# KANSAS DEPARTMENT OF TRANSPORTATION
# SPECIAL PROVISION TO THE
# STANDARD SPECIFICATIONS, 2015 EDITION

**Delete SECTION 1107 and replace with the following:**

## SECTION 1107

## AGGREGATES FOR BACKFILL

### 1107.1 DESCRIPTION

This specification covers aggregate for backfill. Use this when structures, pipe, mechanically stabilized earth (MSE) walls (panel or modular), underdrain, permeable or crushed stone backfill requirements are specified in the Contract Documents.

### 1107.2 REQUIREMENTS

**a. Structures or Pipe**.

(1) Composition. Provide singly or in combination sand, gravel, or crushed stone. Consider limestone, calcite-cemented sandstone, rhyolite, basalt, and granite as crushed stone.

(2) Quality[1].

- Soundness[2], minimum (KTMR-21) ..... 0.85
- Wear[3], maximum (AASHTO T 96) ..... 45%

For Structures Backfill Only:

- Coarse Aggregate Angularity[4], minimum (KT-31) ..... 75%
- Fine Aggregate Angularity[4], minimum (KT-50) ..... 40%

[1]Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2]The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3]The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

[4]Required testing for sand and gravel.

(3) Product Control.

(a) Gradation and Plasticity.

**TABLE 1107-1: AGGREGATES FOR STRUCTURES OR PIPE BACKFILL**

| Type | Percent Retained-Square Mesh Sieves | | | | | | | | | Plasticity Index (Max.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2" | 1 ½" | 1" | ¾" | 3/8" | No. 4 | No. 8 | No. 40 | No. 200 | |
| SB-1 | 0 | 0-10 | | 15-40 | 50-75 | | 95-100 | | | |
| SB-2 | | | 0 | 0-20 | 40-70 | 75-100 | 95-100 | | | |
| SB-3 | 0 | 0-5 | | 5-30 | | 35-60 | 45-70 | 60-84 | 80-92 | 8 |
| PB-1[1] | 0 | 0-10 | | 15-40 | 50-75 | | 95-100 | | | |
| PB-2[1] | | | 0 | 0-20 | 40-70 | 75-100 | 95-100 | | | |
| PB-3[1] | | | 0 | 0-30 | | 35-60 | 50-75 | 70-90 | 90-100 | 8 |

[1]Use of PB is required for PE and PVC pipe backfill.

(b) Deleterious Substances.

- Shale or shalelike material, maximum (KT-8) ..... 3.0%
- Clay Lumps and friable particles, maximum (KT-7) ..... 3.0%
- Sticks (wet), maximum (KT-35) ..... 1.0%

(4) Foundation Stabilization. Use SB aggregates at those locations where the use of SB aggregates for foundation stabilization is specified elsewhere in the Contract Documents. When the preceding sentence applies, use SB-3 when the expected depth of foundation stabilization is less than 6 inches.

Except at the locations described above, the use of alternate granular materials (except chat) may be permitted, but only with the approval of the District Materials Engineer.

**b. MSE Walls**: Precast Panel and Modular Block with Steel Soil Reinforcing Mesh or Steel Reinforcing Strips and Tie Strips.

(1) Composition. Use granular backfill material in the structure volume of sand, sand-gravel, or crushed stone, reasonably free from organics or other deleterious materials, and complies with the following:

(2) Quality. Submit representative material samples for the following tests to the Materials and Research Center, 2300 Van Buren, Topeka, KS 66611 (ATTENTION: Geotechnical Engineer) for acceptance prior to utilizing this material on the project.

(a) The Plasticity Index (P.I.) is 6 maximum, determined by KT-10.

(b) An angle of internal friction of 34 degrees or greater, as determined by the standard direct shear test – AASHTO T 236, utilizing a sample of the material compacted to 95 percent of AASHTO T 99 Methods C or D (with oversize correction, as outlined in Note 9 in AASHTO T 99) at optimum moisture content for sand and sand-gravel combinations. An angle of internal friction of 38 degrees or greater for crushed stone for panel MSE walls.

(c) Soundness. Use material substantially free of shale or other soft, poor durability particles as determined in accordance with **SECTION 1115**. "Freeze and Thaw", minimum 0.90 as determined in **DIVISION 1100**.

(d) Wear. Los Angeles Wear Abrasion, maximum 40%.

(e) Provide material that complies with **TABLE 1107-2**.

| TABLE 1107-2: ELECTROCHEMICAL REQUIREMENTS (PANEL) | |
|---|---|
| **Requirements** | **Test Method** |
| Resistivity > 5000 ohm-cm | KTMR-41 |
| pH: 5.0 to 10.0 | AASHTO T 289 |
| Organic Content < 1% | AASHTO T 267 |

If the resistivity is less than 5000 ohm-cm, but greater than 3000 ohm-cm, the backfill material can be accepted if it complies with **TABLE 1107-3**.

| TABLE 1107-3: ADDITIONAL ELECTROCHEMICAL REQUIREMENTS | | |
|---|---|---|
| **Property** | **Requirements** | **Test Method** |
| Chlorides | < 100 parts per million | ASTM D4327 |
| Sulfates | < 200 parts per million | ASTM D4327 |

(3) Product Control.

(a) Gradation.

| TABLE-1107-4: AGGREGATES FOR PANEL MSE WALLS BACKFILL | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Type** | **Percent Retained-Square Mesh Sieves** | | | | | | | | |
| | **4"** | **3"** | **2-1/2"** | **2"** | **1-1/2"** | **1"** | **1/2"** | **No. 40** | **No. 200** |
| Sand | 0 | | | | | | | 40-100 | 95-100 |
| Crushed Stone | 0 | | 5-25 | 50-100 | | 85-100 | 95-100 | | |

(b) Coefficient of Uniformity, F*. For steel reinforcing strips and tie strip systems (Reinforced Earth) and SINEstrips and Connectors (Sine Wall), use a maximum F* at a depth of 0 feet = 3.5 for course aggregate, 2.8 for fine aggregate (based on pullout tests) with a Coefficient of Uniformity greater than or equal to 4. For all fill types, F* = tan Φ below 20 feet. For select granular backfills consisting of fine aggregate with Coefficients of Uniformity below 4, F* will either be calculated to

be equal to F*= 1.2+log Cu < 2.0 at a depth of 0 feet or pullout tests may be conducted by the University of Kansas, Civil Engineering Department, Geotechnical Section. (Contact: Dr. Jie Han @ 785-864-3714 or Dr. Bob Parsons @ 785-864-2946.)

(4) Use only crushed stone in District 1.

For select granular backfill material composed of crushed stone, submit a proposed project gradation with single-point gradations and tolerances for approval. For sand and sand-gravel combinations, a project gradation will be issued that will specify gradation tolerances after the proposed material is approved. Any quality assurance samples which fall outside the tolerances will necessitate re-approval to be in compliance with **subsection 1108.2 b.(2).**

**c. MSE Walls: Modular Block with Soil Reinforcing Geogrid.**

(1) Composition. Use granular backfill material in the structure volume of sand, sand-gravel, or crushed stone, reasonably free from organics or otherwise deleterious materials, and complies with the following:

(2) Quality. Submit representative material samples for the following tests to the Materials and Research Center, 2300 Van Buren, Topeka, KS 66611 (ATTENTION: Geotechnical Engineer) for acceptance prior to utilizing this material on the project.

(a) The Plasticity Index (P.I.) is 6 maximum, determined by KT-10.

(b) An angle of internal friction of 34 degrees or greater, as determined by the standard direct shear test – AASHTO T 236, utilizing a sample of the material compacted to 95% of AASHTO T 99 Methods C or D (with oversize correction, as outlined in Note 9 in AASHTO T 99) at optimum moisture content.

(c) Soundness. "Freeze and Thaw", minimum 0.90 as determined in **DIVISION 1100**.

(d) Wear. Los Angeles Wear Abrasion, maximum 40%.

(e) Provide material that complies with **TABLE 1107-5**.

| TABLE 1107-5: ELECTROCHEMICAL REQUIREMENTS (Block) | | |
|---|---|---|
| | **Requirements** | **Test Method** |
| (Mesa) | pH > 3.0 | AASHTO T 289 |
| (Anchor **) | pH: 3.0 to 9.0 | AASHTO T 289 |
| | Organic Content < 1% | AASHTO T 267 |

** = Landmark or Vertica

(3) Product Control.

(a) Gradation.

| TABLE 1107-6: AGGREGATES FOR MODULAR BLOCK MSE WALLS BACKFILL | | | |
|---|---|---|---|
| **Type of Material** | **% Retained – Square Mesh Sieves** | | |
| | **1"** | **No. 40** | **No. 200** |
| Sand | 0 | 40-100 | 95-100 |
| Crushed Stone | 0 | 40-100 | 95-100 |

Limit the maximum particle size to ¾ inch for geosynthetic reinforced structures and for epoxy or PVC coated reinforcements. Use only crushed stone in District 1.

For select granular backfill material composed of crushed stone, submit a proposed project gradation with single-point gradations and tolerances for approval. For sand and sand-gravel combinations, a project gradation will be issued that will specify gradation tolerances after the proposed material is approved. Any quality assurance samples which fall outside the tolerances will necessitate re-approval to be in compliance with **subsection 1108.2 c.(2)**.

**d. Underdrain, Permeable or Granular Backfill**.

(1) Composition. Provide washed aggregate Type BD-1 and Type UD-1 and UD-2 composed of crushed or uncrushed gravel, or crushed stone.

(2) Quality.

- Soundness, minimum (KTMR-21) ..... 0.90
- Wear, maximum (KTMR-24) ..... 40%

(3) Product Control. Provide aggregate that complies with **TABLE 1107-7.**

| TABLE-1107-7: AGGREGATES FOR UNDERDRAIN AND OTHER PERMEABLE BACKFILL | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Type** | **Percent Retained-Square Mesh Sieves** | | | | | | | | | | |
| | **1 ½"** | **1"** | **¾"** | **½"** | **3/8"** | **No. 4** | **No. 8** | **No. 16** | **No. 30** | **No. 50** | **No. 100** |
| BD-1* | 0 | 0-10 | 10-40 | | | 80-100 | | 90-100 | | 93-100 | 98-100 |
| UD-1 | | | 0 | | 0-15 | | 40-60 | | 70-95 | | 98-100 |
| UD-2 | | | 0 | 0-10 | 15-50 | 85-100 | | | | | |

*BD-1 is intended for use with a filter fabric.

(4) Deleterious substances.

- Shale or shalelike material, maximum (KT-8) ..... 3.0%
- Clay Lumps and friable particles, maximum (KT-7) ..... 3.0%
- Sticks (wet), maximum (KT-35) ..... 1.0%

**e. Crushed Stone.**

(1) Composition. Provide material produced by the crushing of any type of stone complying with the following.

(2) Quality.

- Soundness, minimum (KTMR-21) ..... 0.70
- Wear, maximum (AASHTO T 96) ..... 50%

(3) Product Control.

(a) Size Requirements. Provide uniformly graded crushed stone, from coarse to fine, for backfill that complies with **TABLE 1107-8**:

| TABLE 1107-8: CRUSHED STONE BACKFILL | | |
|---|---|---|
| **Percent Retained-Square Mesh Sieves** | | |
| **2"** | **3/8"** | **No. 16** |
| 0 | 20 - 50 | 50 - 100 |

(b) Deleterious Substances.

- Clay lumps and friable particles, maximum (KT-7) ..... 5.0%

**1107.3 TEST METHODS**

Test aggregates according to the applicable provisions of **SECTION 1115**.

**1107.4 PREQUALIFICATION**

Prequalify aggregate sources according to **subsection 1101.4**.

**1107.5 BASIS OF ACCEPTANCE**

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5**.