Technical Note 162

Trench Drains

December 2016

Queensland Government

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1 Introduction

This Technical Note applies to the use of trench drains for the collection and conveyance of surface water from roads and areas associated with roads to Transport and Main Roads requirements.

This Technical Note shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

2 Definition of terms and symbols

The terms used in this Technical Note are as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Additional terms used in this Technical Note shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Acceptable quality level (AQL)	Where a continuous series of lots or batches is considered, the quality level, which, for the purpose of sampling inspection, is the limit of a satisfactory process average (see Australian Standard AS1199.1) **Note**: the designation of an AQL does not imply that a manufacturer has the right to supply knowingly any nonconforming unit of product
Clear opening – CO	Unobstructed opening width between the seating of grid unit
Contact surfaces and trafficked edges	Metal edges or similar components applied to or inserted into the trench drain body as seating for gratings and covers and as protection of the trench drain body against damage from traffic
Cushioning insert	Material in a trench drain body, grating or cover used to provide a non-rock seating
Grating / cover	Removable parts of the grid unit which permits, in the case of gratings, the intake of water
Grid unit	Prefabricated trench drain unit, of either monolithic construction with openings incorporated in the top or sides, or with an open top with inserted gratings and/or covers
Inspection level	The relationship between the lot, or batch size, and the sample size (see AS1199.1)
Lot	A clearly identifiable subdivision of a batch for inspection purposes
Mass per unit area	Total mass of the grating or the cover in kilograms divided by the clear area in square metres of the grid unit
Nominal size	Numerical designation of size of components, which is a convenient integer approximately equal to the manufacturing dimensions in millimetres; for the purpose of this Technical Note, the nominal size corresponds numerically to the maximum internal cross-sectional width in millimetres of the trench drain
Pedestrian area	Area reserved for pedestrians but which may also be trafficked occasionally by, for example, delivery, cleaning or emergency vehicles
Production batch	A clearly identifiable collection of units, manufactured consecutively or continuously under the same conditions, using material or compound conforming to the same specification
Sample	One or more units of product drawn from a batch or lot, selected at random without regard to quality **Note**: The number of units of a product in the sample is the sample size

Term	Definition
Seating	Surface on which the grating or the cover rests on the body of a grid unit
Sediment trap	Removable component of a trench drain system which collects dirt and debris
Step of grid units ‘s’	Difference in height between adjacent grid units, as shown in Figure 6.6
Surface water	Water drained from the surface of roads or areas associated with roads
Test load	Load in kilonewtons (kN) applied to a grating / cover or to a trench drain unit during a test
Trench drain	Linear assembly composed of prefabricated units permitting the collection and conveyance of surface water along its total length for onward discharge
Type test	Test to prove the design and which is carried out once to demonstrate conformity with this Technical Note and which is repeated after significant manufacturing, design, or material changes
Ultimate (collapse) load	Maximum load reached by the testing machine during a loading test (that is, when the load recording facility does not show any further increase)
Waterway area	Total area of all slots in gratings within the clear area

Figure 2(A) - Example of grid units (cross sections)

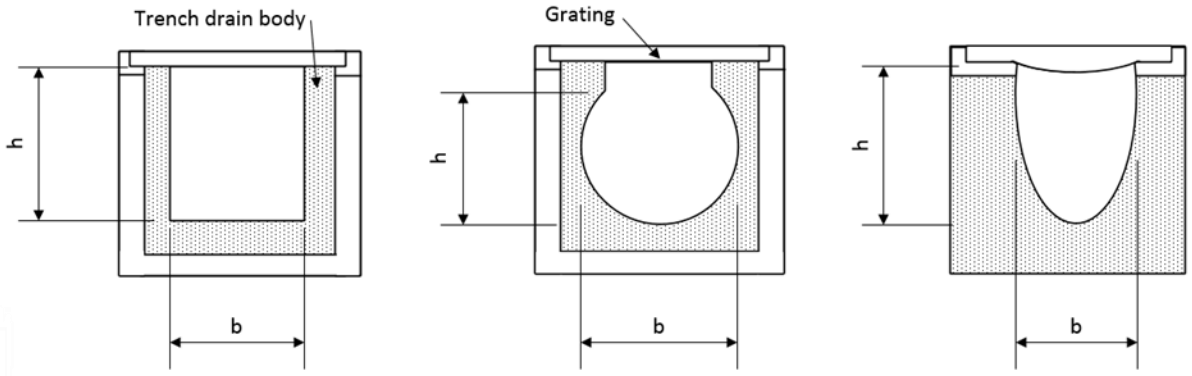
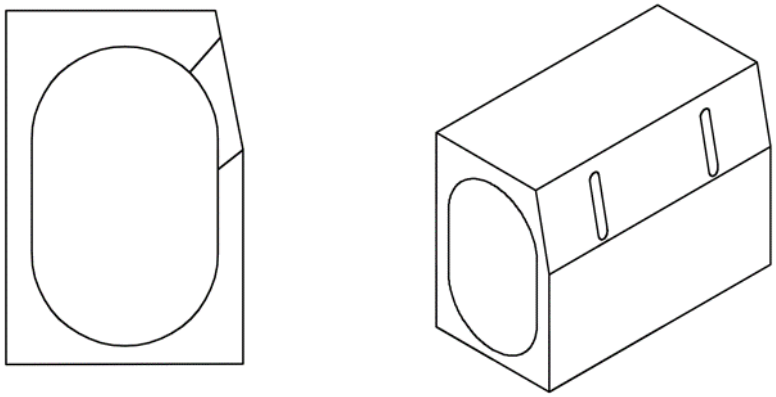


Figure 2(B) - Example of monolithic kerb unit



Cross Section

Isometric view of a monolithic kerb unit

3 Referenced documents

3.1 Australian Standards

The table following lists Australian Standards referenced in this technical document.

Table 3.1 - Referenced Australian Standards

Reference	Title
AS1199.1–2003	Sampling procedures for inspection by attributes – Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
AS3996–2006	Access covers and grates
AS5100.2–2004	Bridge design – Design loads
ISO/IEC Guide 28:2004	Conformity assessment – Guidance on a third-party certification system for products
AS3571.1–2009	Plastic piping systems – Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin – Pressure and non-pressure drainage and sewerage (ISO 10467:2004, MOD)
AS/NZS 5065:2005	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
AS2439.1–2007	Perforated plastics drainage and effluent pipe and fittings – Perforated drainage pipe and associated fittings
ISO 75–2:2013	Plastics – Determination of temperature of deflection under load – Part 2: Plastics and ebonite
ISO 9001:2015	Quality management systems – Requirements

3.2 Transport and Main Roads Technical Specifications

The table following lists Transport and Main Roads Technical Specifications referenced in this technical document.

Table 3.2 - Referenced Transport and Main Roads Technical Specifications

Reference	Title
MRTS01	Introduction to Technical Specifications
MRTS50	Specific Quality System Requirements

3.3 European technical standard

The Irish Standard EN1322 2002 *Drainage Channels for Vehicular and Pedestrian Areas* has been referenced and adapted in some sections of this Technical Note.

4 Material and products

4.1 Materials

4.1.1 General

The materials used in the manufacture and supply of trench drain covers and grates shall comply with the appropriate requirements of this section and effects due to corrosion, fire, thermal expansion, ultraviolet radiation, serviceability, skid resistance and abrasion should be considered.

4.1.2 Synthetic Resin Concrete

For the channel body of trench drains manufactured from Synthetic Resin Concrete (for example, polyester resin), the specimen dimension shall confirmed to the value given in Table 4.1.2(A). The flexural bending strength and the compressive strength at seven days for test specimens shall be in accordance with Table 4.1.2(B). The procedure and recording of results for flexural bending strength and compressive strength is to be included in the manufacturer's Quality Management System that complies with the requirements of ISO 9001:2015 *Quality management systems – Requirements*. The Contractor shall submit the conformance testing results to the Administrator of the contract.

Table 4.1.2(A) - Strength requirements

Strength	Flexural bending strength	Compressive strength
Mean Value of three Test Specimens MPa	≥ 22	≥ 90
Lowest Individual Value MPa	≥ 18	≥ 75

Table 4.1.2(B) - Test specimens

Maximum aggregate size 'a'	a ≤ 8	8 < a ≤ 16
Dimension of test specimens*	40 x 40 x 200	80 x 80 x 400

* Tolerances shall not exceed ± 1 mm

Note: Dimensions are in millimetres.

4.1.3 Glass Reinforced Plastic

4.1.3.1 General

Trench drain channel bodies or fittings with Glass Reinforced Plastic (GRP) shall be constructed using chopped and/or continuous glass filaments, strands or rovings, mats or fabric, and polyester resin with or without fillers and, if applicable, with those additives necessary to impart specific properties to the resin. These additives shall not include compounds based on lead (Pb), cadmium (Cd) or mercury (Hg). The channel body or fitting may also incorporate aggregates. Trench drain with GRP shall withstand any deformation due to shear or torsional stress for the load class specified for the application.

4.1.3.2 Glass reinforcement

The glass used for the manufacture of the reinforcement shall comply with Clause 4.2.2 of AS3571.1:2009 *Plastic piping systems – Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin – Pressure and non-pressure drainage and sewerage* (ISO 10467:2004, MOD).

4.1.3.2.1 Resin

The temperature deflection of the resin used in the channel body shall comply with Clause 4.2.3 of AS3571.1:2009 *Plastic piping systems – Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin – Pressure and non-pressure drainage and sewerage* (ISO 10467:2004, MOD).

4.1.4 High Density Polyethylene and composite products of Polypropylene and Polyethylene

4.1.4.1 General

Trench drains made with High Density Polyethylene (HDPE) or composite products which contain Polypropylene and Polyethylene with a strengthening frame shall withstand load classes as defined by AS3996:2006 *Access covers and grates*. The channel bodies and fittings shall be manufactured from material containing antioxidants, UV stabilisers and pigments and shall not include additives containing compounds based on mercury (Hg), lead (Pb) or cadmium (Cd). Trench drains with HDPE or composite products of Polypropylene and Polyethylene shall withstand any deformation due to shear or torsional stress. The frame is made from material able to resist corrosion due to contact with the surrounding environment.

4.1.4.2 Resin

The temperature deflection of the resin used in the channel body shall comply with Clause 4.2.3 of AS3571.1:2009 *Plastic piping systems – Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin – Pressure and non-pressure drainage and sewerage* (ISO 10467:2004, MOD).

4.1.5 Covers and grates

The materials used specifically in the manufacture and supply of covers and grates for trench drains shall comply with the requirements of AS3996:2006.

4.2 Product manufacturing requirements

4.2.1 General

Trench drains shall be free of defects; that is, broken edges, and/or holes. Trench drain grid units shall have adequate strength to withstand design loads when installed as per the manufacturer's instructions. These design loads include traffic loading, loads due to thermal expansions or loads generated due to installation method (see section 6.1 *Recommendation for installation* in this Technical Note).

Design features and dimensions for covers and grates shall comply with the requirements of sections 3.2 and 3.3 of AS3996:2006 except where alternative requirements are detailed in this Technical Note. The requirements in this Technical Note take precedence under those circumstances.

4.2.2 Design life

The design life means that 95% of the product shall remain in a serviceable condition with negligible maintenance for specified design life.

All trench drain assemblies are to have a design life of 50 years.

4.2.3 Load classification and places of installation

Trench drains shall be designated by classes A, B, C, D, E, F and G according to load capacity as set out in Table 4.2.3. This aligns with the load classes as set out in section 3 of AS3996:2006. Testing of the covers or grates of trench drains shall be in accordance with AS3996:2006. Testing of the prefabricated trench drain grid units shall be in accordance with section 4.3 of this Technical Note. The design loads specified in Table 4.2.3 shall be used for testing.

The appropriate load class for a trench drain depends upon the place of installation. Table 4.2.3 outlines general guidance on places of installation, relative to class. Section 5.3 *Places of installation*

in this Technical Note refers specifically to Transport and Main Roads' requirements in relation to the use of trench drains with respect to roads. The designer should select a higher load class where there is a doubt.

Table 4.2.3 - Load classifications of trench drains

Load class	Typical use	Normal wheel loading Kg	Serviceability design load KN	Ultimate limit state design load KN
A	Areas (including footways) accessible only to pedestrians and pedal cyclists and closed to other traffic (extra light duty)	330	6.7	10
B	Areas (including footways and light tractor paths) accessible to vehicles (excluding commercial vehicles) or livestock (light duty)	2 670	53	80
C	Malls and areas open to slow moving commercial vehicles (medium duty)	5 000	100	150
D	Carriageways of roads and areas open to commercial vehicles (heavy duty)	8 000	140	210
E	General docks and aircraft pavements (extra heavy duty – E)	13 700	267	400

(Adapted from AS 3996–2006)

Notes:

1. Nominal wheel loads are given for guidance only. Consideration should be given to the type, size and pneumatic pressure of the load applied.
2. Class B design loads exceed AS5100.2:2004 *Bridge design – Design loads* requirements for footway loading.
3. Class D design loads exceed AS5100.2:2004 requirements for a W80 wheel load.
4. Class C units are based on an intermediate load.
5. The serviceability load is set at two-thirds of the ultimate limit state design load.
6. A force of 1 KN approximately equal to the weight of 100 kg.

4.2.4 Dimensions and dimensional tolerances

The dimensions and dimensional tolerances of the trench drain grid units and their components shall comply with this Technical Note. The dimensional tolerances of L, b and h shall not exceed those given in Table 4.2.4(A).

Table 4.2.4(A) - Dimensional tolerances

Type of dimension	Length (L)	Tolerance	Width (B)	Tolerance	Height (H)	Tolerance
Nominal size	L ≤ 1000	± 2	B ≤ 500	± 2	H ≤ 200	± 2
	1000 < L* ≤ 4000	± 4	500 < L ≤ 1000	± 3	H > 200	± 1% with a maximum of ± 3 mm
	L > 4000	± 5				

* For kerb and slot units the tolerance of the dimension L shall be ± 5 mm.

The dimensional tolerances of 'a' (see Figure 4.2.4) shall not exceed those given in Table 4.2.4(B).

Figure 4.2.4 - Total clearance

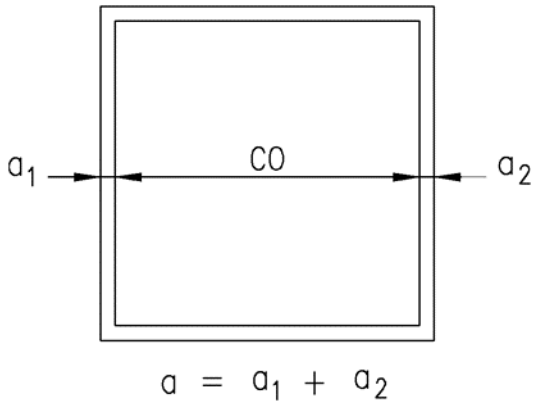


Table 4.2.4(B) - Dimensional tolerances of clear opening

CO	a
≤ 400 mm	≤ 7 mm
> 400 mm	≤ 9 mm.

This is to limit the horizontal displacement of the grating or cover in the trench drain body.

4.2.5 Gradient

Where an invert gradient is provided within a trench drain unit, it shall be not less than 0.25%. In order to assist installation, units shall be marked sequentially.

4.2.6 Jointing of trench drain units and watertightness

Design of the grid units' joints shall allow durably sealed join and, when tested in accordance with section 6.4 *Jointing of grid units* in this Technical Note, the joint shall not show water leakage.

4.2.7 Seating

The seating of the grid unit shall be manufactured to ensure the compatibility of the components. These seatings shall be manufactured to ensure stability and quietness in use and this may be achieved by the use of cushioning inserts or machining of the contact surfaces or any other appropriate methods.

4.2.8 Trafficked edges and contact surface protection

Trafficked edges and contact surface shall have protection. These protections shall be either cast iron, galvanised steel or stainless steel with thickness according to Table 4.2.8. The height difference between the top of the cover or grate and the top of the trench drain traffic edge shall be ± 1 mm.

Table 4.2.8 - Thickness of trafficked edge and contact surface

Load class	Minimum thickness* mm	
	Trafficked edges	Contact surfaces
D	2	1
E	4	2
F, G	According to each design but not less than that required of Class E	

*Without the thickness of additional corrosion protection to steel.

4.2.9 Dimensions of inlet openings

The inlet dimensions shall comply with the requirements of AS3996:2006. The waterway area as defined in Table 2 *Definition of terms* in this Technical Note shall be provided by the manufacturer.

4.2.10 Strength testing

Refer to section 4.3 *Testing* of this Technical Note.

4.3 Testing

Dimensions given in this section shall be measured to an accuracy of ± 1 mm unless otherwise stated.

4.3.1 Load test for grid unit body

Testing of the prefabricated trench drain grid units shall be in accordance with this section 4.3.1 of this Technical Note by a National Association of Testing Authorities (NATA)-accredited test facility. Test reports must include photographic evidence of the specimen tested.

4.3.1.1 Test loads

Bodies of grid units shall be tested to the appropriate load class as follows:

Channel bodies of grid units ≥ 500 mm in length shall be tested to the full test load shown in Table 4.3.1.1. For grid units < 500 mm in length (L) the test load shall be pro rata.

$$\frac{L}{500} \text{ x test load}$$

For example a unit 300 mm in length with test load class A shall be tested at:

$$\frac{300}{500} \text{ x } 10 = 6 \text{ kN}$$

Table 4.3.1.1 - Test Loads

Load class	Test loads kN
A	10
B	80
C	150

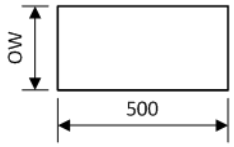
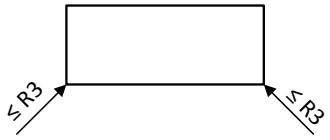
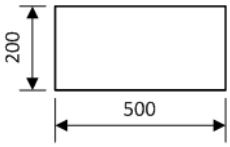
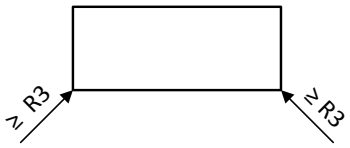
Load class	Test loads kN
D	210
E	400
F	600
G	900

4.3.1.2 Test machine

The test machine shall be capable of applying a test load at least 25% greater than the respective test load for load classes A to E, and at least 10% greater than the respective test load for classes E to G and shall apply the load evenly through the test block. Tolerance of the test load shall be ± 3% of the test load. The test bed dimension shall be greater than the bearing area dimensions of the unit to be tested.

4.3.1.3 Test blocks

Figure 4.3.1.3 - Dimensions and shapes of test blocks

Test block of channel bodies Normal size (NS)		
NS ≤ 200mm	 **PLAN**	 **ELEVATION**
NS ≥ 200mm	 **PLAN**	 **ELEVATION**
OW – overall width of the channel body		

4.3.1.4 Preparation for the test

Test units for grid units shall be bedded and haunched as per the manufacturer's recommendations and the test block placed to ensure:

- the load is applied perpendicular to the surface of the test unit
- the load is applied through the geometric centre of the test unit
- the longer edge of the test block is parallel to the longer edge of the test unit
- the test load is uniformly distributed over the whole surface of the test block. Any surface irregularities shall be balanced by using an intermediate layer of wood, fibre board, felt, gypsum or similar material. The intermediate layer shall have equal plan dimensions as of the test block.

4.3.1.5 Test procedure

The load on test units shall be increased uniformly at a rate of (2 ± 1) kN/s until the test load is reached. Once reached, the test load shall be held for 30 seconds and then released. The unit shall not show any indication of a failure.

Where the test load does not maintain a constant load then the test load can be increased during the 30 seconds' period of hold.

4.3.2 Test specimen

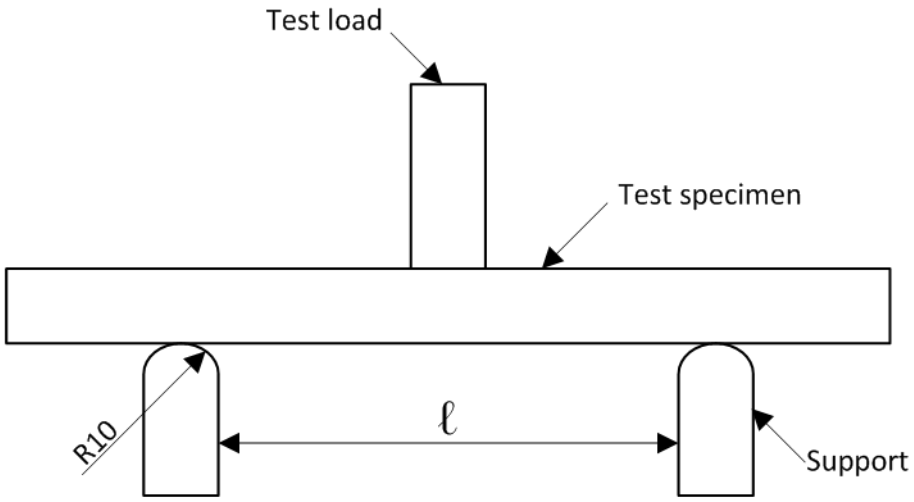
A test specimen complying with the dimension given in Table 4.1.2(B) *Test specimens* shall be used for testing the flexural bending and the compressive strength sequentially. The test also may be carried out on finished products or samples taken from finished products. In this situation, dimensions may differ from Table 4.1.2(B) and criteria of sections 4.3.3.1 *General* and 4.3.3.2 *Gradient* in this Technical Note shall apply by analogy.

4.3.2.1 Test apparatus

Test apparatus as shown in Figure 4.3.2.1 shall be used to test flexural bending strength and the distance 'l' between the supports shall be 120 mm, for 40 mm x 40 mm x 200 mm specimens and 240 mm for 80 mm x 80 mm x 400 mm specimens.

The test specimen for testing compressive strength shall have test plates with dimensions of 40 mm x 62.5 mm for the 40 mm x 40 mm specimens and 80 mm x 80 mm for the 80 mm x 80 mm specimens.

Figure 4.3.2.1 – Flexural bending test



4.3.2.2 Test procedure and determination of strength

The test specimen shall be loaded at a uniform rate such that strength requirements are reached within one minute.

Flexural bending strength and compressive strength are calculated using the following equations.

$$\sigma_b = \frac{3 \times P \times \ell}{2 \times b \times d^2}$$

where:

σ_b is the flexural bending strength, in Newton per square millimetres (N/mm^2)

P is the load at failure, in Newton (N)

b is the actual width of the test specimen, in millimetres (mm)

d is the actual thickness of the test specimen, in millimetres (mm)

ℓ is the distance between the supports, in millimetres (mm).

$$\sigma_c = \frac{P}{F}$$

where

σ_c is the compressive strength, in Newton per square millimetres (N/mm^2)

P is the load at failure, in Newton (N)

F is the pressure area of the test specimen, in square millimetres (mm^2).

The test results shall comply with type testing (section 4.3.4 in this Technical Note) and the requirements of Table 4.1.2(A).

4.3.2.3 Factory production tests

Either flexural or compressive strength tests may be used for factory production testing. In this case, a correlation between flexural and compressive strength shall be established and this correlation being verified regularly but not exceeding 12-month intervals.

4.3.3 Inspections and measurement criteria

4.3.3.1 General

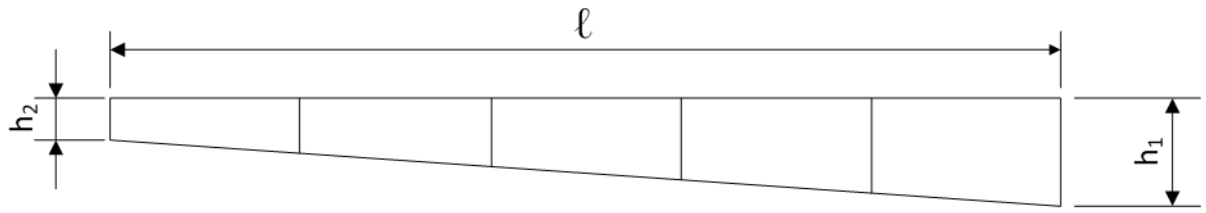
When assessing the requirements of section 4.2.1 *General* in this Technical Note, visual inspections shall be carried out at a distance of two metres in daylight conditions.

The discharge cross-sections and inlet openings shall be measured to an accuracy of ± 1.0 mm and area shall be measured to the nearest 100 mm^2 (see sections 4.2.9 *Dimensions of inlet openings* and 5.1 *Geometric design* in this Technical Note). All other dimensions shall be measured to the accuracy required by an appropriate clause.

4.3.3.2 Gradient

The gradient (h_1-h_2) / ℓ values shall be measured in millimetres in accordance with Figure 4.3.3.2.

Figure 4.3.3.2 - Drainage channel unit (sloped invert with no ground fall)



4.3.3.3 Trafficked edge protection

The accuracy of the thickness measurement of uncoated cast iron or steel traffic edge protection shall be ± 0.1 mm and the hot-dip galvanizing shall be ± 5 µm (see section 4.2.8 *Trafficked edges and contact surface protection* in this Technical Note).

4.3.4 Type testing

Three complete test samples shall be tested complying with sections 4.1 *Materials*, 4.2 *Product manufacturing requirements*, and 4.5 *Marking* before production of the units commences.

Previous tests performed which comply with this Technical Note for the same products may be taken into account. In the case of design changes of the product and/or manufacturing processes, the relevant type tests shall be repeated.

4.3.5 Routine loading test

Following approval of type testing which complies with section 4.3.4 *Type testing* in this Technical Note, an alternative routine load test for grid units may be carried out. This test may be carried out excluding any support or concrete bedding and hunching. A defined relationship between the routine test and the test load specified in sections 4.3.1 *Load test for grid unit body* and 4.3.6 *Load test for covers and grates* shall be established by the manufacturer.

4.3.6 Load test for covers and grates

Covers and grates shall be tested in accordance with AS3996:2006.

Testing of the covers or grates of trench drains shall be in accordance with AS3996:2006 by a NATA-accredited test facility which can issue NATA-endorsed test reports to the requirement of AS3996:2006. NATA-endorsed test reports must include photographic evidence of the specimen tested.

4.4 Evaluation of conformity

4.4.1 General

This section sets out three means by which compliance with this Technical Note is to be demonstrated by a manufacturer, as follows:

a) the use of a product certification scheme

b) the use of a minimum sampling and testing frequency plan

c) type testing with material testing.

Note: Covers and grates are to be evaluated in this manner for their conformance with AS3996:2006 as per the requirements of that particular Standard.

4.4.2 Product certification

Product certification shall comply with the class A4 of AS3996:2006. The compliance certificate shall be provided to the Administrator.

4.4.3 Minimum sampling and testing frequency plan

4.4.3.1 General

Table A1 of AS3996:2006 sets out the minimum sampling and testing frequency plan for a manufacturer to demonstrate compliance of product(s) to this Technical Note.

4.4.3.2 Retesting

In the event of a test failure, retesting of the product shall comply with the clause A5.2 of AS3996:2006.

4.4.3.3 Rejection after test

Rejection after test shall comply with the clause A5.3 of AS3996:2006.

4.4.4 Type testing with material testing

The purpose of this testing is to demonstrate conformity with section 4.3.4 *Type testing* of this Technical Note. This test shall be repeated after significant manufacturing, design or material changes.

4.5 Marking

4.5.1 General

Marking on grid units shall be clear; that is, stamping, casting, printing, and labelling.

Except for grid units with inbuilt gradients, at least 10% of concrete grid units with a minimum of one product per package shall be marked in accordance with sections 4.5.1 *General* and 4.5.2 *Marking of covers and grates* in this Technical Note.

4.5.2 Marking of covers and grates

Covers and grates shall be marked as follows:

a) the appropriate load class

b) the manufacturer's name and/or identification mark or the place of manufacture which may be in code

c) date of manufacture

and may be marked with: intended application of the user, the mark of the certification body and product identification (that is, name and/or catalogue number).

4.5.3 Marking of grid unit body

The grid unit body shall be marked with the appropriate load class, the manufacturer name and/or identification mark and the year of manufacture and the sequence of each unit for grid units with inbuilt gradients.

The grid units may be marked with: intended application of the user, the mark of the certification body and product identification (that is, name and/or catalogue number).

5 Design

5.1 Geometric design

In general, height is greater than or equal to width of a trench drain (see Figure 2(A) or 2(B) *Examples of grid units* in this Technical Note). In order to ascertain the inlet capacity, flow capacity and discharge capacity, the manufacturer shall provide sufficient hydraulic data of the trench drain so the designer is able to select suitable products for the trench drain design. The designer shall consider an appropriate element to be installed at the point of discharge for onward connection to a drainage system. In general, nominal sizes of these outlets and outlet connections shall not be less than 100 mm.

5.2 Performance criteria

The designer should specify the performance criteria of the trench drains such as:

1. capture rates
2. maximum flow width allowed on the road carriage way
3. design life
4. loading
5. lengths
6. places of installation
7. tolerances.

5.3 Places of installation

In general, the Department of Transport and Main Roads requires that the use of trench drains only be considered for those areas associated with roads which are not normally subject to direct vehicular traffic loads. Examples of such locations are:

- immediately adjacent to concrete kerbs or vertical concrete barriers (see Figures 5.3(A), (B) and (C))
- the nose area of a merge or diverge section at an interchange or intersection (see Figure 5.3(D))
- areas protected from traffic such as behind safety barriers.

Normally Load Class D will be sufficient for most uses but the designer is still obligated to consider all circumstances under which the trench drain may be trafficked (for example, for maintenance purposes, in emergency situations or for abnormal load routes). The type and number of vehicles likely to impact on the trench drain under such circumstances should be taken into account when determining the appropriate load class.

Figure 5.3(A) – Adjacent kerb at bus station platform

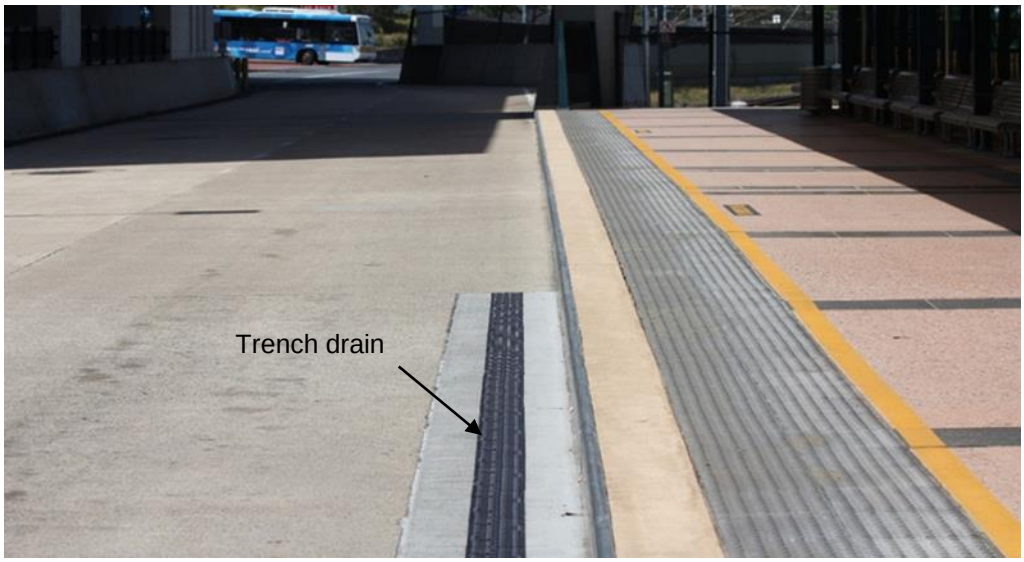


Figure 5.3(B) – Immediately adjacent to concrete kerbs

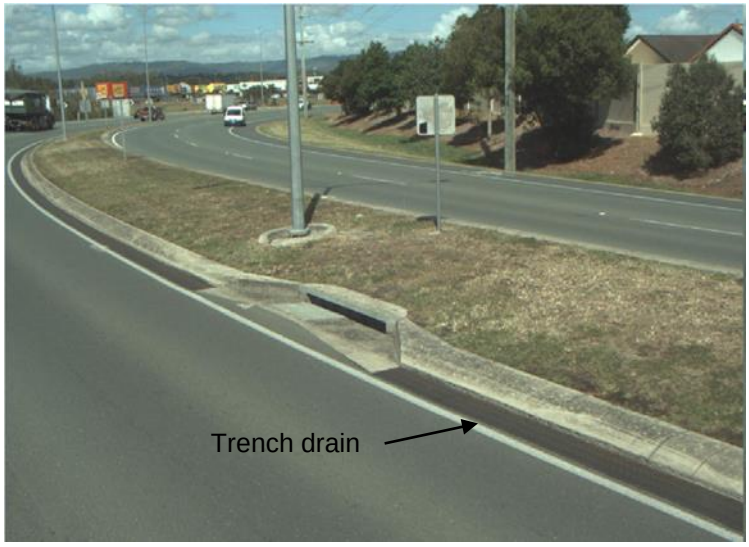


Figure 5.3(C) – Along a vertical wall/barrier

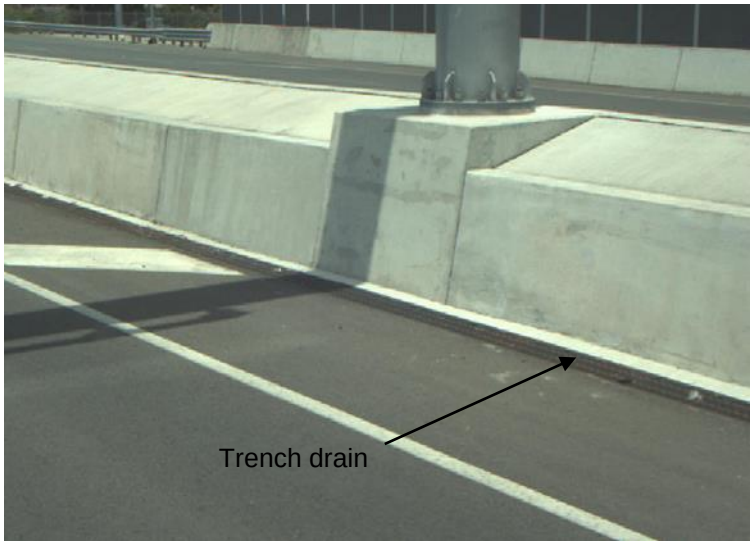
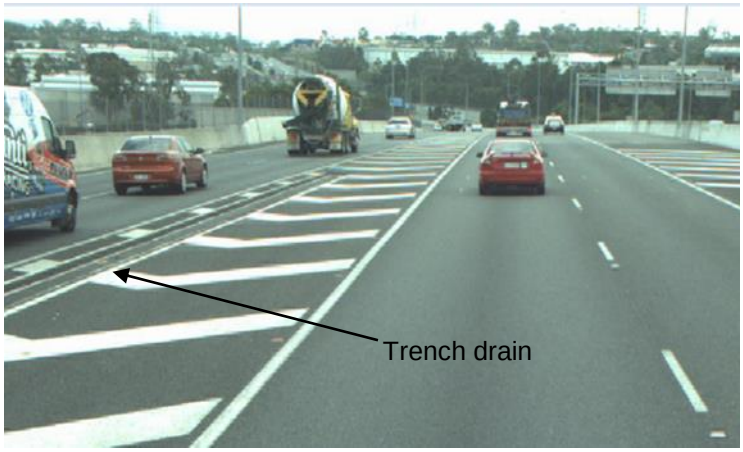


Figure 5.3(D) – Gore areas



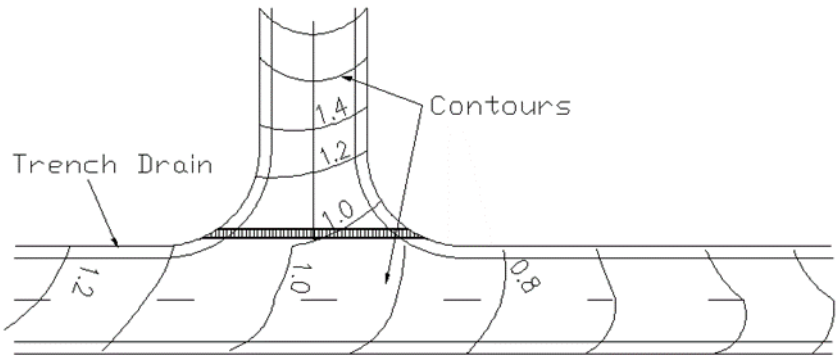
5.3.1 Places of installation – special cases

In general, trench drains that cross traffic lanes (transverse drains) are not permitted; however, there are two special cases where the use of transverse trench drains may be considered, but only after all other options (variations to longitudinal grade and/or crossfall) have been investigated and shown not to work satisfactorily. These cases are to be considered as design exceptions and will require specific approval from the Director–Road Design, Engineering and Technology Branch, Transport and Main Roads. Approval will be based on safety and structural adequacy. Load Class E, F or G must be used in these instances, based on the type and number of vehicles likely to impact on the trench drain.

The first case is to use a trench drain across the minor leg of a priority controlled intersection, where the vertical alignment of the minor leg approach is a steep downgrade and the crossfall of this minor leg is not sufficient to direct road surface flows to the side of the road and into the longitudinal drainage system. In this instance, the use of a trench drain may offer a practical solution to intercepting the road surface flows and prevent this flow from entering the through carriageway and potentially increasing the risk of aquaplaning (refer Figure 5.3.1(A)).

The type of trench drain used must be of monolithic construction. The length of trench drain should not exceed the width of the minor leg approach and allow access for maintenance cleanout from both ends.

Figure 5.3.1(A) – Trench drain at a minor leg of a priority controlled intersection to prevent road surface flows from the minor leg entering the through carriageway.

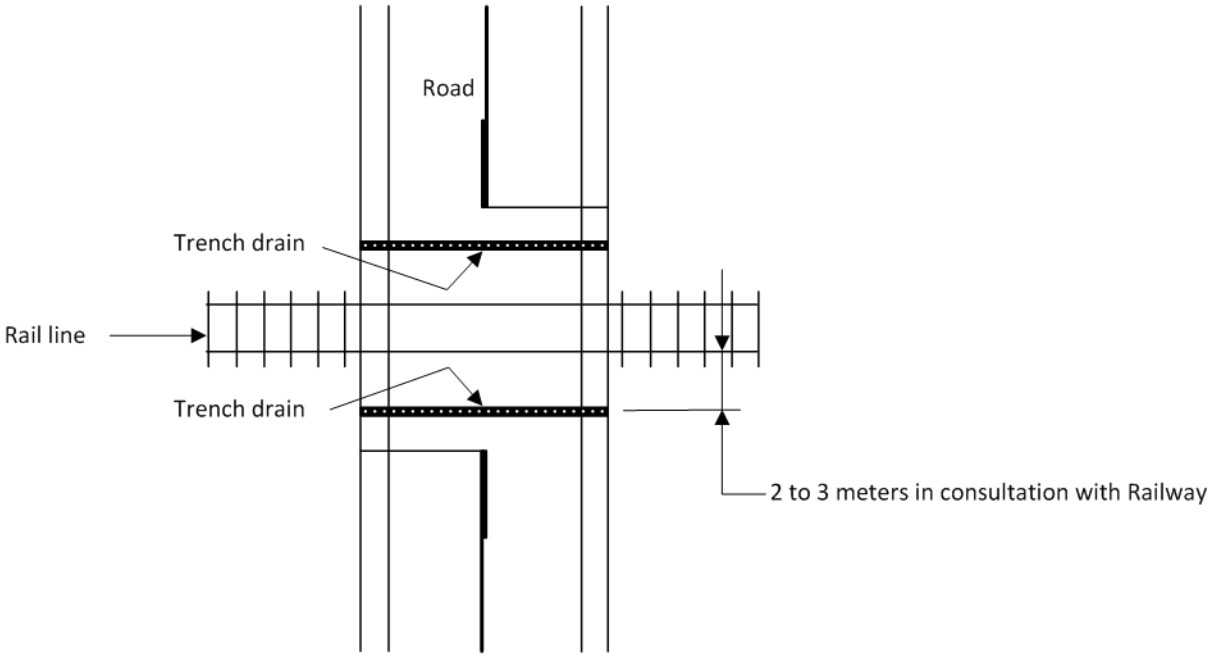


The second case is to use a trench drain across the carriageway immediately adjacent to a railway Open Level Crossing (OLC). Generally the road surface about an OLC is flat due to the rotation of the pavement in order to match the grade of the railway line. In this instance, the use of a trench drain may offer a practical solution to draining the road surface and reducing the risk of aquaplaning (refer Figure 5.3.1(B)).

Installation of the trench drain should be as close to the railway line as possible and liaison with Queensland Rail is required.

The type of trench drain used must be of monolithic construction. The length of trench drain should not exceed much further than the width of the roadway and allow access for maintenance cleanout from both ends.

Figure 5.3.1(B) – Adjacent to railway crossings in order to reduce surface water



5.4 Design of sediment traps

Where sediment traps are specified they shall be designed to ensure that their drainage and ventilation efficiency is not impaired when they are filled completely with silt or other detritus.

5.5 Correct positioning of covers and grates

Where a cover or grate has to be installed in a predetermined position relative to a frame / edge protection / grid unit body, then this shall be ensured by an appropriate design.

6 Installation

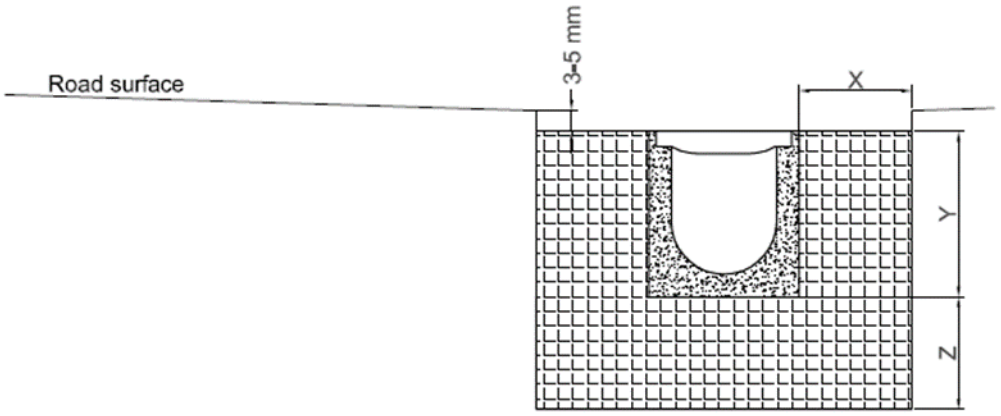
6.1 Recommendations for installation

Installation shall be carried out in accordance with the manufacturer's guide.

The manufacturer shall specify the concrete class required to meet the load classification of the product. Where specific haunching of trench drain units is required, the manufacturer shall also provide instructions and indicate dimensions x, y and z (see Figure 6.1) and shall provide at least the following instructions:

- Backfilling material and requirements
- the support needed onsite for installation and for the loading test appropriate to the place of installation
- the joining and sealing of adjacent trench drains (see sections 4.2.6 *Jointing of trench drain units and watertightness* and 6.4 *Jointing of grid units* in this Technical Note).

Figure 6.1 – Example of a trench drain installation



6.2 Backfilling

Notwithstanding manufacturers' recommendations for support and backfilling, following requirements shall apply:

Excavation and backfilling operations required to be undertaken to install trench drains described by this technical note shall be carried out in accordance with the provisions of MRTS04 *General Earthworks*.

Where backforms are used, they shall be removed prior to backfilling operation.

Backfill material shall comply with the requirements of MRTS04 *General Earthworks* clause 19.2.3 *Select backfill material*.

Layer thickness for backfill shall comply with MRTS04 *General Earthworks* table 15.3-A *Layer thickness for compaction*.

Backfill material shall be compacted to a relative compaction not less than 97%.

Finished surface of the backfill should match the crossfall and grade of adjacent surface. If the adjacent surface has a road pavement, backfill material and the finishing surface of the backfill shall match the road surface, the road pavement material and the compaction of the adjacent road.

Lean mix concrete shall be used as an alternative backfill material in confined excavations and shall comply with the requirements of clause 19.2.11 of MRTS04.

6.3 Level of the grate

The level of the grate shall be about 3 to 5 mm below the road surface (see Figure 6.1).

6.4 Securing of covers and grates

The cover and grates within the trench drain body shall be secured using a locking device or a specific design feature meeting the relevant traffic conditions.

A visual inspection shall be performed of the locking device or specific design feature used to secure a cover and/or grate in a grid unit.

An unrestrained cover or grate relying on its own mass per unit area to secure it in place is unacceptable.

6.5 Jointing of grid units

Joining of the grid units shall be done in accordance with the manufacturer's instructions. Following the installation, both open ends shall be closed and sealed and be filled with water to the maximum designed wetted perimeter. Grid units must then be visually inspected for water leakage through the body or at the joint in a period of 30 minutes ± 30 seconds.

After the drains are constructed, they shall be flushed out. Flushing shall continue until the outlet water is clean and flows consistently.

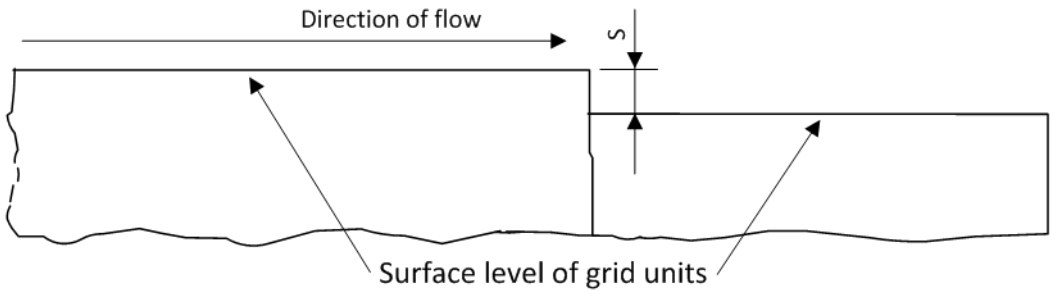
6.6 Seating

After the installation, seating shall be inspected for stability and non-rocking and conformity with the manufacturer's specification (see section 4.2.7 *Seating* in this Technical Note).

6.7 Step of grid units 's'

The joints of adjacent grid units shall have smooth transitions and the step of grid units –'s' shall be ≤ 5 (see Figure 6.6).

Figure 6.6 – Step of grid units 's'



Key:

s Step of surface level.

6.8 Trafficked edge protection

For all load classes, the edge protection, and the grid units shall be visually inspected ensuring secure connections and conformity with the manufacturer's specification (see section 4.2.8 *Trafficked edges and contact surface protection* in this Technical Note).

6.9 Sediment traps

The sediment traps shall be visually inspected ensuring both the drainage and ventilation is still possible. In this instance, the sediment traps shall be filled with suitable material prior to the visual inspection (see section 5.4 *Design of sediment traps* in this Technical Note).

6.10 Correct positioning of covers and grates

If it requires a predetermined position / sequence for installation of grid units, covers and grates, these units shall be visually inspected for indelible marks or register (see section 5.5 *Correct positioning of covers and grates* in this Technical Note).

6.11 Marking

The marking of grid units, grates and covers shall be visually inspected (see section 4.5 *Marking* in this Technical Note).