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.

(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	AASHTO T 288
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 D 4327
Sulfates	< 200 parts per million	ASTM D 4327

(3) Product Control.

(a) Gradation.

TABLE 1107-4: AGGREGATES FOR PANEL MSE WALLS BACKFILL		
Percent Retained – Square Mesh Sieves		
4"	No. 40	No. 200
0	**40 - 100**	**95 - 100**

(b) Coefficient of Uniformity. Provide material with a minimum coefficient of uniformity of 4.0 as defined by ASTM D 2487 for systems that utilize steel reinforcing strips and tie strips (Reinforced Earth). Material with a coefficient of uniformity less than 4.0 may be accepted based on the results of pullout tests 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 Landmark)	pH: 3.0 to 9.0	AASHTO T 289
	Organic Content < 1%	AASHTO T 267

(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 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"**	**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

*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**.