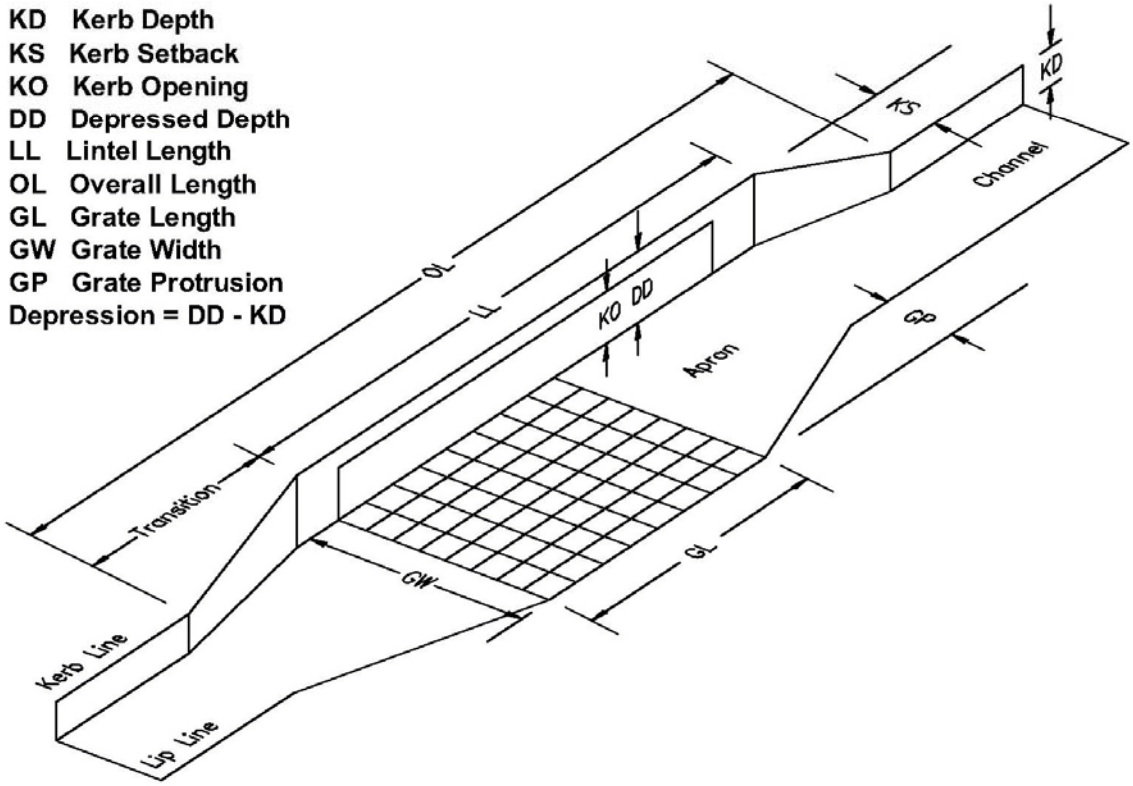
Max Q

Technical Bulletin No 1

STORMWATER INLET DESIGN

INTRODUCTION

Collection of stormwater runoff from roadway kerb and channel, a most elementary civil engineering task, has produced a great variety of solutions. In Queensland, where it is almost universally necessary to design for short duration, high intensity rainfall, a gully pit covered by a grate has always been the most popular method. Capture was first augmented by an extended kerb inlet and more recently by a lintel covering a large extended kerb inlet and channel. There is, however, a great deal of room for variations that produce important desirable and sometimes undesirable characteristics.



Some of the considerations, apart from efficiency of capture, by which an inlet may be judged are: Overall kerb length including kerb-line transitions (OL); length of the kerb opening or overall lintel length (LL); height of kerb opening (KO); setback of the lintel behind the kerb line (KS); depression of the grate below the channel invert (DD - KD); size of the grate (GW x GL); protrusion of the grate beyond the lip line (GP) and configuration of grate bars.

These characteristics affect: aesthetics; kerb length occupied; child safety; pedestrian safety; bicycle safety and trafficability which are considered briefly below.

AESTHETICS

Though this is in part a matter of personal opinion it would be generally agreed that the less obtrusive the inlet the better. Smaller inlets are always more aesthetically pleasing.

KERB LENGTH OCCUPIED

If an inlet is long enough 100% capture may be assured. However kerb space is valuable and in that respect increasing length comes at a cost. Firstly the cost of visual intrusion and secondly the cost of restriction of access affecting property value. Restriction of overall inlet length has to be aimed for.

CHILD SAFETY
To be judged child safe the kerb inlet must exclude entry of small children by feet first entry to an extent that prevents entry of the torso. Though Qudm (TN 7.05.1) permits openings up to 125mm, for child safety, inlet KO needs to be restricted to 90 -100mm.

PEDESTRIAN SAFETY
Pedestrian safety is compromised by the kerb line intrusion into the footpath due to kerb setback (KS), grate depression (DD-KD), and grate openings with slot widths >25mm (Clause 3.3.5, AS 3996 - 2006).

BICYCLE SAFETY
Both bicycle and motorcycle safety are compromised by grate depression (DD-KD), as it affects depression of the grate measured along the lip line of the channel and excessive grate protrusion (GP). Austroads, Part 14 Bicycles, Clause 8.5.1 sets a desirable depression limit of 5mm in 3m of travel.

TRAFFICABILITY
Vehicular safety is adversely affected by a broken kerb line due to kerb setback (KS) and excessive grate protrusion (GP).

CONFIGURATION OF THE GRATE
Grates must be bicycle tyre penetration resistant in accordance with AS 3996-2006, and must permit access to the pit in accordance with Clause 3.3.1, but ideally, should otherwise be no greater in size than is required for adequate capture.

COMPARING SOME AVAILABLE INLETS
Some inlets in current use are compared, on the basis of the categories described above, in the tables which follow.


Manning Kerb-in-line Inlet


BCC Type A Kerb-in-line Inlet

TABLE 1 – Manning v Type A Inlets – Kerb-in-line

Inlet Details	Kerb-in-line - Barrier Kerb - 300 Channel			
	Manning 2400	Type A 2400	Manning 3600	Type A 2400
Overall Length (lintel length)	2400	2400	3600	3600
Grate (frame overall)	862x510	942x676	862x510	942x676
Area (frame overall) m2	0.44	0.64	0.44	0.64
Grate slots < 25mm	Yes	No	Yes	No
Kerb Opening (KO)	90	125	90	125
Depression at lintel (DD)	15	50	15	50
Depression on lip line	13	37	13	37
Grate Protrusion	210	376	210	376
Capture 500L/s - 4% -1:30 Xfall	234	228	272	278
Capture/m of OL	98	95	76	77

Some observations – Kerb-in-line Inlets:

Table 1 compares inlets with Manning grates and BCC inlets with Type A grates. Nearly enough the inlets are equal for capture, otherwise in every category the Manning grated inlet is superior. However it is Child Safety of the 90mm kerb opening, and improved Bicycle Safety from 13mm v 37mm depression on the lip line and reduced Grate Protrusion (GP) that make Manning inlets a standout choice.

TABLE 2 – Manning v Type A Inlets – Lip-in-line

Inlet Details	Lip-in-line - Mountable Kerb - In order of overall length					
	Manning 1600	Manning 2400	Manning 3600	Type A 2400	Manning 4800	Type A 3600
Overall Length (OL)	3000	3800	5000	5400	6200	6600
Transition Length	1400	1400	1400	3000	1400	3000
Lintel Length (LL)	1600	2400	3600	2400	4800	3600
Grate (frame overall)	862x510	862x510	862x510	942x676	862x510	942x676
Area (frame overall) m2	0.44	0.44	0.44	0.64	0.44	0.64
Grate slots < 25mm	Yes	Yes	Yes	No	Yes	No
Kerb Setback (KS)	-40	-40	-40	125	-40	125
Kerb Opening (KO)	100	100	100	125	100	125
Depression at lintel (DD)	25	25	25	50	25	50
Capture 500L/s - 4% -1:30 Xfall [1]	160	187	245	240	300	297
Capture/m of OL	53	49	49	44	48	45

Some observations – Lip-in-line Inlets:

General

(a) Disadvantages of kerb-in-line grate protrusion (GP), replaced by the lip-in-line disadvantages of kerb setback (KS).

Stormway with Manning grates

(b) Pedestrian safe, 17mm slot width grates – 100mm child safe kerb openings (KO) – no footpath intrusion (KS) – for a given overall length (OL), equal or better capture than Type A, though that may require the next lintel size. Calibrated to 2500L/s roadway flow for design cost savings.

(c) Manning inlets should be preferred over Type A for lip-in-line construction with all kerb and channel types but, especially so, because of reduced kerb setback (KS), with 300mm channel barrier kerb.

TABLE 2 – Drainway v Type A Inlets – Lip-in-line

Inlet Details	Lip-in-line - Mountable Kerb					
	Drainway 1TP	Type A 2400	Drainway 2TP	Type A 3600	Drainway 3TP	Type A 4800
Overall Length (OL)	4900	5400	6500	6600	8100	7800
Transition Length	2200	3000	2450	3000	2700	3000
Lintel Length (LL)	2700	2400	4050	3600	5400	4800
Grate (frame overall)	600x600	942x676	600x600	942x676	600x600	942x676
Area (frame overall) m2	0.36	0.64	0.36	0.64	0.36	0.64
Grate slots < 25mm	No	No	No	No	No	No
Kerb Setback (SB)	50	125	50	125	50	125
Kerb Opening (KO)	100	125	100	125	100	125
Depression at lintel (DD)	25	50	25	50	25	50
Capture 500L/s - 4% -1:30 Xfall [1]	264	216	295	267	320	286
Capture/m of OL	54	40	45	40	40	37

Drainway captures are for Maxflow grate. Mannflow grate with 17mm slot width is recommended for CBD and residential areas.

Drainway

(d) Drainway is a premier inlet and manhole system based on long life precast units.

(e) Kerb Setback (KS) is small.

(f) Drainway Plus is calibrated to 2500L/s roadway flow, permitting cost savings in system design.

(g) Drainway Plus with 100mm Child Safe kerb openings (KO), for a given overall length (OL), has better capture than the Type A style inlets.

(h) System recommended for longevity and lip-in-line inlets with 450 channel and mountable kerb.

[1] Type A captures are from BCC charts UMS 381-383, based on modelling with the lintel set 760mm behind the lip rather than 675mm behind for UMS 330 for which captures are likely to be less at lower approach grades. Otherwise, captures compared rely strictly on capture recorded on the University of South Australia model.

BCC Type A inlets are typical of many variations using the BCC grate, for example, the IPWEA lip-in-line inlet Dwg D-0063, with the lintel set 760mm behind the channel lip.