

# Installation Guide

For Corrugated Polyethylene Smooth Flow Pipe and Fittings



Haviland Drainage Products Co.



**DRAINAGE**  
SOLUTIONS, INC

(317) 346-4110

[www.drainagesolutionsinc.com](http://www.drainagesolutionsinc.com)

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# Introduction

This booklet is provided as a basic guide to the handling and installation of Haviland Drainage Products Co. corrugated polyethylene pipe and fittings in applications including most culverts, sewers, and subdrainage systems. Information presented in this guide has been prepared in accordance with recognized principles and practices and is for general reference only. Installation and handling of Haviland Drainage Products Co. pipe is very similar to that of any quality pipe. A quality pipe system is a combination of the pipe, the backfill envelope, and the installation job. Together these three parts provide for the maximum drainage capabilities of a pipe system. Specialized applications, such as landfill leachate systems, septic tank leach fields, and pressure applications require a more detailed engineering analysis and are not included. Competent advice should be secured for all applications, general or specific. All products must be installed according to applicable ASTM and AASHTO specifications.

# Product Handling

## Delivery Inspection

Haviland Drainage Products Co. makes every effort to ensure the quality and accuracy of each shipment. Extensive time and resources are spent each day testing all aspects of our products from the arrival of raw materials to the delivery of the finished products. As a final check, the customer should inspect each delivery to verify the product, quantity, and quality. Special attention should be given to the pipe ends, gaskets, couplers, and other joints, as damage can occur during shipping.

## Product Identification

All pipe is marked for easy identification. Pipe markings are as follows:

DPI - specifies the manufacturer (Drainage Products, Inc.)

Nominal Size - designates the diameter of the pipe in inches and millimeters

AASHTO and ASTM Standards - denotes the specifications and standards which the pipe meets

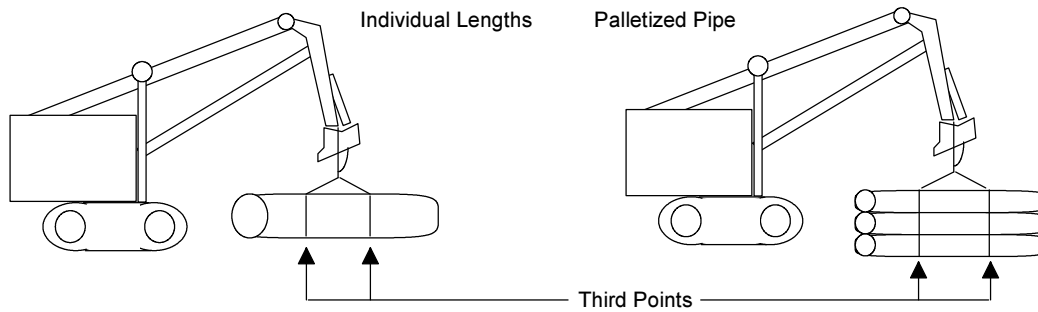
Production Code - enables Haviland Drainage to track the date and origin of the pipe

## Unloading

Haviland Drainage Products Co. normally delivers on specially designed trailers. Drivers are trained in proper unloading procedures; however, assistance may be required. Pipe must be unloaded in a flat area that is free of large rocks and debris and is out of the way of construction traffic.

Pipe is available palletized or loose, depending on the size, type, and quantity of product. Pallets can be unloaded with bucket type equipment and a sling. The sling should be wrapped around the pallet at the third points as it lifts the pallet onto the ground. The third points are located at one third the distance of the pipe from each end. For example, on a length of pipe twenty feet long the third points would be six feet, four inches from each end of the pipe. (Figure 1 gives illustration of the third points.) Pallets can also be opened and unloaded individually. Non-palletized pipe can be unloaded by rolling single lengths of loose pipe from the delivery truck onto a front end loader bucket and then onto the ground. Pipe can also be lifted with a sling positioned around the third points. Do not drop the pipe from the delivery truck to the ground. Special attention should be given to the ends of the pipe, bell, and gaskets to see they are not damaged during unloading. (See Figure 1 for proper unloading techniques.) Coupling bands, fittings, and accessories are packaged in a variety of ways depending on the product, quantity, and size. They should be unloaded in a safe manner that will not cause damage.

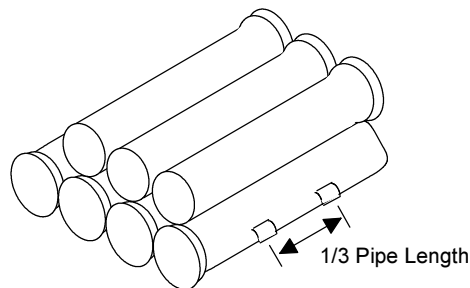
**Figure 1: Pipe Handling Techniques**



## Job Site Storage and Handling

Once unloaded, products not immediately used need to be stored in a flat area free of large rocks and debris that is out of the way of construction traffic. Pipe received in pallets should remain palletized until used. Loose pipe should be stockpiled in carefully constructed piles. Care should be taken during stockpiling. Pipe should not be dropped, dragged, or bumped into other pipe. Each stockpile must be safely chocked at the third points of the pipe (see Figure 2). Pipe may be stacked five feet (1.6 m) high or a maximum of three pieces, whichever is greater. Pipe with bells must be stacked in alternate directions so the bells are not pressing against each other. (See Figure 2 for an example of a properly stacked pile.) Storage space for smooth interior pipe can sometimes be minimized by telescoping smaller sizes into larger sizes. Telescoping should only be done when the pipe can be removed easily. Stockpiles should not be climbed on. Fittings, coupling bands, and other accessories should be stored in a safe convenient area away from construction traffic. Care should be taken to see that fittings are not dropped, dragged, or bumped against the ground or other objects.

**Figure 2: Stockpiling for Belled Pipe**



While polyethylene pipe is lightweight and easy to use, safety precautions should be taken. Smaller diameter pipe may be handled manually by two people positioned one at each third point. Larger diameters require equipment assistance. Place a sling around the third points. (Shown in Figure 1. Refer to Table 1 to determine which method is preferable.) Do not insert forks or any other objects inside of pipe. No more than 1/3 of the pipe should be unsupported at any time.

**Table 1: Approximate Weight of 20 Foot Length of Smooth Flow Pipe**

| Diameter |      | Weight |        |
|----------|------|--------|--------|
| inches   | mm   | lbs    | kg     |
| 4        | 100  | 10     | 4.50   |
| 6        | 150  | 19     | 9.00   |
| 8        | 200  | 35     | 15.75  |
| 10       | 250  | 46     | 22.50  |
| 12       | 300  | 69     | 29.25  |
| 15       | 400  | 90     | 40.50  |
| 18       | 450  | 132    | 60.75  |
| 24       | 600  | 240    | 108.00 |
| 30       | 750  | 308    | 144.00 |
| 36       | 900  | 385    | 157.50 |
| 42       | 1050 | 530    | 240.00 |
| 48       | 1200 | 620    | 280.00 |
| 60       | 1500 | 1100   | 500    |

# Trench Excavation

## Trench Width

ASTM D2321 (Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications) states that the width of the trench should be no wider than what is required to safely place and compact, if necessary, the backfill material on either side of the pipe. Thus the width of the trench depends on the pipe diameter, backfill material, and the method of compaction. Trenches that are too narrow will not allow for proper pipe installation, whereas overly wide trenches are unnecessarily costly. Wide trenches are often thought necessary for flexible pipe; however, this is not true. Wide trenches are not only costly to excavate and fill with backfill material; they may actually detract from the structural integrity of the pipe system. Years of consolidation create a very stable soil environment. The desire is to destroy as little of that stability as necessary when digging the trench. Stable trench walls actually enhance the structural integrity of the system when the trench is relatively narrow. Overly wide trenches also require more backfill material and more compaction which may not form a structure as stable as the undisturbed native material. As a practical matter, the width of a contractor's bucket size may also factor into the decision.

In very poor native soils such as peat, muck, or highly expansive soils, a wider trench width will be required, especially if the pipe will experience relatively heavy loads. This wider trench width should be based on an evaluation of the native soil, service, and required load strength. In unstable soils extra caution should be taken to prevent cave-ins.

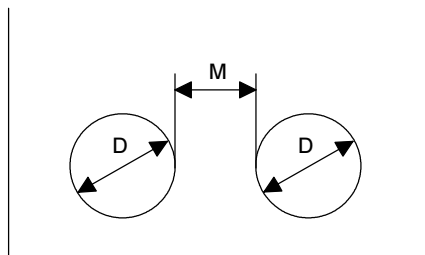
Geotextiles or filter fabrics should be given consideration in areas where the native soil is very soft or migrates easily. The use of such materials can help overcome some of the structural deficiencies in very soft native soils and may allow the trench width to be reduced. Geotextiles can be placed along the trench bottom and sides to separate native soils and backfill material and prevent fines from entering the pipe. Filter wrapped pipe can also be used to minimize the possibility for fines to enter the pipe and is available from Haviland Drainage Products Co. Special guidance should be sought on the most appropriate products for a specific application.

As a general "rule of thumb", trench widths for 10 inch (250 mm) pipe and smaller are usually dictated by the size of the contractor's bucket. Size 12 inch (300 mm) to 24 inch (600 mm) pipe require a trench width twice the nominal diameter and 30 inch (750 mm) to 36 inch (900 mm) pipe requires a trench width of the nominal diameter plus two feet. (Refer to Table 2 for suggested trench widths.) Wider trenches may be required if the trench width proposed in Table 2 is not sufficient for backfill placement.

**Table 2: Suggested Trench Widths**

| Inside Diameter |       | Approx. Outside Diameter |       | Typical Trench Widths |     | ASTM D2321 Trench Widths |     |
|-----------------|-------|--------------------------|-------|-----------------------|-----|--------------------------|-----|
| inches          | mm    | inches                   | mm    | inches                | m   | inches                   | m   |
| 12              | 300   | 15                       | 375   | 24                    | 0.6 | 30                       | 0.8 |
| 15              | 375   | 18                       | 450   | 30                    | 0.8 | 34                       | 0.9 |
| 18              | 450   | 22                       | 550   | 36                    | 0.9 | 38                       | 1.0 |
| 24              | 600   | 28                       | 700   | 48                    | 1.2 | 46                       | 1.2 |
| 30              | 750   | 36                       | 900   | 54                    | 1.4 | 55                       | 1.4 |
| 36              | 900   | 42                       | 1,050 | 60                    | 1.5 | 63                       | 1.6 |
| 42              | 1,050 | 48                       | 1,200 | 66                    | 1.7 | 72                       | 1.8 |
| 48              | 1,200 | 54                       | 1,350 | 72                    | 1.8 | 80                       | 2.0 |
| 60              | 1,500 | 68                       | 1,700 | 86                    | 2.2 | 97                       | 2.5 |

For parallel pipe installations additional trench width is needed. A minimum amount of backfill is required between the pipes to provide adequate strength to the pipe system. Figure 3 shows the minimum suggested spacing; however this dimension may need to be increased depending on the type of backfill, the compaction method, and the joining method.

**Figure 3: Minimum Spacing for Parallel Pipe Installations**

M = minimum spacing

D = nominal diameter

for  $D \leq 24$  inch (600mm)       $M = 1$  ft (.3m)

for  $D > 24$  inch (600mm)       $M = D / 2$

## Trench Foundation

All sound pipe installations begin with a stable foundation. If a stable foundation for the pipe is not available, additional excavation is required. The trench bottom should be slightly over excavated to allow for bedding material and should be free of large stones, clumps of soil, frozen soil, or debris. Rock outcroppings, muck, and other unsuitable materials may not provide uniform and proper support. They should be removed and replaced with suitable granular material.

Water in the trench during pipe installation can create a safety hazard as well as make it almost impossible to install the pipe properly. Water will tend to float the pipe so that maintaining proper slope becomes much more difficult. It is necessary to drain the trench in these situations to ensure a proper installation.



# Backfill Envelope Construction

Construction of a backfill envelope for polyethylene pipe is very similar to that of most other types of pipe. In many cases the same general methods and backfill materials may be used. ASTM D2321 serves as the basis for installation recommendations in trafficked installations. The primary purpose of the backfill envelope is to provide support to the pipe. A properly constructed envelope transfers the weight of the load across the crown of the pipe to the material along the sides and then to the pipe bedding and foundation. This load arching effect means that most of the load is carried by the backfill and only a small portion of the total load is supported by the pipe.

The load that a pipe system will carry is directly related to the backfill envelope. The load carrying ability of a pipe system is determined by a combination of the type of backfill material, the level of compaction, and the placement of the backfill material. The construction of the backfill envelope is broken into six sections: backfill material, bedding, laying and joining, haunching, initial backfill, and final backfill.

## Backfill Material

The selection of the backfill material is the first and most important step to creating a structurally sound backfill envelope. A backfill material should generally be of a compactable aggregate type. Some native soils and many other materials meet these requirements. The cost and availability of materials and the type of application typically play key roles in determining backfill material.

Backfill offers passive resistance termed the “backfill modulus” denoted by the symbol  $E'$ . The backfill modulus is determined by a combination of the material and the level of compaction. Table 3 provides information set forth by the Bureau of Reclamation using the combination of material and the compaction level to arrive at the backfill modulus. This information has been used by drainage system designers for many years.

Haviland Drainage Products Co. recommends a minimum backfill modulus of 1,000 psi. Shallow and non-trafficked installations may not demand material to be this level of backfill quality, while deep and trafficked installations may require a higher quality material. Installations involving heavier loads may require a higher backfill modulus. Application engineers can provide additional guidance in these situations.

A more specialized type of backfill material that is increasing in use is flowable fill. This material is basically low strength concrete that is poured around the pipe. The  $E'$  value for this material is estimated at 25,000 psi (172,000 kPa). The structural integrity of flowable fill is excellent but precautions must be taken or it can misalign or float the pipe. Weighting the pipe or pouring the flowable fill in layers is recommended to prevent these problems.

**Table 3: Backfill Class and Quality**

N/R: Use not recommended by ASTM D2321 for part of the backfill envelope

| Class | PIPE EMBEDMENT MATERIAL                                |          |   |                                    |                                     | E', psi (kPa)<br>For Degree of Embedment Compaction |                  |                   |                       |                   |
|-------|--|----------|---|------------------------------------|-------------------------------------|---|------------------|-------------------|-----------------------|-------------------|
|       | ASTM D2321*<br>Description                             | Notation | ASTM D2487<br>Description   | AASHTO<br>M43<br>Notation          | Min. Std.<br>Proctor<br>Density (%) | Lift Placement<br>Depth                             | Dumped           | Slightly<br>< 85% | Moderate<br>85% - 95% | High<br>> 95%     |
| IA    | Open-graded, clean manufactured aggregates             | NA       | Angular crushed stone or rock, crushed gravel, crushed slag; large voids with little or no fines          | 5<br>56                            | Dumped                              | 18"<br>450 mm                                       | 1,000<br>(6,900) | 3,000<br>(20,700) | 3,000<br>(20,700)     | 3,000<br>(20,700) |
| IB    | Dense-graded, clean manufactured, processed aggregates | NA       | Angular crushed stone or other Class IA material and gravel/sand mixtures; little or no fines             |                                    |                                     |   |                  |                   |                       |                   |
| II    | Clean, coarse-grained soils                            | GW       | Well-graded gravel, gravel/sand mixtures; little or no fines  | 57<br>6<br>67                      | 85%                                 | 12"<br>300 mm                                       | N/R              | 1,000<br>(6,900)  | 2,000<br>(13,800)     | 3,000<br>(20,700) |
|       |  | GP       | Poorly-graded gravels, gravel/sand mixtures; little or no fines   |                                    |                                     |   |                  |                   |                       |                   |
|       |  | SW       | Well-graded sands, gravelly sands; little or no fines   |                                    |                                     |   |                  |                   |                       |                   |
|       |  | SP       | Poorly-graded sands, gravelly sands; little or no fines   |                                    |                                     |   |                  |                   |                       |                   |
| III   | Coarse-grained soils with fines                        | GM       | Silty gravels, gravel/sand/silt mixtures  | Gravel and sand with<br><10% fines | 90%                                 | 9"<br>225 mm  | N/R              | N/R               | 1,000<br>(6,900)      | 2,000<br>(13,800) |
|       |  | GC       | Clayey gravels, gravel/sand/silt mixtures   |                                    |                                     |   |                  |                   |                       |                   |
|       |  | SM       | Silty sands, sand/clay mixtures   |                                    |                                     |   |                  |                   |                       |                   |
|       |  | SC       | Clayey sands, sand/clay mixtures  |                                    |                                     |   |                  |                   |                       |                   |
| IVA** | Inorganic fine-grained soils                           | ML       | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts with slight plasticity |                                    |                                     |   | N/R              | N/R               | N/R                   | N/R               |
|       |  | CL       | Inorganic clays of low to medium plasticity; gravelly, sandy or silty clays; lean clays                   |                                    |                                     |   |                  |                   |                       |                   |
| IVB   | Inorganic fine-grained soils                           | MH       | Inorganic silts, macaceous or diamaceous fine sandy or silty soils, elastic soils                         |                                    |                                     |   | N/R              | N/R               | N/R                   | N/R               |
|       |  | CH       | Inorganic clays of high plasticity, fat clays   |                                    |                                     |   |                  |                   |                       |                   |
| V     | Organic or highly organic soils                        | OL       | Organic silts and organic silty clays of low plasticity   |                                    |                                     |   | N/R              | N/R               | N/R                   | N/R               |
|       |  | OH       | Organic clays of medium to high plasticity, organic silts   |                                    |                                     |   |                  |                   |                       |                   |
|       |  | PT       | Peat and other high organic soils   |                                    |                                     |   |                  |                   |                       |                   |

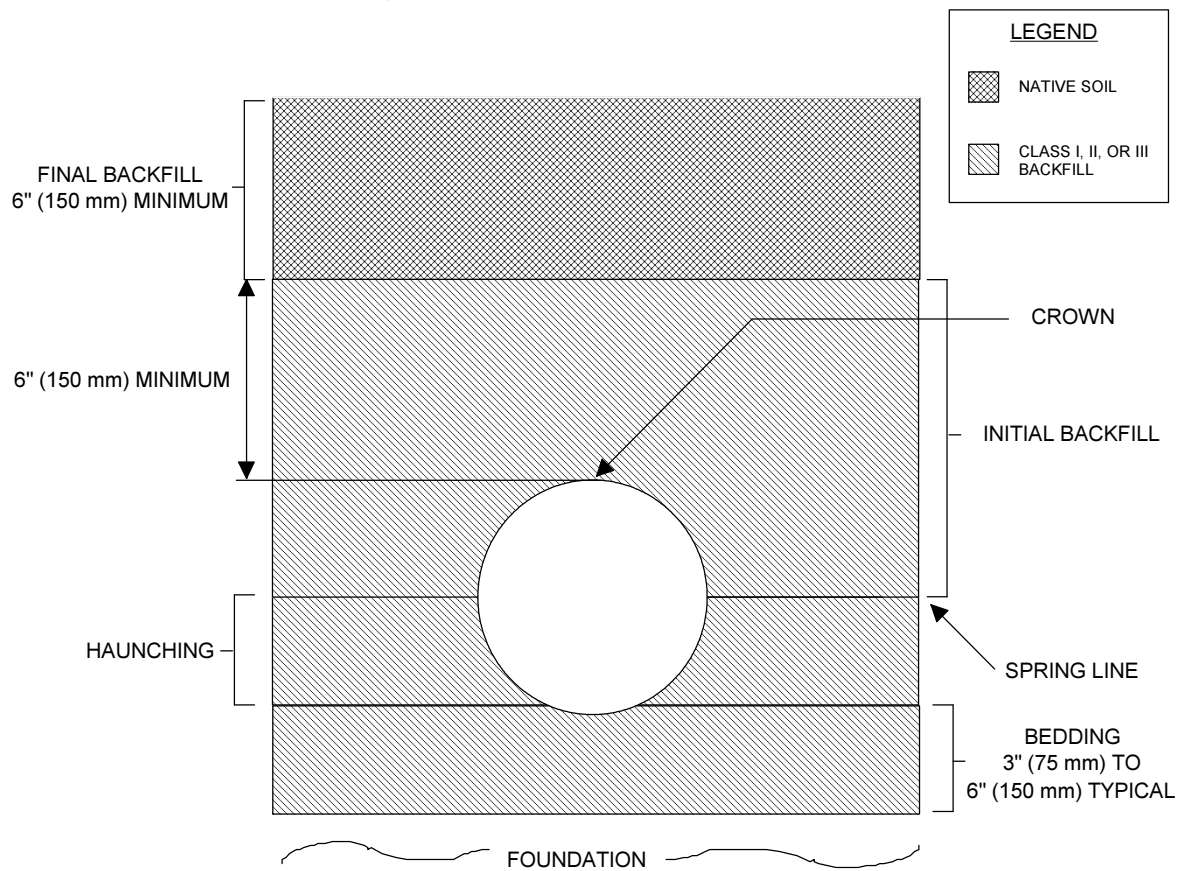
\* Refer to ASTM D2321 for more complete descriptions.

\*\* Use under the direction of a soils expert.

# Bedding

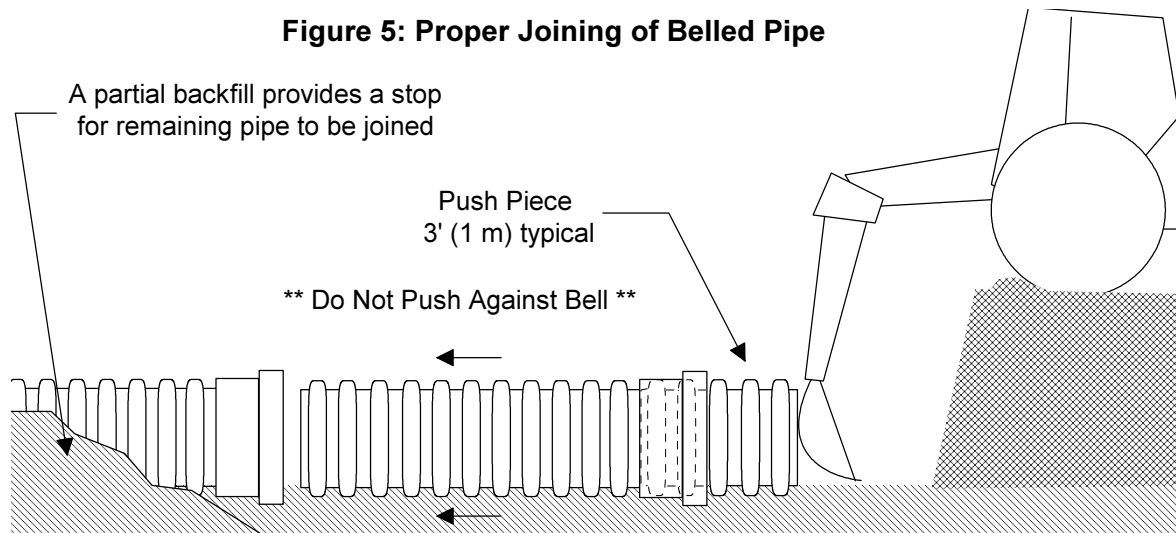
Bedding is the portion of the backfill envelope that is placed directly on the foundation. (Refer to Figure 4 for the location of the bedding area.) The bedding area must provide a uniform firm support for the pipe and maintain correct pipe grade. Larger pipe is usually placed on the bedding and fill is carefully tamped or shoveled under the haunches to the specified compaction level, defined in Table 3. The bedding can also be shaped to conform with the outside of the pipe. A commonly referenced minimum bedding depth is four inches (100 mm).

**Figure 4: Typical Backfill Structure**



## Laying and Joining

Depending on pipe size and trench conditions lengths of pipe should be lowered into the trench manually or with equipment. Do not drag, drop, or roll pipe into the trench. Coupling bands, fittings, and similar products should be handled with care, using equipment if necessary. Belled pipe should be connected using a “push piece”. A “push piece” is a short length of the same size pipe, typically three feet (1.0 m), used to prevent damaging the bell while joining belled pipe. “Push pieces” can be made from any length of pipe by simply cutting the pipe in the valley of the corrugation. (Cutting and modifying pipe is explained in detail on page 18, and is illustrated in Figure 10. Proper joining of belled pipe is shown in Figure 5.) All pipe and accessories should be inspected for damage after they have been lowered into the trench but before they are connected. Pipe and fitting ends should be as clean as possible to permit proper assembly and optimum joint performance.



## Haunching

The haunching area is the most important layer since it provides the pipe with most of the support against the soil and traffic loads. The backfill material should be installed uniformly on each side of the pipe in layers or lifts. Layers of about 4 to 6 inches (100 - 150 mm) are recommended for optimum construction. Tamp to achieve the compaction level specified in Table 3. Care should be taken to avoid misaligning or damaging the pipe during compaction. If compaction is not required, the backfill should be shoveled under the pipe, taking care to eliminate all voids. Construction of each layer should be repeated up to the spring line.

Extra attention should be given to backfill placement and compaction around pipe connections at manholes, catch basins, fittings, and other structures. Since it is usually more difficult to work in these areas the backfilling process is often neglected. This can lead to non-uniform settlement or product damage. As a precautionary measure in critical applications a pipe joint can be made close to the manhole to help accommodate settlement. The flexible nature of polyethylene pipe also helps to accommodate differential settlement.

## Initial Backfill

The initial backfill is located from the springline of the pipe to a minimum of 6 inches (150 mm) above the pipe crown. It is the job of the initial backfill to anchor the pipe and distribute the load into the haunching. The backfill material should be placed and compacted in layers. Compaction equipment must not be used directly on the pipe. (See Figure 4 for initial backfill location.)

## Final Backfill

The last layer in a backfill envelope is the final backfill. It extends from the initial backfill to the top of the trench. The final backfill must be a minimum of 6 inches (150 mm). Since this layer does not support the pipe the material and compaction level should be based on surface load conditions. If no loads will be crossing the pipe and settlement is not an issue then compaction is unnecessary and the excavated native soil is usually adequate backfill. However, if there will be roads or drives crossing the pipe then a relatively high strength material and compaction level will be needed to prevent settlement. (For more compaction information refer to Table 3 and ASTM D2321.)

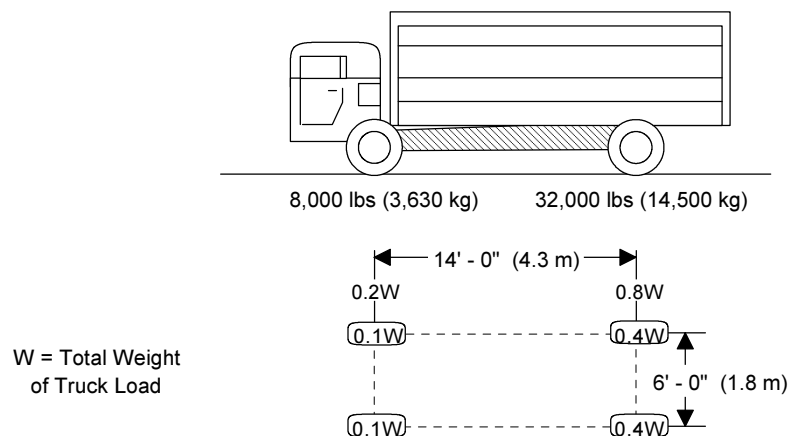
Additional measures must be taken if heavy construction traffic in excess of the design load will be present. As a precautionary measure all traffic should be rerouted around the pipe. In the event heavy equipment can not be rerouted, a minimum of three feet (1.0 m) of additional cover is needed. This additional cover can simply be mounded and compacted over the pipe and then grated off when construction is complete.

## AASHTO H-20

Vehicular load are typically based on the AASHTO H-20 configuration, shown in Figure 6. This figure represents a 20 ton (18.2 metric tons) semi-truck with a 32,000 lb. (14,500 kg) axle load.

## Trench Depth

**Figure 6: AASHTO H-20 Highway Load**



The depth of the trench is dictated by the geography of the site, the pipe slope required, and the job specifications. In applications of 48" diameter and smaller a minimum of one foot of cover over the crown of the pipe to bottom of asphalt (flexible pavement) is required, for 60" diameter pipe a minimum of 24" of cover over the crown of the pipe to bottom of asphalt (flexible pavement), as shown in Figure 4. The backfill envelope should be compacted to a minimum E' value of 1,000 psi (6,900 kPa). (Refer to Table 3 for compaction detail.)

| Maximum Cover Dual Wall HDPE Pipe, ft (m) |                 |                |                |                |                |                |               |
|---|-----------------|----------------|----------------|----------------|----------------|----------------|---------------|
| Diameter in.<br>(mm)                      | Class 1         | Class 2        |                |                | Class 3        |                |               |
|   | Compacted       | 95%            | 90%            | 85%            | 95%            | 90%            | 85%           |
| 12" (300)                                 | 41 ft<br>(10.4) | 28 ft<br>(6.1) | 19 ft<br>(3.4) | 9 ft<br>(2.1)  | 20 ft<br>(3.4) | 11 ft<br>(2.1) | 7 ft<br>(1.5) |
| 15" (375)                                 | 41 ft<br>(11.0) | 28 ft<br>(6.4) | 20 ft<br>(3.4) | 10 ft<br>(2.1) | 20 ft<br>(3.4) | 11 ft<br>(2.1) | 7 ft<br>(1.5) |
| 18" (450)                                 | 40 ft<br>(10.7) | 27 ft<br>(6.1) | 20 ft<br>(3.4) | 9 ft<br>(2.1)  | 20 ft<br>(3.4) | 11 ft<br>(2.1) | 7 ft<br>(1.5) |
| 24" (600)                                 | 34 ft<br>(10.1) | 24 ft<br>(5.8) | 17 ft<br>(3.4) | 9 ft<br>(2.1)  | 17 ft<br>(3.0) | 11 ft<br>(2.1) | 7 ft<br>(1.5) |
| 30" (750)                                 | 34 ft<br>(9.1)  | 23 ft<br>(5.2) | 16 ft<br>(2.7) | 7 ft<br>(1.8)  | 17 ft<br>(2.7) | 9 ft<br>(1.5)  | 6 ft<br>(.9)  |
| 36" (900)                                 | 32 ft<br>(8.8)  | 22 ft<br>(5.2) | 15 ft<br>(2.7) | 7 ft<br>(1.8)  | 16 ft<br>(2.7) | 9 ft<br>(1.5)  | 6 ft<br>(.9)  |
| 42" (1050)                                | 32 ft<br>(9.8)  | 23 ft<br>(5.8) | 15 ft<br>(3.0) | 8 ft<br>(1.8)  | 15 ft<br>(2.7) | 10 ft<br>(1.5) | 6 ft<br>(.9)  |
| 48" (1200)                                | 31 ft<br>(9.4)  | 22 ft<br>(5.8) | 14 ft<br>(3.0) | 7 ft<br>(1.8)  | 15 ft<br>(2.7) | 10 ft<br>(1.5) | 6 ft<br>(.9)  |
| 60" (1500)                                | 31 ft<br>(9.4)  | 20 ft<br>(5.8) | 14 ft<br>(3.0) | 6 ft<br>(1.8)  | 15 ft<br>(2.7) | 8 ft<br>(1.5)  | 5 ft<br>(.9)  |

Notes:

1. Installation assumed to be in accordance with ASTM D2321 and the installation section of the Drainage handbook.
2. Backfill materials and compaction levels not shown may also be acceptable. Contact Haviland Drainage for further details.
3. Materials must be adequately tamped into haunch and between corrugations. Compaction must be uniform throughout the entire backfill zone.
4. Compaction levels shown are for standard Proctor density.
5. For Projects which exceed the listed maximum values, contact Haviland Drainage for specific design considerations.

# Compaction

The degree of compaction required will vary depending on the backfill material and installation requirements. Compaction does not always require extra effort or compaction equipment. Crushed stone and similar materials are usually not compacted, but do require care to see that voids are eliminated in the backfill envelope. For other materials, compaction methods will depend primarily on the backfill modulus required and the moisture level of the material. At optimum moisture levels, some Class II and III soils can be compacted to minimum recommended levels by walking on each layer of backfill. (See Table 3 for compaction details.)

Mechanical compaction is required in some situations. The method used will depend on the type of backfill material, level of compaction required, and moisture levels. The subsequent paragraphs provide general guidance on typical types of compaction equipment and the soils for which they are most appropriate. Equipment of any type should never be used directly on the pipe. Care should also be taken to avoid misaligning the pipe.

## Tampers

The haunching layer may require a small tamping mechanism to obtain the specified compaction in a confined area. A handheld pole or two-by-four are typically used. Tampers should be lightweight with a face limited to an area no larger than 6-inch by 6-inch (150 by 150 mm).

## Rammers

Rammers use an impact action to force out air and water from between soil particles to compact the fill. Rammers works well on cohesive or high-clay content soils. Water content has a considerable affect on the degree of compaction and may require monitoring. Rammers should not be used directly on the pipe.

## Static Compactors

Compaction with static compactors is caused by a combination of the weight and rolling motion of the equipment. Static compactors are most effective when used on non-cohesive backfill. Other methods of compaction should be used near the pipe.

## Vibrating Compactors

Vibrating compactors “shake” the soil particles into a more dense arrangement and work best with non-cohesive aggregates with very little fines. They may be used close to the pipe depending on the size and weight of the machine. Care should be taken not to directly impact the pipe with a great deal of force.

# Trench Boxes

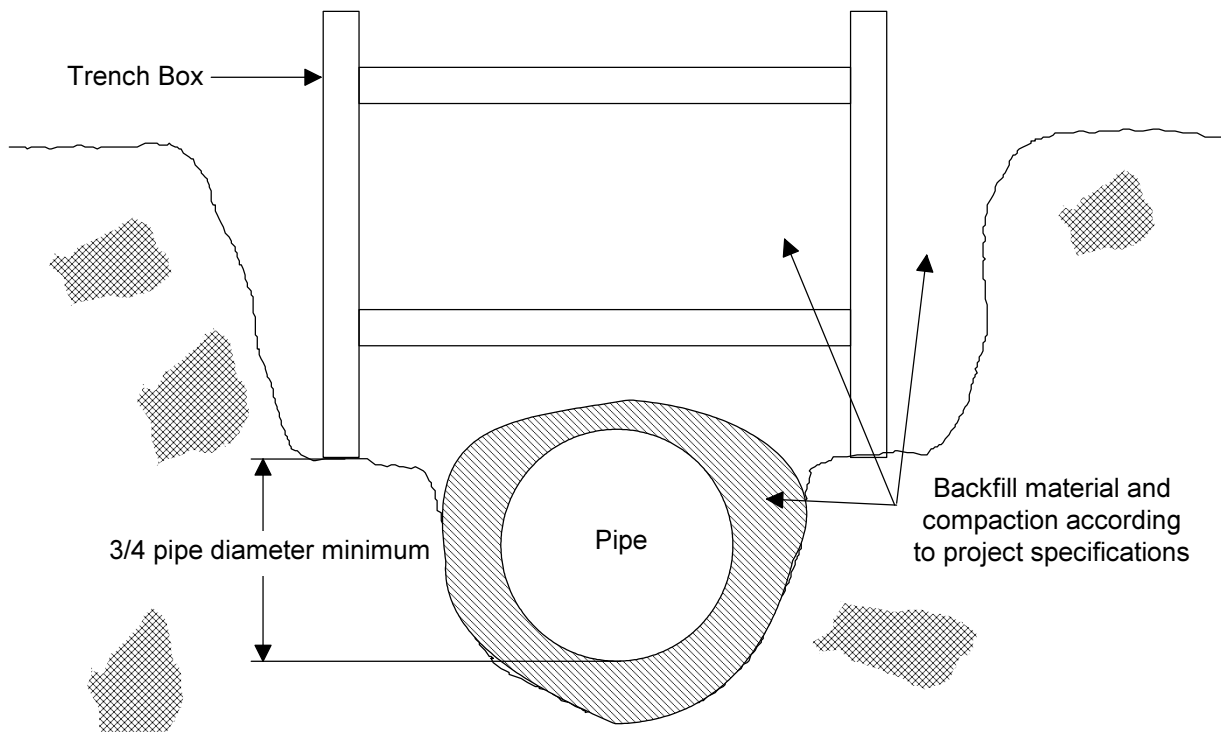
One of the primary safety concerns during pipe installation is the trench itself. Trench walls should be sloped if there is space available. If sloping is not possible, trench boxes should be used to provide a safe work area.

It is important to use trench boxes correctly. Improper use can disturb the backfill and the pipe joints. Please use the following information to prevent problems with the pipe while using a trench box. This information is not to compromise any safety or installation requirements furnished in the project specifications.

## Subtrench Installations

The most effective way to avoid causing problems with the pipe and backfill while using a trench box is to place a “sub-trench” in the bottom of the trench. The subtrench should be located above the bedding a minimum of  $\frac{3}{4}$  the diameter of the pipe. This allows the trench box to be pulled along the top edge of the subtrench without disrupting the pipe or backfill. The subtrench should be backfilled in accordance to the design specifications. Figure 6 shows the proper use of a trench box in subtrench installation.

**Figure 7: Proper Use of Trench Box in Subtrench Installation**





## Standard Trench Installations

In installations where a subtrench is not used, care must be taken while using the trench box. The trench box should only be pulled along if it does not damage the pipe, joints, or disturb the backfill. Should any disruption occur, the trench box should be lifted vertically and then lowered into its new position. Using this method the backfill material can flow out of the bottom of the box around the pipe, keeping backfill disturbance to a minimum.

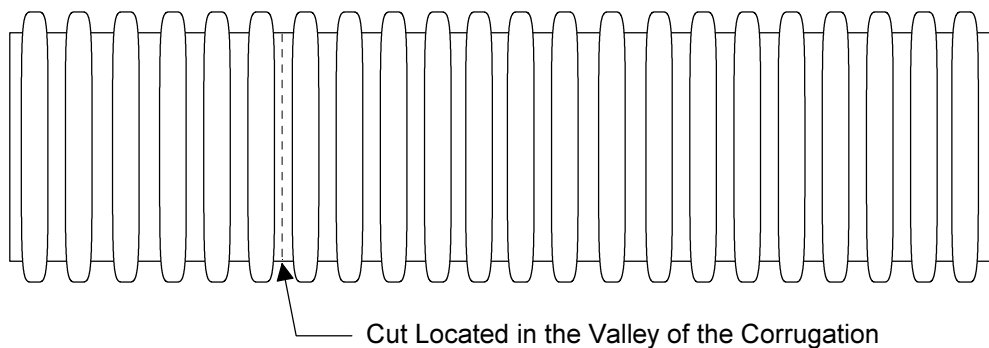
Another method of using a trench box without a subtrench is to place a well-graded granular backfill material two diameters on either side of the pipe and compact it to a minimum of 90% standard Proctor density (see Table 3) before moving the box. Then fill the area between the pipe/backfill structure and the trench wall with a granular material. This method is usually less desirable due to the increased cost in material and excavation.

# Job Site Alterations

## On-Site Pipe Modification

Careful planning can reduce the amount of modifications on a job. In virtually all installations, a number of pipe lengths will need to be adapted to meet job requirements. Polyethylene pipe's lightweight plastic nature makes it very easy to cut with a reciprocating saw, hand saw or similar equipment, while retaining its strength and structural integrity. All cuts should be made in the valley of the corrugation. The cut should be as straight as possible and free from burs. Figure 7 shows the correct placement of a cut.

**Figure 8: Correct Placement of an On-Site Cut**



# Joints and Connections

## Pipe Joints

Joints serve several purposes in a pipe system. Their main purpose is to hold lengths of pipe together. They also maintain alignment between pipe ends and help prevent damage should the pipe settle or shift. Joints also help prevent material from moving in or out of the pipe system depending on the application. Joints that are well designed compliment a quality pipe system.

There are three basic categories in which to classify joints: soil-tight, silt-tight, and watertight. Local codes and regulations or job specifications will usually determine what type of joint is used. Soil-tight is defined as preventing larger soil or backfill material from entering a pipe system. AASHTO Section 26.4.2(e) sets the criteria for soil-tight joints. In general most joints are soil-tight with the use of any type of connector. Silt-tight joints require the prevention of small soil or silt from entering a pipe system. These joints usually work with the use of a gasket. Silt-tight joints considerably reduce the leakage of water compared to a soil-tight joint, but are not watertight. Watertight joints prevent the leakage of water. Contact Haviland Drainage Products for more details on watertight joints.

## Pipe Fittings

Fittings are used to adapt pipe to different sizes, directions, and other connections. This makes accommodating changes, planned or unplanned, easy. Haviland Drainage Products manufactures many standard fittings, as well as custom made fittings for special applications. Adapters, reducers, tees, wyes, and elbows of various angles are a few of the standard fittings available from Haviland Drainage Products Co. Many fittings are available with bell couplers on each end, making connections more convenient and the purchase of separate connectors unnecessary. For more details regarding fitting types, dimensions, and other fitting information contact Haviland Drainage Products Co.

## Joining with Manholes, Catch Basins, and Other Types of Pipe

Drainage systems almost always require the changing of pipe sizes, direction, or grade, or connecting to pipe of different materials. These transitions are usually limited by the joint quality required. Many changes and connections can be easily achieved with the use of specially designed fittings and adapters sold by Haviland Drainage Products Co. A common method of joining pipe of different material and sizes is the use of a concrete collar. This collar is formed by butting the pipe ends together and wrapping the junction with a geotextile and then pouring concrete that covers both ends of the pipe. Many agencies, however, require the use of manholes or catch basins at all changes in pipe material or sizes.

Manholes and catch basins allow a point for changes in pipe grade, direction, and size. They also provide for system access and allow a place for storm runoff to enter. Manholes and catch basins

connect with pipe in many ways. The most common way is to grout the pipe into the concrete manhole or basin opening. The grout should be pressed between the corrugated pipe and the manhole opening. Due to the corrugated exterior this will provide a watertight connection. Flexible watertight connections, or “manhole boots”, are also commonly used to provide a watertight connection.

Haviland Drainage Products Co. Smooth Flow pipe is sometimes installed vertically for use as a manhole, catch basin, or similar application. One advantage with polyethylene pipe manholes and catch basins is the ability to be tailored to adapt directly to polyethylene pipe without the use of other connectors. Pipe installed vertically behaves differently than horizontally installed pipe because the interaction between the pipe and the soil is different. In a vertical installation soil locks into the corrugations, causing the pipe to move along with soil compaction. This may cause a rippling of the inner liner, but unless severe, will not affect the performance of the system.

The installation requirements for vertical installations are very important. The backfill material and compaction level will determine the performance of the finished installation. In all applications the backfill should extend a minimum of one foot around the outside of the pipe. The backfill material and compaction levels are identical to those for horizontal installations. Refer to Table 3 for these requirements. The maximum height of any vertical installation should be eight feet. If traffic, cast iron frames, or any loads will be placed on the pipe, a concrete collar or similar structure must be constructed to transfer the weight of the load into the backfill material. No loads should be placed on vertically installed pipe.

# Summary

Corrugated polyethylene pipe is an economical quality choice for pipe systems. It can be easily handled with manual labor or equipment and straps when necessary. Pipe should be stored in a flat area, in a manner which prevents damage to the pipe or accessories.

Trenches should be constructed in the most convenient way possible while conforming to all specifications. They should be free of water or any materials that will prevent proper pipe alignment. A firm foundation should be established in the trench bottom.

The backfill envelope should be constructed in layers on either side of the pipe in a way that does not disrupt the pipe alignment. Backfill material should be of the correct type and compacted to the correct degree. The structural backfill should extend at least 6" (0.15 m) above the crown of the pipe. The minimal amount of cover allowed should be at least 1' (0.3 m). Any equipment used in compaction should not come directly in contact with the pipe.

Trench boxes can be used to improve worker's safety. The best method of use is pulling the trench box along a sub trench. If this method is not used, it is important that the trench box does not cause problems for the pipe system.

Modifications to pipe can be achieved easily with the use of standard tools. The cut should always be in the valley of the corrugation and should be clean and square. Joints and connections should be of the correct quality to meet job specifications. Proper fittings and procedures should be followed to obtain optimum performance.

Haviland Drainage Products Co. hopes this manual will be helpful to you as you install your quality Haviland pipe. The specifications outlined in this guide are not meant to replace any job specifications; however, all job specifications should meet the minimum requirements set forth in this guide. Should any questions arise or special situations occur that are not mentioned in the text, please contact Haviland Drainage Products Co.