
PART 1 GENERAL**1.1 SCOPE:**

- A. This item includes the work necessary for providing a gravel base for one or more courses of aggregates, as subbase, base, pipe foundation, pipe bedding, pipe zone and/ or trench backfill.

1.2 DEFINITIONS:

- A. **UNDERDRAIN GRAVEL** - Underdrain gravel, usually wrapped in geotextile fabric, is specifically graded rock (pea-gravel) to allow flow as for french-drains, and/or perforated pipe drains, etc.
- B. **BASE AGGREGATES** - Base aggregates are defined as crushed, dimensional rock as specified for use in subbase, base course, leveling course, trench foundation stabilization, trench foundation, pipe bedding, pipe zone, and/or trench backfill.
- C. **SUBGRADE STABILIZATION** - Subgrade stabilization is defined as the zone of material, engineered fill, which makes up the foundation due to liquefaction caused by high pore water pressure found in an excavation, which is to be built upon.
- D. **LOOSE RIP RAP** – Specified classes of graded rock placed on prepared slope, riprap geotextile or filter blanket as specified.
- E. **KEYED RIPRAP** – Loose riprap placed on prepared slope, riprap geotextile, or filter blanket as specified and keyed in place by slapping the surface with a piece of armor plating.
- F. **GROUTED RIPRAP** – Loose riprap with all or part of the spaces filled with Portland cement mortar.

1.3 CERTIFIED SOURCE SUPPLIER:

- A. The Contractor shall ensure that his aggregate supplier is certified by the city as an acceptable source.
- B. Any material supplier may become a certified supplier by providing the City Engineer a copy of lab results, from a certified lab, which show that material meets specifications herein.
- C. The Contractor may use any previously certified source supplier on file with the city. The city reserves the right to bestow or revoke certification of any supplier the Engineer deems to meet the standard.

PART 2 PRODUCTS**2.1 UNDERDRAIN GRAVEL:**

- A. Drain rock shall be clean, crushed or uncrushed gravel specially graded and wrapped in filter fabric, unless otherwise specified and have the following gradation;

TABLE B-1

<u>SIEVE SIZE PASSING</u>	<u>PERCENT PASSING</u>
3/8"	100
No.4	54 to 82
No.10	34 to 56
No.40	9 to 17
No.100	0 to 3

2.2 BASE AGGREGATES:

- A. Base aggregates shall consist of crushed gravel or crushed rock, including sand.

2.3 FRACTURE OF GRAVEL:

- A. Material shall be tested in accordance with ODOT TM 213.
- B. Gravel shall have at least one fractured face on 50-percent of the material retained on each sieve size 1.5-inch and above and 70-percent for the material passing the 1.5-inch sieve and retained on each of the sieves down to 1/4-inch.

2.4 DURABILITY:

- A. The source material from which aggregate base materials are obtained, produced or manufactured, shall meet the following qualifying test requirements:

TABLE B-2

<u>TEST</u>	<u>TEST METHOD</u>	<u>REQUIREMENTS</u>
Degradation:		
Passing No.20 sieve	ODOT TM 208	30% Max.
Sediment Height	ODOT TM 208	3" Max.
Abrasion:	ODOT TM 211 (AASHTO T 96)	35% Max.

2.5 SAND EQUIVALENT:

- A. Base aggregates to be incorporated in the work shall have a sand equivalent of not less than 30 when tested in conformance with ODOT TM 101, AASHTO T 176, or ASTM D2419.

2.6 LIQUID LIMIT AND PLASTICITY:

- A. Base aggregate shall meet the following requirements.

TABLE B-3**LIQUID LIMIT AND PLASTICITY INDEX VALUES**

<u>Percent of Material Passing No. 40 Sieve</u>	<u>Liquid Limit (Maximum) AASHTO T 89/ ODOT TM 102</u>	<u>Plasticity Index (Maximum) AASHTO T 90/ ODOT TM 103</u>
0.0 to 5.0, inclusive	33	6
5.1 to 10.0, inclusive	30	5
10.1 to 15.0, inclusive	27	4
15.1 to 20.0, inclusive	24	3
20.1 to 25.0, inclusive	21	2
Over 25.0	21	0 or N.P.

2.7 SIEVE REQUIREMENTS:

- A. Base aggregates shall conform to the following requirements:

TABLE B-4

GRADING REQUIREMENTS FOR BASE AGGREGATES					
Separated Sizes	2-1/2" minus	2" minus	1-1/2" minus	1" minus	3/4" minus
Sieve Size	Percentage Passing (by weight)				
3"	100				
2-1/2"	95-100	100			
2"	--	95-100	100		
1-1/2"	--	--	95-100	100	
1-1/4:	55-75	--	--	--	
1"	--	55-75	--	90-100	100
3/4"	--	--	55-75	--	90-100
1/2"	--	--	--	55-75	--
3/8"	--	--	--	--	55-75
1/4"	30-45	30-45	35-50	40-55	40-60
No.10	12-27	12-27	14-30	16-33	16-36
No.40	0-16	0-16	3-18	8-24	-16
No.200	0-9	0-9	0-8	0-8	0-10

- B. Sieve analysis shall be conducted in accordance with AASHTO T11 and T27 (ASTM C117 and C136).

2.8 SUBGRADE STABILIZATION MATERIAL:

- A. Subgrade stabilization material is crushed rock, well fractured, and uniformly graded 4-inch minus.
- B. Subgrade stabilization may, at the discretion of the Engineer, require that geotextile fabric be placed on the native subgrade. Geotextile shall conform to specifications in SECTION 2200 "Geotextile Fabrics" of these Specifications.

2.9 RIPRAP – Shall meet the following requirements;

A.

MATERIAL TEST	REQUIREMENT
Apparent Specific Gravity (AASHTO T85)	2.5 Min.
% Absorption (AASHTO T85)	6.0 Max.
Degradation (ODOT TM 208A) Passing 850µm Sieve Sediment height	35.0% 200 mm Max.
Soundness (ODOT TM206) Avg. loss of 63mm – 37.5mm and 37.5mm – 19.0mm fraction after 5 alterations	16.0%

- B. Gradation Requirements – Control of gradation will be by visual inspection. Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truck loads (chosen by the Engineer). Mechanical equipment, a sorting site and labor needed to assist in checking gradation shall be provided by the Contractor at no expense to the Owner. Gradation by Class shall be as shown in the Table below.

CLASS 25	CLASS 50	CLASS 100	CLASS 350	Percent (by mass)
SIZE OF ROCK (kg)				
25-15	50-30	100-65	350-250	20.0
15-7	30-12	65-35	250-100	30.0
7-1	12-1	35-5	100-10	40.0
1-0	1-0	5-0	10-0	10. - 0
<i>Uniformly grade each load of riprap from the smallest to the largest size specified.</i>				

- C. Grouted Riprap shall conform to Section 2300 (2.9)(A)(B) with the addition of portland cement grout as specified in Section 2050 (2.5).

PART 3 EXECUTION

3.1 STOCKPILING:

- A. The materials to be furnished in stockpiles shall be of the kinds, sizes and quality specified. Each designated size of material shall be placed in a separate stockpile.
- B. Stockpiles shall be no more than 8-feet high with side slopes of 1.5:1 horizontal to vertical. The method used in placing the material in the stockpile shall be such as to minimize segregation of the aggregate particles.

3.2 MIXING:

- A. The materials shall be mixed until well blended. The Contractor shall add water during mixing in an amount sufficient to provide optimum moisture content plus or minus 2-percent.
- B. Base or subbase material shall be mixed by one of the following methods:
 - 1. Stationary Plant Method - Materials mixed by means of a pug mill or other type of mixer, transported to the project at proper moisture content and placed by and aggregate spreader.
 - 2. Travel Plant Method - Materials mixed and placed on the project in a continuous operation.
 - 3. Road Mix Method - Materials mixed on the project by motor graders or other approved equipment.

3.3 WEATHER LIMITATIONS:

- A. When, in the judgment of the Engineer, weather conditions will be detrimental to the work, the Contractor shall suspend operations until the weather is favorable.

3.4 EQUIPMENT:

- A. Hauling Equipment - Vehicles for hauling aggregate or mixtures of aggregate and water shall be capable of depositing the material into or in front of spreading equipment with minimum of segregation.
- B. Spreading Equipment - The equipment shall be capable of spreading and striking off material to the designated line, grade and transverse slope with a uniform surface texture free of excessive segregation or fracture of material.

3.5 THICKNESS OF LIFTS:

- A. If the required depth of the subbase, base, trench foundation and/or backfill course exceeds 8-inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 8-inches.

3.6 COMPACTION:**A. EQUIPMENT.**

- 1. Equipment used to compact aggregate bases shall be self-propelled steel wheel or pneumatic tire rollers. Rollers shall be capable of compacting materials to a firm, even surface to grade.

B. DENSITY.

- 1. During compaction, materials shall be maintained within 2-percent of the optimum moisture content.

2. The Contractor shall begin compaction of each layer immediately after the material is spread and continue until a density specified has been achieved. Maximum density will be determined by AASHTO T-180 or ASTM D 1557 method.
3. If the specified compaction is not obtained, the Contractor shall notify the Engineer. The Contractor may be required to use a modified compaction procedure or apply additional compactive effort. If approved materials meeting the specifications cannot be compacted to the required density regardless of compactive effort or method, the Engineer may reduce the required density or direct that alternate materials be used. In no case shall aggregate placement proceed until the Contractor is able to compact the material to the satisfaction of the Engineer.

C. SURFACE TOLERANCE.

1. The surface of the aggregate base shall be within -0.02-foot to +0.02-foot of plan elevation at any one point. The final surface shall not deviate at any point more than 0.02-foot from the bottom of a 12-foot straightedge laid in any direction on the surface on either side of the roadway crown.

3.7 MEASUREMENT AND PAYMENT:

- A. When listed in the Form of Proposal as a separate bid item aggregates will be field measured and paid for by the unit price in the bid proposal to the nearest 0.1-CY or Ton.
- B. When required as a component in another bid item they will be incidental to that bid item.

3.8 SUBMITTAL REQUIREMENTS:

- A. Submit the following as a minimum.
 1. Supplier name address and phone number.
 2. Sieve analysis date, location, testing lab
 3. Source Qualifying Tests;
 - a. Fracture Faces
 - b. Durability
 - c. Sand Equivalent
 - d. Liquid Limit
 - e. Plastic Index
 4. AASHTO T-180 density and optimum moisture.

PART 4 TESTING

4.1 GENERAL:

- A. At the direction of the Engineer the Supplier shall make his aggregate material available to the Engineer's testing laboratory to retrieve an adequate sample, which will be tested for conformance to these Specifications. Testing prior to construction and after award of the Bid, for the purpose of certification, will be paid by the Owner. The Owner will pay for certification of the low bidder on a city-funded project only.

4.2 MATERIAL QUALITY:

- A. At the direction of the Engineer a sample of the material shall be taken, in accordance with AASHTO T2 or ASTM D75, and tested by a qualified/certified laboratory for fractures, durability, sand equivalent, liquid limit, gradation, and plasticity. The Engineer reserves the right to request any test to ensure the quality of materials on the Project.
- B. The material shall be within the acceptable limits as set forth herein.

4.3 GRADATION:

- A. At the direction of the Engineer a sample of in-place material shall be taken and tested by a qualified/certified laboratory for gradation in accordance with AASHTO T-27, ASTM D422. Gradations shall be within tolerances of these specifications.

4.4 MOISTURE-DENSITY:

- A. The Engineer may test in-place material for compaction and moisture content to be in conformance with these specifications. In-place moisture shall be tested in accordance with ASTM D2922 (AASHTO T 238) and ASTM D3017 (AASHTO T 239) for density
- B. Testing will be done by an independent certified laboratory at no cost to the Contractor for the first test. If the material fails to meet the specified requirements and additional testing is required, the cost will be at the sole expense of the Contractor.

4.5 SURFACE TOLERANCES:

- A. When directed by the Engineer, the surface shall be tested with a 12-foot straightedge. The surface shall not vary more than outlined in (3.6)(C). The Engineer will observe this testing and may require additional testing.

END OF SECTION