

Technical Note

TN 2.11 Duraslot® and Duraslot® XL Burial Depth and Backfill Conditions

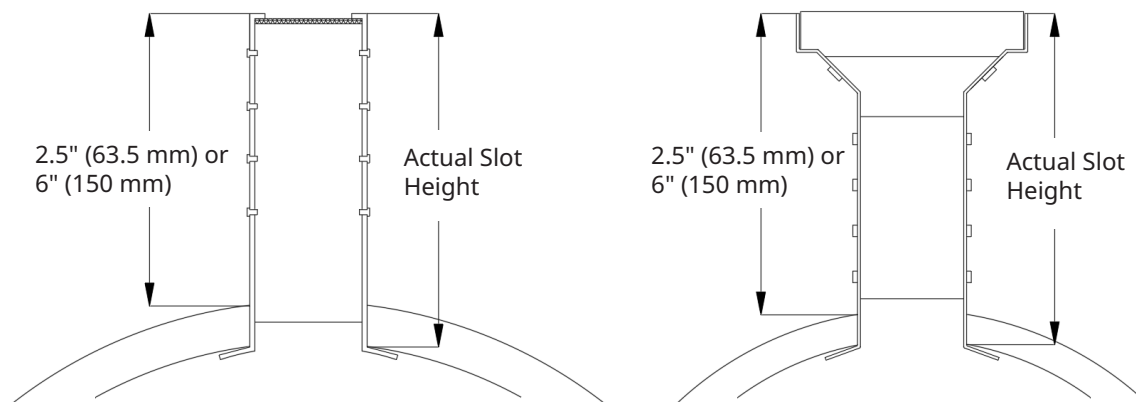
Overview

The purpose of this technical memo is to provide general design information about Advanced Drainage System's (ADS) Duraslot slotted drain's and Duraslot XL trench drain's slot height, burial depth requirements, and backfill conditions. The backfill envelope around these linear drains is the primary structural system to resist surface loads. Requirements for the backfill envelope and installation depth varies depending on loads anticipated in the application. This tech note provides basic configuration recommendations, including burial depth limits for three typical application classes: light duty, roadway, and special design loading projects. Ultimately, it is the responsibility of the design engineer to specify the backfill and other installation details which meet the project's requirements.

Burial Depth and Slot Height Limits

The nominal slot height for Duraslot and Duraslot XL is the distance from the top of grate to the outside crown of the pipe. ADS recommends a minimum slot height of 2.5" (64 mm) for light duty applications and 6" (153 mm) for installations subject to meet HS20 or HS25 loads per the American Association of State Highway and Transportation Officials (AASHTO) specification M306. There is also the actual slot height which is the measurement taken from the top of grate to the inside crown of the pipe and accounts for the approximate height of the pipe corrugation. Actual slot height should be used when calculating invert elevations (see Table 1 and Table 2 below). The difference between the nominal and actual slot height is depicted in Figure 1.

Figure 1: Actual Slot Height



In addition to the burial depth, Duraslot slotted drain should be recessed into the finished pavement to provide protection for the slot and support proper drainage. The recess should be 0.25" (7 mm) for light duty applications, 0.25" - 0.5" (7 - 13 mm) for HS20 and HS25 loads, and 0.5" (13 mm) for anything above HS25. Similarly, Duraslot XL trench drains should be recessed 0.125" (3 mm) into the pavement in all applications to ensure proper drainage.

Table 1 provides the minimum recommended invert depth for these linear drains, given the pipe size and application. Invert depths (denoted as “H” in Figures 2 – 5) are calculated by adding the inside diameter of the pipe, approximate corrugation thickness and minimum recommended slot height from the grate to the outside crown of pipe. Note the required slot recess into the finished pavement is not accounted for.

Table 1: Recommended Minimum Invert Depths below Finish Grade by Pipe Size and Loading Condition

| Inside Diameter of Pipe, in. (mm) | | 4* (100) | 6 (150) | 8 (200) | 10 (250) | 12 (300) | 15 (375) | 18 (450) | 24 (600) | 30 (750) | 36 (900) |
|-----------------------------------|-----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|----------------|----------------|-----------------|
| Minimum Invert Depth, in. (mm) | <i>Light Duty Projects:</i> | 6.75 (171) | 9.00 (229) | 11.00 (279) | 13.00 (330) | 15.50 (394) | 18.75 (476) | 22.00 (559) | 28.75 (730) | 35.00 (889) | 41.25 (1048) |
| | <i>Roadway Projects:</i> | 10.25 (260) | 12.50 (318) | 14.50 (368) | 16.50 (419) | 19.00 (483) | 22.00 (559) | 25.500 (635) | 31.25 (794) | 38.25 (972) | 44.25 (1024) |

* Only available for Duraslot slotted drains.

Both these products can also be made to order with a custom (sometimes called variable) slot height and channel pipe slope, which provides a high level of design flexibility for a site. Table 2 provides the maximum invert depth by pipe diameter. Invert depths are calculated by adding the inside diameter of the pipe and maximum actual slot height. Note the required slot recess into the finished pavement is not accounted for.

Table 2: Maximum Allowable Invert Depth below Finish Grade by Pipe Size

| Inside Diameter of Pipe, in. (mm) | | 4* (100) | 6 (150) | 8 (200) | 10 (250) | 12 (300) | 15 (375) | 18 (450) | 24 (600) | 30 (750) | 36 (900) |
|-----------------------------------|-------------------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Minimum Invert Depth, in. (mm) | <i>Pedestrian Only:</i> | 28.00 (711) | 30.00 (762) | 32.00 (813) | 34.00 (864) | 48.00 (1219) | 51.00 (1295) | 54.00 (1372) | 60.00 (1524) | 66.00 (1676) | 72.00 (1829) |

* Only available for Duraslot slotted drains.

Installation Considerations

Installation conditions of Duraslot slotted drains and Duraslot XL trench drains, especially the backfill envelope, drive the structural performance and longevity of the product. Thus, minimum installation requirements will vary based on the application and project conditions. In particular, the backfill conditions and surface treatment should be specified to resist the project design loads. This section of the technical note provides general installation recommendations for three typical application classes: light duty, roadway, and special design loading projects. Please note that these recommendations are intended as guidance only, and that it is the responsibility of the design engineer to develop installation details appropriate to the project conditions.

Light Duty Installation

For linear drain products in light duty applications (i.e., pedestrian only traffic), properly compacted soil or gravel may be used to backfill most of the trench. ADS recommends a slot height no less than 2.5 inches (64 mm) from the top of grate to crown of pipe and invert depth (H) per pipe size can be referred to in Tables 1 – 2. The surface conditions surrounding the product should be paved as determined by the design engineer to meet the project requirements. It is important for the slot to be recessed at least 0.25 inches (7 mm) below the top of the pavement overlay for Duraslot, and 0.125 inches (3 mm) for Duraslot XL to ensure proper drainage and promote system longevity. In addition, it is important that the lip under the Duraslot XL grate frame has proper support to handle any surface loading. Finally, please note that the coupler connections are only soiltight. If needed, neoprene sheets or mastic fillers provided by others can be used to achieve watertight joints. Figures 2 – 3 shows example profile views of what a final backfill design may look like. These details are also available in pdf and dwg formats.

Figure 2: Example Installation Detail for Duraslot in a Pedestrian Only Application

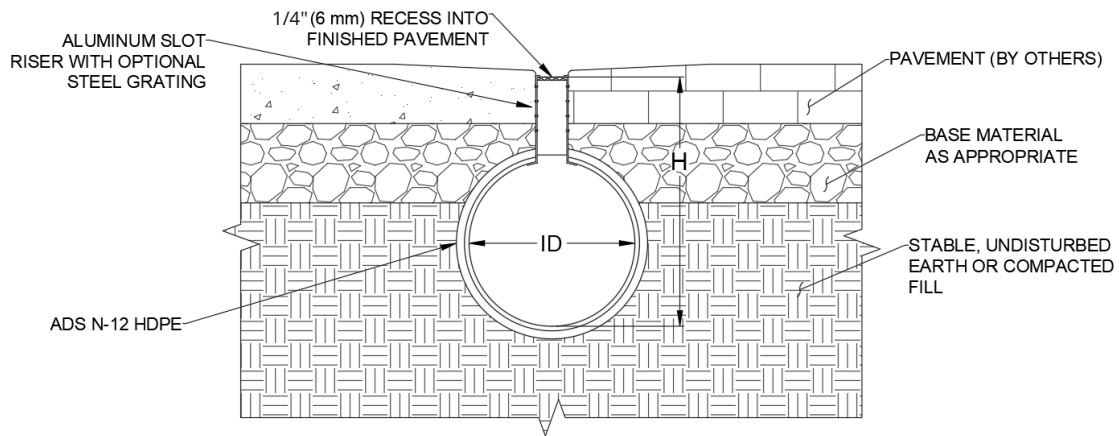
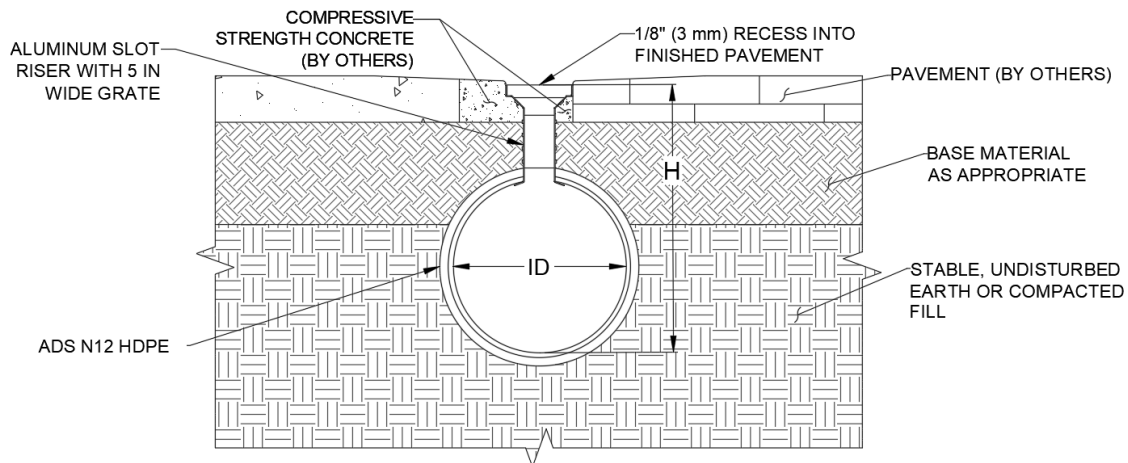


Figure 3: Example Install Detail for Duraslot XL in a Pedestrian Only Application



Roadway Installation

For Duraslot and Duraslot XL applications that involve AASHTO HS20 or HS25 traffic design, ADS recommends a slot height no less than 6" (153 mm) from the top of grate to the crown of pipe and invert depth (H) per pipe size can be found in Tables 1 - 2. The trench should be excavated so that there is a minimum clearance of 6" (153 mm) on either side of the pipe once lowered into the trench. Bedding material should be added to the bottom of the trench as necessary to create a stable base for installation. The rest of the trench, from pipe invert to finished grade, should be backfilled in concrete. The concrete material requirements should be specified as required for the application by the designer. As a point of reference, testing conducted by ADS indicates a 4000-psi concrete mix is sufficient for loading up to HS25. An expansion joint is also recommended between the concrete backfill and the abutting pavement to help against ground heave. In addition, Duraslot systems should be recessed 0.25 - 0.5" (7 - 13 mm) below the top of the pavement overlay and 0.125" (3 mm) for Duraslot XL to optimize drainage performance and maximize service life. Figure 4 - 5 shows an example profile view of what a final backfill design may look like. These details are also available in pdf and dwg formats.

Figure 4: Example Installation Detail for Duraslot in a Roadway Application

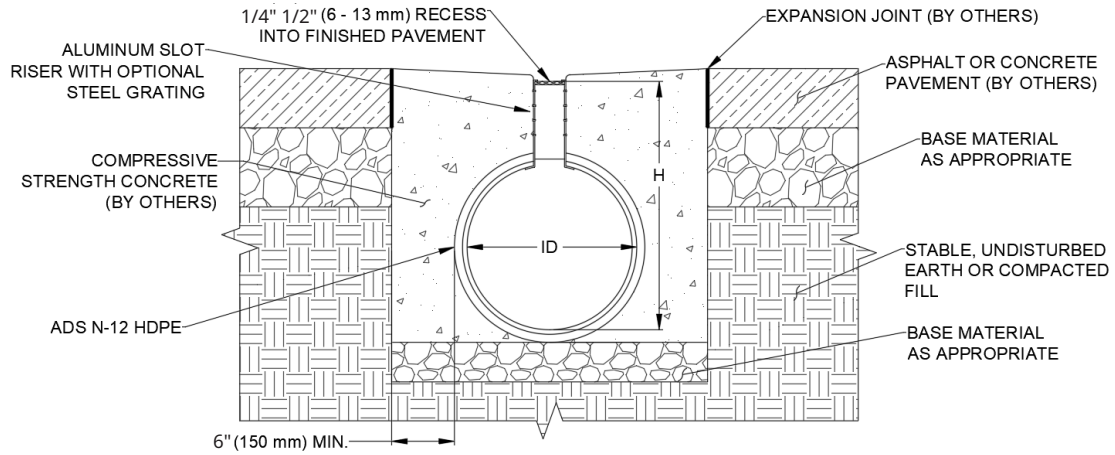
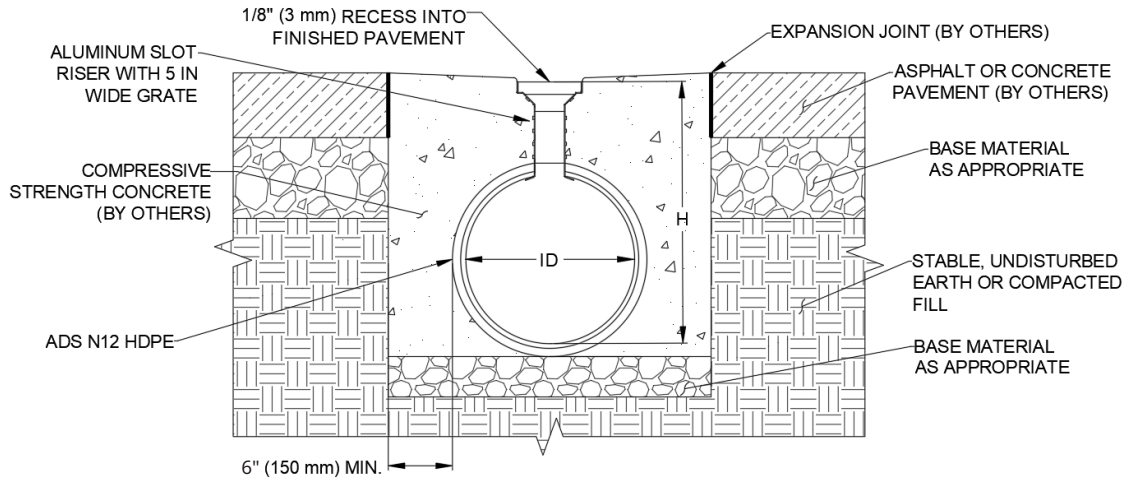


Figure 5: Example Installation Detail for Duraslot XL in a Roadway Application



Special Design Loading Installations

Duraslot slotted drain is recommended over Duraslot XL trench drains for installations subject to loading above AASHTO HS25 as the slotted drain sheds load into the surrounding backfill more efficiently. A design engineer should prepare a site-specific design and consider the following factors for their structural analysis. All loading is eventually transferred into the surrounding soil, so soil classification, soil bearing capacity and soil settlement need to be considered. There is also vehicle weight, vehicle speed, tire size, and tire pressure, which contribute to the live load. Lastly, there is the system itself, including the backfill envelope, the presence and quantity of steel rebar, product pipe diameter, slot height, and surface grating condition. The backfill envelope is the most critical component as most loading is transferred through this medium. A designer should consider the entire length of the system as a continuous concrete beam. The section view also needs to be considered as the concrete over the pipe will act as a cantilever when force is applied, just like a retaining wall.

Much like in HS25 designs, the slot should be recessed 0.5" (13 mm) below the top of the finished pavement. This will maintain effective drainage and provide added durability to the system. The trench should be excavated to have at least 6" (150 mm) of clearance on either side of the pipe, have a compacted or remediated subgrade to provide a stable base, and the backfill from pipe invert to ground surface should be concrete. An expansion joint is also recommended between the concrete backfill and the abutting pavement to help against ground heave. ADS may be contacted to discuss additional guidance for designing these site.

