

Section 02255**BEDDING, BACKFILL, AND EMBANKMENT MATERIALS****1.0 GENERAL****1.01 SECTION INCLUDES**

- A A reference source for materials used as embedment, backfill, back-dressing, and embankment, specified elsewhere in the Technical Specifications, and their associated material qualification testing requirements.
- B Source qualifications and handling of these materials.
- C Material use and application is specified on the Plans or in individual Technical Specifications referencing materials either by Material Classification or by Product Description.
- D References to Technical Specifications:
 - 1. Section 03300 – Cast-in-Place Concrete
 - 2. Section 02910 – Topsoil
 - 3. Section 02252 – Cement Stabilized Sand
- E Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 2487, “Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)”
 - b. ASTM C 142, “Standard Test Method for Clay Lumps and Friable Particles in Aggregates”
 - c. ASTM C 123, “Standard Test Method for Lightweight Particles in Aggregate”
 - d. ASTM C 40, “Standard Test Method for Organic Impurities in Fine Aggregates for Concrete”
 - e. ASTM C 4318, “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils”
 - f. ASTM D 1140, “Standard Test Methods for Amount of Material in Soils Finer the No. 200 (70-um) Sieve”
 - g. ASTM C 33, “Standard Specification for Concrete Aggregates”
 - h. ASTM C 136, “Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates”
 - i. ASTM C 131, “Standard Test Methods for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine”

2.0 PRODUCTS

2.01 MATERIAL CLASSIFICATIONS

- A Materials shall be classified for the purpose of quality control in accordance with the Unified Soil Classification Symbols as defined in ASTM D 2487.
1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
 - a. Plasticity index: non-plastic.
 - b. Gradation: D_{60}/D_{10} - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.
 2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines:
 - a. Plasticity index: non-plastic to 4.
 - b. Gradations:
Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.
 - c. Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.
 3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
 - a. Plasticity index: greater than 7.
 - b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.
 4. Class IVA: Lean clays (CL).
 - a. Plasticity Indexes:
Plasticity index: greater than 7, and above A line.
Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
 - b. Liquid limit: less than 50.
 - c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
 - d. Inorganic.
 5. Class IVB: Fat clays (CH)
 - a. Plasticity index: above A line.
 - b. Liquid limit: 50 or greater.
 - c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
 - d. Inorganic.
- B Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to the more restrictive class.

2.02 PRODUCT DESCRIPTIONS

- A Unsuitable Material. Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH and OL according to ASTM D 2487.
 2. Materials that cannot be compacted to the required density due to either gradation, plasticity, or moisture content.
 3. Materials that contain large clods, aggregates, stones greater than 3 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
 4. Materials that are contaminated with hydrocarbons or other chemical contaminants.
- B Suitable Material. Soil materials meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with, for example, lime or cement shall be considered suitable, unless otherwise indicated.
- C General Fill. Material that is free of stones greater than 3 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to the following limits for deleterious materials:
1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.
 2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.
 3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.
- D Random Fill. Soils defined by ASTM D 2487 as Class I, II, III, IV, or fat clay (CH), sand, gravel, or a combination, from excavation or borrow, which can be compacted to form stable embankments, and conforming to:
1. Liquid Limit: 65 maximum, ASTM - D4318.
 2. Plasticity Index: 0 minimum, 45 maximum, ASTM - D4318.
 3. Free from trash, vegetation, organic matter, large stones, hard lumps of earth and frozen, corrosive or perishable material.
 4. Well broken up, free of clods greater than 6 inches, hard earth, rocks, and stones greater than 2-inch dimension.
- E Structural Fill. Soils defined by ASTM D 2487 as Class I, II, III, or IV, sand, gravel, or a combination, from excavation or borrow, which can be compacted to form stable embankments and fills conforming to:
1. Liquid Limit: 45 maximum, ASTM D 4318.
 2. Plasticity Index: 12 minimum, 20 maximum, ASTM D 4318.
 3. Free from trash, vegetation, organic matter, large stones, hard lumps of earth and frozen, corrosive or perishable material.
 4. Well broken up, free of clods greater than 6 inches, hard earth, rocks, and stones greater than 2-inch dimension.
- F Select Fill. Class III clayey gravel or sand or Class IV lean clay or clayey soils treated with lime or cement, and conforming to:

1. Plasticity Index: 7 minimum, 20 maximum, ASTM D 4318.
 2. Free from trash, vegetation, organic matter, large stones, hard lumps of earth and frozen, corrosive or perishable material.
 3. Well broken up, free of clods greater than 6 inches, hard earth, rocks, and stones greater than 2-inch dimension.
- G Concrete Fill. Conform to requirements for Class B concrete as specified in Section 03300 - Cast-in-Place Concrete.
- H Topsoil. Conform to requirements specified in Section 02910 - Topsoil.
- I Bank Sand: Durable Bank Sand classified as SP, SW, or SM by the Unified Soil Classification System (ASTM D 2487) meeting the following requirements:
1. Less than 15 percent passing the number 200 sieve when tested in accordance with ASTM D 1140. The amount of clay lumps or balls not exceeding 2 percent.
 2. Material passing the number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318:
 - a. Liquid limit: not exceeding 25 percent.
 - b. Plasticity index: not exceeding 7.
- J Cement Stabilized Sand. Conform to requirements of Section 02252 - Cement Stabilized Sand.
- K Concrete Sand. Natural sand, manufactured sand, or a combination of natural and manufactured sand conforming to the requirements of ASTM C 33 and graded within the following limits when tested in accordance with ASTM C 136:

SIEVE	PERCENT PASSING
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

- L Gem Sand. Sand conforming to the requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

SIEVE	PERCENT PASSING
3/8"	95 to 100
No. 4	60 to 80
No. 8	15 to 40

- M Pea Gravel. Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

SIEVE	PERCENT PASSING
1/2"	100
3/8"	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

- N Crushed Aggregates. Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for the same construction activity from a single source.
2. Non-plastic fines.
3. Los Angeles Abrasion Test wear not exceeding 45 percent when tested in accordance with ASTM C 131.
4. Crushed aggregate shall have a minimum of 90 percent of the particles retained on the No. 4 sieve with 2 or more crushed faces as determined by TxDOT Tex-460-A, Part I.
5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from a naturally occurring single source. Uncrushed gravel are not acceptable materials for embedment where crushed stone is shown on the applicable utility embedment drawing details.
6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are the same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.
7. Gradations, as determined in accordance with TxDOT Tex-110-E.

SIEVE	PERCENT PASSING BY WEIGHT FOR PIPE EMBEDMENT BY RANGES OF NOMINAL PIPES SIZES		
	>15"	15" - 8"	<8"
1"	95 - 100	100	-
3/4"	60 - 90	90 - 100	100
1/2"	25 - 60	-	90 - 100
3/8"	-	20 - 55	40 - 70
No. 4	0 - 5	0 - 10	0 - 15
No. 8	-	0 - 5	0 - 5

3.0 EXECUTION**3.01 SOURCE QUALIFICATIONS FOR BORROW MATERIAL**

- A Use of material encountered in excavations is acceptable, provided applicable requirements are satisfied. If excavation material is not acceptable, provide from other approved source.
- B Identify off-site sources for materials at least 14 days ahead of intended use so that the Engineer may obtain samples for verification testing.
- C Obtain approval for each material source by the Engineer before delivery is started. If sources previously approved do not produce uniform and satisfactory products, furnish materials from other approved sources. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet the requirements will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once a material is approved by the Engineer, a Change Order is required to change to a different material.
- D Bank sand, select fill, and random fill, if available in the project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete the Work from off-site sources.
- E The Owner does not represent or guarantee that any soil found in the excavation work will be suitable and acceptable as backfill material.

3.02 MATERIAL HANDLING

- A When material is obtained from either a commercial or non-commercial borrow pit, open the pit to expose the vertical faces of the various strata for identification and selection of approved material to be used. Excavate the selected material by vertical cuts extending through the exposed strata to achieve uniformity in the product.
- B Establish temporary stockpile locations for practical material handling and control, and verification testing by the Engineer in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.
- C When stockpiling material near the Project Site, use appropriate methods to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering the drainage system.
- D Place material suitable for backfilling in stockpiles at a distance from the trench to prevent slides or cave-ins. Do not place stockpiles of excavated materials on public streets.

- E Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

END OF SECTION