TECHNICAL NOTE

TECHNICAL INFORMATION FROM THE CONCRETE PIPE ASSOCIATION OF AUSTRALASIA

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DESIGNING RIGID & FLEXIBLE PIPELINE SYSTEMS

In Australia and New Zealand the requirements for the design and installation of pipelines is specified in a number of Australian/New Zealand Standards that relate to the specific pipe type and material to be used. The pipe types predominantly used in Australia and New Zealand are rigid (i.e. steel reinforced concrete pipe) and flexible (i.e. plastic and metallic).

The structural performance and in-service life of pipelines is dependent on the specified design and installation requirements, appropriate to the selected pipe material and the available site conditions being achieved.

The design requirements for each pipe alternative vary markedly with properties such as the rigidity or stiffness of the pipe material selected, its need or ability to react with the embedment materials, and the shape and dimensions of the embedment. The 5 points below are the main design differences that should be considered when comparing rigid and flexible pipe.

1. Materials selection

- **Concrete is rigid, plastic is flexible** – Rigid pipe has sufficient strength to carry working loads on its own, flexible pipe deflects when under load and requires the interaction of the soil to have enough strength not to collapse.
- **Different materials need different Standards** – Concrete pipe has one product specific material Standard, AS/NZS 4058 "Precast concrete pipe (pressure and non-pressure)". AS/NZS 3725 "Design for installation of buried concrete pipe"is then used to determine the expected loads on the pipe.

  The various plastic pipe types, PVC, PE, GRP, all have a specific product Standard, whilst design is conducted in accordance with AS 2566.1 "Flexible plastic pipe – Design" and installation in accordance with AS 2566.2 "Flexible plastic pipe – Installation".
- **AS/NZS 4058 is the only pipe Standard that requires ALL product raw materials to comply with Australian and New Zealand Standards.** This is not the case for all flexible pipe raw materials. Refer to the relevant standards to understand what is required for each pipe material.

2. Product size and load class

- **There are big differences in size availability** – Concrete comes in 27 nominal sizes as per AS/NZS 4058, from 225mm to 4200mm diameter. Plastic is unregulated and the size depends on the supplier and type.
- **There is no comparison to load class** – Concrete load capability is high and increases with class and size. Plastic pipe's load carrying capability is dependent on the pipe stiffness and the soil interaction around it.

3. Structural design

- **The main load bearing section of rigid and flexible pipelines is very different** – For rigid concrete pipe it is the PIPE. For flexible plastic pipe it is the SOIL.
- **This means the design criteria is critical for flexible pipe** – Plastic has very low strength or stiffness, and as a result AS/NZS 2566.1 "Flexible plastic pipe – Design" requires the designer to calculate for the expected pipe deflection, stiffness and buckling, over its service life and determine what level of soil interaction is required to ensure it does not fail in the short or long term.

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