

Chapter 11 & 12 Bedding and Backfill



Ch 11 Section 9 Design of Sewers

(c)(i)(F)(I) Excavation.

Trench width from the trench bottom to a point one foot above the top of the pipe shall be no less than the outside diameter of the pipe plus 8-inches but not more than 24 inches plus the pipe O.D. The trench bottom shall be excavated for the pipe bell. Rock within 6-inches shall be removed. The trench shall be dewatered.



Ch 11 Section 9 Design of Sewers

(c)(i)(F)(II) Bedding.

Bedding shall be designed in accordance with:

- 1) Rigid pipe. Types A, B, C (Water Pollution Control Federation Manual of Practice No. 9) or ASTM C12-81.**
- 2) Flexible Pipe. Types I, II, III, ASTM D2321-74.**



Ch 11 Section 9 Design of Sewers

(c)(i)(F)(II) Backfill. Backfill shall be performed without disturbing pipe alignment. Backfill shall not contain debris, frozen materials, unstable material, or large clods. Stones greater than three inches in diameter shall not be placed within two feet of pipe. Compaction shall be to a density equal to or greater than the surrounding soil.



Ch 12 Section 14 Distribution Systems

(f)(i) Excavation. The trench bottom shall be excavated for the pipe bell. All rock shall be removed within 6-inches of the pipe. The trench shall be dewatered for all work.



Ch 12 Section 14 Distribution Systems

(f)(i) Bedding. Bedding shall be designed in accordance with ASTM C12 – types A,B,C – for rigid pipe and ASTM D2321 – types I, II, III – for flexible pipe.



Ch 12 Section 14 Distribution Systems

(f)(i) Installation. The pipe shall be joined to assure a watertight fitting. Ductile iron pipe shall be installed in accordance with AWWA 600 and PVC piping shall be installed in accordance with AWWA M23.



Ch 12 Section 14 Distribution Systems

(f)(vi) Backfill. Backfill shall be performed without disturbing pipe alignment. Backfill shall not contain debris, frozen materials, unstable material, or large clods. Stones greater than 3 inches in diameter shall not be placed within 2 feet of pipe. Compaction shall be to a density equal to or greater than the surrounding soil.



Details of Bedding and Backfill



Key Consideration to Increase Useful Life

- **Projected Useful Life**
 - Sewer Main 100 years
 - Water Main 50 years
- **Investigated Subsurface Conditions and then design**
- **Compact Embedment Materials Under Pipe Haunches**
- **Control Migration of Fines**
 - **Compaction**
 - **Seepage along pipe**



Key Consideration to Increase Useful Life

- **Administer and Enforce Your Contract**
- **Full Time Professional Inspection**
- **Call WDEQ We Have a Copy of the Approved Plans and Specifications**
- **4 foot is not 6 foot**
- **Uphill is not downhill**



Soil Classification Examples

- 1) **AASHTO** – The American Association of State Highway Transportation Officials – Classification System is Based on the Sieve Analysis, Liquid Limit and Plasticity Index.
- 2) **USCS** – Unified Soil Classification System - Classification System is Based on the Grain Size Distribution, Liquid Limit and Plasticity Index of the Soil.
 - a) **Coarse** –grained soils, Gravel Soils (G), Sand Soils (S), subcategories – well- graded (W), significant clay (C), poorly graded (P), significant silt (M)
 - b) **Fine** -grained soils, Inorganic Silts (M), Inorganic Clays (C), Organic Silts and Clays (O), subcategories – low and high compressibilities (LL)(>50 and <50)



Unified Soil Classification System

USCS –

- 1) Fines – passes No. 200
- 2) Clay- exhibit plasticity
- 3) Silt- non-plastic
- 4) Sand- pass No. 4 not 200
- 5) Gravel – rock that will pass a 3 –inch but not a $\frac{3}{4}$ -inch opening
- 6) Cobbles- rock that will pass a 12-inch opening but not a 3-inch
- 7) Boulders – rock that will not pass a 12-inch opening



ASTM D 2321 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications

What is the material class?

For Types I,II and III

(Class of Material)

- **Manufactured Aggregates & Coarse Grained Soils**

- 100% Passing 1 ½" Sieve

- **For I an II**

- <5% Passing No. 200 Sieve

- **Non Plastic**

- **For III 12% to 50%**



ASTM D 2321 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications

Where can the material class be used?

For Bedding

Class IA –Suitable as restricted above. Install in 6-inch maximum layers. Level final grade by hand Minimum depth 4 inch (6 inch in rock cuts).

For Haunching

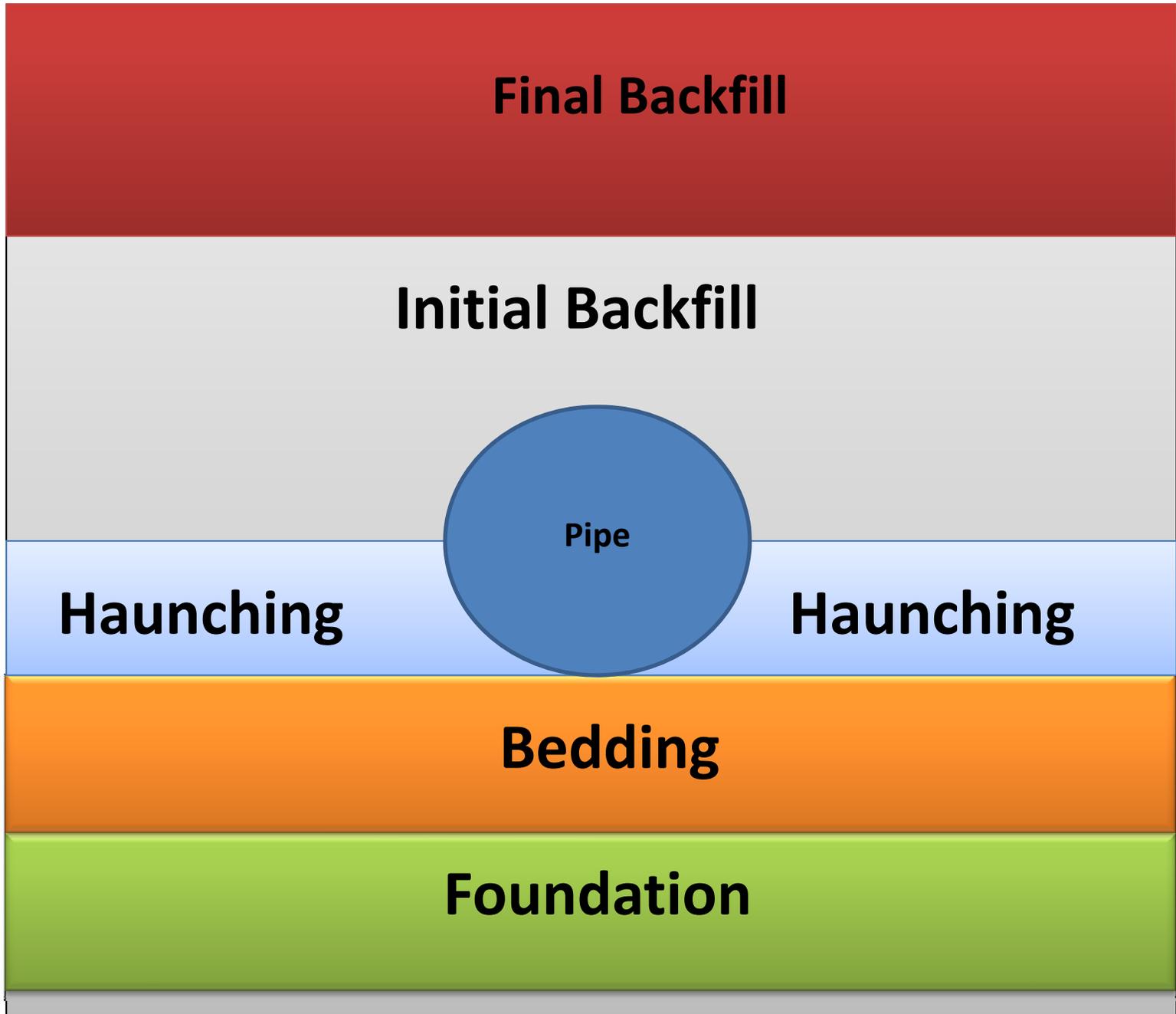
Class IA –Suitable as restricted above. Install in 6-inch maximum layers. Work in around the pipe to provide uniform support.



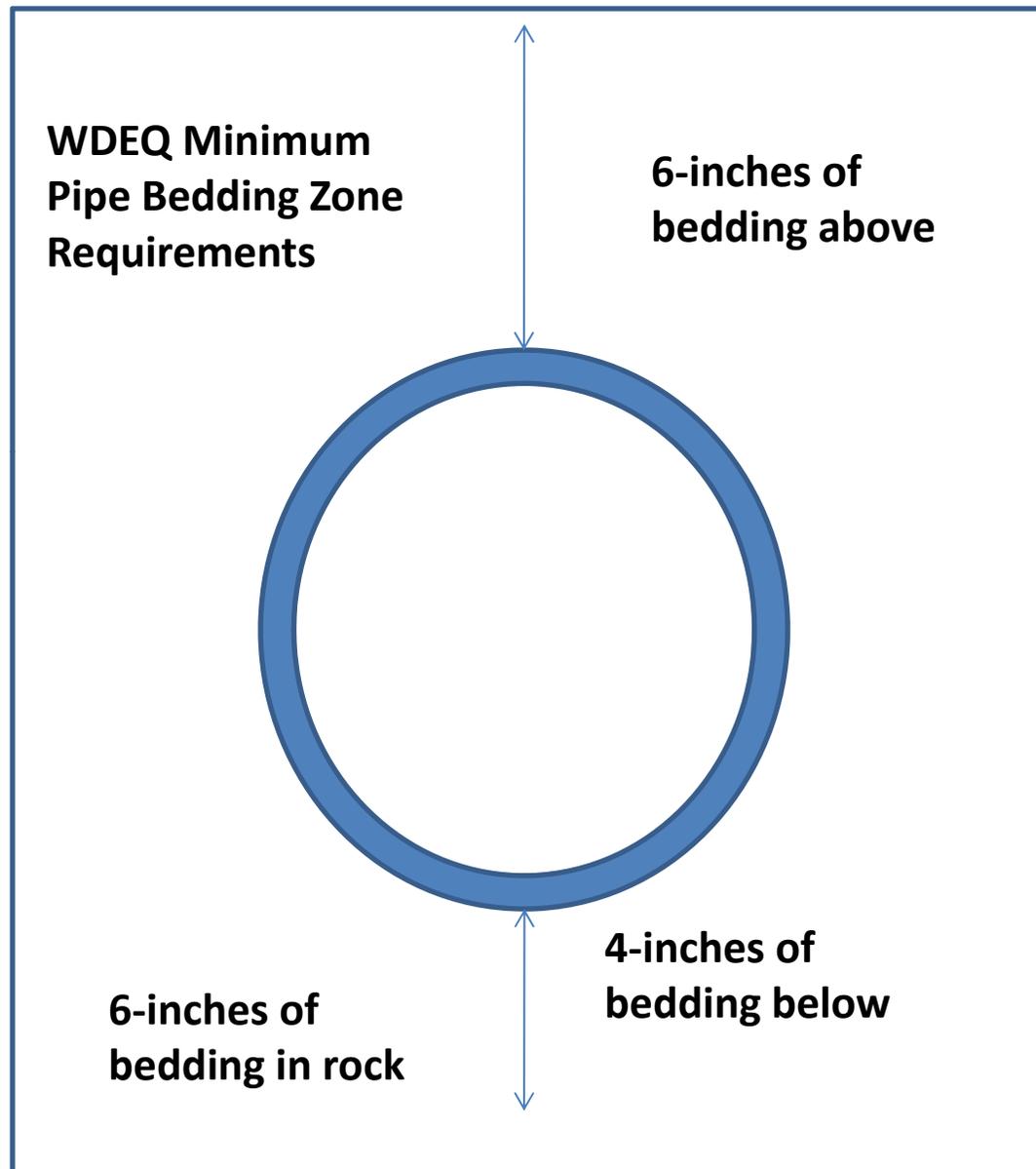
AWWA Manual of Water Supply Practices M23

- The Upper Limit For Round Stone is 1 ½ Inches
- The Upper Limit For Angular Rock is ¾ Inches

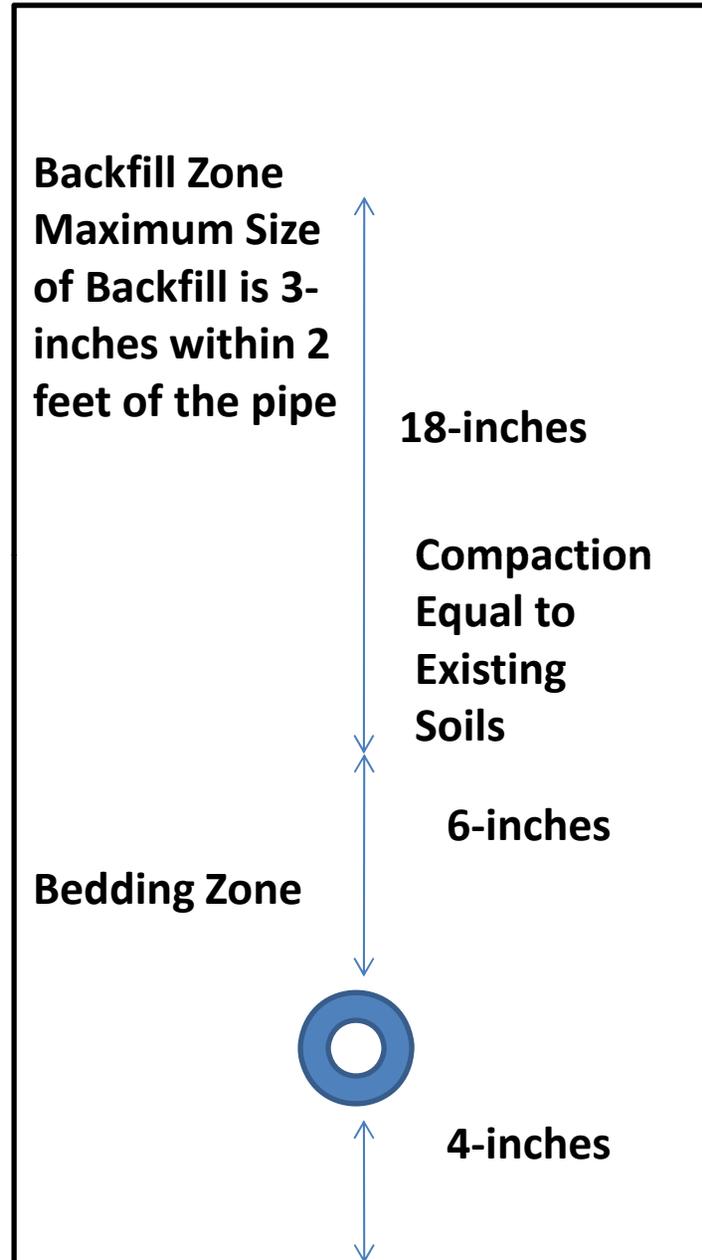




WDEQ Minimum Pipe Bedding Zone Requirements



WDEQ Minimum Pipe Bedding Zone Requirements

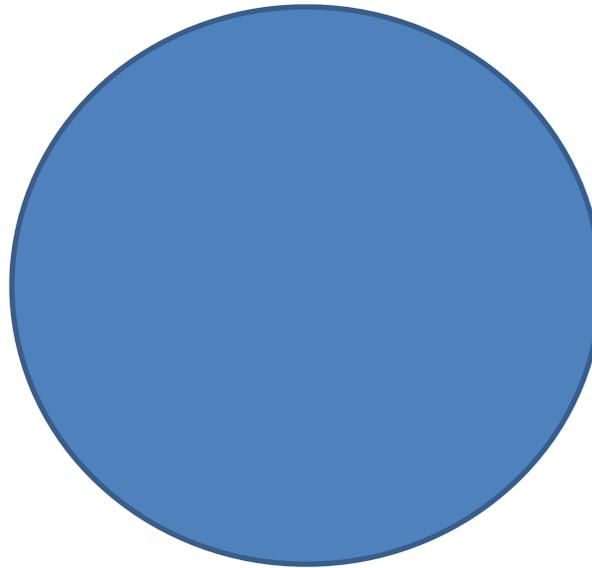


For Rigid Pipe

Backfill Load & Live Loads



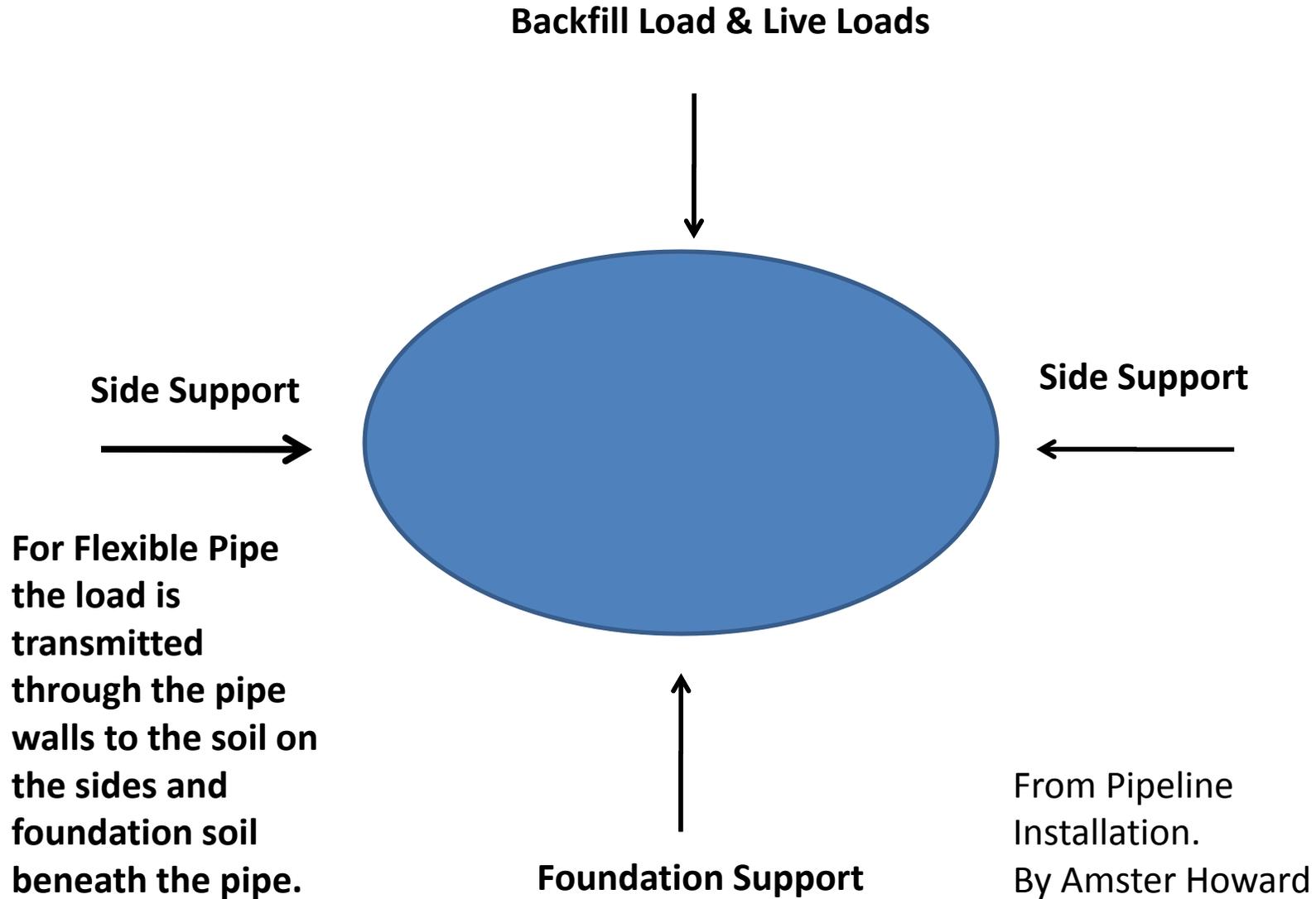
For Rigid Pipe the load is transmitted through the pipe walls to the foundation soil beneath the pipe.



Foundation Support

From Pipeline Installation.
By Amster Howard

For Flexible Pipe



Wyoming Public Works Sec 02225 Trench Backfill

Part 2 Products

2.01 Materials

A. Pipe Bedding Materials

1. Type 1 Bedding material around the pipe from six (6) inches under the pipe to twelve (12) inches over the pipe shall consist of course grained soils (over 50% retained on a No. 200 Sieve) and less than 5% fines such as gravel, sand, or silty sand meeting unified soil classification requirements as per ASTM designation D-2487 for type GW,GP,GM,GC,SW,SP, SM & SC or as specifically approved by the engineer.



Wyoming Public Works Sec 02225 Trench Backfill

Part 2 Products

2.01 Materials

A. Pipe Bedding Materials

Bedding material shall not consist of fine soil (less than 50% retained on a No. 200 sieve) such as silt, clay & organic soils meeting requirements for soil types ML, CH & PT. Bedding material shall be free from clods, frozen materials, or stone larger than $\frac{3}{4}$ inch in their maximum dimension. Where wet or otherwise unstable conditions exist, the material in this zone shall be free draining, non-plastic material.



Wyoming Public Works Sec 02225 Trench Backfill

Part 2 Products

2.01 Materials

A. Pipe Bedding Materials

Where suitable material is available in the material excavated from the trench the Contractor may procure the select material by screening, sifting or manually sorting the material removed from the trench in a manner approved by the Engineer.



Wyoming Public Works Sec 02225 Trench Backfill

Part 2 Products

2.01 Materials

A. Pipe Bedding Materials

2. Type 2 Pipe Bedding is required for foundation in over-excavated trenches and shall consist of the bedding material from six (6) inches under the pipe and below. The bedding material shall consist of sand, sandy gravel, compacted rock or gravel having a maximum size of 1 ½ inches, uniformly graded and having a maximum plasticity of six (6) as determined by AASHTO Methods T-89 and T-90.



Wyoming Public Works Sec 02225 Trench Backfill

Part 3 Execution

3.01 Construction

- A. Common and Select Backfill
- 2. After the select pipe bedding materials has been placed and compacted as specified above, the remainder of the trench backfilling shall be done. All backfill materials shall be free from cinders, ashes, refuse, organic and frozen material, boulders, or other materials that are unsuitable. From one (1) foot above the top of the pipe to six (6) inches below the ground surface, or to the subgrade elevation for streets or paved surfaces, material containing stones up to four (4) inches in the greatest dimension may be used.



Wyoming Public Works Sec 02225 Trench Backfill

Part 3 Execution

3.01 Construction

B. Type A Trench Backfill – Streets, Paved Areas or Alleys

Materials used for bedding and backfill shall be carefully deposited in depth layers suitable to the equipment used for compaction, wetted to 3% below to 2% above optimum moisture content, and compacted to at least 96% maximum density as determined by AASHTO T-99 (Standard Proctor).



Wyoming Public Works Sec 02225 Trench Backfill

Part 3 Execution

3.01 Construction

C. Type B Trench Backfill – Fields, Borrow Pits, Unimproved Streets or Other Unsurfaced Areas.

1. Materials used for Type B Trench Backfill shall not require special compaction. The material shall be compacted in layers to achieve a density approximately equal to the density of the existing soil.



Questions?

