

TECHNICAL NOTE

TECHNICAL INFORMATION FROM THE CONCRETE PIPE ASSOCIATION OF AUSTRALASIA

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INFLUENCE OF BEDDING SUPPORT ON PIPE CLASS

Concrete pipes are rigid pipeline systems that do not deform. They utilise their inherent strength to withstand loads and stresses. Typically a high percentage of the design strength of a pipeline is built into the concrete pipe itself at the manufacturing stage. The remainder of the design strength is achieved through additional structural support from the soil underneath and around the pipe. This is known as the bedding support.

Bedding support provided to a buried concrete pipe acts as both the foundation but can also significantly increase the load carrying capacity of the pipeline. The support types allowed for typical trench and embankment installation conditions, contained in AS/NZS 3725 – 2007 "Design for installation of buried concrete pipe", include:

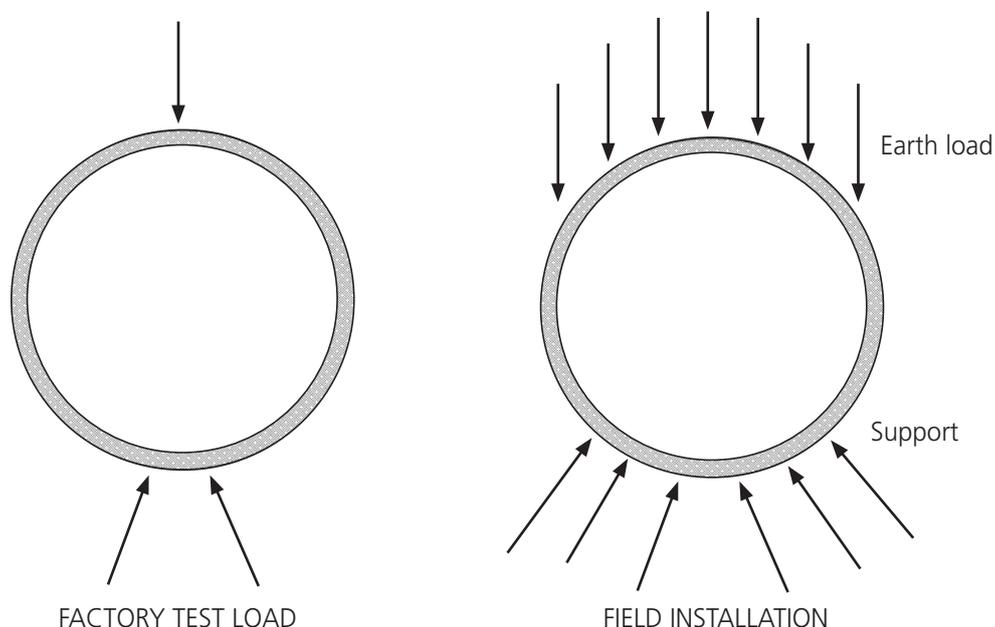
Type U Support – Uncontrolled. In this type of support pipes are basically placed directly on the excavated foundation and then backfilled with no specific control of compaction. If there is a rock foundation then there is a minimum requirement for compacted material to be placed in the bed zone. This type of support is only recommended for minor pipelines where there is shallow depths of fill and little or no live loads.

Type H1 & H2 Supports – Haunch Support. In these types of supports compacted granular material is placed in the bed and haunch zones to varying heights and compaction standards. The H2 support is recommended for most drainage pipe installations not under roadways.

Type HS1, HS2 & HS3 Supports – Haunch and Side Support. In these types of supports compacted granular fill is placed in the side zone in addition to the material placed in the haunch and side zones of the type H supports. The extent and compaction requirements of the different support types vary. The HS2 support type is recommended for most installations under a roadway and the HS3 support is recommended for high embankment fill situations.

The compacted granular support limits the load effects (bending moments and shear forces) acting in the wall of the concrete pipe for a given application of external force. Associated with each support type is a numerical measure of this reduction, or increase in load carrying capacity of a given pipe installation, which is known as the **bedding factor**.

The bedding factor is an approximation of the ratio of the bending moment in the wall of the pipe which will be developed in the factory proof load test and the bending moment which will result in the field installation for a given value of external load. A schematic diagram of the two different loadings is shown below. For more information on the factory test load refer to AS/NZS 4058:2007 "Precast Concrete Pipe" or the CCAA Technical Note "Acceptance Testing of Concrete Pipe".



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The bedding factors associated with each support type are shown in the table below. Reduced bedding factors can be selected when the grading limits required for the material in the haunch zones cannot be met.

Support Type	Maximum Bedding Factor	Reduced Bedding Factor
U	1.0	1.0
H1	1.5	1.3
H2	2.0	1.7
HS1	2.0	1.7
HS2	2.5	2.1
HS3	4.0	3.4

NOTES:

- 1. The bedding factors in the table above apply only to dead load.** A bedding factor of 1.5 applies to all live/superimposed loads, regardless of installation type. In shallow installations this results in an overall bedding factor closer to 1.5 regardless of the installation type.
- 2. The soil structure interaction reduces the structural impact of any load applied (except for Support Type U) so that a pipe of given diameter and Class can carry more applied load with improved bedding installation (e.g. An H2 support with a bedding factor of 2 reduces the “structural impact” on pipe by 50%, and so can carry twice the proof rated load).**

In some instances it may be of benefit to consider increasing the bedding support (i.e. increasing the bedding factor) to reduce the class of pipe, or vice versa, depending on the project, for economical and efficiency reasons.

When designing for the selection of the class of pipe, the installation support to be used must be chosen, along with the appropriate bedding factor. It is then important for the contractor to (a) use the appropriate fill material during the installation and (b) achieve the nominated compaction limits, which will allow for the designed bedding factor to be achieved in practice. Any compromise in this may reduce the bedding factor and increase the stress placed on the pipe. This is most important for HS3 applications and large diameter pipes (refer to Notes 2 and 3 of Table 5 in AS/NZS 3725 – 2007 “Design for installation of buried concrete pipes”).

NOTE: For small diameter pipes (i.e. 450mm diameter and below) it is particularly important to provide uniform bedding support to avoid “beam” failures. Refer to the CPAA Technical Note “Installing small diameter pipe under road” for more specific details.

As the inherent strength of the concrete allows the pipe to take a significant part of the load, the actual size of the associated bedding supports required to complete the design is small. When compared to other pipe materials this means lower fill material costs, reduced installation time, less environmental impact and less risk on the overall performance of the pipeline. However, care must be taken at all times to ensure that the bedding support matches the design requirements.

