

.9800	60	.9723	.9686	116	.9385	.9305	171	.9057	.8938
	[140]			[240]			[340]		
.9788	63	.9706	.9666	118	.9369	.9286	174	.9040	.8920
	[145]			[245]			[345]		
.9775	66	.9689	.9647	121	.9352	.9268	177	.9024	.8902
	[150]			[250]			[350]		

702.09 Asphalt Filler for Structural Plate Arches Asphalt for filling spaces between the structural plates and the substructure metal connectors of the arch shall conform to the requirements for bituminous material of AASHTO M190 or of AASHTO M320, Table 1, for PG 64-28.

702.12 Emulsified Asphalt Sealing Compound Emulsified asphalt sealing compound shall be an approved commercially prepared product manufactured for specific protective coating, colored as required. It shall contain fillers, pigments and sand or fibrous materials suspended in a suitable emulsified asphalt or tar. It shall be of such consistency that it can be applied at atmospheric temperatures and capable of being easily diluted with the addition of water and mixed by hand stirring at the site of application.

SECTION 703 - AGGREGATES

703.01 Fine Aggregate for Concrete Fine aggregate for concrete shall consist of natural sand or, when approved by the Resident, other inert materials with similar characteristics or combinations thereof, having strong, durable particles. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of construction or mix without permission of the Resident.

All fine aggregate shall be free from injurious amounts of organic impurities. Should the fine aggregate, when subjected to the colorimetric test for organic impurities, AASHTO T21 (ASTM C40), produce a color darker than the reference standard color solution (laboratory designation Plate III), the fine aggregate shall be rejected.

The fine aggregate shall be well graded from coarse to fine material and shall meet the following grading requirements when tested according to AASHTO T11 and AASHTO T27.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
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Metric	US Customary	
9.5 mm	• inch	100
4.75 mm	No. 4	95-100
2.36 mm	No. 8	80-100
1.18 mm	No. 16	50-85
600 μm	No. 30	25-60
300 μm	No. 50	10-30
150 μm	No. 100	2-10
75 μm	No. 200	0-5.0

Fine aggregate failing to meet the minimum requirements for material passing the 300 μm and/or 150 μm [No. 50 and/or No. 100] sieves may be retested and approved for use provided an approved inorganic fine material is added to correct the deficiency in grading.

The gradation requirements given above are the extreme limits to be used in determining the suitability of materials from all possible sources of supply.

The fineness modulus shall not be less than 2.3 or more than 3.1, nor vary by more than 0.20 from the value assumed in selecting proportions of the concrete. If this value is exceeded, the fine aggregate will be rejected unless suitable adjustments are made in proportions of coarse and fine aggregate. The fineness modulus of fine aggregate shall be determined by adding the cumulative percentages of material by weight retained on the following sieves: 4.75 mm, 2.36 mm, 1.18 mm, 600 μm , 300 μm and 150 μm [US Standard sieves Nos. 4, 8, 16, 30, 50, 100] and dividing by 100.

Mortar cubes containing the fine aggregates and made according to AASHTO T71 (ASTM C87) using cement conforming to AASHTO M85, Type II, shall develop compressive strength, at the age of 7 days, of not less than 90% of the strength developed by a mortar prepared in the same manner with the same cement and graded Ottawa sand having a fineness modulus of 2.40 +/- 0.10. After the initial test for each year and the fine aggregate has been accepted, the above compressive test will not be required unless the Resident deems it necessary.

Fine aggregate, from an individual source or stockpile used for blending when tested for absorption as specified in AASHTO T84 (ASTM C128), shall show a percent of absorption of not more than 2.30.

703.02 Coarse Aggregate for Concrete Coarse aggregate for concrete shall consist of crushed stone or gravel having hard, strong, durable pieces, free from adherent coatings and of which the portion retained on the 9.5 mm [\bullet in] sieve shall contain not more than 15%, by weight of flat and elongated particles when performed in accordance with test method ASTM D4791, Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate, using a dimensional ratio of 1:5.

The coarse aggregate shall not contain more than 3%, by weight, of deleterious material from an individual or blended source or stockpile.

Deleterious material is defined as those particles of aggregate that may be crumbled in the hand and those that have an absorption greater than 3% by weight determined in accordance with AASHTO T85 modified for weight of sample. The types that are determined to be deleterious are generally highly absorptive shales, phylites, sandstones, and rotten rock of various kinds.

Coarse aggregate shall conform to the requirements of the following table for the size or sizes designated and shall be well graded between the limits specified.

Percentage by Weight Passing a Square Mesh Sieve

CLASSES	A	AA	S	
LATEX				
Sieve Designation				
50.0 mm [2 in]			100	
37.5 mm [1½ in]	100		95-100	
25.0 mm [1 in]	95-100	100	-	
19.0 mm [¾ in]	-	90-100	35-70	
100				
12.5 mm. [½ in]	25-60	-	-	90-
100				
9.5 mm [\bullet in]	-	20-55	10-30	40-
70				
4.75 mm [No. 4]	0-10	0-10	0-5	0-
15				
2.36 mm [No. 8]	0-5	0-5	-	0-
5				

1.18 mm [No. 16]	-	-	-	-
300 μ m [No. 50]	-	-	-	-
75 μ m [No. 200]	1.5 Max.	1.5	1.5	
<u>1.5</u>				
AGG. SIZE	25mm[1 in]	19mm[¾ in]	37.5mm[1½ in]	
12.5mm[½ in]				

The material passing the 75 μ m [No. 200] sieve shall be determined in accordance with AASHTO T11 and AASHTO T27.

Coarse aggregate for a non-integral structural concrete wearing surface shall be hard and durable crushed ledge rock.

703.0201 Alkali Silica Reactive Aggregates. All coarse aggregates proposed for use in concrete shall be tested for Alkali Silica Reactivity (ASR) potential under AASHTO T303 (ASTM C1260), Accelerated Mortar Bar Method, prior to being accepted for use. Acceptance will be based on testing performed by the Department. Sampling will be performed by the Department from stockpiles located at the Contractor's/supplier's ready mixed concrete plants. Aggregate approvals will be performed on a 3-year cycle, unless the source or character of the aggregate in question has changed within 3 years from the last test date.

A list of pre-approved coarse aggregate and aggregate-cement/pozzolan blends is maintained by the Department and will determine the acceptability of concrete mix designs proposed for use.

As per AASHTO T303 (ASTM C1260): Use of a particular coarse aggregate will be allowed with no restrictions when the mortar bars made with this aggregate expand less than or equal to 0.10% at 16 days; use of a particular coarse aggregate will be classified as potentially reactive when the mortar bars made with this aggregate expand greater than 0.10% at 16 days, and use of this aggregate will be allowed only with the use of cement-pozzolan blends and/or chemical admixtures that result in mortar bar expansion of less than 0.10% at 16 days.

Acceptable pozzolans and chemical admixtures that may be used when an aggregate is classified as potentially reactive include, but are not limited to, the following:

A. Class F Coal Fly Ash meeting the requirements of ASTM C618.

- B. Ground Granulated Blast Furnace Slag (Grade 100 and 120) meeting the requirements of ASTM C989.
- C. Densified Silica Fume (powder or slurry) meeting the requirements of AASHTO M307.
- D. Lithium Hydroxide Monohydrate (LiOH-H₂O).

Pozzolans or chemical admixtures required to offset the effects of potentially reactive aggregates will be incorporated into the concrete at no additional cost to the Department.

Aggregates classified as potentially reactive by the requirements of this specification may be used, provided they meet one of the following criteria:

- A. A well-documented history showing that the proposed aggregate is innocuous is provided to the Department of at least 10 structures containing this aggregate. These structures must be at least 15 years of age, exposed to moisture in service, contain high alkali cement (greater than 0.80% alkali) and exhibit a lack of ASR-related distress. Cores taken from the existing structures shall be petrographically analyzed in accordance with ASTM C856; these analyses must indicate the absence of ASR gel formation, aggregate rimming and associated micro cracking. The locations and sampling of cores shall be the responsibility of the Department. All costs associated with the petrographic evaluation of cores, including transportation of the cores to the testing facility, shall be the responsibility of the Contractor.
- B. Certified test results from an accredited independent laboratory utilizing the current AASHTO T303 (ASTM C1260) Accelerated Mortar Bar Method, indicating an acceptable alkali-aggregate combination, are submitted to the Department.

703.05 Aggregate for Sand Leveling Aggregate for sand leveling shall be sand of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation shall meet the grading requirements of the following table.

Sieve Designation		Percent by Weight Passing Square Mesh Sieve
Metric	US Customary	
9.5 mm	• in	85-10
75 µm	No. 200	0-5.0

703.06 Aggregate for Base and Subbase. The material shall have a minimum degradation value of 15 as determined by the Washington State Degradation Test of 1967, except that the test will be run on the portion of a sample that passes the 12.5 mm [$\frac{1}{2}$ in] sieve and is retained on the 2.00 mm [No. 10] sieve, minus any reclaimed asphalt pavement used.

a. Aggregate for base shall be screened or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of the part that passes a 75 mm [3 in] sieve shall meet the grading requirements of the following table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves		
Metric	US Customary	Aggregates		
		Type A	Type B	Type C
12.5 mm	$\frac{1}{2}$ in	45-70	35-75	
6.3 mm	$\frac{1}{4}$ in	30-55	25-60	25-70
425 μ m	No. 40	0-20	0-25	0-30
75 μ m	No. 200	0-5.0	0-5.0	0-5.0

Type A aggregate for base shall only contain particles of rock that will pass the 50 mm [2 in] square mesh sieve.

Type B aggregate for base shall only contain particles of rock that will pass the 100 mm [4 in] square mesh sieve.

Type C aggregate for base shall only contain particles of rock that will pass the 150 mm [6 in] square mesh sieve.

b. Aggregate for subbase shall be sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of the part that passes a 75 mm [3 in] sieve shall meet the grading requirements of the following table:

Sieve	Percentage by Weight
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Designation		Passing Square Mesh Sieves		
Metric	US Customary	Type D	Type E	Aggregates Type F
Type G				
6.3 mm	¼ in	25-70	25-100	60-100
-				
425 µm	No. 40	0-30	0-50	0-50
0-70				
75 µm	No. 200	0-7.0	0-7.0	0-7.0
0-10.0				

Aggregate for subbase shall not contain particles of rock which will not pass the 150 mm [6 in] square mesh sieve.

703.07 Aggregates for HMA Pavements Coarse aggregate and fine aggregate for hot mix asphalt pavements shall be of such gradation that when combined in the proper proportions, including filler, if required, the resultant blend will meet the composition of mixture for the type of pavement specified.

Coarse aggregate, that material retained on the 2.36 mm [No. 8] sieve, shall be crushed stone or crushed gravel and, unless otherwise stipulated, shall consist of clean, tough, durable fragments free from an excess of soft or disintegrated pieces and free from stone coated with dirt or other objectionable matter.

Fine aggregate, material that passes the 2.36 mm [No. 8] sieve, shall consist of natural sand, manufactured sand, or a combination of these. It shall consist of hard, tough grains, free from injurious amounts of clay, loam, or other deleterious substances. Fine aggregate, shall not exceed an absorption of 3% by weight as determined by AASHTO T84.

The composite blend shall have a Micro-Deval value of 18.0 or less as determined by AASHTO TP58-99. In the event of a failure, the Washington State Degradation test of 1967 shall be run before rejection of the material. Material with a value of 30 or more may be accepted.

Aggregates shall also meet the following consensus properties. The Department reserves the right to sample and test the composite aggregate for any of the following properties at

any time.

TABLE 3: AGGREGATE CONSENSUS PROPERTIES CRITERIA

Estimated Traffic, Million 80 kN [18 kip] ESALs	ASTM D5821 Coarse Aggregate Angularity (Minimum)	AASHTO T-304 Method A Uncompacted Void Content of Fine Aggregate (Min)	ASTM D4791 (8.4) Flat and Elongated Particles (Maximum)	AASHTO T176 Clay Content/ Sand Equivalent (Minimum)
< 0.3	60/60	40	10	45
0.3 to < 3.0	75/60			
3.0 to < 10	85/80	45	10	50
10 to < 30	95/90			
≥ 30	100/100			

ASTM D5821 - “85/80 denotes that 85% of the coarse aggregate has one fractured face and 80% has two fractured faces.

AASHTO TP304 - Criteria are presented as percent air voids in loosely compacted fine aggregate, (U).

ASTM 4791 - Criteria are presented as maximum percent by weight of flat and elongated particles (5:1 ratio).

The entire HMA wearing course shall come from the same source of material and the same job mix formula, except when permission is obtained from the Resident to change sources.

703.09 HMA Mixture Composition The coarse and fine aggregate shall meet the requirements of Section 703.07. The several aggregate fractions for mixtures shall be sized, graded, and combined in such proportions that the resulting composite blends will meet the grading requirements of the following tables or as otherwise specified.

TABLE 1: COMPOSITION OF MIXTURES - CONTROL POINTS

SIEVE SIZE	GRADING			
	TYPE 19 mm [¾ in]	TYPE 12.5 mm [½ in]	TYPE 9.5 mm [• in]	TYPE 4.75 mm [#40]
PERCENT BY WEIGHT PASSING - COMBINED AGGREGATE				
37.5 mm [1½ in]				

25 mm [1 in]	100			
19 mm [¾ in]	90-100	100		
12.5 mm [½ in]	-90	90-100	100	100
9.5 mm [• in]	-	-90	90-100	95-100
4.75 mm [No. 4]	-	-	-90	90-100
2.36 mm [No. 8]	23-49	28-58	32-67	-
1.18 mm [No. 16]	-	-	-	30-60
600 µm [No. 30]	-	-	-	-
300 µm [No. 50]	-	-	-	-
75 µm [No. 200]	2-8	2-10	2-10	6-12

SIEVE SIZE	RESTRICTED ZONES			
	TYPE 19 mm [¾ in]	TYPE 12.5 mm [½ in]	*TYPE 9.5 mm [• in]	TYPE 4.75 mm [#40]
	PERCENT BY WEIGHT PASSING - COMBINED AGGREGATE			
37.5 mm [1½ in]	-	-	-	-
25 mm [1 in]	-	-	-	-
19 mm [¾ in]	-	-	-	-
12.5 mm [½ in]	-	-	-	-
9.5 mm [• in]	-	-	-	-
4.75 mm [No. 4]	-	-	-	-
2.36 mm [No. 8]	34.6	39.1	47.2	-
1.18 mm [No. 16]	22.3-28.3	25.6-31.6	31.6-37.6	-
600 µm [No. 30]	16.7-20.7	19.1-23.1	23.5-27.5	-
300 µm [No. 50]	13.7	15.5	18.7	-
75 µm [No. 200]	-	-	-	-

* The restricted zone is presented for information and definition of “Fine” 9.5mm mixes only.

If a Grading “D” mixture is allowed per Special Provision Section 403, it shall meet the following gradation and the aggregate requirements of Section 703.07.

Sieve Designation (Metric)	Sieve Designation (US Customary)	Percentage by Weight Passing Square Mesh Sieves
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12.5 mm	½ in	100
9.5 mm	• in	93-100
4.75mm	No. 4	60-80
2.36 mm	No. 8	46-65
1.18 mm	No. 16	25-55
600 µm	No. 30	16-40
300 µm	No. 50	10-30
150 µm	No. 100	6-22
75 µm	No. 200	3.0-8.0

703.10 Aggregate for Untreated Surface Course and Leveling Course Aggregate for untreated surface course and leveling course shall be screened or crushed gravel consisting of hard durable particles which are free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of the material shall meet the grading requirements of the following table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
25.0 mm	1 in	95-100
19.0 mm	¾ in	90-100
4.75 mm	No. 4	40-65
2.00 mm	No. 10	10-45
75 µm	No. 200	0-7.0

703.11 Aggregate for Shoulder Aggregate for add shoulder gravel shall meet the grading requirements of the following table.

*Paved or Unpaved Lifts 100 mm [4 in] or Greater	Paved Lifts < 100 mm [4 in]	Unpaved Lifts < 100
Percent Passing	Percent Passing	Percent
25 mm [1 in]	90 - 100	90 - 100
6.3 mm [¼ in]	25 - 100	25 - 70

425µm [No. 40]	5 - 30	5 - 50	5 - 30
75µm [No. 200]	2 - 10	2 - 10	2 - 10

*Shall not contain particles larger than 150 mm [6 in] or the thickness of the lift being placed, whichever is less.

703.12 Aggregate for Crushed Stone Surface Crushed stone surface shall be of quarried stone and meet the applicable requirements of Section 703.07(a) Coarse Aggregate. The aggregate shall meet the following gradation requirements:

Sieve Designation	Percent of Weight Passing Square Mesh Sieves
25 mm [1 in]	100
19 mm [$\frac{3}{4}$ in]	60 - 90
12.5 mm [$\frac{1}{2}$ in]	10 - 35
9.5 mm [\bullet in]	2 - 15
4.75 mm [No. 4]	0 - 5

Gradation tests shall conform to AASHTO Method T27.

703.15 Filler These materials shall conform to the following specification requirements for the designated materials.

Mineral filler shall conform to the requirements of AASHTO M17.

703.18 Common Borrow Common borrow shall consist of earth, suitable for embankment construction. It shall be free from frozen material, perishable rubbish, peat and other unsuitable material.

The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4% above optimum, which shall be determined in accordance with AASHTO T180, Method C or D.

703.19 Granular Borrow Granular borrow shall consist of sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that portion passing a 75 mm [3 in] sieve shall meet the

gradation requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves		
	Metric	US Customary	Material for Underwater Embankment
			Material for Backfill Construction
425 μm	No. 40		0-70
75 μm	No. 200		0-20.0

Granular borrow shall contain no particles or fragments with a maximum dimension in excess of the compacted thickness of the layer being placed.

703.20 Gravel Borrow Gravel borrow shall consist of well graded granular material having no rocks with a maximum dimension of over 150 mm [6 in] and that portion passing a 75 mm [3 in] square mesh sieve shall contain not more than 70% passing a 6.3 mm [$\frac{1}{4}$ in] mesh sieve and not more than 10% passing a 75 μm [No. 200] mesh sieve.

703.21 Rock Borrow Rock borrow shall consist of hard durable rock broken to various sizes that will form a compact embankment with a minimum of voids. The maximum size for any rock shall be 900 mm [3 ft] in its greatest dimension.

703.22 Underdrain Backfill Material. Granular material for Underdrain Type B shall be free from organic matter and shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
25.0 mm [1 in]	95-100
12.5 mm [$\frac{1}{2}$ in]	75-100
4.75 mm [No. 4]	50-100
850 μm [No. 20]	15-80
300 μm [No. 50]	0-15
75 μm [No. 200]	0-5.0

Crushed or uncrushed material for Underdrain Type C shall conform to the following

table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
25.0 mm	1 in	100
19.0 mm	¾ in	90-100
9.5 mm	• in	0-75
4.75 mm	No. 4	0-25
2.00 mm	No. 10	0-5

703.24 Stone for French Drains Stones for French drains shall consist of hard, durable rock and shall conform to the following table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
150 mm	6 in	90-100
37.5 mm	1½ in	0-40
4.75 mm	No. 4	0-5

Gradation test shall conform to AASHTO T27 except that the total sample shall be sieved and the minimum weight of the sample will be 55 kg [120 lb].

703.25 Stone Fill Stones for stone fill shall consist of sound durable rock that will not disintegrate by exposure to water or weather. Either field stone or rough, unhewn quarry stone may be used. Stones shall weigh from 5 kg [10 lb] to a maximum of 225 kg [500 lb] or larger if approved by the Resident. 50 percent by weight of the stones shall be approximately 100 kg [200 lb].

703.26 Plain and Hand Laid Riprap Stones shall consist of sound durable rock which will not disintegrate by exposure to water or weather. Either field stone or rough, unhewn quarry stone may be used. Exposed stones shall be angular and as nearly rectangular in cross-section as practicable. Rounded boulders or cobbles will not be permitted. Stones

shall weigh from 5 kg [10 lb] to 100 kg [200 lb] except that when available suitable stones weighing more than 90 kg [200 lb] may be used. Approximately 50% of the stones by volume, shall exceed a mass of 25 kg [50 lb] each.

703.27 Stone Blanket Stones shall consist of sound durable rock that will not disintegrate by exposure to water or wind. Either field stone or rough, unhewn quarry stone may be used. Stones shall weigh from 150 kg [300 lb] to 1500 kg [3,000 lb]. Approximately 50% of the stones, by volume, shall exceed a mass of 450 kg [1,000 lb] each.

703.28 Heavy Riprap Stones shall consist of sound, durable rock, resistant to the action of air and water. Either field stone or rough, unhewn quarry stone may be used. The exposed stones shall be angular. Round or thin, flat stones will not be permitted. Stones shall have a minimum weight of 225 kg [500 lb] each and at least 50% of the stones, by volume, shall exceed 450 kg [1,000 lb] each.

703.29 Stone Ditch Protection Rock used for ditch protection shall consist of sound, durable rock that will not disintegrate by exposure to water or weather. Fieldstone, rough quarry stone, blasted ledge rock or tailings may be used. The rock shall be graded within the following limits or as otherwise approved.

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
300 mm	12 in	90-100
100 mm	4 in	0-15

The size of any stone shall not exceed 450 mm [18 in] when measured along its longest axis.

703.31 Crushed Stone Crushed stone shall be obtained from rock of uniform quality and shall consist of clean, angular fragments of quarried rock, free from soft disintegrated pieces or other objectionable matter.

The stone, which shall be similar to railroad ballast, shall meet the following gradation requirements in the stockpile at the source.

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
63 mm	2½ in	100
50 mm	2 in	95-100
25 mm	1 in	0-30
19 mm	¾ in	0-5

SECTION 704 - MASONRY UNITS

704.01 Clay or Shale Brick Except as modified below, brick shall conform to the requirements of one of the following specifications:

Type of Brick	Specification
Sewer and Manhole	AASHTO M91, Grade MS or SM
Building	AASHTO M114, Grade SW

Size Number 1 brick of a nominal length of 190 mm [7 in] may be used.

704.02 Brick for Paving Brick for paving shall conform to the requirements of ASTM (C62, Grade SW) for Building brick or shale, with the following modifications:

- The absorption limits shall be from 5% to 12% for the average of 5 bricks.
- The compressive strength shall not be less than 41.4 MPa [6,000 psi].
- The modulus of rupture shall not be less than 6.9 MPa [1,000 psi].
- The bricks shall be No. 1, water struck type for paving.

The bricks shall be 57 mm by 90 mm by 190 mm [2¼ in by 3¾ in by 8 in] with permissible variations not to exceed 1.5 mm [$\frac{1}{16}$ in] in depth, 3 mm [\bullet in] in width and 6 mm [$\frac{1}{4}$ in] in length.

Before ordering new brick, samples shall be submitted in whole straps to show color range.

704.03 Concrete Masonry Blocks Concrete masonry blocks may be rectangular or