The use of slotted drains and trench drains

Road Design Note
RDN 05-03
May 2021

Abstract

This Road Design Note (RDN) provides the Department of Transport's (DoT) position on the use of longitudinal inlet drains, including slotted drains and trench drains.

Key Information

This document must be read in conjunction with the DoT Supplement to AGRD Part 5, Part 5A and relevant Standard Specifications for Roadworks.

Where information contained in this RDN cannot be followed, the designer, engineer or team may seek technical advice (from the Department of Transport or delegated Technical Advisor) and gain acceptance (where necessary) for a departure from this guideline.

1. Introduction

This Road Design Note (RDN) provides the Department of Transport's (DoTs) position on the use of 'longitudinal inlet drains', including slotted drains and trench drains. This document provides a range of design, manufacture, installation, and maintenance requirements that must be considered by designers, installers, and product suppliers.

Prior to the commencement of a drainage system design, the designer should familiarise themselves with the various types of drainage components (e.g. inlet pits) available to them, including their uses and their limitations. Designers must also familiarise themselves with any requirements that have been imposed by DoT, which could include the preference or limitation of certain component types, shapes, materials, dimensions or attachments, in order to create operational, maintenance and safety benefits across the entire network or within a certain context.

DoT will continue to review and update this RDN as required.

2. Background

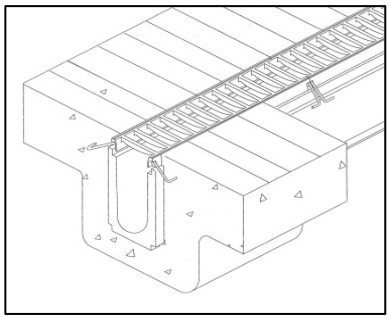
Longitudinal inlet drains (called 'continuous capture inlets' by Austroads) are useful, and sometimes essential, in situations where flat crossfalls make it difficult to capture flows using conventional pits, and in problematic areas where kerb and grate inlets are ineffective such as along a concrete median barrier. There are two common forms of longitudinal inlet drains in Victoria.

Trench Drains

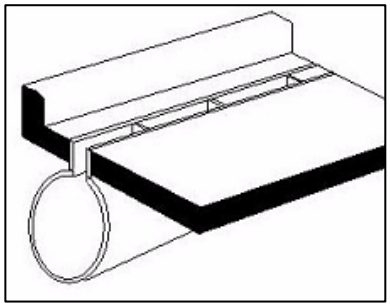
Trench drains have been used within Victoria and Australia for many years, mostly within urban low-speed environments or in critical locations on freeways to limit flow widths, such as ramp gore areas.

Trench drains have the advantage of a shallower embedment depth, but the disadvantage of having a limited volume because of their size. As such, trench drains can often require a parallel drainage line underneath, to provide suitable discharge points and additional capacity.

Trench drains have interchangeable grates, which can be selected based on the presence of pedestrians and cyclists. While some Trench Drains have non-removable grates to avoid them coming loose, most modern trench drains come with a quick-lock grate system to prevent dislodgement. Trench drains must be maintained by removing the grate or from the nearest junction pit.



Trench Drain



Slotted Drain

Slotted Drains

Slotted drains are a relative new concept within Victoria, with very few installations on the declared road network.

A suitable pipe is cut along a longitudinal axis, and a trapezoidal or straight-sided grate with reinforcing spacer plates is welded to form a slot opening. The slot collects runoff and channels it to the pipe below from which it flows to the appropriate outlet. A cast in-situ concrete pad/collar is poured over the slotted pipe and around the longitudinal grate to lock it into place. Alternate slip-form solutions are also available.

Slotted drains have additional volume, but are deeper than trench drains and must be installed with sufficient slope (longitudinal grade) for an effective self-cleaning velocity.

Slotted drain grates are non-removable and are less customisable. Therefore, clean out access boxes are needed at the far end of each slotted drain run to facilitate maintenance and cleaning.

3. The use of longitudinal inlet drains

Using a slotted drain or trench drain as a component of the drainage system shall form part of the Extended Design Domain.

This applies to all proprietary products formerly published in 'RDN 05-02 Accepted Drainage Products' and the public domain trench drain previously provided on 'SD1501 – Grated trench'.

Designers will need to justify that a slotted or trench drain system is suitable in the proposed location and obtain acceptance from DoT. The conditions and requirements in this RDN will assist with justification and must be documented within the submission. Whilst meeting these requirements does not guarantee acceptance, they aim to minimise common issues experienced with maintaining these drainage systems. Hence, some requirements may be more context specific than others and the designer may apply engineering judgement. Where a requirement of this RDN cannot be met, the designer must demonstrate how the risk has been reasonably managed.

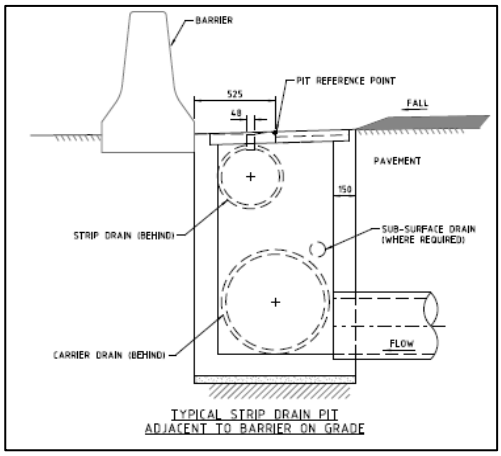
DoT will continue to review all trench drain and slotted drain submissions with an aim to move certain applications (i.e. installation conditions) into the Normal Design Domain.

4. Conditions of acceptable use

- Longitudinal inlet drains shall be used as a last resort and only when a conventional kerbed, pit and pipe solution is not reasonably practical, including:
    - where the required pit spacing reduces to less than 10m in order to maintain flow widths and thus becomes impractical.
    - where the available shoulder width would require pits to protrude into high speed (≥V80km/h) traffic lanes, and only after first considering the use of a narrower non-standard pit solution.
- Longitudinal inlet drains shall not be used;
    - where vegetation debris (e.g. leaves and bark) is probable
    - in remote/isolated areas (outside of metropolitan/urban areas) where specialised equipment for maintenance would increase issue response times and cost of cleaning
    - where significant sediment is probable (e.g. near quarry accesses or roads within a cut batter or coastal areas with potential for sand drifts)
    - to achieve a constructability/installation cost saving.
- Longitudinal inlet drains (inc. the concrete surround) shall not be used;
    - within 500mm of a freeway/highway traffic lane, or
    - within the traffic lane of an arterial road (inc. the edgeline).

  The following exceptions apply;
    - On freeway/highway medians, trench drains shall be considered Design Exception regardless of offset, due to the recent and ongoing maintenance challenges. As such, all trench drain proposals within a freeway/highway median will require significant justification before being considered acceptable, especially in relation to the intended Operation & Maintenance procedures (refer Section 7).
    - On arterial roads, a slotted drain system may be considered on the line of kerb (minimum), where the designer can demonstrate that a kerb and longitudinal inlet drain could not be feasibly located outside the traffic lane.

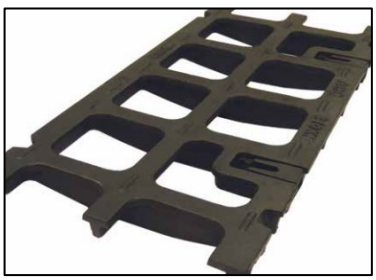
5. Design requirements



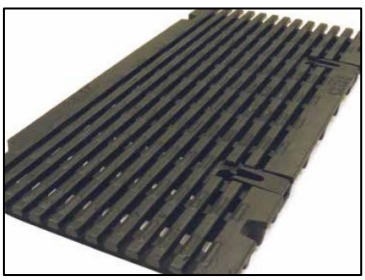
- Drain invert gradient/slope is to be maximised as practically possible to reduce the risk of blockage and ensure pipes are self-cleaning.
- Desirable minimum pipe velocities must be achieved in accordance with AGRD Part 5A, Section 6.5.4. Velocities achieved are to be documented on the design drawings and all submissions must discuss how velocities have been maximised.
- The slope and size of the pipe must not be below 1% and 375mm pipe respectively (or equivalent for trench drain system) to ensure self-cleaning operations. 300mm pipe may be accepted by concession, where sufficient slope is provided; the first section of a run may be steepened as needed.
- The maximum length of any one run of slotted drain should be approximately 50m. The maximum length of any one run of trench drain should be 100m. Longer lengths may require specialist maintenance equipment.
- Standard DoT stormwater pits must be installed at each end of a run of a longitudinal inlet drain. Refer figure.
    - Proprietary ‘in-line grated pits’, in accordance with the Suppliers manual, may be considered within a run or on the upstream end of a longitudinal inlet drain run to increase flow velocity. This should not restrict the ability to flush the system from one end.
- A flushing point should be considered to enable pipe cleaning without the need for traffic control or removal of grates. Refer product manual.
- Product specific designs must meet all design requirements provided by the System Supplier.
- The surrounding terrain must be suitable for maintenance vehicles. Truck mounted water jet and suction trucks are required for cleaning.

6. Manufacture and installation requirements

- Longitudinal inlet drains (inc. concrete surround and connecting pits) must achieve Class D in accordance with AS3996:2019, and must be certified with a supporting NATA endorsed load test report. Class E must be achieved on urban freeways/highways.
- Installation shall be carried out in accordance with the product suppliers’ requirements. The supplier must specify the concrete class required to meet the load classification of the product.
- Trench drain systems with an internal “V” (or “U”) shaped profile must be used. Flat bottomed internal profile channels should only be used in shallow depth areas and then must have sufficient upstream flow. Flat bottomed internal profiles will be considered a Design Exception (DE) and will require significant justification before being considered acceptable.
- Trench drain gratings should have large aperture inlets for high water intake in non-pedestrian locations. Slot widths measure at a maximum of 80mm. Pedestrian compliant gratings shall be installed in pedestrian crossing locations with an aperture of no more than 10mm. Refer image.
- Removable gratings must have an anti-shunt lug feature to prevent longitudinal movement of the gratings.
- Gratings should be secured with a boltless locking mechanism.



80mm aperture



<10mm aperture

Anti-shunt lug

7. Maintenance requirements

- A site-specific operation and maintenance (O&M) manual must be developed and submitted for review. This should be developed collaboratively with DoT, to ensure consistent maintenance practices are achieved across the network. The O&M manual must adapt all requirements from the system supplier into a site-specific procedure. At minimum, the O&M manual must include:
    - Any location specific details,
    - A traffic management plan, including lane closure requirements,
    - A general maintenance procedure, including the necessary resource such as material, tools /equipment and time needed to complete the task.
    - An indicative estimate of quantity of resource and cost per maintenance cycle shall be included to facilitate the maintenance cost profile
- All maintenance activities must be accomplished within the closest traffic lane, equivalent to current pit and pipe practices.
- Truck mounted water jet and suction trucks are required for cleaning. All water blasted into the drains must be vacuumed and disposed off-site.
- Temporary mats shall be used to prevent flushing debris. These can be placed on the inlet above the water jet and moved as needed.

8. Revision History

Version	Date	Clause	Description of Change
1.0	May 2021	All	First version

9. Contact Details

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