AQA Guidance on Pipe Bedding Materials and Their Usage

Why this Guide was Created

The AQA is responding to a request for clearer information on pipe bedding materials.

Rigid vs Flexible Pipes

Buried pipes broadly fall into two categories: rigid and flexible. Rigid pipes (e.g. precast concrete) are pipes that have enough strength to carry the working load on their own. Flexible pipes (e.g. various plastics and metals) deflect enough so that the combined strength of the pipe and bedding support can support the working load.

Select Fill

Select fill is usually a maximum 20mm size and can be well-graded or single-sized. Some typical particle size distributions are shown in this guide.

Generally, rigid pipes only require select fill in the bedding and haunch zones, whereas flexible pipes require select fill all around the pipe (the embedment zone).

Compaction

Correct compaction is important for effective pipe bedding. Lack of compaction effort will leave a pipe unequally supported and could cause early failure.

Local Options

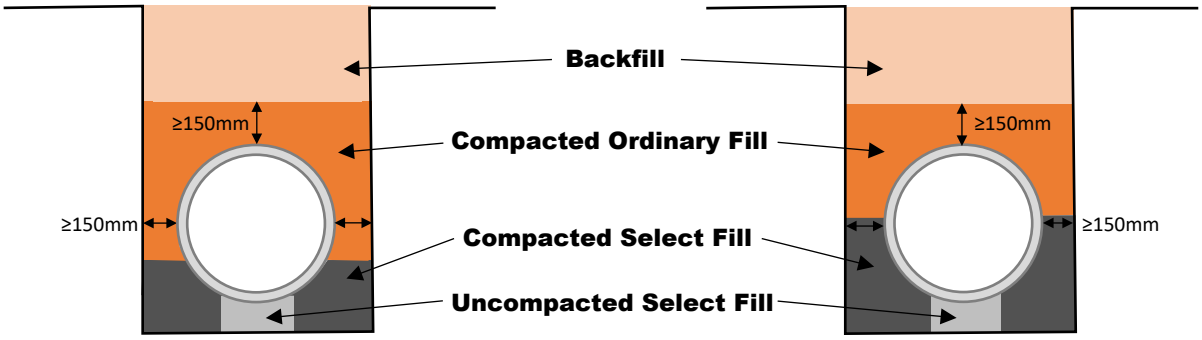
Although the below standards and tables are reasonable guidance on a national level, local authorities will have various modifications around these specifications. The reader is advised to check with their local authority for further guidance.

AS/NZS 3725:2007 – Installation of Rigid (Steel Reinforced Concrete) Pipes

Type U (Unbedded) support is where the rigid pipe is placed directly on the trench foundation.

Type H (Haunch) support includes select fill in a bedding layer under the pipe, and the haunch zones of the pipe. H2 is slightly deeper than H1.

Type HS (Haunch & Sides) support adds side support around the pipe, and there are extra compaction criteria. Side fill comes at least halfway up the side of the pipe.



H1 & H2 Bedding *HS1, HS2, HS3 Bedding*

The set grading for select fill is shown in the following table.

Sieve Size (mm)	Select Fill for Bed & Haunch Zones (NZS 3725 Table 6)	Select Fill for Side Zones (NZS 3725 Table 7)
75.0	100	100
19.0	100	-
9.50	-	50-100
2.36	50-100	30-100
0.600	20-90	15-50
0.300	10-60	-
0.150	0-25	-
0.075	0-10	0-25

Note (1): *Granular material that would break down when wetted, such as shale or gravely conglomerates shall not be used.*
Note (2): *A small section of fill underneath the centre of the pipe is* ***not*** *compacted. This is 1/3 of the pipe diameter.*
Note (3): *Do not use cohesive soils in the bed and haunch zones.*

Bedding Types from the Concrete Pipe Association of Australasia (CPAA)

The Concrete Pipe Association of Australasia (CPAA) recognised that select fill conforming to the gradings shown in tables 6 and 7 from AS/NZS 3725 (above) may not always be available and so they offer guidance on selecting alternate materials.

Materials shown in the following tables may be used so long as:

1. Minimum compaction levels listed can be achieved;
2. Methods to prevent soil fines migration shall be used in conditions where migration is likely;
3. Long thin particles are not used (increased risk of stress on the pipe); and
4. Recommended maximum particle sizes are enforced (to prevent concentrated point loading).

TABLE 1 FROM AS/NZS 3725: SOIL CLASSES AS DEFINED IN AS 1726

Abbreviation	Description
SC	Clayey sands with fines of low plasticity
SP	Poorly graded sands
SW	Well-graded sands
GC	Clayey gravels with fines of low plasticity
GW	Well-graded sand and gravel mixtures with little or no plastic fines
GP	Poorly graded sand and gravel mixtures with little or no plastic fines

MINIMUM COMPACTION REQUIREMENTS FOR VARIOUS BEDDING TYPES AND SELECT FILL SOIL CLASSES

Bedding Type	HS3		HS2		HS1		H2		H1	
Bedding Material	I_D	R_D	I_D	R_D	I_D	R_D	I_D	R_D	I_D	R_D
SW, SP, GW, GP	70	95	60	90	50	85	60	90	50	85
SC, GC	n/a	n/a	70	95	60	90	70	95	60	90

NOTES: 1. I_D refers to Density Index (%) and is for cohesionless materials (refer to Clause 8, AS/NZS 3725 for more information).
2. R_D refers to Dry Density Ratio (%) and is for cohesive materials (refer to Clause 8, AS/NZS 3725 for more information).

RECOMMENDED MAXIMUM PARTICLE SIZE (mm)

Pipe diameter	Bedding Zone	
DN	Bed and Haunch	Side
225- 1350	20	40
1500 - 2250	40	75
> 2250	65	75

See the whole document: *Selecting Materials for Bedding Steel Reinforced Concrete Pipe* (Concrete Pipe Association of Australasia):
https://www.cpaa.asn.au/images/publications/engineering_guidelines/Selected_Materials_Bedding_SRCP.pdf

AS/NZS 2566:1998 – Buried Flexible Pipelines

Many flexible pipe manufacturers have their own guides for pipe installation. Most refer to AS/NZS 2566 for the grading of the pipe bedding material. Around flexible pipes, this material is called Embedment Material. Embedment Materials Gradings in AS/NZS 2566 are shown in Tables G2 and G3.

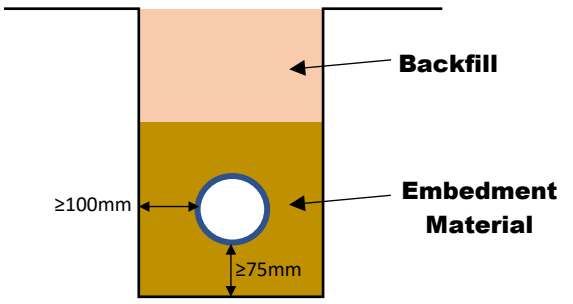
TABLE G2: PROCESSED AGGREGATES – ACCEPTABLE FOR EMBEDMENT MATERIALS

Sieve Size (mm)	Mass of sample passing (%)						
	Nominal size of graded aggregate (mm)		Nominal size of single-size aggregates (mm)				
	20	14	20	14	10	7	5
26.5	100	-	100	-	-	-	-
19.0	85-100	100	85-100	100	-	-	-
13.2	-	85-100	-	85-100	100	-	-
9.50	25-55	-	0-20	-	85-100	100	-
6.70	-	25-55	-	0-20	-	85-100	100
4.75	0-10	-	0-5	-	0-20	-	85-100
2.36	0-5	0-10	-	0-5	0-5	0-20	0-40
0.075	0-2	0-2	0-2	0-2	0-2	0-2	0-2

TABLE G3: OTHER MATERIALS – ACCEPTABLE FOR EMBEDMENT MATERIALS

Sieve Size (mm)	Mass of sample passing (%)			
	Crushed Rock Dust	Well graded crushed rock		Sand
		20mm	10mm	
26.5	-	100	-	-
19.0	-	85-100	-	-
13.2	-	-	100	-
9.50	100	60-80	90-100	-
6.70	85-100	55-72	-	-
4.75	-	42-62	60-80	100
2.36	0-20	30-48	40-65	90-100
1.18	-	22-36	25-50	85-100
0.600	-	16-28	16-38	70-100
0.300	-	10-20	9-30	50-100
0.150	-	6-15	5-24	0-40
0.075	0-2	4-12	2-20	0-5
Liquid Limit PI		25 4	25 6	

Note: *Tolerances on aggregates are generally ±10% for sieve sizes above 2.36mm (see AS 2758.1-1998 for details).*



Refer to AS/NZS 2566.1 Fig 3.1 for required embedment depths

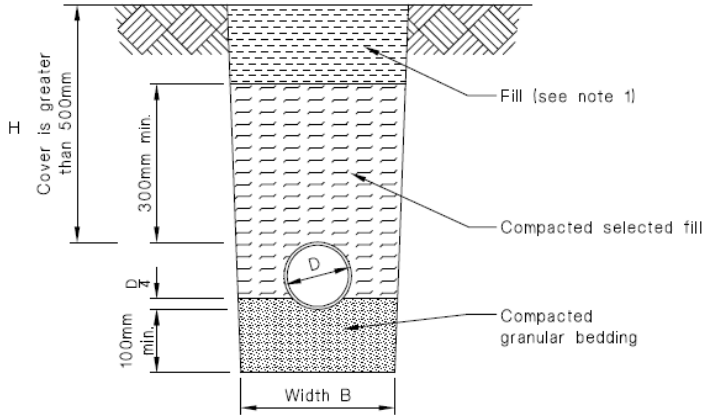
Flexible Pipe Bedding

(From Section 2.1.1) Fill materials, as shown in Figure 7, shall be:

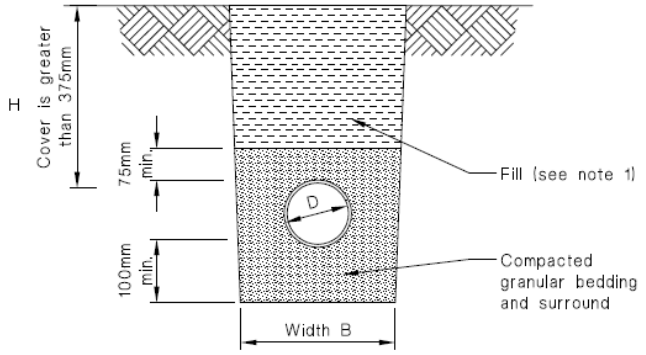
a) Bedding material of clean granular non-cohesive material with a maximum particle size of 20mm,
b) Selected fill of fine-grained soil or granular material that is free from topsoil and rubbish and has a maximum particle size of 20 mm, or
c) Ordinary fill of excavated material.

Note: *Fill shall always be compacted*

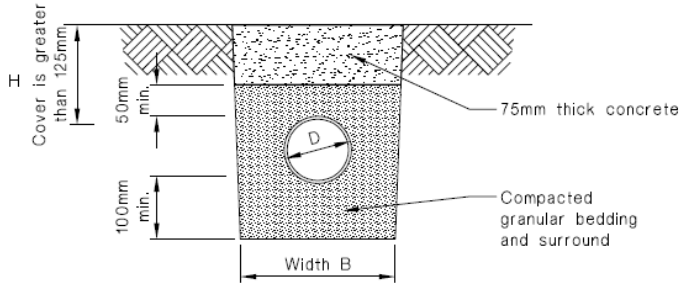
Figure 7: **Bedding and backfilling**
Paragraphs 5.2.1, 5.3.1 and 5.4.1



(a) Bedding type 'B' of NZS 7643
Cover greater than 500mm



(b) Bedding type 'D' of NZS 7643
Cover greater than 375mm



(c) Cover between 125mm and 375mm

NOTE:
1. Fill shall be:
-Ordinary fill where drains are located below gardens and open country.
-Compacted selected fill where the drains are located below residential driveways and similar areas subject to light traffic.