Technical Bulletin

DRAINAGE SYSTEM COMPARISON

Whether frequent light rainfall or occasional heavy downpours, surface drainage is necessary to prevent damage to pavement or property, and reduces safety hazards caused by ponding. Methods for dealing with surface drainage are:

- Grated pit & pipe system – point drainage (Figure 1.) or
- Grated trench drains (Figure 2.), which can be further categorised into:
    a. Cast in-situ trench drains
    b. Precast modular trench drains (ACO Drain®)

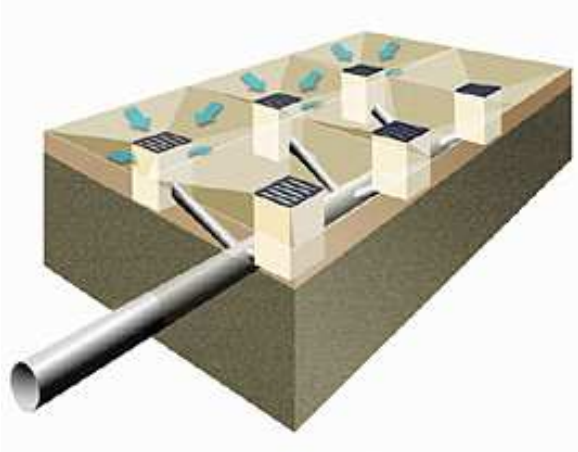

Figure 1.

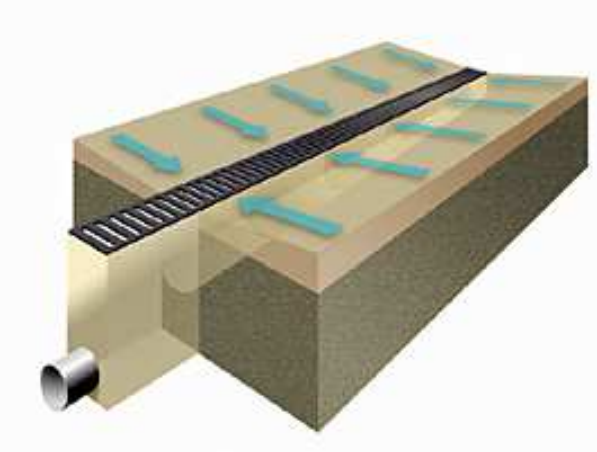

Figure 2.

In 2014, a report was prepared by an independent quantity surveyor, Rider Levett Bucknall, to compare the installation costs of the three alternative surface drainage methods mentioned above for the carpark of the Aquatic Centre at Homebush, NSW.

Cost Comparison Results

1.	Cast in-situ trench drains	**$393,000**	
2.	Grated pit & pipe system	**$377,000**	**(4% cheaper than cast in-situ trench drains)**
3.	ACO Drain®	**$340,000**	**(13% cheaper than cast in-situ trench drains)**

The ACO Drain® option was determined to be cheaper than the cast in-situ trench drains and grated pit & pipe system. Breakdown of all costs are shown in Table 1.

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Table 1. Breakdown of Costs for Each Option.
(Rates are current at August 2014)

Installation Activity	1. Cast in-situ trench drain cost	2. Grated Pit & pipe system cost	3. ACO Drain® cost
Excavate for concrete drain	$21,420	-	-
Excavate for channel/concrete encasing	-	-	$21,000
Excavate for drainage pipe	$20,020	-	$20,020
Excavate for pipe avg 750mm deep	-	$57,400	-
Excavate for junction/gully pit	$1,680	$8,120	$1,680
Sub base, 150mm deep	$12,625	$21,825	$8,775
Backfilling and compaction	$3,060	$6,510	$7,650
Remove surplus spoil from site	$2,050	$9,650	$1,900
Concrete in channel	$61,600	-	-
Formwork to sides of channel150mm high	$36,720	-	-
ACO Drain® channel	-	-	$84,750
Concrete encasing of channel	-	-	$75,200
375mm Dia drainage pipe	$50,560	$108,320	$50,560
450mm Dia drainage pipe	$5,625	$24,525	$5,625
525mm Dia drainage pipe	$2,800	$24,360	$2,800
1 way junction gully pit	$4,000	$48,000	$4,000
2 way junction gully pit	$6,000	$34,000	$6,000
3 way junction gully pit	$10,000	$26,000	$10,000
4 way junction gully pit	$4,000	$8,000	$4,000
1 way channel/pipe junction	$2,000	-	$2,000
2 way channel/pipe junction	$14,000	-	$14,000
2 way channel junction	-	-	$18,000
2 way channel junction	-	-	$2,000
Grating over channel	$134,640	-	-
Sundries	$200	$290	$40
Total cost:	**$393,000**	**$377,000**	**$340,000**
Percentage cheaper than cast in-situ trench drain installation:		**4%**	**13%**

Principal Assumptions (extract from report)
The following assumptions were employed by Rider Levett Bucknall when preparing the cost report:

- Excavation for trenches, pits, gullies, junction in “other than rock”
- Excavation can be easily performed by machine
- All materials are readily available when required

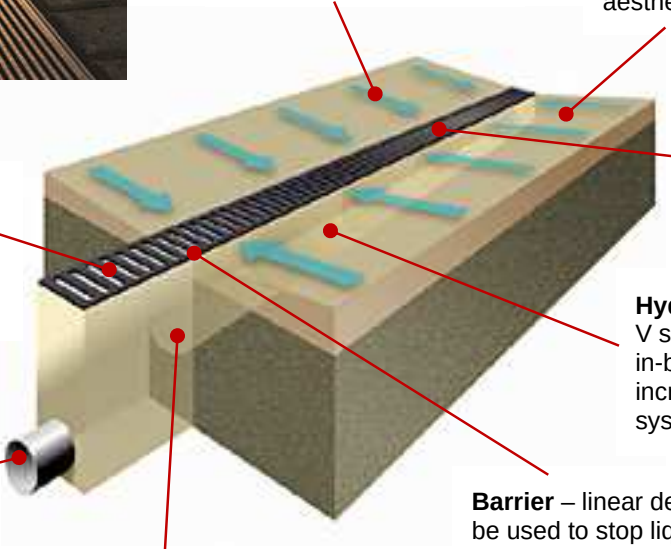
Exclusions (extract from report)
In compiling the cost estimate, no allowance was made by Rider Levett Bucknall for the following cost items:

- Work to the carpark surface, kerbs, gutters, landscaping (for this study the effect on these items were considered negligible)
- Roads to the east and south of the service road (owing to lack or missing information)
- Fluctuations in labour and material costs after July 2014
- Negotiated, staged or other special form of contract
- Overtime necessitated by a restricted period or to attract labour
- Limitations on plant, equipment and construction methods to be used
- Connection to mains
- Removal of contaminated materials
- Diversions of existing services
- Statutory authorities’ payments, contributions and compliance orders
- Preliminaries
- Builders overheads and margins
- Goods and services tax
- Contingencies

Other than installation costs, there are other advantages precast modular trench drains have over the grated pit & pipe systems and cast in-situ trench drains.

Grading – neat linear appearance with simple one-way slopes; easy and quick to construct.

Pavement longevity – reduced standing water extends service life and aesthetics of pavements.



Maintenance – easy access to system through grate and shallow trench.

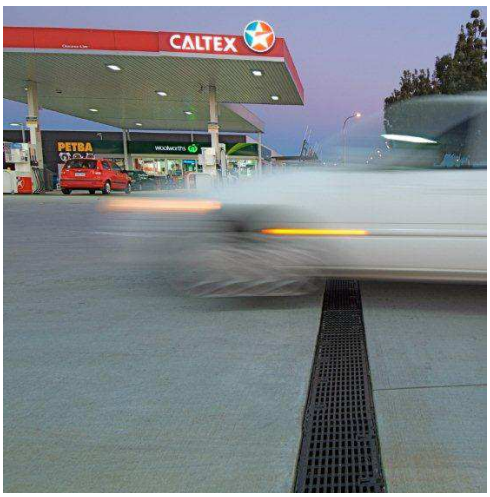
Safety – superior liquid capture along its length minimises slip hazards to pedestrians and vehicles (reduce risk of litigation).

Hydraulics – narrower V shaped systems with in-built slopes create increased velocity and system efficiency.

Pipe savings – minimal underground pipe, related excavation and site work required.

Barrier – linear design can be used to stop liquids from transgressing into sensitive or unwanted areas.

Quality - factory precision manufactured modular channel units made from corrosion resistant materials.



Issues with grated pit & pipe systems

Hydraulics:

- Intake – not as efficient compared to the continuous capture inlet along the length of precast modular trench drains.
- Ponding – can occur if pavement not graded correctly.

Safety:

- Overland flow – hazards caused by increasing flow depth and width of flow between widely spaced pits.
- Maintenance – hazards from entering confined spaces and deep pits to clear blockages.
- Pavement longevity – ponding and undulating surface results in a deteriorating pavement, causing hazards such as pot holes and loose pavement.

Installation:

- Excavation – extensive deep underground pipe network, pit construction and site work required.
- Grading – complex four-way slopes can be difficult and timely to design and construct.
- Quality – inconsistent pavement quality may cause ponding
- Services – potential clash of deep pipes with existing services, which is extremely costly to relocate.

Maintenance:

- Blockage – pipes can be easily blocked from a build-up of debris and require frequent maintenance.
- Access – difficult to clear blockages and hard to locate as pipes are deep in the ground.

Issues with cast in-situ trench drains

Hydraulics:

- Roughness – cement concrete is not as smooth and as hydraulically efficient as polymer concrete.
- Box profile – not as hydraulically efficient as ‘U’ and ‘V’ profile channels during low flows.

Safety:

- Locking – hard to lock grate to frame, and bolts can rattle loose under traffic.
- Grates – if not locked down, they can pose hazards particularly if a grate is missing.

Installation:

- Site work – excavation, formwork construction, creation of slope can be costly and time consuming.
- Quality – dependent on the experience of the installer, can be inconsistent and vary greatly.
- Frame – difficult to achieve level frame with good concrete support which is a common cause of future problems.

Maintenance:

- Access – time consuming to undo bolts to access channels compared to the boltless locking options available for precast modular trench drains.
- Siltation – roughness of concrete will more likely silt up and require cleaning out more frequently.