NOTE TO CONSULTANTS: Edit with Track Changes turned on, any text in this section that appears in bold and italics then turn off the bold and italics for the final approved version. (Remove this Note).

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Aggregates for Concrete, Asphalt, Reinforced Turf, and Granite and Crushed Stone Paving Work. Also includes aggregates for various Sanitary and Storm Utility Work.

1.02 RELATED SECTIONS:

Section 03 30 00 - Cast in Place Concrete

Section 32 12 16.13 - Asphalt Paving

Section 32 13 13 - Concrete Paving

Section 32 13 13.13 - Porous Concrete Paving

Section 32 14 13.13 - Precast Concrete Masonry Unit Paving

Section 32 14 13.19 - Precast Concrete Reinforced Turf Paving

Section 32 14 40 - Granite Stone Paving

Section 32 14 43 - Plastic Reinforced Turf Paving

Section 32 15 40 - Crushed Stone Paving

Section 33 30 00 - Sanitary Sewerage Utilities

Section 33 34 00 - Storm Drainage Utilities

1.03 SUBMITTALS:

A. Submit material gradation sieve analysis per ASTM D-422.

1.04 GENERAL REQUIREMENTS:

A. Mineral Aggregates shall be composed of clean; uniform (in quality) particulate size groups essentially free from wood Waste and other deleterious Materials. They shall be obtained only from sources approved by the Engineer.

1. Written requests for source approval shall be submitted to the Engineer not less than 10 Days prior to the intended use of the Mineral Aggregate.

2. Should the proposed source be one that the Engineer has no history of Material performance with, the Engineer reserves the right to take preliminary samples at the proposed source, and make preliminary tests, to first determine acceptability of the new source and then perform the applicable Material approval testing.

3. Continued approval of a source is contingent upon the Mineral Aggregates from that source continuing to meet Contract requirements.

B. Mineral aggregates shall meet the Standard Specifications for grading and quality for use in the Work; however, allowable exceptions may be specified in other Project Manual Sections.

C. Crushed concrete shall meet the requirements specified in "Aggregate for Bases" and "Ballasting and Crushed Surfacing" Articles of this Section as applicable.

D. All percentages are by weight unless otherwise specified.

PART 2 – PRODUCTS

2.01 AGGREGATE FOR BASES:

A. At the option of the Contractor, recycled concrete crushed to the requirements of this Section will be permitted as a substitute for Mineral Aggregate (Type) with the following exceptions:

1. In exposed areas.

2. Where free drainage is required.

3. For pavement base and sub-base when wet conditions exist.

B. Recycled aggregates include recycled concrete and recycled asphalt concrete.

C. At least 10 Working Days in advance of ordering, the Contractor shall submit to the Engineer for approval, the following:

1. A 75 pound sample of adequately broken recycled Portland cement concrete shall be submitted to the Engineer for approval

a. Testing for Determination of Degradation Value and Abrasion of Coarse Aggregates by Use of the Los Angeles Machine will be done in accordance with this Section.

b. In addition, the source of any native material that may be blended with the recycled Portland cement concrete rubble shall also meet these same requirements for the Mineral Aggregate Type being used.

2. A 75 pound sample of recycled asphalt concrete shall be submitted to the Engineer for approval.

a. A maximum of 15% by weight of recycled asphalt concrete pavement may be used in the blended product.

b. The asphalt concrete content is calculated as the amount of asphalt particles retained on all screens ¼ inch and above for the Mineral Aggregate being used.

D. The recycled aggregates shall be stockpiled in such a manner that each certified test report can be identified with a single stockpile of not more than 10,000 tons.

E. The Contractor shall submit a Manufacturer's Certificate of Compliance including certified laboratory test reports certifying that the recycled material is neither hazardous nor toxic.

1. This certification shall address the toxicity characteristics, and sampling and testing in accordance with Chapter 173-303 WAC.

2. Sampling and testing shall be one sample per 10,000 or less tons from any single source, and not less than one sample from any single source.

F. Gradation, sand equivalent, L. A. Abrasion, fracture, and other requirements, as applicable, for each Mineral Aggregate shall be per requirements of this Section.

2.02 BALLASTING AND CRUSHED SURFACING:

A. Material Requirements:

1.	Dust Palliative:	Dust Palliative Oil CMS-2
2.	Roadway Ballast:	Mineral Aggregate Types 2 and 14
3.	Shoulder Ballast:	Mineral Aggregate Type 13
4.	Base Course:	Mineral Aggregate Type 2
5.	Crushed Surfacing:	Mineral Aggregate Type 1
6.	Maintenance Rock:	Mineral Aggregate Type 3
7.	Sand Filler:	Mineral Aggregate Type 11
8.	Dust Palliative Sand:	Mineral Aggregate Type 6
9.	Gravel Base:	Mineral Aggregate Type 17

B. Crushed Gravel, Mineral Aggregates Type 1G and Type 2G shall not be used as a substitute for Mineral Aggregates Type 1 and Type 2 except when specified in the Contract Documents for specific locations or uses.

1. The Contractor shall provide written notification of these substitutions as required in Section 00 71 00 - General Conditions, Paragraph 1.03.R.

C. Crushed gravel Mineral Aggregates Type 1G and Type 2G shall not be used as a base course Material under asphalt concrete pavement, unless the Pavement Structure is a composite Pavement Structure consisting of asphalt concrete over Portland cement concrete base (or rigid base).

D. Crushed gravel may be used as a substitute for base course under Portland cement concrete pavement.

E. Recycled concrete crushed to the requirements of this Section and proposed for pavement base or Sub-base where wet conditions do not exist, will be permitted as a substitute for gravel base when approved by the Engineer, and shall meet the requirements of this Section.

2.03 AGGREGATES FOR ASPHALT CONCRETE:

A. General Requirements:

1. Aggregates for asphalt concrete shall be manufactured from ledge rock, talus, or gravel.

2. The Material from which they are produced shall meet the following test requirements:

   a. Los Angeles Wear, 500 Rev.: 30% max.

   b. Degradation Factor, Wearing Course: 30 min.

   c. Degradation Factor, Other Courses: 20 min.

3. It shall be uniform in quality, substantially free from wood, roots, bark, extraneous materials, and adherent coatings.

   a. The presence of a thin, firmly adhering film of weathered rock is not considered as coating unless it exists on more than 50 percent of the surface area of any size between consecutive laboratory sieves.

4. 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 ¼ inch square sieve shall not contain more than 0.1% by weight of Material with a specific gravity less than 1.0.

B. Test Requirements:

1. Aggregate for asphalt concrete shall meet the following test requirements:

   a. Class A:

      1) At least 1 fractured face on 90 percent of the Material retained on each sieve size U.S. No. 10 and above, if that sieve retains more than 5 percent of the total sample.

      2) Sand Equivalent (Min.): 40.

   b. Class B:

      1) A least 1 fractured face on 75 percent of the Material retained on each sieve size U.S. No. 10 and above, if that sieve retains more than 5 percent of the total sample.

      2) Sand Equivalent (Min.): 40.

   c. Class D:

      1) Fracture, by weight.

      2) The fracture requirements are at least 2 fractured faces on 75 percent and at least 1 fractured face on 90 percent of the Material retained on each sieve, U.S. No. 8 and above, if that sieve retains more than 5 percent of the total sample.

      3) Sand Equivalent (Min.): 40

   d. Class E:

      1) A least 1 fractured face on 50 percent of the Material retained on each sieve size U.S. No. 10 and above, if that sieve retains more than 5 percent of the total sample.

      2) Sand Equivalent (Min.): 40.

e. Class F:

1) A least 1 fractured face on 50 percent of the Material retained on each sieve size U.S. No. 10 and above, if that sieve retains more than 5 percent of the total sample.

2) Sand Equivalent (Min.): 30.

f. Class G:

1) A least 1 fractured face on 75 percent of the Material retained on each sieve size U.S. No. 10 and above, if that sieve retains more than 5 percent of the total sample.

2) Sand Equivalent (Min.): 40.

2. When Material is being produced and stockpiled for use on a specific contract or for a future contract, the fracture and sand equivalent requirements shall apply at the time of stockpiling.

3. When Material is used from a stockpile that has not been tested as provided above, the requirements for fracture and sand equivalents shall apply at the time of its introduction to the cold feed of the mixing plant.

C. Properties of the Aggregate:

1. The properties of the aggregate in a preliminary mix design for asphalt concrete shall be such that when it is combined within the limits set forth in the "Proportions of Materials for Asphalt Concrete" Article of this Section, and mixed in the Laboratory with the designated grade of asphalt, mixtures with the following test values can be produced:

	Class of Hot Mix Asphalt					
	A	B	D	E	F	G
Stabilometer Value, Min.	37	35	---	35	35	35
Cohesiometer Value, Min.	100	100	---	100	50	100
Percent Air Voids	2 - 4.5	2 - 4.5	---	2 - 4.5	2 – 4.5	2 - 4.5
Modified Lottman Stripping Test	Pass	Pass	Pass	Pass	Pass	Pass

2. The stabilometer value for asphalt concrete containing 50 % or more recycled asphalt concrete shall be 30 minimum.

3. Aggregates utilized in MC 250 and MC 800 asphalt concrete mixes shall meet the same requirements as the aggregates used in asphalt concrete Class B.

D. Gradation - Recycled Asphalt Pavement and Mineral Aggregate:

1. Asphalt concrete planeings or old asphalt concrete utilized in the production of asphalt concrete shall be sized prior to entering the mixer so that a uniform and thoroughly mixed asphalt concrete is produced in the mixer.

2. If there is evidence of the old asphalt concrete not breaking down during the heating and mixing of the asphalt concrete, the Engineer may elect to modify the maximum size entering the mixer.

3. No contamination by deleterious Materials will be allowed in the old asphalt concrete used.

4. The gradation for the new aggregate used in the production of the asphalt concrete 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 ACP as listed in the "Proportions Of Materials For Asphalt Concrete" Article of this Section, unless the Contract specifies otherwise. The new aggregate shall meet the general requirements and shall meet the appropriate fracture and sand equivalent requirements as listed in this Article.

E. Blending Sand:

1. In the production of aggregate for asphalt concrete, there is often a deficiency of material passing the U.S. No. 40. When this occurs, blending sand in an amount specified by the Engineer may be used to make up this deficiency, provided that an acceptable final mix is produced, including fracture requirements.

2. Blending sand shall be clean, hard, sound material, either naturally occurring sand or crusher fines, or shall be material which readily accepts 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 the "Proportions of Materials for Asphalt Concrete" Article of this Section, for the class of Material involved.

3. Blending sand shall meet the following quality requirement:

a. Sand Equivalent: 30 min.

4. Blending sand shall be tested by the Materials Laboratory before it may be approved for use.

F. Mineral Filler:

1. Mineral filler used in asphalt cement pavement mix shall conform to the requirements of AASHTO M 17.

2.04 PROPORTIONS OF MATERIALS FOR HOT MIX ASPHALT:

A. For the determination of a Project mix design, the Contractor shall submit to the Engineer representative samples of the various aggregates to be used along with gradation data showing the stockpile averages and variation of the aggregates as produced together with proposed combining ratios and average gradation of the completed mix.

1. The initial asphalt content shall be determined by the Engineer from the aggregates and data provided.

B. The percentages of aggregate, including mineral filler, when used, refer to the completed dry mix. The percentage of asphalt refers to the complete asphalt concrete mixture.

C. Aggregate gradings within the above ranges shall be such that there is a minimum of 2 percent of the total aggregate retained between any successive pair of sieves finer than the U.S. No. 10. The gradings shall be of such uniformity that the fractions of aggregate passing the ¼ inch and U.S. No. 10 during the Day's run shall conform to the following limitations:

1. Maximum variation in percentage of Material passing ¼" square: 10%

2. Maximum variation in percentage of Material passing U.S. No. 10: 8%

D. For asphalt concrete Class A, Class B, Class E, Class F and Class G produced using recycled asphalt Materials, the sand silt requirements and the gradation for the U.S. No. 200 sieve for the asphalt concrete for placement in areas other than the wearing course of traveled lanes are revised as follows:

	U.S. No. 200 - Percent Passing	Sand/Silt
50%-60% Recycled Material	3.0 – 8.0%	Waived
61%-70% Recycled Material	3.0 – 9.0%	Waived
71%-100% Recycled Material	3.0 – 10.0%	Waived

HOT MIX ASPHALT GRADING REQUIREMENTS:						
Sieve Size/Number	Class A	Class B	Class D	Class E	Class F	Class G
	Percent Passing					
1-1/4" square	---	---	---	100	---	---
1" square	---	---	---	90 – 100	---	---
3/4" square	100	100	---	---	100	---
5/8" square	---	---	---	67 - 86	---	---
1/2" square	90 – 100	90 - 100	100	60 - 80	80 – 100	100
3/8" square	75 – 90	75 - 90	97 - 100	---	---	97 - 100
1/4" square	55 – 75	55 - 75	---	40 - 62	45 – 78	60 - 88
U.S. No. 4	---	---	30 - 50	---	---	---
U.S. No. 8	---	---	5 - 15	---	---	---
U.S. No. 10	30 – 42	30 - 42	---	25 - 40	30 – 50	32 - 53
U.S. No. 40	11 – 24	11 - 24	---	10 - 23	---	11 - 24
U.S. No. 200	3 – 7	3 - 7	2 - 5	2 - 9	2 – 8	3 - 7
Mineral Filler	3.0 - 7.0	3.0 - 7.0	2.0 - 5.0	2.0 - 9.0	2.0 - 8.0	3.0 - 7.0
Asphalt % of total mixture	4.0 - 7.5	4.0 - 7.5	5.5 - 8.5	3.5 - 7	4 – 7	4 - 7.5
Sand-Silt Ratio	5.5 -10.5	5.5 - 10.5	---	---	---	5.5 - 10.5

2.05 AGGREGATES FOR PORTLAND CEMENT CONCRETE:

A. General Requirements:

1. Portland cement concrete aggregates shall be manufactured from ledge rock, talus, or sand and gravel.

2. They shall possess the characteristics of shape and size such that the concrete, resulting from a mixture of fine and coarse aggregates in the specified proportions, has workability acceptable to the Engineer.

3. Regardless of compliance with all other provisions of these Specifications, if the concrete is not of a workable character, or does not exhibit a proper surface when finished, either the fine or the coarse aggregate or both, will be rejected, or shall be altered as required by the Engineer.

4. If, in the judgment of the Engineer, based on previous experience or on Laboratory tests, concrete aggregates from a given source are detrimentally reactive with Alkalies in Portland cement, corrective measures, including use of only low-alkali cement may be required as a condition of approval.

B. Fine Aggregate for Portland Cement Concrete:

1. General.

a. Fine aggregate for Portland cement concrete 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.

2. Deleterious Substances:

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

      1) Particles having a specific gravity less than 1.95 shall not exceed 1.0% of total weight.

      2) Organic matter, by calorimetric 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.

3. Grading.

   a. Fine aggregate for Portland cement concrete shall be graded to conform to the following requirements expressed as percentages by weight:

Sieve Size/Number	(Paving/State)		(Building/Concrete)	
	Class 1		Class 2	
	Max.	Min.	Max.	Min.
3/8 Square	100	100	---	---
% Passing No.4	100	95	100	95
% Passing No.8	86	68	95	85
% Passing No.16	65	47	80	45
% Passing No.30	42	27	60	40
% Passing No.50	20	9	30	10
% Passing No.100	7	0	10	2
% Passing No.200 (wet sieving)	2.5	0	2.5	0

Sieve Size/Number	Permissible Variation in Individual Tests
No. 30 and coarser	2.0%
No. 50 and finer	0.5 %

4. Use of Substandard Gradings:

   a. 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 cost, by 1/3% for each 1% the fine aggregate passing each sieve is in excess of the maximum.

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

Sieve Size/Number	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

C. Coarse Aggregate for Portland Cement Concrete:

1. General:

   a. Coarse aggregate for Portland cement concrete shall consist of gravel, crushed stone, or other inert Material or combinations thereof approved by the Engineer, having hard, strong, durable pieces free from adherent coatings. Coarse aggregate shall be washed thoroughly to remove clay, silt, bark, sticks, alkali, organic matter, or other deleterious Material. When required by the Engineer, coarse aggregate shall be handpicked to remove harmful Material.

2. Deleterious Substances: The amount of deleterious substances shall not exceed the following values:

   a. Amount finer than U.S. No. 200 0.5%

   b. Pieces with a specific gravity less than 1.95 2.0%

   c. Clay lumps 0.5%

   d. Shale 2.0%

   c. Wood Waste 0.05%

3. Wear In Los Angeles Machine:

   a. Coarse aggregate shall not have a percentage of wear in the Los Angeles machine in excess of 35 after 500 revolutions in accordance with ASTM C 131.

4. Grading:

Sieve Size/Number	Percent Passing							
	Grading No. 2		Grading No. 4		Grading No. 5		Grading No. 6	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1½" square	100	100	---	---	---	---	---	---
1¼" square	95	100	90	100	---	---	---	---
1" square	---	---	---	---	100	---	---	---
¾" square	40	70	0	20	80	100	100	---
½" square	---	---	---	---	---	---	90	100
3/8" square	5	20	0	2	10	40	40	90
U.S. No. 4	0	2	---	---	0	4	5	30
U.S. No. 200	0	0.5	0	0.5	0	0.5	0	0.5

a. In individual tests, a variation of four percent under the minimum percentages or over the maximum percentages will be allowed. The average of three successive tests shall be within the percentages stated above.

b. Coarse aggregate shall contain no pieces larger than two times the maximum sieve size for the specified grading measured along the line of greatest dimension.

c. Acceptance of grading and quality of the aggregate will be based on samples taken from stockpiles at the concrete plant. The exact point of acceptance will be determined in the field by the Engineer.

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

1) The resulting aggregate meets all requirements for specified grading;

2) Each size used makes up at least 5% of the blend;

3) The Contractor supplies the Engineer with gradings for the proposed sizes, along with their proper proportions before producing the aggregate. If the aggregate comes from commercial sources, the Contractor shall supply this information and have it approved before proportioning and mixing the concrete.

e. In place of grading No. 2, the Contractor may substitute a 50-50 mix of Grading Nos. 4 and 5.

5. Use of Substandard Gradings.

a. Coarse aggregate containing 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 sole expense.

b. The cement content shall be increased 0.25% for each 1% the amount passing each of the 3/4 inch, 3/8 inch, and No. 4 sieves is in excess of the maximum specified in "Grading" Paragraph of this Article.

c. Coarse aggregate No. 2 shall not be used under any circumstances when the combined amount passing any of the following sieve sizes exceeds the following:

Sieve Size/Number	Percent Passing
3/4” square	70
3/8” square	30
U.S. No. 4	5

d. Coarse aggregate No. 5 shall not be used under any circumstances when the combined amount passing any of the following sieve sizes exceeds the following:

Sieve Size/Number	Percent Passing
3/8" square	50%
U.S. No. 4	8%

2.06 QUARRY SPALLS:

A. The spall shall be hard, sound, and durable. It shall be free from fracture, seams, cracks, and other discontinuities tending to adversely impact its resistance to weathering. The quarry spall shall meet the 5 test requirements listed in Section 9-03.17 of the City of Seattle Standard Specifications. Quarry spalls shall meet the following gradation requirements:

2 inch to 4 inch quarry spalls:

Sieve Size/Number	Percent Passing
4 inch	100
2 inch	40 max
1-1/4 inch	5 max

4 inch to 8 inch quarry spalls:

Sieve Size/Number	Percent Passing
8 inch	100
4 inch	40 max
2 inch	5 max

2.07 ROCK FACING MATERIAL:

A. Rock for constructing new rock facing shall be large, broken pieces of igneous and metamorphic rock types. Each rock shall be rectangular, intact, fracture free, sound and durable material, resistant to weathering and free of soft weathered material and seams of soft rock susceptible to deterioration.

The size categories for rock shall be as follows:

Size	Approx. Weight	Min. Approx. Dimensions	Approx. Volume
One-man rock	200-400 lbs	12 inches	2 cf
Two-man rock	500-800 lbs	13 inches	4 cf
Three-man rock	900-1200 lbs	16 inches	6.6 cf
Four-man rock	1300-2000 lbs	18 inches	12.5 cf
Five-man rock	2000-4000 lbs	24 inches	18.5 cf
Six-man rock	4100-6000 lbs	30 inches	31 cf

Note: Rocks less than 1.5 cubic foot (cf) in volume shall not be used.

B. The Contractor shall provide the services of an ASTM or AASHTO accredited testing laboratory approved the Engineer to sample the rock from the quarry source, ensuring that rock samples are representative of the rock anticipated for use on the project, and to perform the following laboratory tests.

Specific Gravity	ASTM C 127	Minimum 2.65
Soundness	AASHTO T 104 (section 5.2.2)	Not greater than 5% loss
Accelerated Expansion	CRD-C-148	Not greater than 15% breakdown
Absorption	ASTM C 127	Not greater than 2%
L.A. Abrasion	ASTM C 131	Maximum 20% loss @ 500 revolutions

PART 3 - EXECUTION

3.01 TEST METHODS FOR AGGREGATES: Material properties in these Specifications shall be determined in accordance with the following test methods:

Title	Test Method
Sampling	AASHTO T 2
Organic Impurities	WSDOT No. 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
Sieve Analysis of Fine and Coarse Aggregates	AASHTO T 27
Determination of Degradation Value	WSDOT No. 113
Determination of Fineness Modulus	AASHTO T 27
Lightweight Pieces in Aggregates	WSDOT No. 122
Mortar Strength	WSDOT No. 311
Percentage of Particles Smaller than 0.025 mm and 0.005 mm	AASHTO T 88
Stabilometer R Value, Untreated Materials	WSDOT No. 611
Swell Pressure and Permeability	WSDOT No. 611
Stabilometer S Value, Treated Materials	WSDOT No. 703
Cohesiometer	WSDOT No. 703
Compressive Strength of Concrete	AASHTO T 22
Flexural Strength of Concrete	WSDOT No. 802
Specification for Wire-Cloth Sieves for Testing Purposes	AASHTO M 92

END OF SECTION