

SECTION 32 11 23
AGGREGATE BASE AND SUBBASE COURSE(S)

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
 - a. C29, Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate.
 - b. C88, Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - c. C117, Standard Method of Test for Materials Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.
 - d. C131, Standard Specification for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - e. C183, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates.
 - f. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³)).
 - g. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³ (2700 kN-m/m³)).
 - h. D1883, Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - i. D2216, Standard Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
 - j. D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - k. D2844, Standard Specification for Resistance R-Value and Expansion Pressure of Compacted Soils.
 - l. D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - m. D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
 - n. D5195, Standard Test Methods for Density of Soil and Rock In-Place Below Surface by Nuclear Methods.
 - o. D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

- A. Base Course: Crushed aggregate or similar as specified placed and compacted on prepared subgrade or subbase course.
- B. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross-section.
- C. Completed Lift: Compacted with uniform cross-section thickness.
- D. Gravel Surfacing: Aggregate used for construction of low-volume access and staging area that can be easily graded and compacted.
- E. Specifications: Contract Documents that describe the Work and include the General Conditions, the Technical Specifications, the Supplementary Conditions, and any Reference Specifications incorporated therein.

1.03 SUBMITTALS

- A. Action Submittals:
 - 1. Samples: Submit for specified materials 20 days prior to delivery to Site.
- B. Informational Submittals:
 - 1. Certified Test Results on Source Materials: Submit copies from commercial testing laboratory 20 days prior to delivery of materials to Project showing materials meeting the physical qualities specified.
 - 2. Certified results of in-place density tests from independent testing agency.

PART 2 PRODUCTS

2.01 BASE COURSE

- A. Physical Characteristics:
 - 1. Clean, hard durable, pit run gravel or crushed stone graded from coarse to fine containing enough fines to bind material when compacted. Gradation as specified in Table 2.
 - 2. Abrasion ASTM C131: 35 percent maximum wear.
 - 3. Fractured Face: 75 percent minimum particles.
 - 4. Liquid Limit, ASTM D4318: Maximum 30 percent.
 - 5. Plasticity Index, ASTM D4318: Maximum 6 percent.
 - 6. Sand Equivalency, ASTM D2419: 35 percent, minimum.
 - 7. Crushed Recycled Concrete: Base course may consist of crushed recycled concrete consisting of previously hardened Portland cement

concrete or other concrete containing pozzolanic binder material. Provide recycled material free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material, crushed and processed to meet gradation requirements below. Crushed material may be blended with native aggregate. Base course utilizing crushed concrete must meet requirements for aggregate base course.

8. Gradation as specified in Table 1.

B. Functional Characteristics: None.

C. Performance Characteristics: None.

Table 1		
Gradation		
Percent Passing by Weight		
Requirement Sieve	Aggregate Base Course Percent Passing	Gravel Surfacing Percent Passing
1"	100	-
3/4"	80-100	100
1/2"	68-91	-
No. 4	46-70	50-78
No. 8	35-54	37-67
No. 40	13-35	13-35
No. 200	3-12	4-15
Plasticity Index	0-6	4-10

2.02 GRAVEL SURFACING

A. Physical Characteristics:

1. Same abrasion, fractured face, liquid limit, plasticity index, sand equivalency, and crushed recycled concrete physical characteristics as for base course.
2. Clean, tough, uniform quality, durable fragments of crushed rock, free from flat, elongated, soft or disintegrated pieces, or other objectionable

matter occurring either free or as coating on stone. Gradation as specified in Table 1.

- B. Functional Characteristics: None.
- C. Performance Characteristics: None.

2.03 SOURCE QUALITY CONTROL

- A. Physical Characteristics: None.
- B. Functional Characteristics:
 - 1. Perform tests necessary to locate acceptable source of materials meeting specified requirements.
 - 2. Final approval of aggregate material will be based on test results of installed materials.
- C. Performance Characteristics: Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

- A. As specified in Section 31 23 13, Subgrade Preparation.
- B. Obtain Contracting Officer's acceptance of subgrade before placing base course or surfacing material.
- C. Do not place base course or surfacing materials in snow or on soft, muddy, subgrade.

3.02 EQUIPMENT

- A. Compaction Equipment: Adequate in design and number to provide compaction and to obtain specified density for each layer.

3.03 HAULING AND SPREADING

- A. Hauling Materials:
 - 1. Do not haul over surfacing in process of construction.
 - 2. Loads: Of uniform capacity.
 - 3. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.

B. Spreading Materials:

1. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.
2. Produce even distribution of material upon roadway or prepared surface without segregation.
3. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

3.04 CONSTRUCTION OF COURSES

A. Base Course:

1. Maximum Completed Lift Thickness: As shown.
2. Spread lift on preceding course to required cross-section.
3. Lightly blade and roll surface until thoroughly compacted.
4. Add keystone to achieve compaction and as required when aggregate does not compact readily because of lack of fines or natural cementing properties, as follows:
 - a. Use surfacing material as keystone.
 - b. Spread evenly on top of base course, using spreader boxes or chip spreaders.
 - c. Roll surface until keystone is worked into interstices of base course without excessive displacement.
 - d. Continue operation until course has become thoroughly keyed, compacted, and will not creep or move under roller.
5. Blade or broom surface to maintain true line, grade, and cross-section.

B. Gravel Surfacing:

1. Maximum Completed Lift Thickness: As shown.
2. Spread on preceding course in accordance with cross-section shown.
3. Blade lightly and roll surface until material is thoroughly compacted.

3.05 ROLLING AND COMPACTION

- A. Commence compaction of each layer of base course gravel surfacing after spreading operations and continue until density of 95 percent of maximum density has been achieved as determined by ASTM D1557.
- B. Commence rolling at outer edges and continue toward center; do not roll center of road first.
- C. Apply water as needed to obtain specified densities.

- D. Place and compact each lift to the required density before succeeding lift is placed.
- E. Remove floating or loose stone from surface of preceding course before placing next course.
- F. Surface Defects: Remedy by loosening and rerolling. Reroll entire area, including surrounding surface, until thoroughly compacted.
- G. Finished surface shall be true to grade and crown before proceeding with surfacing.

3.06 SURFACE TOLERANCES

- A. Blade or otherwise work surfacing as necessary to maintain grade and cross-section at all times, and to keep surface smooth and thoroughly compacted.
- B. Finished Surface of Untreated Aggregate Base: Within plus or minus 0.04 foot of grade shown at any individual point.
- C. Gravel Surfacing: Within 0.04 foot from lower edge of 10-foot straightedge placed on finished surface, parallel to centerline.
- D. Overall Average: Within plus or minus 0.01 foot from crown and grade specified.

3.07 FIELD QUALITY CONTROL

- A. In-Place Density Tests:
 - 1. Provide Contracting Officer at least 24 hours' advance notification prior to testing.
 - 2. Show proof that areas meet specified requirements before identifying density test locations.
 - 3. Refer to Table 2 for minimum sampling and testing requirements for aggregate base course and surfacing.

Table 2 Minimum Sampling and Testing Requirements			
Property	Test Method	Frequency	Sampling Point
Gradation	ASTM C117 and ASTM C183	One sample every 500 tons but at least every 4 hours of production	Roadbed after processing
Moisture Density	ASTM D1557,	One test for every	Production

Table 2 Minimum Sampling and Testing Requirements			
Property	Test Method	Frequency	Sampling Point
(Maximum Density)	Method D	aggregate grading produced	output or stockpile
In-Place Density and Moisture Content	ASTM D5195, ASTM D6938, and ASTM D2216 for moisture content	One for each 500 ton but at least every 10,000 sq ft of area	In-place completed, compacted area

3.08 CLEANING

- A. Remove excess material from the Work area. Clean stockpile and staging areas of all excess aggregate.

END OF SECTION

