0 to 30	0 to 10	0 to 5
9	No. 4 to No. 16	-	-	100	85 to 100	10 to 40	0 to 10	0 to 5
10	No. 4 to 0	-	-	100	85 to 100	-	-	-

The gradations in Table 1 represent the extreme limits for the various sizes indicated which will be used in determining the suitability for use of coarse aggregate from all sources of supply. For any grade from any one source, the gradation shall be held reasonably uniform and not subject to the extreme percentages of gradation specified above.

**901-2 Natural Stones.**

Coarse aggregate may be processed from gravels, granites, limestones, dolomite, sandstones, or other naturally occurring hard, sound, durable materials meeting the requirements of this Section.

**901-2.1 Gravels:** Gravel shall be composed of naturally occurring quartz, free from deleterious coatings of any kind. The minimum dry-rodded weight AASHTO T-19 shall be 95 pounds per cubic foot.

Crushed gravel shall consist of a minimum of 85%, by weight, of the material retained on the No. 4 sieve, having at least three fractured faces.

**901-2.2 Granites:** Coarse aggregate produced from the crushing of granites shall be sound and durable. For granites to be used in bituminous mixtures and surface treatments, the Los Angeles Abrasion requirement of 901-1.3 is modified to permit a maximum loss up to 50 (FM 1-T096). Maximum amount of mica schist permitted is 5% (FM 5-584).

**901-2.3 Limestones, Dolomite and Sandstone:** Coarse aggregates may be produced from limestone, dolomite, sandstones, and other naturally occurring hard, durable materials meeting the requirements of this Section. When used as a friction course, crushed limestone shall have a minimum acid insoluble content of 12% (FM 5-510). Other materials must meet the approval requirements for friction course determined by Rule 14-103.005(1), Florida Administrative Code (FAC).

Pre-Cenozoic limestones and dolomite shall not be used as crushed stone aggregates either coarse or fine for asphalt concrete friction courses, or any other asphalt concrete mixture or surface treatment serving as the final wearing course. This specifically includes materials from the Ketone Dolomite (Cambrian) Newala Limestone (Mississippian) geologic formations in Northern Alabama and Georgia.

As an exception to the above, up to 20% fine aggregate from these materials may be used in asphalt concrete mixtures other than friction courses which serve as the final wearing course.

**901-2.4 Cemented Coquina Rock:** For cemented coquina rock to be used in bituminous mixtures, the Los Angeles Abrasion requirement of 901-1.3 is modified to permit a maximum loss up to 50 (FM 1-T 096) provided that the amount of material finer than No. 200 generated during the Los Angeles Abrasion test is less than 18%.

### **901-3 Manufactured Stones.**

**901-3.1 Slags:** Coarse aggregate may be produced from molten nonmetallic by-products consisting essentially of silicates and aluminosilicates of calcium and other bases, such as air-cooled blast-furnace slag or phosphate slag, provided it is reasonably uniform in density and quality, and reasonably free from deleterious substances as specified in 901-1.2. In addition, it must meet the following specific requirements:

- Sulphur content ..... not more than 1.5%
- Dry rodded weight AASHTO T-19..... minimum 70 lb/ft<sup>3</sup>
- Glassy Particles ..... not more than 10%
- Slag shall not be used as an aggregate for Portland cement concrete.

For air-cooled blast furnace slag, the Los Angeles Abrasion requirement of 901-1.3 is modified to permit a maximum loss up to 50 (FM 1-T096) provided that the amount of material finer than No. 200 sieve generated during the Los Angeles Abrasion test is less than 18%.

### **901-4 Lightweight Aggregates.**

**901-4.1 Lightweight Coarse Aggregate for Bituminous Construction:** Lightweight coarse aggregate may be produced from naturally occurring materials such as pumice, scoria and tuff or from expanded clay, shale or slate fired in a rotary kiln. It shall be reasonably uniform in quality and density, and free of deleterious substances as specified in 901-1.2, except that the term cinders and clinkers shall apply to those particles clearly foreign to the extended aggregate in question.

In addition, it must meet the following specific requirements:

- Material passing the No. 200 Sieve  
.....maximum 3.00%, (FM 1-T011)
- Dry loose weight (AASHTO T-19)\*..... 33-55 lb/ft<sup>3</sup>
- Los Angeles Abrasion (FM 1-T096). maximum 35%
- Ferric Oxide (ASTM C641)..... maximum 1.5 mg

\* Source shall maintain dry-loose unit weight within plus or minus 6% of Quality Control average. Point of use dry-loose unit weight shall be within plus or minus 10% of Source Quality Control average.

**901-4.2 Lightweight Coarse Aggregate for Structural Concrete:** The requirements of 901-4.1 are modified as follows:

- Aggregates shall not be produced from pumice and scoria.
- Los Angeles Abrasion (FM 1-T096, Section 12) shall be 45%, maximum.
- Gradation shall meet the requirements of AASHTO M-195 for 3/4 inch, 1/2 inch and 3/8 inch.

**901-5 Recycled Concrete Aggregate (RCA).**

RCA shall be crushed and processed to provide a clean, hard, durable aggregate having a uniform gradation free from adherent coatings.

RCA can be used as coarse aggregate in pipe backfill under wet conditions, underdrain aggregate, or concrete meeting the requirements of Section 347. RCA can only be used in bituminous mixtures if the RCA originated from a concrete mix which was produced and placed in accordance with Section 346. RCA shall be asbestos free.

The Contractor's (Producer's) crushing operation shall produce an aggregate meeting the applicable gradation requirements. The physical property requirements of 901-1.3 for soundness shall not apply and the maximum loss as determined by the Los Angeles Abrasion (FM 1-T096) is changed to 50.

The sources of reclaimed portland cement concrete will be treated as a mine and subject to the requirements of Section 6 and Section 105.

**901-6 Exceptions, Additions and Restrictions.**

Pertinent specification modifications, based on material usage, will be found in other Sections of the specifications.