

**9-03 AGGREGATES****9-03.1 Aggregates for Portland Cement Concrete****9-03.1(1) General Requirements**

Portland cement concrete aggregates shall be manufactured from ledge rock, talus, or sand and gravel in accordance with the provisions of Section 3-01.

The material from which concrete aggregate is manufactured shall meet the following test requirements:

Los Angeles Wear, 500 Rev.	35 max.
Degradation Factor (Structural and Paving Concrete)	30 min.
Degradation Factor (Other as defined in 6-02.3(2)B)	20 min.

Aggregates tested in accordance with AASHTO T 303 or ASTM C 1260 with expansion greater than 0.20 percent are Alkali Silica Reactive (ASR) and will require mitigating measures. Aggregates tested in accordance with ASTM C 1293 with expansion greater than 0.04 percent are Alkali Silica Reactive (ASR) and will require mitigating measures.

Aggregates for use in Commercial Concrete as defined in 6-02.3(2)B shall not require mitigation.

Mitigating measures for aggregates with expansions from 0.21 to 0.45 percent, when tested in accordance with AASHTO T 303 or ASTM C 1260, may be accomplished by using low alkali cement as per 9-01.2(3) or by using 25% Class F fly ash by total weight of the cementitious materials. The Contractor may submit an alternative mitigating measure through the Project Engineer to the State Materials Laboratory for approval along with evidence in the form of test results from ASTM C 1567 that demonstrate the mitigation when used with the proposed aggregate controls expansion to 0.20 percent or less. The agency may test the proposed ASR mitigation measure to verify its effectiveness. In the event of a dispute, the agency's results will prevail.

Mitigating measures for aggregates with expansions greater than 0.45 percent when tested in accordance with AASHTO T-303 or ASTM C-1260 shall include the use of low alkali cement per 9-01.2(3) and may include the use of fly ash, lithium compound admixtures, ground granulated blast furnace slag or other material as approved by the Engineer. The Contractor shall submit evidence in the form of test results from ASTM C 1567 through the Project Engineer to the State Materials Laboratory that demonstrate the proposed mitigation when used with the aggregates proposed will control the potential expansion to 0.20 percent or less before the aggregate source may be used in concrete. The agency may test the proposed ASR mitigation measure to verify its effectiveness. In the event of a dispute, the agency's results will prevail.

Passing petrographic analysis (ASTM C 295) accepted by WSDOT prior to August 1, 2005, is acceptable as proof of mitigation until the aggregate source is reevaluated.

ASTM C 1293 sampling and testing must be coordinated through the WSDOT State Materials Laboratory, Documentation Section utilizing the ASA (Aggregate Source Approval) process. Cost of sampling, testing, and processing will be borne by the source owner.

**9-03.1(2) Fine Aggregate for Portland Cement Concrete**

Fine aggregate shall consist of sand or other inert materials, or combinations thereof, approved by the Engineer, having hard, strong, durable particles free from adherent coating. Fine aggregate shall be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious matter.

**9-03.1(2)A Deleterious Substances**

The amount of deleterious substances in the washed aggregate shall not exceed the following values:

1. Particles of specific gravity less than 1.95 ..... 1.0 percent by weight.
2. Organic matter, by colorimetric test, shall not be darker than the reference standard color (organic plate No. 3) AASHTO T 21 unless other tests prove a darker color to be harmless.

**9-03.1(2)B Grading**

Fine aggregate shall be graded to conform to the following requirements expressed as percentages by weight:

Sieve Size	Class 1 Percent Passing		Class 2 Percent Passing	
	Min.	Max.	Min.	Max.
3/8" square	100		100	
U.S. No. 4	95	100	95	100
U.S. No. 8	68	86	---	---
U.S. No. 16	47	65	45	80
U.S. No. 30	27	42	---	---
U.S. No. 50	9	20	10	30
U.S. No. 100	0	7	2	10
U.S. No. 200	0	2.5	0	2.5

For fine aggregate Class 1, individual test variations under the minimum or over the maximum will be permitted as follows, provided the average of three consecutive tests is within the Specification limits:

Sieve Size	Permissible Percent of Variation in Individual Tests
U.S. No. 30 and coarser	2
U.S. No. 50 and finer	0.5

Within the gradation limits for fine aggregate Class 2, uniformity of gradation shall be limited to a range of plus or minus 0.20 of the reference fineness modulus. The reference fineness modulus shall be determined from a representative sample from the proposed source as submitted by the Contractor.

**9-03.1(2)C Use of Substandard Gradings**

Fine aggregate with more than the maximum percentage passing any sieve may be accepted provided the cement content of the finished concrete is increased at the Contractor's expense,  $\frac{1}{3}$  percent for each 1 percent the fine aggregate passing each sieve is in excess of the maximum.

Under no circumstances shall fine aggregate Class 1 be used which has a grading finer than the following:

Sieve Size	Percent Passing
U.S. No. 8	95
U.S. No. 16	80
U.S. No. 30	60
U.S. No. 50	25
U.S. No. 200	2.5

All percentages are by weight.

**9-03.1(3) Vacant**

**9-03.1(4) Coarse Aggregate for Portland Cement Concrete**

Coarse aggregate for concrete shall consist of gravel, crushed stone, or other inert material or combinations thereof having hard, strong, durable pieces free from adherent coatings. Coarse aggregate shall be washed to remove clay, silt, bark, sticks, alkali, organic matter, or other deleterious material.

**9-03.1(4)A Deleterious Substances**

The amount of deleterious substances shall not exceed the following values:

Amount finer than U.S. No. 200	1.00 percent by weight
Pieces of specific gravity less than 1.95	2.00 percent by weight
Clay lumps	0.50 percent by weight
Shale	2.00 percent by weight
Wood waste	0.05 percent by weight

For coarse aggregate with a minimum single face fracture content of 25 percent by weight, the material finer than the U.S. No. 200 sieve may increase to a maximum of 1.5 percent by weight. The fracture requirement shall be at least one fractured face and will apply to the combined aggregate retained on the U.S. No. 4 sieve in accordance with FOP for AASHTO TP 61.

**9-03.1(4)B Vacant**

**9-03.1(4)C Grading**

Coarse aggregate for Portland cement concrete when separated by means of laboratory sieves shall conform to one or more of the following gradings as called for elsewhere in these Specifications, Special Provisions, or in the Plans:

Passing	AASHTO Grading No. 467		AASHTO Grading No. 4		AASHTO Grading No. 57		AASHTO Grading No. 67		AASHTO Grading No. 7		AASHTO Grading No. 8	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
2" square	100	—	100	--	—	—	—	—	—	—	—	—
1½ square	95	100	90	100	100	—	—	—	—	—	—	—
1 square	—	—	20	55	95	100	100	—	—	—	—	—
¾ square	35	70	0	15	—	—	90	100	100	—	—	—
½ square	—	—	--	--	25	60	—	—	90	100	100	—
⅓ square	10	30	0	5	—	—	20	55	40	70	85	100
U.S. No. 4	0	5	--	--	0	10	0	10	0	15	10	30
U.S. No. 8	—	—	--	--	0	5	0	5	0	5	0	10
U.S. No. 16	—	—	--	--	—	—	—	—	—	—	0	5

All percentages are by weight.

In individual tests, a variation of four under the minimum percentages or over the maximum percentages will be permitted, provided the average of three consecutive tests is within the Specification limits. Coarse aggregate shall contain no piece of greater size than two times the maximum sieve size for the specified grading measured along the line of greatest dimension.

When the Engineer approves, the coarse aggregate may be blended from other sizes if:

1. The resulting aggregate meets all requirements for the approved grading;
2. Each size used makes up at least 5 percent of the blend; and
3. The Contractor supplies the Engineer with gradings for the proposed sizes, along with their proper proportions.

#### 9-03.1(5) Combined Aggregate Gradation for Portland Cement Concrete

As an option to using Coarse and Fine graded aggregates for Portland Cement Concrete, aggregate gradation may consist of a combined gradation. Aggregates shall consist of sand, gravel, crushed stone, or other inert material or combinations thereof, having hard, strong durable particles free from adherent coatings. Aggregates shall be washed to remove clay, loam, alkali, organic matter, silt, bark, sticks, or other deleterious matter.

#### 9-03.1(5)A Deleterious Substances

The amount of deleterious substances in the washed aggregate shall not exceed the following values:

1. Particles of specific gravity less than 1.95 2.0 percent by weight
2. Organic matter, by colorimetric test, shall not be darker than the reference Standard color (organic plate No. 3) AASHTO T21 unless other tests prove a darker color to be harmless.
3. Aggregates retained on the U.S. No. 4 sieve shall not have a percentage of wear in Los Angeles machine in excess of 35 after 500 revolutions.

4. Clay lumps	0.3 percent by weight
5. Shale	1.00 percent by weight
6. Wood Waste	0.03 percent by weight
7. Amount finer than U.S. No. 200 sieve	2.0 percent by weight

**9-03.1(5)B Grading**

If a nominal maximum aggregate size is not specified, the Contractor shall determine the nominal maximum aggregate size, using ACI 211.1 as a guide. In no case will the maximum aggregate size exceed one-fifth of the narrowest dimension between sides of the forms, one-third the depth of slabs, nor three-fourths of the minimum clear spacing between individual reinforcing bars, bundles of bars, or pretensioning strands.

The combined aggregate shall conform to the following requirements based upon the nominal maximum aggregate size.

Nominal Maximum Aggregate Size	1-½	1	¾	½	⅜	No. 4
2" square	100					
1½" square	87-100*	100				
1" square		82-100*	100			
¾" square	62-88		87-100*	100		
½" square		57-83		81-100*	100	
⅜" square	43-64		60-88		86-100*	100
U.S. No. 4	29-47	34-54	41-64	48-73		68-100*
U.S. No. 8	19-34	22-39	27-47	31-54	39-73	
U.S. No. 16	12-25	14-29	17-34	20-39	24-54	28-73
U.S. No. 30	7-18	8-21	9-25	11-29	13-39	16-54
U.S. No. 50	3-14	3-15	4-18	5-21	6-29	7-39
U.S. No. 100	0-10	0-11	0-14	0-15	0-21	0-29
U.S. No. 200	0-2.0	0-2.0	0-2.0	0-2.0	0-2.0	0-2.0

\* = Nominal Maximum Size

All percentages are by weight.

Nominal maximum size for concrete aggregate is defined as the smallest standard sieve opening through which the entire amount of the aggregate is permitted to pass. Standard sieve sizes shall be those listed in ASTM C 33.

The Contracting Agency may sample each component aggregate prior to introduction to the weigh batcher or as otherwise determined by the Engineer. Each separate component will be sieve analyzed alone per AASHTO Test Method T-11/27. All material components will be mathematically re-combined by proportions (Weighted Average), supplied by the Contractor.

**9-03.2 Vacant**

**9-03.3 Vacant**

**9-03.4 Aggregate for Bituminous Surface Treatment****9-03.4(1) General Requirements**

Aggregate for bituminous surface treatment shall be manufactured from ledge rock, talus, or gravel, in accordance with Section 3-01, which meets the following test requirements:

Los Angeles Wear, 500 Rev.	35% max.
Degradation Factor	30 min.

**9-03.4(2) Grading and Quality**

Aggregate for bituminous surface treatment shall conform to the requirements in the table below for grading and quality. The particular type or grading to be used shall be as shown in the Plans. All percentages are by weight.

The material shall meet the requirements for grading and quality when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the Engineer.

	Crushed Screening Percent Passing					
	$\frac{3}{4}$ "- $\frac{1}{2}$ "	$\frac{5}{8}$ "-US No. 4	$\frac{1}{2}$ "-US No. 4	$\frac{3}{8}$ "-US No. 4	$\frac{3}{8}$ "- US No. 10	US No. 4-0
1"square	100	---	---		---	---
$\frac{3}{4}$ " square	95-100	100	---		---	---
$\frac{5}{8}$ " square	---	95-100	100		---	---
$\frac{1}{2}$ " square	0-20	---	97-100	100	100	---
$\frac{3}{8}$ " square	0-5	---	---	70-90	95-100	100
$\frac{1}{4}$ " square			0-15			
U.S. No. 4	---	0-10	0-5	0-5	0-35	76-100
U.S. No 8				0-3		
U.S. No. 10	---	0-3	0-2		0-10	30-60
U.S. No. 200	0-1.5	0-1.5	0-1.5	0-1.5	0-1.5	0-10.0
% fracture, by weight, min.	90	90	90	90	90	90

All percentages are by weight.

The fracture requirement shall be at least one fractured face and will apply to the combined aggregate retained on the U.S. No. 4 sieve in accordance with FOP for AASHTO TP 61.

The finished product shall be clean, uniform in quality, and free from wood, bark, roots, and other deleterious materials.

Crushed screenings shall be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock shall not be considered as coating unless it exists on more than 50 percent of the surface area of any size between successive laboratory sieves.

The portion of aggregate for bituminous surface treatment retained on a U.S. No. 4 sieve shall not contain more than 0.1 percent deleterious materials by weight.

**9-03.5 Vacant**

**9-03.6 Aggregates for Asphalt Treated Base (ATB)**

**9-03.6(1) General Requirements**

Aggregates for asphalt treated base shall be manufactured from ledge rock, talus, or gravel, in accordance with the provisions of Section 3-01, that meet the following test requirements:

Los Angeles Wear, 500 Rev.	30% max.
Degradation Factor	15 min.

**9-03.6(2) Grading**

Aggregates for asphalt treated base shall meet the following requirements for grading:

Sieve Size	Percent Passing
2" square	100
½" square	56-100
U.S. No. 4	32-72
U.S. No. 10	22-57
U.S. No. 40	8-32
U.S. No. 200	2.0-9.0

All percentages are by weight.

**9-03.6(3) Test Requirements**

When the aggregates are combined within the limits set forth in Section 9-03.6(2) and mixed in the laboratory with the designated grade of asphalt, the mixture shall be capable of meeting the following test values:

% of Theoretical Maximum Specific Gravity (GMM) (approximate)	93@ 100 gyrations
Modified Lottman Stripping Test	Pass

The sand equivalent value of the mineral aggregate for asphalt treated base shall not be less than 35.

**9-03.7 Vacant**

**9-03.8 Aggregates for Hot Mix Asphalt**

**9-03.8(1) General Requirements**

Aggregates for hot mix asphalt shall be manufactured from ledge rock, talus, or gravel, in accordance with the provisions of Section 3-01. The material from which they are produced shall meet the following test requirements:

Los Angeles Wear, 500 Rev.	30% max.
Degradation Factor, Wearing Course	30 min.
Degradation Factor, Other Courses	20 min.

Aggregates shall be uniform in quality, substantially free from wood, roots, bark, extraneous materials, and adherent coatings. The presence of a thin, firmly adhering film of weathered rock will not be considered as coating unless it exists on more than 50 percent of the surface area of any size between consecutive laboratory sieves.

Aggregate removed from deposits contaminated with various types of wood waste shall be washed, processed, selected, or otherwise treated to remove sufficient wood waste so that the oven dried material retained on a U.S. No. 4 sieve shall not contain more than 0.1 percent by weight of material with a specific gravity less than 1.0.

**9-03.8(2) HMA Test Requirements**

Aggregate for HMA shall meet the following test requirements:

1. Vacant
2. The fracture requirements for the combined coarse aggregate shall apply to the material retained on the U.S. No. 4 sieve and above, when tested in accordance with FOP for AASHTO TP 61.

ESAL's (millions)	# Fractured Faces	% Fracture
< 10	1 or more	90
≥ 10	2 or more	90

3. The uncompacted void content for the combined fine aggregate is tested in accordance with WSDOT Test Method for AASHTO T 304, Method A. The minimum percent voids shall be as required in the following table:

Traffic ESAL's (millions)	HMA Evaluation	
	Statistical & Nonstatistical	Commercial
< 3	40	40
≥ 3	44	40

4. The minimum sand equivalent for the aggregate shall be 45.

The mix design shall produce HMA mixtures when combined within the limits set forth in Section 9-03.8(6) and mixed in the laboratory with the designated grade of asphalt binder, using the Superpave gyratory compactor in accordance with WSDOT FOP for AASHTO T 312, and at the required gyrations for N initial, N design, and N maximum with the following properties:

Mix Criteria	HMA Class							
	3/8-inch		1/2-inch		3/4-inch		1-inch	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Voids in Mineral Aggregate (VMA), %	15.0		14.0		13.0		12.0	
<b>Voids Filled with Asphalt (VFA), %</b>								
ESAL's (millions)	VFA							
< 0.3	70	80	70	80	70	80	67	80
0.3 to < 3	65	78	65	78	65	78	65	78
3 to < 10	73	76	65	75	65	75	65	75
10 to < 30	73	76	65	75	65	75	65	75
≥ 30	73	76	65	75	65	75	65	75
Dust/Asphalt Ratio	0.6	1.6	0.6	1.6	0.6	1.6	0.6	1.6
Modified Lottman Stripping Test	Pass		Pass		Pass		Pass	

	ESAL's (millions)	N initial	N design	N maximum
% Gmm	< 0.3	≤ 91.5	96.0	≤ 98.0
	0.3 to < 3	≤ 90.5	96.0	≤ 98.0
	≥ 3	≤ 89.0	96.0	≤ 98.0
Gyratory Compaction (number of gyrations)	< 0.3	6	50	75
	0.3 to < 3	7	75	115
	3 to < 30	8	100	160
	≥ 30	9	125	205

The mix criteria VMA and VFA only apply to HMA accepted by statistical evaluation.

When material is being produced and stockpiled for use on a specific contract or for a future contract, the uncompacted void content, fracture, and sand equivalent requirements shall apply at the time of stockpiling. When material is used from a stockpile that has not been tested as provided above, the Specifications for uncompacted void content, fracture, and sand equivalent shall apply at the time of its introduction to the cold feed of the mixing plant.

### 9-03.8(3) Grading

#### 9-03.8(3)A Gradation

The Contractor may furnish aggregates for use on the same contract from multiple stockpiles. The gradation of the aggregates shall be such that the completed mixture complies in all respects with the pertinent requirements of Section 9-03.8(6).

Acceptance of the aggregate gradation shall be based on samples taken from the final mix.

#### 9-03.8(3)B Gradation — Recycled Asphalt Pavement and Mineral Aggregate

Asphalt concrete plantings or old asphalt concrete utilized in the production of HMA shall be sized prior to entering the mixer so that a uniform and thoroughly mixed HMA is produced in the mixer. If there is evidence of the old asphalt concrete not breaking down during the heating and mixing of the HMA, the Engineer may elect to modify the maximum size entering the mixer. No contamination by deleterious materials will be allowed in the old asphalt concrete used.

The gradation for the new aggregate used in the production of the HMA shall be the responsibility of the Contractor, and when combined with recycled material, the combined material shall meet the gradation Specification requirements for the specified Class HMA as listed in Section 9-03.8(6) or as shown in the Special Provisions. The new aggregate shall meet the general requirements listed in Section 9-03.8(1) and Section 9-03.8(2).

**9-03.8(4) Blending Sand**

Blending sand shall be clean, hard, sound material, either naturally occurring sand or crusher fines, and must be material which will readily accept an asphalt coating. The exact grading requirements for the blending sand shall be such that, when it is mixed with an aggregate, the combined product shall meet the requirements of Section 9-03.8(6) for the class of material involved. Blending sand shall meet the following quality requirement:

Sand Equivalent 30 Minimum

**9-03.8(5) Mineral Filler**

Mineral filler, when used in HMA mix, shall conform to the requirements of AASHTO M 17.

**9-03.8(6) HMA Proportions of Materials**

The materials of which HMA is composed shall be of such sizes, grading, and quantity that, when proportioned and mixed together, they will produce a well graded mixture within the requirements listed below.

The aggregate percentage refers to completed dry mix, and includes mineral filler when used.

<b>Aggregate Gradation Control Points</b>				
<b>Sieve Sizes Percent Passing:</b>	<b>3/8 In.</b>	<b>1/2 In.</b>	<b>3/4 In.</b>	<b>1 In.</b>
1 1/2" square				100
1" square			100	90-100
3/4" square		100	90-100	90 Maximum
1/2" square	100	90 - 100	90 Maximum	
3/8" square	90 - 100	90 Maximum		
U.S. No. 4	90 Maximum			
U.S. No. 8	32-67	28-58	23-49	19-45
U.S. No. 200	2.0-7.0	2.0-7.0	2.0-7.0	1.0-7.0

**9-03.8(7) HMA Tolerances and Adjustments**

- Job Mix Formula Tolerances.** The constituents of the mixture at the time of acceptance shall conform to the following tolerances:

	<b>Statistical Evaluation</b>	<b>Nonstatistical Evaluation</b>	<b>Commercial Evaluation</b>
Aggregate, percent passing			
1", 3/4", 1/2" and 3/8" sieves	± 6%	± 6%	± 8%
U.S. No. 4 sieve	± 5%	± 6%	± 8%
U.S. No. 8 sieve	± 4%	± 6%	± 8%
U.S. No. 200 sieve	± 2.0%	± 2.0%	± 3.0%
Asphalt binder	± 0.5%	± 0.5%	± 0.7%
VMA	1.5% below minimum value in Section 9-03.8(2)		
VFA	minimum and maximum as listed in Section 9-03.8(2)		
Va	2.5% minimum and 5.5% maximum		

These tolerance limits constitute the allowable limits as described in Section 1-06.2. The tolerance limit for aggregate shall not exceed the limits of the control points, except the tolerance limits for sieves designated as 100% passing will be 99-100. The tolerance limits on sieves shall only apply to sieves with control points. The tolerances for VMA, and Va are for mix design verification and acceptance of the test section. The tolerances for VFA are for mix design verification only. VMA and VFA only apply to HMA accepted by statistical evaluation.

2. Job Mix Formula Adjustments. An adjustment to the aggregate gradation or asphalt binder content of the JMF requires approval of the Project Engineer. Adjustments to the JMF will only be considered if the change produces material of equal or better quality and may require the development of a new mix design if the adjustment exceeds the amounts listed below.
  - A. **Aggregates.** The maximum adjustment from the approved mix design shall be 2 percent for the aggregate passing the 1½", 1", ¾", ½", ⅜", and the U.S. No. 4 sieves, 1 percent for aggregate passing the U.S. No. 8 sieve, and 0.5 percent for the aggregate passing the U.S. No. 200 sieve. The adjusted JMF shall be within the range of the control points in Section 9-03.8(6).
  - B. **Asphalt Binder Content.** The Project Engineer may order or approve changes to asphalt binder content. The maximum adjustment from the approved mix design for the asphalt binder content shall be 0.3 percent.

**9-03.9 Aggregates for Ballast and Crushed Surfacing**

**9-03.9(1) Ballast**

Ballast shall consist of crushed, partially crushed, or naturally occurring granular material from approved sources manufactured in accordance with the provisions of Section 3-01.

The material from which ballast is to be manufactured shall meet the following test requirements:

Los Angeles Wear, 500 Rev	40% max.
Degradation Factor	15 min.

Ballast shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the Engineer.

Sieve Size	Percent Passing
2½" square	100
2" square	65-100
1" square	50-85
U.S. No. 4	26-44
U.S. No. 40	16 max.
U.S. No. 200	9.0 max.
Dust Ratio:	⅓ max.
Sand Equivalent	35 min.

All percentages are by weight.

The portion of ballast retained on U.S. No. 4 sieve shall not contain more than 0.2 percent wood waste.

### 9-03.9(2) Shoulder Ballast

Shoulder ballast shall meet the requirements of Section 9-03.9(1) for ballast except for the following special requirements.

The grading and quality requirements are:

Sieve Size	Percent Passing
2½" square	100
2" square	65-100
¾" square	40-80
U.S. No. 4	5 max.
U.S. No. 100	0-2
% Fracture	75 min.

All percentages are by weight.

The sand equivalent value and dust ratio requirements do not apply.

The fracture requirement shall be at least one fractured face and will apply the combined aggregate retained on the U.S. No. 4 sieve in accordance with FOP for AASHTO TP 61.

### 9-03.9(3) Crushed Surfacing

Crushed surfacing shall be manufactured from ledge rock, talus, or gravel in accordance with the provisions of Section 3-01. The materials shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material and shall meet the following quality test requirements:

Los Angeles Wear, 500 Rev.	35% max.
Degradation Factor — Top Course	25 min.
Degradation Factor — Base Course	15 min.

Crushed surfacing of the various classes shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the Engineer.

Sieve Size	Base Course	Top Course and Keystone
	Percent Passing	
1¼" square	100	
1" square	80-100	
¾" square		100
⅝" square	50-80	
½" square		80-100
U.S. No. 4	25-45	46-66
U.S. No. 40	3-18	8-24
U.S. No. 200	7.5 max.	10.0 max.
% Fracture	75 min.	75 min.
Sand Equivalent	40 min.	40 min.

All percentages are by weight.

The fracture requirement shall be at least one fractured face and will apply to the combined aggregate retained on the U.S. No. 4 sieve in accordance with FOP for AASHTO TP 61.

The portion of crushed surfacing retained on a U.S. No. 4 sieve shall not contain more than 0.15 percent wood waste.

**9-03.9(4) Maintenance Rock**

Maintenance rock shall meet all requirements of Section 9-03.9(3) for crushed surfacing top course except that it shall meet the following Specifications for grading:

Sieve Size	Percent Passing
5/8" square	100
1/2" square	90-100
U.S. No. 4	45-66
U.S. No. 40	10-25
U.S. No. 200	7 max.

All percentages are by weight.

**9-03.10 Aggregate for Gravel Base**

Gravel base shall consist of granular material, either naturally occurring or processed. It shall be essentially free from various types of wood waste or other extraneous or objectionable materials. It shall have such characteristics of size and shape that it will compact readily and shall meet the following test requirements:

Stabilometer "R" Value	72 min.
Swell pressure	0.3 psi max.

The maximum particle size shall not exceed 2/3 of the depth of the layer being placed.

Gravel base shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the Engineer.

Sieve Size	Percent Passing
2" square	75-100
U.S. No. 4	22-100
U.S. No. 200	0-10
Dust Ratio:	2/3 max.
Sand Equivalent	30 min.

All percentages are by weight.

Gravel base material retained on a U.S. No. 4 sieve shall contain not more than 0.20 percent by weight of wood waste.

**9-03.11 Streambed Aggregates**

Streambed aggregates shall be naturally occurring water rounded aggregates. Aggregates from quarries, ledge rock, and talus slopes are not acceptable for these applications. Streambed aggregates shall meet the following test requirements for quality:

Aggregate Property	Test Method	Requirement
Degradation Factor	WSDOT T 113	15 min.
Los Angeles Wear, 500 Rev.	AASHTO T 96	50% max.
Bulk Specific Gravity	AASHTO T 85	2.55 min.

### 9-03.11(1) Streambed Sediment

Streambed sediment shall meet the following requirements for grading when placed in hauling vehicles for delivery to the project or during manufacture and placement into temporary stockpile. The exact point of acceptance will be determined by the Engineer.

Sieve Size	Percent Passing
2½" square	100
2" square	65 – 95
1" square	50 – 85
U.S. No. 4	26 – 44
U.S. No. 40	16 max.
U.S. No. 200	5.0 – 9.0

All percentages are by mass.

The portion of sediment retained on U.S. No. 4 sieve shall not contain more than 0.2 percent wood waste.

### 9-03.11(2) Streambed Cobbles

Streambed cobbles shall be clean, naturally occurring water rounded gravel material. Streambed cobbles shall have uniform distribution of cobble sizes and conform to one or more of the following gradings as shown in the Plans:

Approximate Size <sup>Note 1</sup>	Percent Passing				
	4" Cobbles	6" Cobbles	8" Cobbles	10" Cobbles	12" Cobbles
12"					100
10"				100	
8"			100		70 max.
6"		100		70 max.	
5"			70 max.		40 max.
4"	100	70 max.		40 max.	
3"			40 max.		
2"		40 max.			
1 ½"	40 max.				
¾"	10 max.	10 max.	10 max.	10 max.	10 max.

The grading of the cobbles shall be determined by the Engineer by visual inspection of the load before it is dumped into place, or, if so ordered by the Engineer, by dumping individual loads on a flat surface and sorting and measuring the individual rocks contained in the load.

Note 1: Approximate size can be determined by taking the average dimension of the three axes of the rock; length, width, and thickness by use of the following calculation:

$$\frac{\text{Length} + \text{Width} + \text{Thickness}}{3} = \text{Approximate Size}$$

Length is the longest axis, width is the second longest axis, and thickness is the shortest axis.

**9-03.11(3) Streambed Boulders**

Streambed boulders shall be hard, sound and durable material, free from seams, cracks, and other defects tending to destroy its resistance to weather. Streambed Boulders shall be rounded to sub-angular in shape and the thickness axis shall be greater than 60% of the length axis <sup>Note 1</sup>. Streambed boulders sizes are approximately as follows, see Plans for sizes specified:

Rock Size	Approximate Size <sup>Note 1</sup>
One Man	12" - 18"
Two Man	18" - 28"
Three Man	28" - 36"
Four Man	36" - 48"
Five Man	48" - 54"
Six Man	54" - 60"

Note 1: Approximate size can be determined by taking the average dimension of the three axes of the rock; length, width, and thickness by use of the following calculation:

$$\frac{\text{Length} + \text{Width} + \text{Thickness}}{3} = \text{Approximate Size}$$

Length is the longest axis, width is the second longest axis, and thickness is the shortest axis.

**9-03.11(4) Habitat Boulders**

Habitat boulders shall be hard, sound and durable material, free from seams, cracks, and other defects tending to destroy its resistance to weather. Habitat Boulders shall be rounded to sub-angular in shape and the thickness axis shall be greater than 60% of the width axis and the length shall be 1.5 to 3 times the width axis <sup>Note 1</sup>. Habitat boulders sizes are approximately as follows, see Plans for sizes specified:

Rock Size	Approximate Size <sup>Note 1</sup>
Three Man	28" - 36"
Four Man	36" - 48"
Five Man	48" - 54"
Six Man	54" - 60"

Note 1: Approximate size can be determined by taking the average dimension of the three axes of the rock; length, width, and thickness by use of the following calculation:

$$\frac{\text{Length} + \text{Width} + \text{Thickness}}{3} = \text{Approximate Size}$$

Length is the longest axis, width is the second longest axis, and thickness is the shortest axis.

### 9-03.12 Gravel Backfill

Gravel backfill shall consist of crushed, partially crushed, or naturally occurring granular material produced in accordance with the provisions of Section 3-01.

#### 9-03.12(1) Gravel Backfill for Foundations

##### 9-03.12(1)A Class A

Gravel backfill for foundations, Class A, shall conform to the requirements of Section 9-03.9 for ballast or Section 9-03.9(3) for crushed surfacing base course.

##### 9-03.12(1)B Class B

Gravel backfill for foundations, Class B, shall conform to the requirements of Section 9-03.10 except that the requirements for stabilometer "R" value and swell pressure do not apply.

#### 9-03.12(2) Gravel Backfill for Walls

Gravel backfill for walls shall consist of free draining granular material, essentially free from various types of wood waste or other extraneous or objectionable materials. It shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the Engineer.

Sieve Size	Percent Passing
4" square	100
2" square	75-100
U.S. No. 4	22-66
U.S. No. 200	5.0 max.
Dust Ratio: $\frac{\% \text{ Passing U.S. No. 200}}{\% \text{ Passing U.S. No. 40}}$	$\frac{2}{3}$ max.
Sand Equivalent	60 min.

All percentages are by weight.

That portion of the material retained on a U.S. No. 4 sieve shall contain not more than 0.20 percent by weight of wood waste.

**9-03.12(3) Gravel Backfill for Pipe Zone Bedding**

Gravel backfill for pipe zone bedding shall consist of crushed, processed, or naturally occurring granular material. It shall be free from various types of wood waste or other extraneous or objectionable materials. It shall have such characteristics of size and shape that it will compact and shall meet the following Specifications for grading and quality:

<b>Sieve Size</b>	<b>Percent Passing</b>
1½" square	100
1" square	75-100
⅝" square	50-100
U.S. No. 4	20-80
U.S. No. 40	3-24
U.S. No. 200	10.0 max.
Sand Equivalent	35 min.

All percentages are by weight.

If, in the opinion of the Engineer, the native granular material is free from wood waste, organic material, and other extraneous or objectionable materials, but otherwise does not conform to the Specifications for grading and Sand Equivalent, it may be used for pipe bedding for rigid pipes, provided the native granular material has a maximum dimension of 1½-inches.

**9-03.12(4) Gravel Backfill for Drains**

Gravel backfill for drains shall conform to the following gradings:

<b>Sieve Size</b>	<b>Percent Passing</b>
1" square	100 - —
¾" square	80-100
⅜" square	0-40
U.S. No. 4	0-4
U.S. No. 200	0-2

Alkali silica reactivity testing is not required.

**9-03.12(5) Gravel Backfill for Drywells**

Gravel backfill for drywells shall conform to the following gradings:

<b>Sieve Size</b>	<b>Percent Passing</b>
1½" square	100
1" square	50-100
¾" square	0-20
⅜" square	0-2
U.S. No. 200	0-1.5

Alkali silica reactivity testing is not required.

**9-03.13 Backfill for Sand Drains**

Backfill for sand drains shall conform to the following grading:

Sieve Size	Percent Passing
½" square	90-100
U.S. No. 4	57-100
U.S. No. 10	40-100
U.S. No. 50	3-30
U.S. No. 100	0-4
U.S. No. 200	0-3.0

All percentages are by weight.

**9-03.13(1) Sand Drainage Blanket**

Aggregate for the sand drainage blanket shall consist of granular material, free from wood, bark, or other extraneous material and shall meet the following requirements for grading:

Sieve Size	Percent Passing
2½" square	90-100
U.S. No. 4	24-100
U.S. No. 10	14-100
U.S. No. 50	0-30
U.S. No. 100	0-7.0
U.S. No. 200	0-3.0

All percentages are by weight.

That portion of backfill for sand drains and sand drainage blanket retained on a U.S. No. 4 sieve shall contain not more than 0.05 percent by weight of wood waste.

**9-03.14 Borrow****9-03.14(1) Gravel Borrow**

Aggregate for gravel borrow shall consist of granular material, either naturally occurring or processed, and shall meet the following requirements for grading and quality:

Sieve Size	Percent Passing
4" square <sup>1</sup>	100
2" square	75-100
U.S. No. 4	50-80
U.S. No. 40	30 max.
U.S. No. 200	7.0 max.
Sand Equivalent	50 min.

All percentages are by weight.

<sup>1</sup>For geosynthetic reinforced walls or slopes, 100 percent passing 1¼-inch square sieve and 90 to 100 percent passing 1-inch square sieve.

Ballast may be substituted for gravel borrow for embankment construction.

**9-03.14(2) Select Borrow**

Material for select borrow shall consist of granular material, either naturally occurring or processed, and shall meet the following requirements for grading and quality:

Sieve Size	Percent Passing
6" square <sup>1,2</sup>	100
3" square	75-100
U.S. No. 40	50 max.
U.S. No. 200	10.0 max.
Sand Equivalent	30 min.

All percentages are by weight.

<sup>1</sup>For geosynthetic reinforced walls or slopes, 100 percent passing 1¼-inch square sieve and 90 to 100 percent passing 1-inch square sieve.

<sup>2</sup>100 percent shall pass 4-inch square sieve and 75 to 100 percent shall pass 2-inch square sieve when select borrow is used in the top 2-feet of embankments or where Method C compaction is required.

**9-03.14(3) Common Borrow**

Material for common borrow shall consist of granular or nongranular soil and/or aggregate which is free of deleterious material and is nonplastic.

Deleterious material includes wood, organic waste, coal, charcoal, or any other extraneous or objectionable material.

The material shall be considered nonplastic if the percent by weight passing the U.S. No. 200 sieve does not exceed 15 percent, or if the soil fraction passing the U.S. No. 40 sieve cannot be rolled, at any moisture content, into a thread as prescribed in Section 4 of AASHTO Test Method T 90. If requested by the Contractor, the plasticity may be increased with the approval of the Engineer if it is determined that an increased plasticity will be satisfactory for the specified embankment construction.

The material shall not contain more than 3 percent organic material by weight.

**9-03.14(4) Gravel Borrow for Geosynthetic Retaining Wall**

All backfill material used in the reinforced soil zone of the geosynthetic retaining wall shall conform to requirements of Section 9-03.14(1) and shall be free draining, free from organic or otherwise deleterious material. The material shall be substantially free of shale or other soft, poor durability particles, and shall not contain recycled materials, such as glass, shredded tires, portland cement concrete rubble, or asphaltic concrete rubble. The backfill material shall meet the following requirements:

Property	Test Method	Allowable Test Value
Los Angeles Wear, 500 rev.	AASHTO T 96	35 percent max.
Degradation pH	WSDOT Test Method 113 AASHTO T 289-91	15 min. **

\*\* 4.5 to 9 for permanent walls and 3 to 10 for temporary walls

Wall backfill material satisfying these gradation, durability and chemical requirements shall be classified as nonaggressive.

**9-03.15 Native Material for Trench Backfill**

Trench backfill outside the roadway prism shall be excavated material free of wood waste, debris, clods or rocks greater than 6-inches in any dimension.

**9-03.16 Vacant****9-03.17 Foundation Material Class A and Class B**

Foundation material Class A and Class B shall conform to the following gradations:

Sieve Size	Percent Passing	
	Class A	Class B
2½" square	98-100	95-100
2" square	92-100	75-100
1½" square	72-87	30-60
1¼" square	58-75	0-15
¾" square	27-47	0-1
⅜" square	3-14	---
U.S. No. 4	0-1	---

All percentages are by weight.

**9-03.18 Foundation Material Class C**

Foundation material Class C shall consist of clean bank run sand and gravel, free from dirt, roots, topsoil, and debris and contain not less than 35 percent retained on a U.S. No. 4 sieve and with all stones larger than 2-inches in the longest dimension removed.

**9-03.19 Bank Run Gravel for Trench Backfill**

Trench backfill material shall consist of aggregate for gravel base, as specified in Section 9-03.10, excepting however, that 100 percent of the material shall pass a 2½-inch square screen.

**9-03.20 Test Methods for Aggregates**

The properties enumerated in these Specifications shall be determined in accordance with the following methods of test:

<b>Title</b>	<b>Test Method</b>
Sampling	WSDOT FOP for AASHTO T 2
Organic Impurities	AASHTO T 21
Clay Lumps in Aggregates	AASHTO T 112
Abrasion of Coarse Aggregates by Use of the Los Angeles Machine	AASHTO T 96
Material Finer than U.S. No. 200 Sieve in Aggregates	AASHTO T 11
Percent of Fracture in Aggregates	WSDOT FOP for AASHTO TP 61
Sieve Analysis of Fine and Coarse Aggregates and Aggregates in HMA	WAQTC FOP for T 27/11
Sand Equivalent Test for Surfacing Materials	WSDOT FOP for AASHTO T 176
Determination of Degradation Value	WSDOT T 113
Determination of Fineness Modulus	AASHTO T 27
Particle Size Analysis of Soils	AASHTO T 88
Stabilometer R Value, Untreated Materials	WSDOT T 611
Swell Pressure and Permeability	WSDOT T 611
Stabilometer S Value, Treated Materials	WSDOT T 703
Determining Stripping of HMA	WSDOT T 718
Compressive Strength of Concrete	WSDOT FOP for AASHTO T 22
Flexural Strength of Concrete	WSDOT T 802

**9-03.21 Recycled Material****9-03.21(1) General Requirements**

Recycled materials that are identified below may be used as, or blended uniformly with, naturally occurring materials for aggregates. The final blended product shall meet the requirements for the specified type of aggregate. In addition, each recycled material component included in a blended product, shall meet the specific requirements listed below.

Recycled materials obtained from the Contracting Agency's roadways will not require testing and certification for toxicity testing or certification for toxicity characteristics.

For recycled materials that are imported to the job site, the Contractor shall certify that the recycled material is not a Washington State Dangerous Waste per the Dangerous Waste Regulations WAC 173-303. Sampling and testing for toxicity shall be at a frequency of one per 10,000 tons prior to combining with other materials and not less than one sample from any single source.

**9-03.21(2) Recycled Hot Mix Asphalt**

Recycled asphalt concrete pavement may be uniformly blended with the following materials, to the extent that the specified maximum bitumen content in the final product shall not exceed the following:

		<b>Maximum Bitumen Content (Percent)</b>
Fine Aggregate for Portland Cement Concrete	9-03.1(2)	0
Coarse Aggregates for Portland Cement Concrete	9-03.1(4)	0
Aggregates for Asphalt Treated Base (ATB)	9-03.6	See 5-04.2
Aggregates for Hot Mix Asphalt	9-03.8	See 5-04.2
Ballast	9-03.9(1)	1.2
Shoulder Ballast	9-03.9(2)	1.2
Crushed Surfacing	9-03.9(3)	1.2
Aggregate for Gravel Base	9-03.10	1.2
Gravel Backfill for Foundations – Class A	9-03.12(1)A	1.2
Gravel Backfill for Foundations – Class B	9-03.12(1)B	1.2
Gravel Backfill for Walls	9-03.12(2)	0
Gravel Backfill for Pipe Zone Bedding	9-03.12(3)	0
Gravel Backfill for Drains	9-03.12(4)	0
Gravel Backfill for Drywells	9-03.12(5)	0
Backfill for Sand Drains	9-03.13	0
Sand Drainage Blanket	9-03.13(1)	0
Gravel Borrow	9-03.14(1)	1.2
Select Borrow	9-03.14(2)	1.2
Select Borrow (greater than 3-feet below Subgrade and side slopes)	9-03.14(2)	8.0
Common Borrow	9-03.14(3)	1.2
Common Borrow - (greater than 3-feet below Subgrade and side slopes)	9-03.14(3)	8.0
Foundation Material Class A and Class B	9-03.17	0
Foundation Material Class C	9-03.18	0
Bank Run Gravel for Trench Backfill	9-03.19	0

The following field operating procedures will determine total bitumen content:

AASHTO T 308

WSDOT TM 6

The Contractor shall verify the asphalt content for the blended mix. A statewide average of 0.70 may be used as a calibration factor for AASHTO T-308.

**9-03.21(3) Recycled Portland Cement Concrete Rubble**

Recycled portland cement concrete rubble may be uniformly blended with the following materials, to the extent that the specified maximum concrete rubble content in the final product shall not exceed the following:

		<b>Maximum Concrete Rubble (Percent)</b>
Fine Aggregate for Portland Cement Concrete	9-03.1(2)	0
Coarse Aggregates for Portland Cement Concrete	9-03.1(4)	0
Aggregates for Asphalt Treated Base (ATB)	9-03.6	0
Aggregates for Hot Mix Asphalt	9-03.8	0
Ballast	9-03.9(1)	100
Shoulder Ballast	9-03.9(2)	100
Crushed Surfacing	9-03.9(3)	100
Aggregate for Gravel Base	9-03.10	100
Gravel Backfill for Foundations – Class A	9-03.12(1)A	100
Gravel Backfill for Foundations – Class B	9-03.12(1)B	100
Gravel Backfill for Walls	9-03.12(2)	100
Gravel Backfill for Pipe Zone Bedding	9-03.12(3)	100
Gravel Backfill for Drains	9-03.12(4)	100
Gravel Backfill for Drywells	9-03.12(5)	0
Backfill for Sand Drains	9-03.13	100
Sand Drainage Blanket	9-03.13(1)	100
Gravel Borrow	9-03.14(1)	100
Select Borrow	9-03.14(2)	100
Common Borrow	9-03.14(3)	100
Foundation Material Class A and Class B	9-03.17	100
Foundation Material Class C	9-03.18	100
Bank Run Gravel for Trench Backfill	9-03.19	100

**9-03.21(4) Recycled Glass Aggregates**

Recycled glass may be uniformly blended with the following materials, to the extent that the maximum recycled glass content in the final product shall not exceed the following:

		<b>Maximum Recycled Glass (Percent)</b>
Fine Aggregate for Portland Cement Concrete	9-03.1(2)	0
Coarse Aggregates for Portland Cement Concrete	9-03.1(4)	0
Aggregates for Asphalt Treated Base (ATB)	9-03.6	0
Aggregates for Hot Mix Asphalt	9-03.8	0
Ballast	9-03.9(1)	15
Shoulder Ballast	9-03.9(2)	15
Crushed Surfacing	9-03.9(3)	15
Aggregate for Gravel Base	9-03.10	15
Gravel Backfill for Foundations – Class A	9-03.12(1)A	15
Gravel Backfill for Foundations – Class B	9-03.12(1)B	15
Gravel Backfill for Walls	9-03.12(2)	15
Gravel Backfill for Pipe Zone Bedding	9-03.12(3)	15
Gravel Backfill for Drains	9-03.12(4)	100
Gravel Backfill for Drywells	9-03.12(5)	100
Backfill for Sand Drains	9-03.13	100
Sand Drainage Blanket	9-03.13(1)	100
Gravel Borrow	9-03.14(1)	100
Select Borrow	9-03.14(2)	100
Common Borrow	9-03.14(3)	100
Foundation Material Class A and Class B	9-03.17	100
Foundation Material Class C	9-03.18	100
Bank Run Gravel for Trench Backfill	9-03.19	100

The product supplier shall perform total lead content testing quarterly. Tests shall include a minimum of five samples. Sample collection shall be conducted according to ASTM D 75. Total lead content testing will be conducted according to EPA Method 3010/6010.

A test shall not exceed 250 ppm using a total lead analysis EPA Test Method 6010. In addition, the Toxicity Characteristics Leaching Procedure, EPA Test Method 1311 shall be used and a test shall not exceed 5.0 ppm. The product supplier shall keep all test results on file.

**9-03.21(5) Steel Furnace Slag**

Steel furnace slag may be uniformly blended with the following materials, to the extent that the specified maximum steel furnace slag content in the final product shall not exceed the following:

		<b>Maximum Steel Furnace Slag (Percent)</b>
Fine Aggregate for Portland Cement Concrete	9-03.1(2)	0
Coarse Aggregates for Portland Cement Concrete	9-03.1(4)	0
Aggregates for Asphalt Treated Base (ATB)	9-03.6	20
Aggregates for Hot Mix Asphalt	9-03.8	20
Ballast	9-03.9(1)	20
Shoulder Ballast	9-03.9(2)	20
Crushed Surfacing	9-03.9(3)	20
Aggregate for Gravel Base	9-03.10	20
Gravel Backfill for Foundations – Class A	9-03.12(1)A	20
Gravel Backfill for Foundations – Class B	9-03.12(1)B	20
Gravel Backfill for Walls	9-03.12(2)	20
Gravel Backfill for Pipe Zone Bedding	9-03.12(3)	20
Gravel Backfill for Drains	9-03.12(4)	0
Gravel Backfill for Drywells	9-03.12(5)	0
Backfill for Sand Drains	9-03.13	0
Sand Drainage Blanket	9-03.13(1)	0
Gravel Borrow	9-03.14(1)	20
Select Borrow	9-03.14(2)	20
Select Borrow (greater than 3-feet below Subgrade and side slopes)	9-03.14(2)	20
Common Borrow	9-03.14(3)	20
Common Borrow (greater than 3-feet below Subgrade and side slopes)	9-03.14(3)	20
Foundation Material Class A and Class B	9-03.17	20
Foundation Material Class C	9-03.18	20
Bank Run Gravel for Trench Backfill	9-03.19	20

The Contractor shall notify the Engineer the proposed steel furnace slag blends that will be used in the final product prior to use.