

# Contractor's Corner: Let's Talk Risers

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One of our frequently asked questions is "How deep can I bury PVC pipe?" A similar question is "How shallow can I bury PVC pipe?" We also receive a great many calls dealing with the external load design of the sewer main. Comparatively speaking, we receive far fewer calls asking about risers and service connections. Structurally speaking, the design of deep riser connections can be a very challenging engineering problem, requiring the particular attention of the design engineer, and deserving of guidance to the contractor that goes beyond just making sure the house lateral at elevation X flows downhill to the sewer main connection at elevation Y.

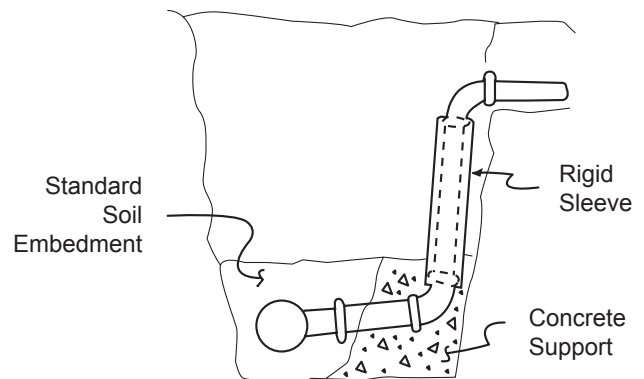
This article offers the design engineer and the contractor a few general guidelines and follows the "Keep It Simple" principle. For more specifics, you are invited to refer to Uni-Bell's Technical Bulletin, "Installation Guide for Risers," or Chapter 10, "Construction," of the Handbook of PVC Pipe: Design and Construction. The Technical Bulletin is available for download from the "Literature and Software" section of our website, [www.uni-bell.org](http://www.uni-bell.org).

## MINIMIZE SOIL SETTLEMENT AND MOVEMENT

Soil is definitely not your most predictable structural material, but it is a key component in the structural system that is being installed. The following suggestions will help manage soil behavior and accommodate soil movement. Riser problems can often be traced back to the soil "misbehaving". To make this part of the system "behave" better:

- DO firmly support the horizontal portion of the service connection. How? When the native material is stable, lay the service on undisturbed native material.

- DO NOT drive over the top of the riser with heavy construction equipment.
- DO compact the embedment material in lifts to provide a proper bridge between the undisturbed native material and the riser. As you know, compaction is the time honored means of making soils behave better.
- DO compact, in lifts, the backfill material around the riser. This will reduce settlement and drag down forces.
- DO hand place a layer of material over the top of the service to protect it during the final backfill operation. As with the sewer mains, risers need initial backfill, too.
- DO consider other options like concrete encasement or cement stabilization if firm support can not be achieved through compaction or if the site conditions make it impractical to compact the embedment material in lifts. Figure 1 shows an example.
- DO consider increasing the riser system's resistance to soil movement by employing solvent welded connections for the riser lateral rather than gasketed connections if firm support can not be achieved through compaction.



Rigid Sleeve  
(Concrete Must Support Sleeve)

Figure 1: Concrete transfers the loads from the rigid sleeve into the native soil

# PVC PIPE *news*

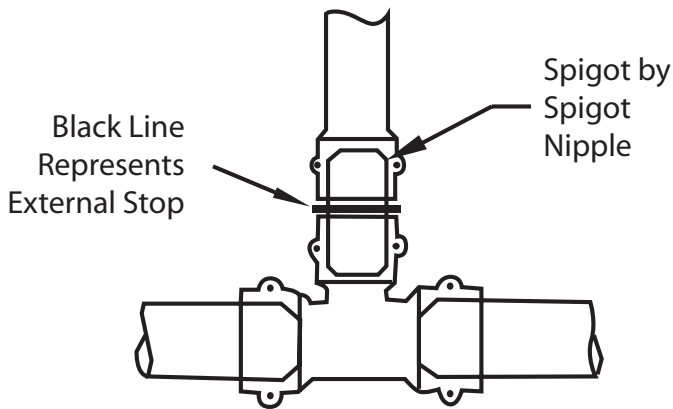


Figure 2: Sketch of a spigot-by-spigot nipple

## CONSIDER SETTLEMENT

The previous section used the word minimize settlement, not eliminate. One is possible; the other is not. So, make allowances for the inevitable settlement that will occur.

- DO consider using spigot-by-spigot nipples rather than the standard bell-and-spigot connections for the steeper portions of the riser. The spigot-by-spigot nipples result in bell-to-bell contact and prevent over insertion of the spigot into the bell and prevent the point loads that can result from an over-inserted spigot. A sketch of a spigot-by-spigot nipple is shown in Figure 2.
- DO consider using a deep-socketed fitting to give the spigot of the riser pipe plenty of travel room before it makes contact with the bell of the fitting if the riser is vertical along the trench wall. Extra travel room is also available with standard depth fittings when the insertion depth recommendations of the fittings manufacturer are followed. (See Figure 3.)
- DO consider a fitting that is more accommodating of angular deflection (rotation) when the riser is at an angle instead of vertical. Settlement may torque the upper and lower fittings.

## GOOD CONSTRUCTION PRACTICES

Your new crew members may not be aware of all of the following, common sense, practices:

- DO field cut pipe clean and square. If unexpected movement in the riser system does occur (remember how unpredictable soil can be) and results in an over-inserted spigot, the bell of the fitting can take a much greater load when the over-inserted spigot is square and cleanly cut.

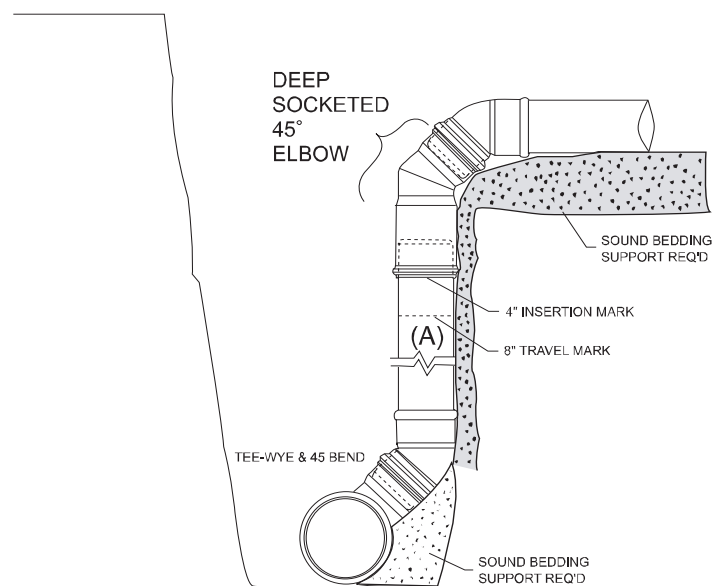
Nominal Diameter (Inches)	Actual Outside Diameter (Inches)		
	ASTM D3034	ASTM D1785 & ASTM D2241	AWWA C900
4	4.215	4.500	4.800
6	6.275	6.625	6.900
8	8.400	8.625	9.050
10	10.500	10.750	11.100
12	12.500	12.750	13.200
15	15.300	N/A	N/A

Table 1: Outside Diameters for Various PVC Pipe Standards

An uneven cut results in point loading of the bell. A square cut engages the entire circumference of the bell.

- DO keep riser pipe sections between fittings in straight alignment. If the pipe is excessively bent (usually by using the fitting as the fulcrum), unnecessary - and possibly damaging - stresses are created. Use fittings - not bending - to achieve changes in direction.
- DO be aware that not all pipe and fitting standards have the same diameter regimen. In other words, a nominal 4" ASTM D3034 product does not have the same outside diameter as a nominal 4" ASTM D2241 product. Both may be SDR 26, but the D3034 has an actual outside diameter of 4.215-inches, while the D2241 product has a 4.500-inch outside diameter. So make sure the diameter regimens for the pipe and fittings are compatible. ASTM D3034 has sewer pipe diameters. ASTM D2241 and D1785 have a IPS diameters. AWWA C900 has cast iron outside diameters. Table 1 has the actual outside diameters of PVC pipe standards discussed.
- DO realize that the bell depth of the fitting most likely will be different than the bell depth of the pipe. As a result, follow the fittings manufacturer's recommendations for proper insertion depth. The pipe manufacturer's recommended insertion depth assumes that the joint being made is a pipe-spigot-to-pipe-bell joint.
- DO NOT install the branch of a wye vertically.

This article provides general guidelines and IS NOT a substitute for the design engineer's thoughtful consideration of the particular requirements of the project. The one-size-fits-all approach is the beginning of a vicious cycle. If the design option selected will accommodate the worst-case scenario for all possible contingencies, the result is an exorbitantly expensive riser system that nobody wants to pay for. If the design option selected only accommodates the most likely scenario, it is an efficient design for most cases, but may result in an expensive emergency repair in others. These guidelines are intended to assist the contractors and design engineers in addressing the issue of deep service connections.



THE DEEP SOCKET ELBOW SHOULD BE INSERTED 4" ONTO THE RISER PIPE (A). TWO LINES SHOULD BE MARKED ON RISER PIPE (A). MARK AT 4" FOR INSERTION AND AT 8" TO MEASURE ANY TRAVEL THAT MAY OCCUR.

Figure 3: Deep-socketed fitting accommodates vertical soil settlement