PART X MATERIALS

SECTION 1001 AGGREGATES

Delete this Section in its entirety and replace with the following:

SECTION 1001
AGGREGATES

1001-1 GENERAL: Aggregates shall be from a source listed in the QPL.

1001-1.1 Abrasion Resistance and Soundness: Maximum soundness loss of aggregate shall be 15% when subjected to 5 cycles of magnesium sulfate soundness test by AASHTO T 104. Coarse aggregates for portland cement concrete and asphalt concrete shall show an abrasion loss of not more than 40% when tested by AASHTO T 96.

1001-1.2 Physical Properties: Physical properties shall be determined in accordance with test methods shown:

Property	Test Method
Deleterious Materials	DOTD TR 119
Unit Weight	AASHTO T 19
Specific Gravity & Absorption of Coarse Aggregate	AASHTO T 85
Specific Gravity & Absorption of Fine Aggregate	AASHTO T 84
Polish Value	AASHTO T 278 & T 279
Amount of Material Finer than No. 200 Sieve	DOTD TR 112
Sieve Analysis (Gradation)	DOTD TR 113
Liquid Limit	DOTD TR 428
Plasticity Index	DOTD TR 428

1001-2 AGGREGATES FOR PORTLAND CEMENT CONCRETE AND MORTAR:

1001-2.1 General: When tested in accordance with ASTM C 289, C 586 and C 1260, aggregates potentially reactive with cement alkalies will be restricted to use with cement containing 0.6% or less alkalies (sodium oxide equivalent).

1001-2.2 Fine Aggregate: Fine aggregate shall be sand in which deleterious substances do not exceed the following:

Property	Maximum %
Coal and Lignite	0.25
Clay Lumps	0.05
Clay Lumps & Friable Particles	3.00

Fine aggregate subjected to colorimetric test for organic impurities (AASHTO T 21) which produces a color darker than Organic Color No. 3 shall be subjected to mortar strength test (AASHTO T 71). Mortar shall show a minimum compressive strength of 95% of reference mortar.

Fine aggregate shall conform to the following gradations:

CONCRETE SAND

U. S. Sieve	% Passing
3/8"	100
No. 4	95-100
No. 16	45-90
No. 50	7-30

No. 100	0-7
No. 200	0-3

MORTAR SAND

U. S. Sieve	% Passing
No. 4	100
No. 8	95-100
No. 100	0-25
No. 200	0-10

1001-2.3 Coarse Aggregate: Coarse aggregate shall be gravel, stone or crushed concrete.

The amounts by weight of deleterious substances shall be as follows:

Property	Maximum %
Clay Lumps	0.05
Clay Lumps & Friable Particles	3.0
Iron Ore	2.0[1]
Coal & Lignite	1.0[1]
Sticks (Wet)	0.05
Total Clay Lumps & Friable Particles, Iron Ore, Coal & Lignite, and Wood	5.0

[1]Aggregate used in concrete railings shall be free from coal, lignite and iron ore.

Coarse aggregate shall conform to the following gradations:

% Passing U.S. Sieve	Grade A	Grade B	Grade D[1]	Grade F	Grade P[2]
2 1/2"	---	---	100	---	---
2"	---	100	90-100	---	---
1 1/2"	100	85-100	---	---	---
1"	90-100	---	35-70	---	---
3/4"	---	35-70	---	100	100
1/2"	25-60	---	10-30	90-100	90-100
3/8"	---	10-30	---	---	20-55
No. 4	0-10	0-5	0-5	15-60	0-10
No. 8	0-5	---	---	0-15	0-5
No. 16	---	---	---	0-5	---
No. 200	0-1	0-1	0-1	0-1	0-1

[1]Crushed stone only.
[2]For slip form of concrete curb if allowed by the project engineer.

If material finer than No. 200 sieve consists of dust from crushing, essentially free of clay, this percentage shall be 0-2. If total material passing No. 200 sieve from coarse and fine aggregates does not exceed 5%, material passing No. 200 sieve from crushed coarse aggregate may be increased to 3%.

1001-3 BASE AND SUBBASE AGGREGATES:

1001-3.1 Base Stone: This material shall consist of crushed stone or crushed concrete and shall conform to the following gradation:

U. S. Sieve	% Passing
1 1/2"	100
1"	90-100
3/4"	70-100
No. 4	35-65

No. 40	12-32
No. 200	5-12

Material passing No. 40 sieve shall conform to the following:

	Maximum
Liquid Limit	25
Plasticity Index	4

1001-3.2 Sub-base Stone: This material shall consist of crushed stone or crushed concrete and shall conform to the following gradation:

U. S. Sieve	% Passing
2"	100
1 1/2"	90-100
1"	20-55
3/4"	0-15
3/8”	0-5

1001-4 SURFACE COURSE AGGREGATES:

1001-4.1 Stone: This aggregate shall consist of crushed stone or crushed concrete and shall conform to the following gradation:

U. S. Sieve	% Passing
1 1/2"	100
3/4"	50-100
No. 4	35-65
No. 40	10-32
No. 200	3-15

Material passing No. 40 sieve shall conform to the following:

	Maximum
Liquid Limit	25
Plasticity Index	4

1001-4.2 Gravel: Gravel shall be free of sticks and other foreign material, and shall be graded as follows:

U. S. Sieve	% Passing
1 1/2"	95-100
No. 4	0-15
No. 200	0-2

1001-5 ASPHALT CONCRETE AGGREGATES:

These aggregates shall be assigned a Friction Rating as shown in Table 1001-1 and indicated in QPL 2.

Table 1001-1

Aggregate Friction Rating

Friction Rating	Description
I	Aggregates that have a Polish Value of greater than 37 or demonstrate the ability to retain acceptable friction numbers for the life of the pavement.
II	Aggregates that have a Polish Value of 35 to 37 or demonstrate the ability to retain acceptable friction numbers for the life of the pavement.
III	Aggregates that have a Polish Value of 30 to 34 or demonstrate the ability to retain acceptable friction numbers for the life of the pavement.
IV	Aggregates with a Polish Value of 20 to 29.

1001-5.1 Gravel, Stone, Slag and Crushed Concrete: The amount of clay lumps and friable particles shall not exceed 5% by weight.

1001-5.2 Coarse Sand: Coarse sand shall be free from vegetative and other foreign matter.

1001-5.3 Fine Sand: Fine sand shall be free from vegetative and other foreign matter. Fine sand shall be nonplastic with a maximum of 25% passing No. 200 sieve.

1001-5.4 Screenings: Screenings shall be made by crushing aggregates which conform to requirements for coarse aggregates in Subsection 1001-1. Screenings shall meet the following gradation requirements.

U. S. Sieve	% Passing
3/8"	100
No. 4	85-100

1001-5.5 Reclaimed Asphalt Concrete: Stockpiles of reclaimed asphalt concrete shall be approved prior to use. Stockpiles shall be uniform and free of soil, debris, foreign matter and other contaminants. Reclaimed material shall pass a 2" sieve.

1001-5.6 Mineral Filler: Mineral filler shall be limestone dust, pulverized hydrated lime, portland cement, or cement stack dust. Mineral dust collected in bag houses or by other dust collectors at asphalt concrete plants is not classified as mineral filler. Cement stack dust shall be material collected from waste gases discharged through a collector of a cement plant. Mineral filler shall conform to the following gradation:

U. S. Sieve	% Passing
No. 30	100
No. 80	95-100
No. 200	70-100
No. 270	60-100

1001-6 BEDDING MATERIAL: Bedding materials shall be a sand-aggregate mixture. Aggregate in the mixture shall be gravel, stone or crushed concrete. The mixture shall be free of foreign matter and shall be graded as follows:

U. S. Sieve	% Passing
1 ½"	95-100
No. 4	30-50
No. 10	20-45
No. 200	0-10

1001-7 BACKFILL SAND: Sand for backfilling trenches and structures shall be non-plastic siliceous material, graded as follows:

U. S. Sieve	% Passing
½"	100
No. 10	75-100
No. 200	0-10

1001-8 RIPRAP: Riprap shall be crushed stone or crushed concrete. The smallest dimension shall be at least 1/3 the largest dimension. Crushed concrete shall be free of protruding steel reinforcement.

Riprap shall be graded as follows:

Table 1001-2
Riprap Gradation

Riprap Class [1]	Stone Size lb	Spherical Diameter [2] ft	Percent of Stone Smaller Than
2 lb	10 4 2 0.75	0.51 0.38 0.30 0.22	100 40-100 15-50 0-15
10 lb	50 20 10 5	0.88 0.65 0.51 0.41	100 50-100 15-50 0-15
30 lb	140 60 30 10	1.24 0.94 0.74 0.51	100 42-100 15-50 0-15
55 lb [3]	275 110 55 20	1.50 1.11 0.88 0.63	100 42-100 15-50 0-15
130 lb [3]	650 260 130 40	2.00 1.46 1.17 0.79	100 45-100 15-50 0-15
250 lb [3]	1250 500 250 80	2.50 1.83 1.46 1.00	100 45-100 15-50 0-15
440 lb [3]	2200 900 440 130	3.00 2.23 1.76 1.17	100 40-100 14-50 0-15
1000 lb [3]	5000 2000	4.00 2.91	100 45-100

Riprap Class [1]	Stone Size lb	Spherical Diameter [2] ft	Percent of Stone Smaller Than
	1000 300	2.31 1.55	10-50 0-15

[1]The stone size used to define the Riprap Class is the minimum median stone size for the stone class. The minimum thickness of a riprap layer shall be no less than 18 inches or the spherical diameter of the maximum stone size in the Riprap Class (D_{100}) if greater.

[2]Spherical diameters of riprap classes up to 30 lb are based on a solid weight of 140 lb/cu ft. Spherical diameters of riprap classes above 30 lb are based on a solid weight of 155 lb/cu ft.

[3]Recycled portland cement concrete may not be used in these riprap classes.