

SECTION 02320

BACKFILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backfilling site structures to subgrade elevations.
 - 2. Fill under structures.
 - 3. Fill for over-excavation.

- B. Related Sections:
 - 1. Section 02060 - Aggregate
 - 2. Section 02315 - Excavation.

1.2 REFERENCES

- A. Colorado Department of Transportation:
 - 1. 2017 CDOT Standard Specifications for Road and Bridge Construction.

- B. American Society for Testing and Materials:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.

1.3 SUBMITTALS

- A. Materials Source: Submit name of imported materials suppliers.

- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Road Base: Type Class 6 as specified in Section 02060.
- B. Ordinary Backfill: Type A3 as specified in Section 02060, only as directed by Engineer.
- C. Stabilizing Material: Minimum of 1 ½ inch, uniformly graded, clean rock, or as directed by Engineer.
- D. Rip Rap: Stone Size; d50=12” minimum or larger as directed by Engineer.
- E. Flow-Fill: Structural Backfill that meets the requirements of 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 206.02; within the following limits:
 - 1. Components per cubic yard

Fine Aggregates (Type A2 as specified in Section 02060)	1,845 lbs.
Coarse Aggregates (Type A1 as specified in Section 02060)	1,700 lbs.
Cement	50 lbs.
Water	325 lbs.
 - 2. Slump – 6 inch minimum, 8 inch maximum
 - 3. Strength – 10 psi minimum in 1 day, 60 psi maximum in 18 days.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify subgrade is suitable for placement of backfill.
- B. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place aggregate in maximum 8 inch layers and compact to 95 percent, maximum dry density, ASTM D698, Standard Proctor, except for the top 4 feet of trench, which shall be compacted to 97 percent, maximum dry density, ASTM D698, Standard Proctor. Lift size may be increased when it is demonstrated that compaction requirements can be met using other methods. The Engineer will make final determination on the thickness of each lift in the field.
- D. Use smaller mechanical tamping equipment in areas inaccessible to compaction equipment.
- E. Place fill material in continuous layers and compact in accordance with schedule at end of this section.
- F. Employ placement method that does not disturb or damage other work.
- G. Maintain optimum moisture content of backfill materials to attain required compaction density.
- H. Backfill against supported walls. Do not backfill against unsupported walls.
- I. Backfill simultaneously on each side of unsupported walls until supports are in place.
- J. Make gradual grade changes. Blend slope into level areas.
- K. Remove surplus backfill materials from site.
- L. Leave fill material stockpile areas free of excess fill materials.
- M. Rip rap shall be placed and stacked in manner that creates a stable slope that will not impede flow of water.

3.4 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

- A. Compaction Testing: In accordance with ASTM D698.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

C. Compaction Testing for Bedding and Backfill:

1. Contractor is required to hire an independent, licensed engineer experienced in soil analysis and evaluation to perform required compaction tests in accordance with ASTM D698. Furnish copies of all Proctor curves and test results showing exact location of sample collection and test sites to Engineer. Engineer shall be informed prior to testing and he may designate areas of testing.
2. Performed by City personnel or Contractor at option of Engineer in accordance with ASTM D698.
3. Testing is to be done at various elevations in trench, which may require excavation by Contractor after backfill is installed.
4. Frequency of Compaction Tests will be specified by Engineer in field but shall be no less than every 200 feet at every 1 foot of depth of the backfill or anytime the means and methods of compaction change.
5. For trenches greater than 4 feet in depth, compaction effort shall be visually observed based on an initial test to determine a best means and methods of compaction that can subsequently be used for trench side observation. A new initial test shall be performed, whenever backfill materials or means and methods of compaction change.
6. Testing shall use the Standard Proctor method. Alternatives such as Modified Proctor or Relative Density based on necessity due to material type may be used with the permission of the Engineer so long as the necessary conversion data, testing, and information has been completed and submitted prior commencement of the work.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.6 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic during construction.
- B. All areas showing signs of settlement shall be filled and maintained by Contractor during all construction phases and for a period of two years following the date of final acceptance, except areas where Ordinary Backfill, Section 02060, was installed, for which the period is extended to 5 years.
- C. When Contractor is notified by the City or Engineer that any backfill is hazardous, the condition shall be corrected at once.

3.7 SCHEDULE

- D. Fill Behind Abutment and Wing Walls:
 - 1. Fill Type Class 6, from bottom of excavation to top of walls, compact uniformly to 97 percent of maximum density.
- E. Fill Wing Walls (ditch side):
 - 1. Fill Rip Rap, from ditch bottom to top of adjacent disturbed soil, stacked tight and stable.
- F. Fill Under Footings, Inlets, Manholes, Vaults, and other Concrete Structures:
 - 1. Fill Flow Fill, 18 inch thick to required elevations for the width of the footing.
 - 2. See Section 02630.
- G. Fill Under and Around Cast in Place Concrete:
 - 1. See Section 03300.
- H. Fill Over and Around Utilities:
 - 1. See Section 02324, 02512, 02630.
- I. Fill to Correct Over-excavation and Unstable Subgrades:
 - 1. Flow Fill, flush to required elevation, or material as directed by Engineer compacted uniformly to 97 percent of maximum density.

END OF SECTION