DS.603
Structural design of kerbs and edge restraints

Rev.	Status	Created by	Date	Approved by	Date
A	Final	D,Farnham	27.02.12	D.Waters	10.04.12
B	Final	D.Farnham	30.01.13	D.Waters	08.02.13
C	Final	D.Farnham	01.05.13	D.Waters	08.05.13
D	Final	D.Farnham	06.11.13	D.Waters	14.11.13
E	Draft	G Lake	11.03.17	D Foden	18.07.19

Table of Contents

1 Introduction

1.1 Notes

a. This standard explains requirements about designing and constructing pavement edge restraints. This includes upstand kerbs to the footway edge, cross-kerbs within the carriageway, edgings to tree pits and landscaped areas, and other intermediary retaining details for footway and carriageway pavements.

b. See the SSDM/SER engineering materials palette for details of materials that are noted in parenthesis, e.g. [C-ST3]. This provides a quick reference look up table for relevant associated Southwark Highway Specification clauses.

c. Kerbs and other pavement edge restraints serve a number of functions. The most obvious to the general public is as a check to prevent vehicles mounting footways and to define the respective limits of pedestrian and vehicle space. However, their fundamental engineering purpose is to structurally retain individual areas of pavement at their joints and limits in order to prevent failure. Insufficient detailing in this respect is amongst the most common reasons for pavement failure – particularly for rigid natural stone sett surfaced carriageway pavements. In addition, kerbs often serve to check surface water and help direct this towards gullies or other collection points.

2 Use requirements

a. Edge restraints should be provided to retain pavements:

i. At interfaces between pavements with different constructions. This is irrespective of the presence of any level difference between them.
ii. At pronounced changes in level. This includes both locations where:
    - Level changes occur with a pronounced step (e.g. at the interface between footways and carriageways).
    - At pronounced change in surface gradient occurs without adequate transition sections (e.g. pedestrian ramps, ramp faces of vertical traffic calming features, Vehicle Crossings and dropped kerbs, see note 1).
iii. At any edge where no other suitable retaining structure exists (e.g. does not abut a wall with foundations). This includes rear edges of footways. It may also include tree pits and planted areas within pavements.
iv. (For unbound modular unit surfaced pavements) within areas subject to dynamic loading or impact by overrunning heavy vehicles (see note 2) to prevent loss of interlock between surface units.
v. (For bound modular unit surfaced pavements) at any movement joint or edge of pavement transition (see note 3).
vi. At the limits of any basement structure that may underlie the carriageway.

NOTE 1 Where ramps occur in bituminous mixture surfaced pavements to features like Raised Tables then edge restraints will not be necessary in most instances unless these are located on very busy roads and/or use steep gradients. See standard DS.111 for further details about Raised Tables.

NOTE 2: Dynamic forces are those created by vehicles when they break, acceleration or turn on pavements or load onto these at a level change (e.g. when mounting a kerb upstand or moving onto a ramp).

NOTE 3: Any such details need to be securely tied to the pavement they are retaining. This is important to ensure that bound surface course units are kept in place. Absence of such details is a common cause of failure for this type of pavement design.

b. The use of intermediary restraints within pavements for non-structural purposes (e.g. visual amenity through the creation of patterned bands within the surface) should only be used for structural reasons (though see standard DS130 about areas of project where a Special Placemaking Opportunity dispensation has been agreed). If designers propose to introduce any then they must explain within Pavement Design Statements why this is structurally necessary and could not otherwise be reasonably avoided Approving officers have discretion to instruct the removal of intermediary restraints (and/or the use of alternatives) if they reasonably consider either that:

- No sound structural justifications exist for them.
- The need for them could be reasonably avoided by other non-intrusive measures.

c. See standard DS.129 about the use of edge channel details to the edges of carriageway pavements.

d. Final edge restraints should always be in place before construction of pavement laying and surface courses commences.

3 Design requirements

3.1 Use of typical footing details

3.1.1 General

a. Edge and intermediary restraints should be designed as per appropriate details from the following SSDM drawings: LBS/1100/01 to LBS/1100/48
   i. for restraints to and within footways and other non-carriageway areas (including Inset Parking Bays, Vehicle Crossings, Traffic Islands, tree pits and planting beds).
   ii. for cross kerbs/restraints within or between carriageway pavements (excluding those to ramps).
   iii. for cross kerbs/restraints to ramps in the carriageway (including those to Raised Tables).
   - iv. for movement and warping joint details for rigid modular unit surfaced pavements

   Minor modifications to these may be agreed if structural reasons can be demonstrated.

b. If upstand edge restraints are likely to be at high risk of being struck by vehicles then their footings should be reinforced (if not already) by adapting them to include embedded steel dowels or steel fabric. See LBS/1100 series drawings.

NOTE: Examples include the exposed ends of traffic islands and pronounced footway build outs that face approaching traffic. However, reinforcement could also be appropriate if there is known or likely to be an issue with commercial vehicles mounting footway edges.

c. If it is not possible to construct footings in one go then, to secure backing to pre-cured beams, one of the following should be used:
   i. Embedded a steel mesh or steel dowels.
   ii. A 50mm trapezoidal key.

   See LBS/1100 series drawings.

3.1.2 Movement joints within kerb foundations

a. Special care should be taken to ensure that BS 7533-6:1999 requirements are met in relation to providing movement joints through footings at maximum 15m spacings. If movement joints are also present in the upper layers of neighbouring pavement constructions then these should be aligned to one another.

3.2 Acceptable unit types

3.2.1 General

a. All kerb and edge restraint units should be selected from amongst the LBS

Standard Units in SSDM/TDR drawing LBS/1100/01 to LBS/1100/07 (see note 1) in accordance with the requirements of 'b'. Units will be Silver Grey in colour. However, Approving Officers have discretion to require use of other colours (e.g. Mid-Grey or Dark-Grey as per Southwark Highway Specification Series 1100 Clauses) to satisfy standard DS.219 requirements in relation to visual contrast (see note 2).

NOTE 1: In almost all circumstances, kerb and edge restraint units must be from granite natural stone to BS EN 1343. Units are typically fine picked to all faces.

NOTE 2: For instance, were raised edge tree pits or planting beds introduced into a footway that had a light grey modular unit surface, then their edge kerbs may need to be Mid-Grey or Dark-Grey in order to be identifiable to blind and partially sighted people.

b. Irrespective of whether they are LBS Standard Units or other bespoke units, the following selection requirements apply:
   i. Units should be manufactured from a commercial granite or basalt to BS EN 1343. All exposed faces should be fine picked or, subject to level departure, bush hammered.
   ii. Unless required differently by other standards or in the SSDM/TDR details as '3.1.1a', kerb widths should be as Table 1.
   iii. The depth of unit required in a given instance will be determined both by the upstand kerb step that is required as standard DS.202 (see section 3.4) and the required depth of bedding and other dimensions as per the relevant SSDM/TDR detail footing detail as '3.1.1a'.
   iv. Kerb profiles and upstands should be as required in standard DS.202.
   v. If units are laid to corners with a radius ≤12m then radius units should be used.
   vi. Transition units should be used wherever:
      - The kerb width changes (e.g. from 150mm wide to 300mm wide).
      - The kerb upstand height changes (e.g. for dropped kerbs or where the height of raised edge features to planting beds varies).
      - The kerb profile changes (e.g. from a Type 1 profile to a Type 2 profile as per standard DS.202).
      - Suitable units exist in SSDM/TDR drawing LBS/C/005.
   vii. Unless required otherwise in other design standards, at pronounced changes in the kerb alignment:
      - 600mm outer radius kerbs should be used to all convex (outer) corners of features that are exposed to vehicular impact (e.g. the upstream or downstream ends of footway Build Outs to the carriageway edge).
      - Pre-cut quadrants and special angle units should be used to all concave (internal) angles wherever appropriate units for the geometry and kerb profiles exist in SSDM/TDR drawing LBS/C/005.
   viii. If units are laid within carriageway pavements (e.g. as cross-kerbs) they should have a maximum length of 600mm. In most instances this is likely to require cutting of longer units.
   ix. If quadrant units are used then their end widths should match those of the interfacing kerbs wherever appropriate units for the geometry and kerb profiles exist in SSDM/TDR drawing LBS/C/005.

SSDM/RP Specification Area	Required kerb width (unless stated differently in other SSDM/DSR standards), see also notes.
World Centre	300mm
Town Centre	
Village	
Docks	
Heritage	150mm
General	

NOTES
1) If existing kerbs are encountered within a project area that do not meet these requirements they should be replaced.
2) Alternative widths may exceptionally be permitted if overwhelming structural reason for this exists else (within conservation areas designated by the Council acting as Local Planning Authority) that this would be in-keeping with valuable heritage character in the immediate locale on that street. An example of the former might be where roots of mature trees planted close to the footway edge are heaving wide kerbs and introducing narrower ones would help alleviate the issue.

Table 1. Required kerb widths for different SSDM/RP designations.

3.2.2 Use of recycled/reclaimed edge restraint units

a. In General, Docks, Village and Heritage SSDM/RP Specification Areas the use of reclaimed/recycled units may be permitted. Where it is, contractors are responsible for meeting the requirements in 'b' below and relevant Southwark Highway Specification quality control approval requirements. In all other SSDM/RP Specification Areas, only new kerb and edge restraint units may be used (see note).

NOTE: In these other areas, high quality modern visual finishes are required to pavement surfaces. These tend to rely on clean straight lines. Reclaimed units are unlikely to fit with this.

b. If reclaimed kerbs are used to retain pavements with unbound modular surfaces, joint widths within the modular surface must be kept within permissible ranges (for which see standard DS.601). If the faces of the reclaimed kerbs that would make up the joint are irregular (and designers still wish to use these) they should be rendered with a maximum 15mm width of [J-MH2] or [J-MHX] prior to installation of pavement upper layers to create a straight flush face for laying against.

3.3 Cut length of units

a. Units should only be cut where necessary to fit gaps. Cut units should have a minimum length of 300mm where infill pieces are required.

b. See 3.2.1b.viii about cross kerbs in carriageway pavements.

3.4 Relaying edge restraints on existing foundations

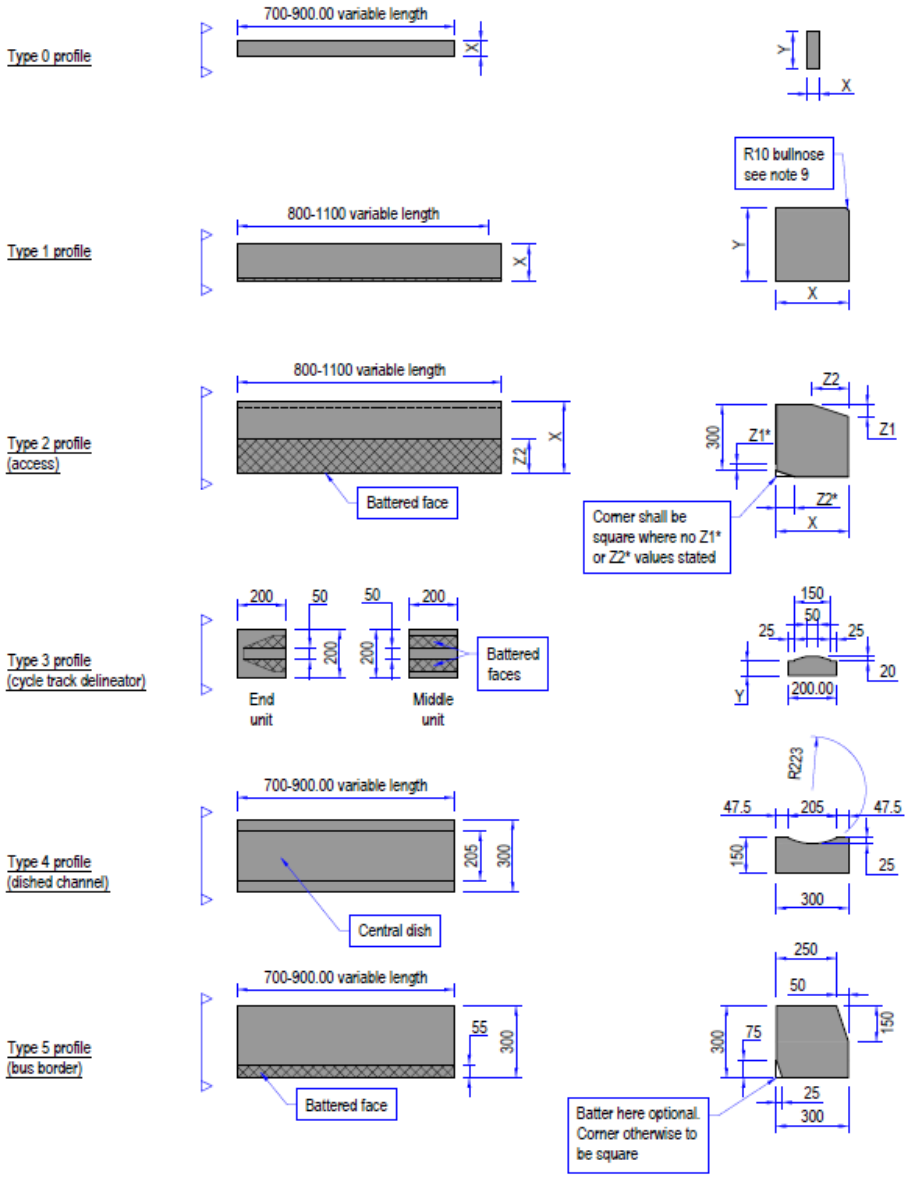
a. Edge restraints may not be laid onto existing retained foundations left over from removal of former restraints. Footings must always be broken out and replaced/reinstated as SSDM/TDR drawings LBS/1100/01 – LBS/1100/48. This applies irrespective of whether the edge restraint units to be laid are new or where previously lifted from the same foundations.

3.5 Edge restraints associated with shallow basement slabs

a. Where modular unit surfaced pavements are proposed over shallow structural concrete basement slabs (or similar) that extend beneath the Highway then associated edge restraints at the limit of the slab should be tied to it with steel dowels or similar. This will likely require agreement of a bespoke footing detail.

Appendix A Extracts from Standard Detail Drawings LBS/1100/01 to 07

STRAIGHT KERBS



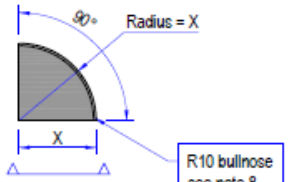
STRAIGHT KERBS							
Profile	Type Designation	X	Y	Z1	Z2	Z1*	Z2*
Type 0 see note 10	ES-N5(150)	65	150	-	-		
	ES-N5(250)	65	250	-	-		
	ES-PC(150) see note 11	50	150	-	-		
	ES-PC(250) see note 11	50	250	-	-		
Type 1 see note 10	KS-T1-150/375	150	375	-	-		
	KS-T1-150/300 see note 12	150	300	-	-		
	KS-T1-300/375	300	375	-	-		
	KS-T1-300/300	300	300	-	-		
	KS-T1-300/150 see note 12	300	150	-	-		
Type 2	KS-T2-150/300/55	150	-	50	150		
	KS-T2-150/300/25	150	-	25	75		
	KS-T2-300/300/100	300	-	100	300		
	KS-T2-300/300/75	300	-	75	225		
	KS-T2-300/300/25-50 see notes 13 and 14	300	-	50	150	25	75
	T5-T2-375/300/150	450	-	150	450		
	T5-T2-375/300/125	450	-	125	375		
Type 3 see note 15	KS-T3-PC1 see note 11	-	60	-	-		
	KS-T3-N51	-	75	-	-		
Type 4	KS-T4-300/150	-	-	-	-		
Type 5	KS-T5-300/300 see note 13	-	-	-	-		

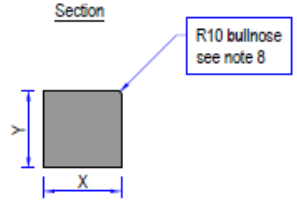
QUADRANT AND ANGLE KERBS

Plan

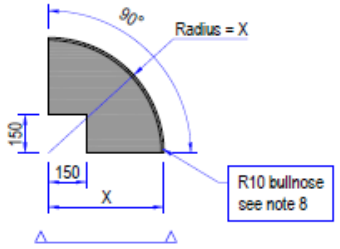
Section

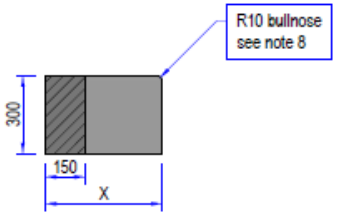
Quadrant - normal
Type 1 profile



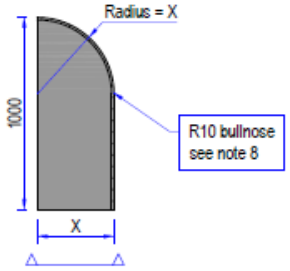


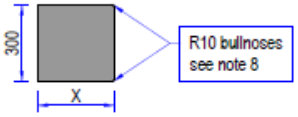
Quadrant - angle-cut
Type 1 profile





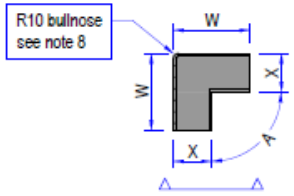
Quadrant - extended
Type 1 profile

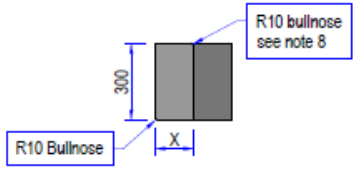




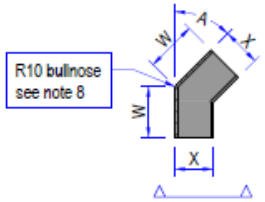
QUADRANT				
Kerb Type	Type Designation	X	Y	Z
Normal	KQ-R300-300	300	300	-
	KQ-R300-150	300	150	-
	KQ-R450-300	450	300	-
Angle-cut	KQ/A-R300-300/150	300	-	-
	KQ/A-R450-300/150	450	-	-
Extended	KQ/E-R300-300/300	300	-	-
	KQ/E-R450-300/300	450	-	-

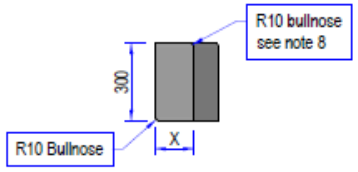
Angle kerb - 90°
Type 1 profile





Angle kerb - 45°
Type 1 profile



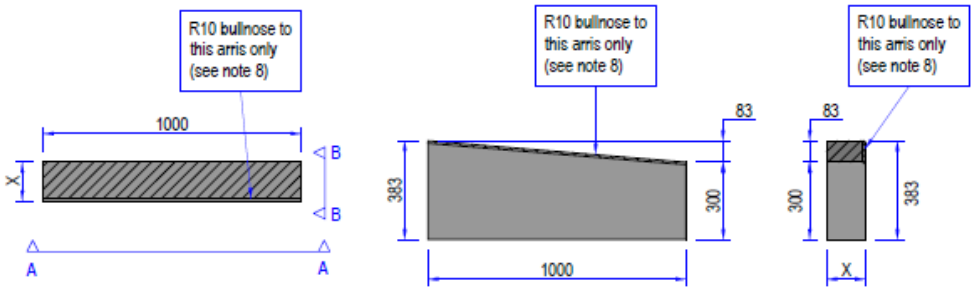


ANGLE KERBS			
Type Designation	A	W	X
KA-A90-150/300/300	90°	300	150
KA-A45-150/300/200	45°	200	150
KA-A90-300/300/500	90°	500	300
KA-A45-300/300/450	45°	450	300

TRANSITION KERBS

Plan | Section A-A | Section B-B

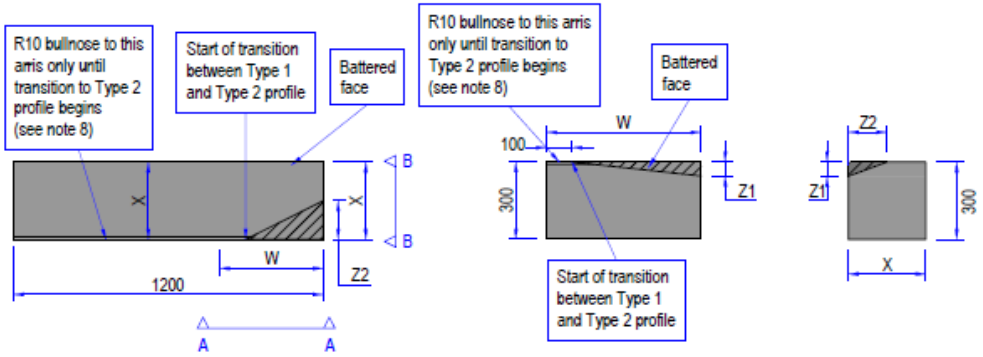
Type 1 into Type 1 profile
(for flared dropped kerb)



STRAIGHT DROPPED TYPE 1 PROFILE TRANSITION KERBS	
Type Designation	X
KT-T1-DRP-150/300	150
KT-T1-DRP-300/300	300

Both the above units shall be available as both left and right mirror image versions

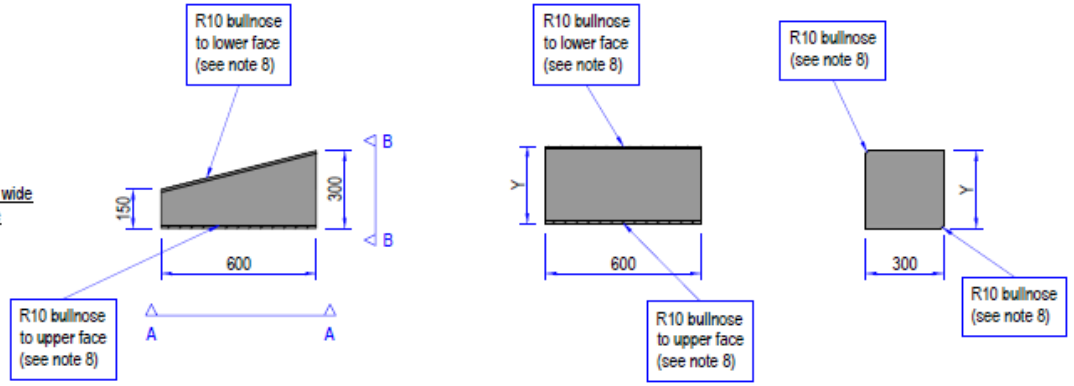
Type 1 into Type 2 profile
(see note 11)



STRAIGHT TYPE 1 INTO 2 PROFILE TRANSITION KERBS				
Type Designation	W	X	Z1	Z2
KT-T1>T2-150/300/50	300	150	50	150
KT-T1>T2-300/300/100	600	300	100	300
KT-T1>T2-300/300/50 Also suitable for Type 1 into Type 5 - see note 12	300	300	50	150

All the above units shall be available as both left and right mirror image versions

150mm wide into 300mm wide
Type 1 into Type 1 profile
(see also notes 13)



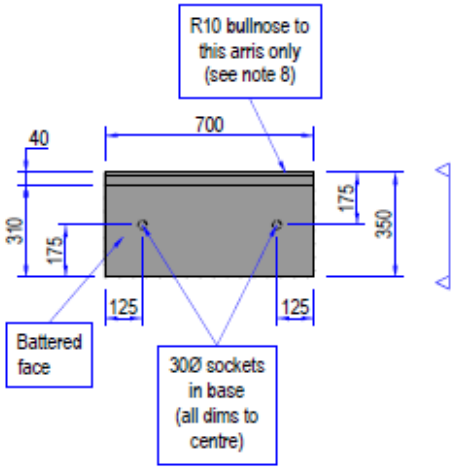
STRAIGHT TYPE 1 INTO 2 PROFILE TRANSITION KERBS	
Type Designation	Y
KT-T1-150>300/300	300
KT-T1-150>300/300	150

Both the above units shall be available as both left and right mirror image versions

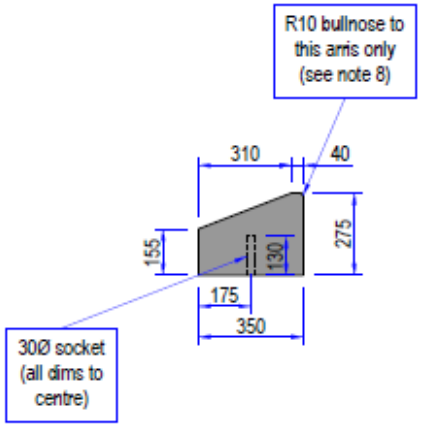
KERBS - MISCELLANEOUS

Traffic Island Stagger kerb
Type Designation: KM-TI-1

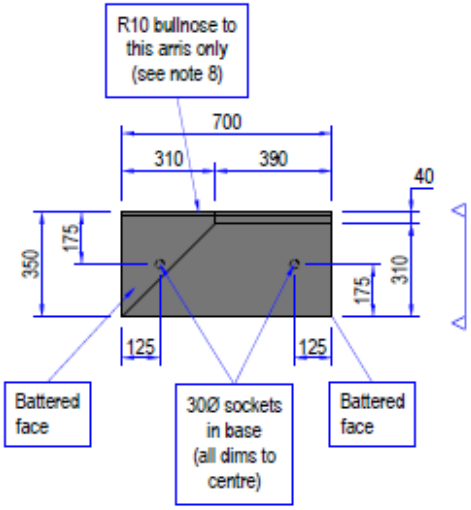
Plan

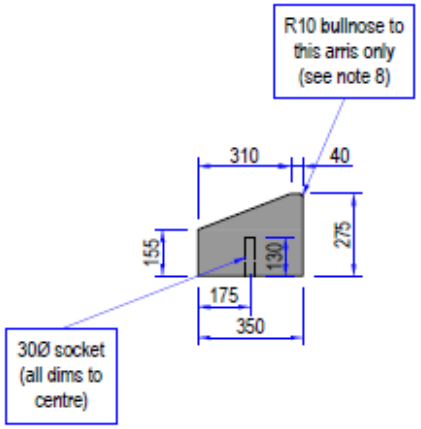


Section



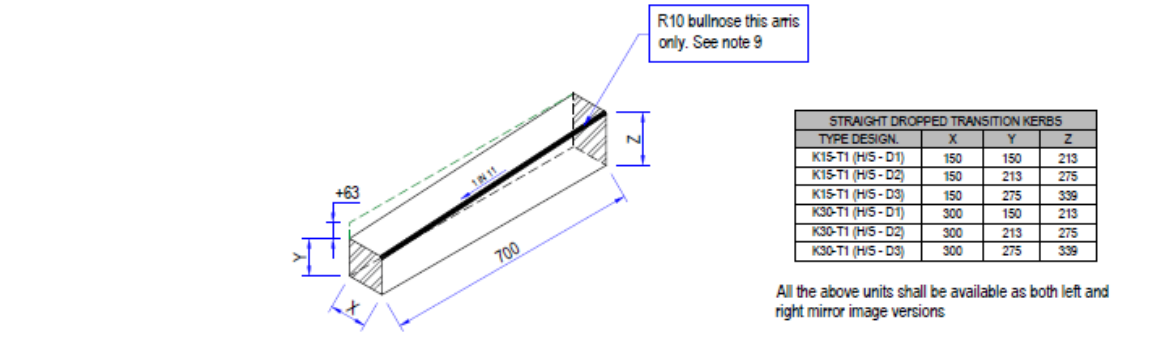
Traffic Island Stagger kerb
Type Designation: KM-TI-2





TRANSITION KERBS - DROPPERS

Type 1 into Type 1 profile (for flared dropped kerb)



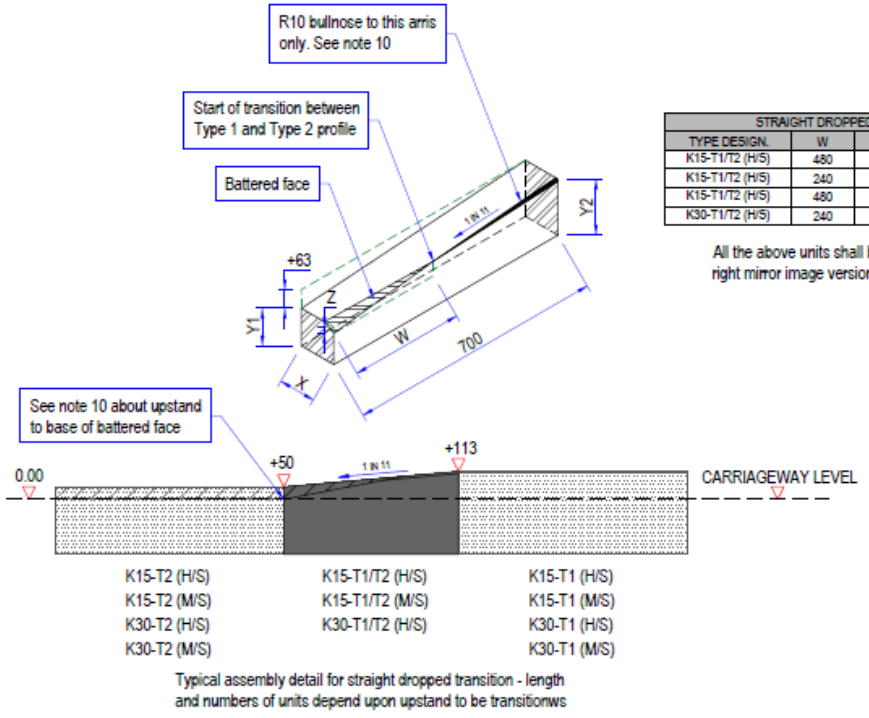
STRAIGHT DROPPED TRANSITION KERBS			
TYPE DESIGN.	X	Y	Z
K15-T1 (H/S - D1)	150	150	213
K15-T1 (H/S - D2)	150	213	275
K15-T1 (H/S - D3)	150	275	339
K30-T1 (H/S - D1)	300	150	213
K30-T1 (H/S - D2)	300	213	275
K30-T1 (H/S - D3)	300	275	339

All the above units shall be available as both left and right mirror image versions

Typical assembly detail for straight dropped transition - length and numbers of units depend upon upstand to be transitionws

Type 1 into Type 2 profile (for flared dropped kerb)

NOTE: This unit type can be substituted into the Type 1 to Type 1 dropped transition assembly indicatively shown above in place of the lowest dropper unit if a transition to a type 2 is required.



STRAIGHT DROPPED TRANSITION KERBS					
TYPE DESIGN.	W	X	Y1	Y2	Z
K15-T1/T2 (H/S)	480	150	270	333	50
K15-T1/T2 (H/S)	240	150	270	333	25
K15-T1/T2 (H/S)	480	300	270	333	50
K30-T1/T2 (H/S)	240	300	270	333	25

All the above units shall be available as both left and right mirror image versions

Typical assembly detail for straight dropped transition - length and numbers of units depend upon upstand to be transitionws