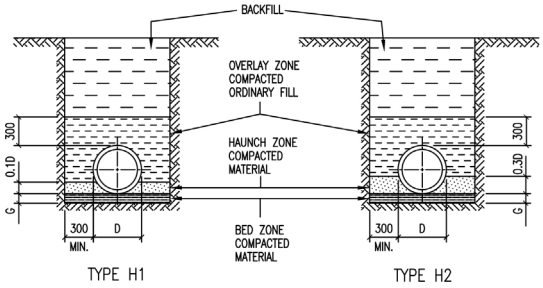
Guidance notes
Trench design and bedding

Fact sheet
May 2021

Background

Designing the pipe trench and the materials used are just as important as the actual pipe. The trench supports the pipe and its proper functioning.

Pipe trenches that are incorrectly designed and executed lead to under performance and early degradation of the pipe.
These pose safety concerns and increases both our carbon footprint and maintenance costs.



Types of pipe trenches

Conventional open cut and fill:

- Very labour intensive and causes a lot of public disruption
- Uses flexible and widely understood design principles for various loading and location scenarios including seismic resilience design
- Higher volume of spoil and bedding material used

Trenchless:

- Potential for economical construction with less disruption to the public
- Frac-out and environmental considerations
- Some methods, such as HDD (horizontal directional drilling) is more suited to steep pipe grades
- Structural design relies on the pipe material properties especially for seismic loading
- Specific grout design is required

Pre-formed trench:

- High cost, more materials are used in the process
- Can be shared by multiple services

Considerations in trench design

- Our 40:20:20 principles help drive decision making and identify efficiencies
- Geotechnical investigation is carried out along the route of the pipe and at the depth of the proposed invert level. Profiling is used to better understand the below surface soils
- Any subsurface changes in material and features (such as groundwater) should be understood to identify ground improvements or treatments that may be required
- Groundwater and subsurface flow paths could trigger consent limitations that will add to the trench design. These limitations could be: The redirection of subsurface water or the potential impact of causing subsidence or flooding elsewhere
- Groundwater can cause flotation and liquefaction in certain areas
- Changes in soil type can create shear zones where pipe displacement or stresses can occur
- Soil competency along with the type of soil can cause pipe bedding materials to migrate out of the trench putting stress on the pipe and leaving it inadequately supported
- Static and dynamic loading including any loads during construction
- Proposed depth and pipe material type

References

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- MS – Material supply standard
- DP-07 – Design for transmission water and wastewater pipeline systems
- 40:20:20 – Strategy to reduce carbon footprint, cost and improve health and wellbeing.

Other

- AS/NZS2566
- NICEE, 2007. Guidelines for Seismic Design of Buried Pipelines
- ALA, 2005 . Siesmic Guidelines for Water Pipelines
- New Zealand Geotechnical Society, 2017. New Zealand Ground Investigation Specification, Volumes 0, 1, 2 and 3
- Bower, J. C. Pipeline Structural Design for Trenchless Applications. Gold.

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Guidance notes *continued*
Trenchless design and bedding

Selecting bedding material

- Particle size and shape must be taken into consideration along with design performance e.g. seismic design may be large and light with low to no compaction ability
- Level of compaction required (location and performance based) e.g. self-compacting or machine compacted for traffic loads
- Pipe material type: for certain materials, mechanical damage may need to be considered and allow additional protection against course soils
- It's important to understand how the bedding material will react (and any mitigation measures) with the soil during transfer and how much support it can deliver. Over time, the support provided by flexible pipe material changes. Small fines dispersing into the surrounding soil can leave the pipe poorly supported.

Selecting backfill material

- Use selected/graded spoil from the excavation process
- Where the pipe is installed in the roading authority's corridor, ensure you comply with their standards/ procedures.

Overcoming certain ground conditions

- Soft soils: consider base strengthening and lining with geotextile
- Shallow cover: material selection is important along with load distribution techniques such as sacrificial covers
- Diversion around obstacles: identify the zone and provide clear space to allow for both the loading and distribution of the bedding material. This must also be considered for adjacent pipes and services
- Below ground to surface transitions: provide for anticipated movement, expansion and contraction
- Seismic mitigation can be a combination of material selection, designing fuse points and trenches that allow the pipe to move freely underground.

Typical solutions

Watercare drawing solutions show some typical options for rigid and flexible pipe material trench designs. These may be used or adapted where appropriate.

Useful links:

www.watercare.co.nz/Water-and-wastewater/Building-and-developing/Engineering-standards-framework

www.aucklanddesignmanual.co.nz/regulations/codes-of-practice

http://www.legislation.govt.nz/act/public/2009/0032/latest/DLM2044909.html

References

Other

- Opus International Consultants, Water NZ 2017. Underground Utilities – Siesmic assessment and design guidelines

Watercare solutions

- DW01 (distribution wastewater) – drawings WW2, WW3, WW16, WW27, WW28
- DW02 (distribution water) – drawing WS2
- DW10 (transmission water) – drawing 2001979.092
- DW08 (transmission wastewater) – drawing 2000244.021

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