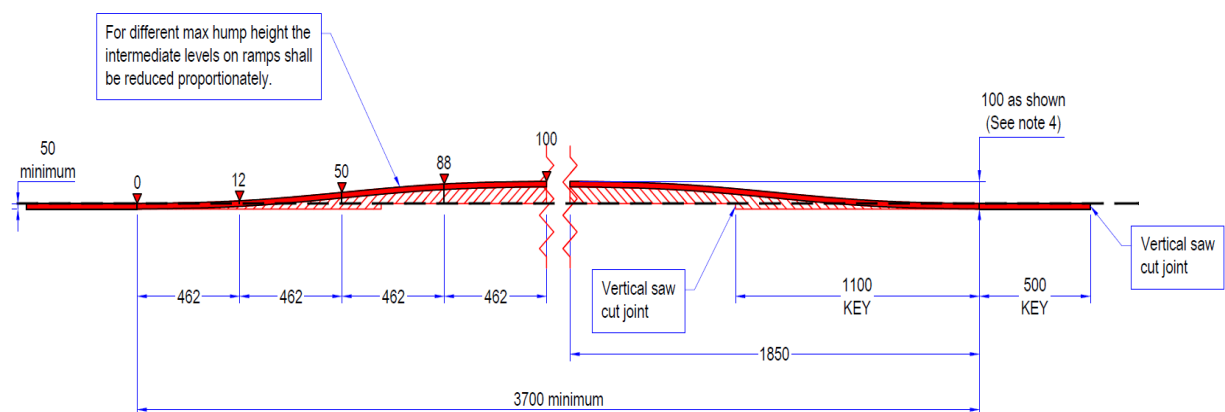


DS.111 Vertical Traffic Calming Features

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SECTION B-B - SINUSOIDAL HUMPS (NOT TO SCALE)

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1 Introduction

1. Notes

- a. This standard explains requirements about the use and design of vertical traffic calming features. These include Raised Tables, Traffic Carpets, Road Humps and Speed Cushions.

- b. See the Southwark Streetscape Design Manual at [Southwark SSDM](#).

2. Types of Feature

- a. Table 1 provides a brief description of the various types of vertical traffic calming feature covered by this design standard whilst Table 2 explains the various sub-types of two of these.

Type	Description	Pros and cons
Raised Table	<ul style="list-style-type: none"> - Raised sections of carriageway that extend kerb to kerb and are broadly flush with neighbouring footways. - Plateaus are bituminous mixture surfaces in Village and General areas or may be modular paving in Town, World, Heritage or Dock areas (refer to Materials Palette). - On/off ramps shall be bituminous mixture surfaced. - Have relatively steep on/off ramp gradients. - Always include at least one Formal Crossing for pedestrians on them. - May be used both at junctions and on links. 	<ul style="list-style-type: none"> - Help make crossing easier and can highlight crossing pedestrians to vehicle users. - Positive townscape value can support creation of shared space. - On/off ramps can provide effective traffic calming (though this depends upon their gradient) - Complex and costly to construct if they include kerbs at the top or base of on/off ramps. - Flush edge with footway can create delineation issues for blind and partially sighted people that are hard to design out. - Can be uncomfortable for bus and ambulance passengers unless ramps are very shallow and plateaus quite long.
Traffic Carpet	<ul style="list-style-type: none"> - Raised sections of carriageway that extend kerb to kerb whilst retaining a 60mm high upstand to neighbouring footway edges (other than at Formal Crossings which are flush). - Plateaus are bituminous mixture surfaces in Village and General areas or may be modular paving in Town, World, Heritage or Dock areas (refer to Materials Palette). - On/off ramps are bituminous mixture surfaced. - Have shallow on/off ramp gradients. - Always includes at least one Formal Crossing for pedestrians on them. - May be used both at junctions and on links. 	<ul style="list-style-type: none"> - Help make crossing easier and can highlight crossing pedestrians to vehicle users. - Positive townscape value can support creation of shared space. - Simpler and cheaper to construct than most types of Raised Tables. - 60mm kerb to footway avoids delineation issues for blind and partially sighted people and simplifies design. - Avoids discomfort issues for bus and ambulance passengers. - Likely to be less effective at reducing vehicle speeds than Raised Tables.
Road Hump	<ul style="list-style-type: none"> - Raised section of carriageway that extend most of the way across the road, stopping ~300mm short of the kerbs. - Between 75-100mm high. - Have relatively steep on/off ramps with sinusoidal profile. - May be relatively brief features or include extended plateaus between the on/off ramps. - Always bituminous mixture surfaced. - Cannot accommodate Formal Crossings. - Can only be used on links. 	<ul style="list-style-type: none"> - Cheap and easy to construct (though construction can be more difficult as sinusoidal profiles are used). - Provide effective traffic calming (though extent will vary for different vehicle types depending on the on/off ramp gradient and profile used). - No positive benefit in townscape terms but need not be unsightly. - Can be uncomfortable for bus and ambulance passengers and cyclists unless sinusoidal profiles are used. However, sinusoidal profiles may provide perceived less effective traffic calming.
Speed Cushion	<ul style="list-style-type: none"> - Raised mounds in the carriageway. Normally only 1-2m wide. Three or four are normally provided in a line across the carriageway with significant gaps between them. - Between 75-100mm high. - Have relatively steep on/off ramps which may adopt one of several profiles (e.g. sinusoidal, round, flat). - Normal only 2-4 m long. - Always bituminous mixture surfaced. - Cannot accommodate pedestrian crossings. - Can only be used on links. 	<ul style="list-style-type: none"> - Easier for buses/ambulances to traverse without discomfort to passengers. - Cheap and easy to construct. - Tend to be unsightly in townscape terms due to related signage and road markings. - Can promote poor positioning by road users and related road safety issues. This can be particularly problematic for cyclists. - May not provide effective traffic calming for larger vehicles (e.g. SUVs).

Table 1 - Types of vertical traffic calming feature

Description of location/arrangement of feature	Raised Table feature and feature sub-type	Traffic Carpet feature and feature sub-type
At a junction spanning the entire intersection space and extending at least 3.5m back down each arm from this	Intersection Table	Intersection Carpet
At a junction across a side road arm (though not extending back into the main intersection space)	Entry Table	Entry Carpet
On a link between junctions	Link Table	Link Carpet

Table 2– Sub-Types of Raised Table and Traffic Carpet

3 Use requirements

3.1 Mandatory requirement to introduce new vertical traffic calming features when carrying out specific works.

- a. Within
- proposed new streets and spaces
 - existing streets and spaces where works require consent via section 278 of the Highways Act 1980 (see note);
- one of the vertical traffic calming features permitted as Table 3 (as appropriate) should be considered at each of the locations identified.

This requirement may be waived by level 1 departure if designers can demonstrate to Approving Officers that introducing one of the required features is inappropriate in the circumstances on either safety or accessibility grounds.

NOTE: This applies to streets that it is intended to offer for adoption under section 38 of the Highways Act 1980. It also applies to new junctions created with existing roads to provide access to new streets.

Feature (as Table 1)	Feature Sub-Type (as Table 2)	Is the feature permitted at a Junction?	Is the feature permitted at a Formal crossing for pedestrians or cyclists away from junction?
Raised Table	Intersection Table	Yes	No
Raised Table	Entry Table	Yes, though this can be problematic if the ramp closest to the junction has a kerb at its base (see note 2)	No
Raised Table	Link Table	No	Yes
Traffic Carpet	Intersection Carpet	Yes	No
Traffic Carpet	Entry Carpet	Potentially, subject to level 1 departure. Designers must demonstrate to the satisfaction of Approving Officers that an Intersection Carpet would not be appropriate	No
Traffic Carpet	Link Carpet	No	Yes

NOTE

- See '3.1.a' for details of the circumstances when the requirements of this Table apply.
- The reason for this issue relates to the footing structure for the base of ramp edge restraint (see drawings LBS/1100/037 & LBS/1100/039). This will extend around 750mm beyond the base of ramp under the preceding carriageway. Consequently, unless the base of ramp is set-back down the side road it is likely to be trafficked by vehicles passing along the major road carriageway. Both this and the unevenly applied load from turning commercial vehicles will increase the likelihood of structural failure of the detail. Introducing Intersection Tables may be preferred in these circumstances.

Table 3– Locations where Raised Tables and Traffic Carpets must be provided in association with developer related works

- b. In instances other than 'a' there is no requirement to introduce any type of new vertical traffic calming feature where none previously existed (though see note below). However, should designers wish to do so then only Raised Tables or Traffic Carpets may be used. Using Speed Cushions or Speed Humps requires level 1 departure.

NOTE: Notwithstanding the above, introducing vertical traffic calming features is encouraged wherever budgets permit. For instance, if there was an Objective to "reduce vehicle speeds" at a particular location then designers might chose to deploy permitted types of vertical traffic calming feature as one means of achieving this.

3.2 Reviewing existing vertical traffic calming features

3.2.1 Road Humps and Speed Cushions

General

- a. Except where 'b' applies, any existing Road Humps or Speed Cushions that are encountered in a project area should be replaced with Raised Tables or Traffic Carpets (as appropriate). These should provide equal or greater traffic calming effect. If there is insufficient funding it may be permitted to:
- i. use other types of non-vertical traffic calming feature instead like rumble strips, speed control bends, landscaped chicanes or '20mph' roundel road markings
 - ii. (exceptionally) replace a feature with a 'sinusoidal profile' Road Hump. Normally this will be permitted only after all the above options have been explored and ruled out due to safety concerns.
- b. In some situations, it may be appropriate to remove Road Humps and Speed Cushions without replacing them with other features (see note).

NOTE: An example of such a situation might be a short cul-de-sac where humps or cushions were provided only to meet now superseded statutory requirements related to creating 20mph zones.

Within Highway Maintenance Projects

- c. If a project is funded solely by Highway maintenance (planned and reactive) budgets then any Speed Cushions or Road Humps encountered within the project area should be replaced with 'sinusoidal profile' Road Humps. If further separate capital funding is available then upgrading facilities to Raised Tables or Traffic Carpets should be considered within the limits of the available budget. However, if no such additional funding is available this is not a requirement. In addition:
- i. it may be permitted to introduce '20mph' roundel markings instead of 'sinusoidal profile' Road Humps. Approving officers should be satisfied that vehicle speeds on the street will remain appropriate. Normally this will be considered only for occasional Speed Cushions or Road Humps and not for all those along a street
 - ii. it may occasionally be appropriate to remove Road Humps and Speed Cushions without replacing them with other features (see note to 'a').

3.2.2. Raised Tables

- a. If existing Raised Tables are encountered within project areas they should be:
- i. reviewed for consistency with this and other design standards
 - ii. upgraded accordingly where possible.
- b. Particular attention should be paid to:
- i. meeting requirements for:
 - delineating the edges of the footways (or other non-carriageway areas) that bound the Table plateau
 - achieving visual contrast between the surfaces used to the Table plateau and those used to the bounding footways (see standard DS.219)
 - providing suitable lengths and types of tactile paving at associated Formal Crossings for pedestrians (see standard DS.207)
 - providing effective drainage at the carriageway edge through Formal Crossings for pedestrians.

- ii. The condition of any edge restraints at the top and/or base of on/off ramps. If these show signs of failure (which may be evidenced by the ramp or plateau surface immediately bounding these failing) then they should be replaced and upgraded to current details.
- iii. The possible presence of any Statutory Undertakers service covers within the faces of on/off ramps. These may have been added since the feature was first constructed. If an affected ramp is modular unit surfaced then it should be replaced with a bituminous mixture surfaced ramp else the ramp should be relocated away from the cover (by extending or shortening the plateau of the Table).

3.3. Consultation requirements

3.3.1. Statutory requirements

- a. Highway Authorities have a statutory duty to consult the police (Highways Act 1980) when road hump schemes are proposed for a road or area (TAL 03/94) and they must also post notices in the street and in local papers advertising the scheme. The 1999 Highways (Road Hump) Regulations require consultation with the fire service, ambulance service and organisations representing those who use the road. This would include the residents' organisations and the bus operators, but it may also include haulage organisations. It is also recommended that the consultation process does not just cover the statutory duties requirements, but that authorities should open up a dialogue with all interested parties (including pedestrians, disabled people, and cyclists' groups) to try to ensure that there is a consensus in favour of the scheme. For disabled people see Laria guidance ([Laria website](#)).

3.3.2. Local constitutional requirements

- a. The Southwark Constitution may also require additional consultation with local

elected bodies (including Community Councils). This is updated annually. Designers are advised to check.

- b. The Highway Authority will consult with the public on any proposal to introduce new Road Humps at least once during Outline Design or Detailed Design of the development process. It will take into account any responses received when determining whether to proceed with or modify proposals. Individual responses will not normally be provided to those who have commented as part of the consultation.
- c. The Highway Authority will not normally consult the public on proposals to modify an existing Road Hump.

4. Design requirements for Raised Tables

4.1. Plateaus

4.1.1. Lengths

- a. Maximum and minimum plateau lengths measured along the carriageway should be as Table 4.
- b. Plateaus should extend 300-500mm beyond any areas of blister tactile surfacing associated with any Formal Crossings provided on the Raised Table (see note 1). Extending plateaus further than this requires level 1 departure.

NOTE 1: This is to help position visually impaired people using Formal Crossings away from off/off ramp faces which may otherwise destabilise them.

NOTE 2: Other delineation measures discussed include raised edge tree pits or planting beds and closely spaced items of street furniture (e.g. cube or sphere bollards). The latter require departure and may not always be permitted owing to the clutter they tend to introduce and the risk of regular vehicle knock-down.

Type of Raised Table (see Table 2)	Letter	Traffic conditions	Required min - max length (metres) – see also note
Entry Table	A	Streets carrying < 500 vehicles in the busiest lane in the peak hour (except where C applies)	4 - 4.8m
Entry Table	B	Streets carrying ≥ 500 vehicles in the busiest lane in the peak hour	4.8 - 6.5m
Entry Table	C	Streets that are Classified Roads (A or B roads)	4.8 - 6.5m
Intersection Table	D	All	3.5m - 4.8m down any arm measured back from the edge of the main junction space
Link Table	E	Streets carrying < 500 vehicles in the busiest lane in the peak hour (except where G or I apply)	4 - 4.8m
Link Table	F	Streets carrying ≥ 500 vehicles in the busiest lane in the peak hour	4.8 - 6.5m
Link Table	G	Streets that are Classified Roads (A or B roads)	4.8 - 6.5m
Link Table	H	Streets that accommodate bus routes (excluding diversionary routes)	4.8 - 6.5m

NOTE

See '4.1.1b' about the length that plateaus should or may extend beyond blister surfaced Formal Crossing areas for pedestrians.

Table 1 - Maximum and minimum plateau lengths for Raised Tables

4.1.2. Heights

- a. The height of plateaus above the underlying carriageway should be
 - i. equal to the height of the neighbouring footway minus the necessary upstand kerb step that must be provided at the interface with the plateau for delineation purposes
 - ii. ≤ 100mm (measured by comparison with a projected line following the centre-line profile of the carriageway through the feature).

- b. Greater heights require level 2 departure. Vertical vehicle auto-tracking simulations must be provided to demonstrate that grounding will not occur.

4.2. On/off ramps

4.2.1. Gradients and profiles

- a. Gradients for on/off ramps should be as Table 5. Alternative gradients require level 1 departure.

Letter	Traffic conditions (see note 1)	Required on/off ramp gradient
A	Streets carrying < 700 vehicles in any lane in the peak hour (except where C or D apply) or where the total design life standard axle trafficking would be as that for Road Category 3B or quieter (see note 2)	1:10 - 1:12
B	Streets carrying ≥ 700 vehicles in any lane in the peak hour or where the total design life standard axle trafficking would be as that for Road Category 3A or busier (see note 2)	1:15 - 1:17
C	Streets that are Classified Roads (A or B roads)	1:15 - 1:17
D	Streets accommodating bus routes (excluding diversionary routes)	1:15 - 1:17

NOTE

1) At Intersection Tables, traffic conditions on each arm should be separately assessed.

2) See Table 3 in standard DS.601 for details of Road Categories and associated trafficking levels.

Table 2 – Vehicle ramp gradients for Raised Tables

- b. The faces of on/off ramps should have a flat profile (see note).

NOTE: Whilst sinusoidal profiles are often requested by cycle campaigners, research suggests that they offer little benefit compared with flat faces when applied to Raised Tables (e.g. features with a flat plateau) in terms of reducing discomfort. See Department for Transport 'Traffic Advisory Leaflet 10/00' for further information. In addition, sinusoidal profiles are more difficult to accurately construct.

4.2.2 Edge restraints at the top and base of on/off ramps

- a. If an on/off ramp has been surfaced with modular units (following a departure) then edge restraints should be provided at both its top and base.
- b. If a plateau is surfaced with modular units (but not associated on/off ramps) then an edge restraint should be provided to the top of each bounding on/off ramp to retain the units used to the plateau.
- c. If all parts of a Raised Table are bituminous mixture surfaced then providing edge restraints to either the top or the base of ramps is optional (see note). However, approving officers may require this if ramp gradients < 1:15 are exceptionally permitted on streets with traffic conditions as (B), (C) or (D) in Table 5.

NOTE: Whilst introducing edge restraints can help define Formal Crossings for pedestrians (and so exert a traffic calming influence) this will likely increase costs and construction times on site due to the complexity of the necessary footing detail. See section 4.6 for further discussion about construction issues.

4.2.3. Kerb upstands

- a. Upstands to kerbs, edge restraints and other transitions at the top or base of on/off ramps should be flush (0mm upstand).

NOTE: Any significant upstand will cause substantial discomfort for vehicle users. However, it should be appreciated that construction tolerances will apply as usual on top of the flush value.

4.2.4. Locating ramp bases in relation to footway build outs

- a. If an on/off ramp coincides with the start of a Build Out at the carriageway edge then its base should be aligned to the start of the 'body' section of the Build Out (see note). It should not coincide with the start of the tapers from which the Build Out develops.

NOTE: The 'body' section of a Build Out is the point at which start and end tapers have finished developing and the feature has assumed it's typical width.

4.2.5. Service covers and chambers

- a. Statutory Undertakers service covers and associated chambers should not be located within on/off ramps. Ramps should be positioned to ensure this. Where it can be demonstrated that this is unavoidable (which may include owing to an unsatisfactory layout otherwise) then only bituminous mixture surfacing should be used to the on/off ramp.

NOTE: This a common cause of pavement failure. However, members of the public should appreciate that the Highway Authority is unable to prevent Statutory Undertakers from inserting Service Covers (and associated chambers) into Highway pavements after Raised Tables (and other features) have been constructed.

4.3. Surface landscaping

4.3.1. Surfacing materials

- a. In existing streets and spaces
 - i. unless level 1 departure is agreed, bituminous mixture surfacing should be used to the plateaus in Village and General areas, whereas modular unit surfacing should be used to the plateaus of new Raised Tables in World, Heritage, Docks and Town Centre areas. Whilst designers have discretion to use modular unit surfacing to the plateau of a Table they are under no obligation to do so.
 - ii. bituminous mixture surfacing should be used to all ramps of any new Raised Tables (see note). However, prestigious World Centre schemes may have bound modular ramp construction as a level 1 departure.

- b. In new streets and spaces plateaus of Raised Tables should be bituminous mixture surfacing in Village and General areas, whereas modular unit surfacing should be used to the plateaus of new Raised Tables in World, Heritage, Docks and Town Centre areas. However, approving officers have discretion to permit or instruct by level 1 departure the use of bituminous mixture surfacing to the plateau if they reasonably consider that using modular unit surfacing is inappropriate for engineering, road safety, accessibility or network management reasons.

NOTE: Bituminous mixtures should be neutral grey/black. Coloured mixtures should not be used.

- c. If modular unit surfacing is used then:
- i. unless departure is permitted the type of unit used should be as directed in the SSDM Surfacing Materials palette for the relevant SSDM/RP designation(s) area for the location. See DS.130 for further details.
 - ii. care should be taken to retain required joint widths at the interface between units and the edge restraints at the top of the ramp (see note). See standard DS.601 for details of necessary joint widths.

NOTE: This may require taper cutting of units to the rows making up these joints.

- d. See also :
- i. standard DS.130 about the visual design of surfaces
 - ii. section 5 of standard DS.601 for details of permitted laying patterns for unbound modular unit surfaces should these be used to plateaus
 - iii. standard DS.219 for information about related pedestrian accessibility issues (including a requirement that plateaus and adjoining footways visually contrast).

4.4 Delineating footway edges beside plateaus

- a. Delineation measures include raised edge tree pits or planting beds and closely spaced items of street furniture (e.g. cube or sphere bollards). The latter require departure and may not always be permitted owing to the clutter they tend to introduce and the risk of regular vehicle knock-down.

NOTE: This is of considerable importance to ensuring appropriate safety and accessibility for blind and partially sighted people (as well as people from some other vulnerable groups).

4.5 Formal Crossings for pedestrians

NOTE: See standard DS.206 about providing Formal Crossings for pedestrians at junctions and along links in general. This includes details of the number of arms that Crossings must be provided on and how far back from the main junction space they may be located.

- a. At least one Formal Crossing for pedestrians should be provided over each Raised Table. That may be either a Controlled Crossing or an Uncontrolled Crossing.

NOTE: Designers should note that, in the case of Intersection Tables, DS.206 will often dictate providing a Formal Crossing on each arm of the junction spanned by the Table.

4.6. Structural requirements

4.6.1. Raised Tables that include edge restraints to their on/off ramps

- a. If Raised Tables include edge restraints to the top and/or base of their on/off ramps (see section 4.2.2) then they should be designed as per appropriate details from drawing LBS/1100/36, 37, 38 and 39 (see Appendix C). The appropriate detail will depend upon:
- i. the respective surfacing materials that are used on the plateau (for which see section 4.3.1)
 - ii. whether the on/off ramps have edge restraints at both their tops and bases (for which see section 4.2.2)
 - iii. the overall length of the feature.

- b. Designers should note that:
- i. steel reinforcement details associated with on/off ramp footings may sometimes need to be slightly modified to accommodate different depths of kerb embedment/modular unit cover
 - ii. if modular unit surfacing is used to plateaus then it may be laid either bound or unbound. The use and design requirements of standard DS.601 remain applicable in respect to each of these methods.

4.6.2. Fully flexible bituminous mixture Raised Tables that do not include any edge restraints to their on/off ramps

- a. Except if 'b' applies, bituminous mixture Raised Tables of the above type should be machine-laid. However, hand-cut, saw-cut joints are to be provided at the base and top of the ramps. This is intended to create a definite change in road surface gradient at the start and end of the ramps, rather than it "rolls" over, permitting increased vehicle speeds. If it can be demonstrated that it is impractical to machine-lay the asphalt, hand laid asphalt Raised Tables may be permitted by a level 1 departure.
- b. As an exception from 'a', if either:
 - i. a round or sinusoidal on/off ramp profile is used
 - ii. a flat on/off ramp profile with a gradient steeper than 1:15 is used
 - iii. the overall length of the Raised Table (including both on/off ramps and plateaus) is < 7.0m

then the Raised Table should be hand-laid, owing to the impracticality of machine-laying the asphalt courses under such circumstances. See also section 4.6.3 about levels issues. These are important to ride quality, drainage, and achieving satisfactory tie-in with the carriageways that immediately precede a feature.

4.6.3. Levels issues

- a. Great care and attention to detail is required when determining surface grades and levels on and when transitioning into Raised Tables. Issues to consider include
 - i. ensuring sufficient grades to maintain positive drainage whilst avoiding
 - substantial variation in the kerb upstand at the footway interface
 - ponding over the footway edge and in front of waiting areas associated with Formal Crossings
 - ii. how to transition from a likely centrally-crowned carriageway profile before/after the Raised Table whilst at the same time avoiding flat profiles at the bases of on/off ramps which may encourage ponding
 - iii. (if rigid pavement constructions are used to Plateaus) how best to align movement and warping joints in order to
 - keep these out of wheel paths (likely to be of greatest concern for warping joints) and so minimise the need for future in-service maintenance
 - avoid visually disrupting laying patterns (if modular unit surfacing is used)
 - simplify overall design and construction
 - iv. The above will likely prove to be most challenging for Intersection Tables that have bound/rigid modular unit surfaced plateau pavements. Straightforward for Link Tables (since intersection with other carriageways is then avoided) and where plateau pavements have a flexible bituminous or modular unit surfaced design (since these are more easily shaped to profiles and avoid the need for joints).
- b. The appropriate response to address the issues in 'a' will vary with constraints. This makes it difficult to provide definitive guidance. Notwithstanding this, designers are responsible for addressing these issues and must explain in Pavement Design Statements how they have done so.

4.7 Drainage considerations

- a. Similar to any other part of the Highway, no valleys may exist in surfaces to Raised Tables that may cause surface water to pond – unless a gully or other collector opening is located there. This requires careful grading of surface levels (in terms of both longitudinal and cross falls) and design of kerbs/drainage checks. A particular concern should be avoiding risk of ponding in front of Formal Crossing waiting areas (see note 1). Wherever possible designers should look to introduce sufficient falls to shed water off of the plateau into the preceding carriageway (see note 2). Surface water should not be shed onto neighbouring footways. Where it is not possible to shed surface water from the plateau then introducing gullies or other collector openings within this may be necessary. Any such features should be located just upstream of the Formal Crossing but outside of the crossing path - as they may introduce heel traps.

NOTE 1: In periods of heavy rainfall this may otherwise make crossings completely unusable. Waiting pedestrians may also be sprayed by vehicles as they pass through the puddles that develop.

NOTE 2: This is the most economic strategy as it will reduce the overall number of gullies required in the street.

4.8. Miscellaneous

4.8.1. Locating parking on Raised Tables

NOTE: As discussed in Appendix A, no statutory requirements exist in Greater London about the design of Raised Tables or other vertical traffic calming features. Therefore, unless stated otherwise, the requirements in the following sections represent local requirements for roads for which Southwark Council is the Highway Authority only.

- a. Parking bays for waiting or loading should not be located on Raised Tables (see note 1). Any existing instances encountered on existing Raised Tables should be reviewed with a view to designing these. Retaining instances requires Level 1 Departure.

NOTE 1: This is because pedestrians are likely to cross informally anywhere on Raised Tables (including at locations away from defined Formal Crossings). Parked vehicles may obscure visibility of them for approaching vehicles.

4.8.2. Traffic Islands on Raised Tables

- a. If Traffic Islands are located on Raised Tables then all parts of them (other than any areas providing through-passage for pedestrians) should be higher than the plateau of the Raised Table. Not more than 0.5m of any end of a Traffic Island may extend out onto an on/off ramp.

5 Design requirements for Traffic Carpets

5.1 Plateaus

5.1.1 Lengths

- a. Plateaus should:
 - i. be ≥ 4.5 m in length when measured along the carriageway
 - ii. extend a minimum of 300mm beyond any areas of blister tactile surfacing associated with any Formal Crossings for pedestrians provided over the feature (see section 5.5 and see note).

NOTE: This is to help position vulnerable pedestrians who may be using the crossing (such as visually impaired people) away from flares associated with dropped kerbs. These might otherwise pose a trip hazard were they to veer slightly off course when crossing.

5.1.2 Heights

- a. Plateau heights above the underlying carriageway (see note) should be equal to the height of the neighbouring footway minus the necessary upstand kerb step that must be retained at the interface with the plateau for delineation purposes (for which see section 4.4).
- b. No maximum limit is placed on the height since – given the very shallow ramp gradients used to Traffic Carpets (for which see section 5.2.1) there is little risk of vehicle grounding.

NOTE: This is measured by comparison with a projected line following the centreline profile of the carriageway through the feature.

5.2 On/off ramps

5.2.1 Gradients and profiles

- a. Gradients to on/off ramps should be 1:18 or shallower.
- b. The faces of on/off ramps should have a flat profile.

5.2.2 Provision of edge restraints to the top and base of ramps

- a. Since Traffic Carpets may have modular unit surfacing on their plateaus (see section 5.3), an edge restraint should be provided to the top of each bounding on/off ramp to retain the plateau surface.

5.2.3 Kerb upstands

- a. The upstand of the kerb used to the top of each on/off ramp (see section 5.2.1b) should be flush (0 upstand).

NOTE: Any significant upstand will cause substantial discomfort for vehicle users. However, it should be appreciated that construction tolerances will apply as usual on top of the flush value.

5.3 Surface landscaping

5.3.1 Surfacing materials

Plateaus

- a. Plateaus of Traffic Carpets should be modular unit surfaced to their full extent in areas other than Village and General. However, for Intersection Carpets, it may sometimes be permitted by level 1 departure to use bituminous mixture surfacing to some (but not all) parts of the plateau (see note). Normally this will be permitted only due to construction feasibility issues. It is important that this does not undermine the traffic calming effect of the feature, since the presence of contrasting modular unit surfacing is key to this.

NOTE: An example of such an arrangement might be an intersection Carpets where modular unit surfacing is used to the arms but bituminous mixture surfacing used to the main intersection space).

- b. The modular units used to the plateaus should contrast visually with both:
 - i. the surface of on/off ramps (see 'c'). This helps provide visual notice of features and the likely presence of crossing pedestrians and is therefore important to their traffic calming effectiveness.
 - ii. the footways that bound features. This is important for reasons of pedestrian accessibility. See standard DS.219 for further details.

Ramps

- c. On/off ramps to Traffic Carpets should be bituminous mixture surfaced. However, prestigious World Centre schemes may have bound modular ramp construction as a level 1 departure.

Other considerations

- d. If modular unit surfacing is used then, unless departure is agreed, the type of unit used should be as directed in the SSDM Surfacing Materials palette(s) for the relevant SSDM/RP designation(s) for that location. See DS.130 for further details.
- e. If bituminous mixture surfacing is used then, as per standard DS.338, it should be neutral grey/black. Coloured mixtures should not be used.
- f. See also:
 - i. standard DS.130 about the visual design of surfaces (including laying patterns for modular unit surfaces)
 - ii. standard DS.219 for information about related accessibility issues (including a requirement that plateaus and adjoining footways visually contrast).

5.4 Delineating footway edges beside plateaus

- a. Broadly, a 60mm high upstand kerb to be used (other than at Formal Crossing Points, where flush dropped kerbs should be provided as usual). This helps provide effective delineation for blind and partially sighted people (as well as other vulnerable user groups) whilst at the same time reducing both visual segregation between the footway and carriageway, and the kerb height that people must step over

(remembering that more ambulant pedestrians will often cross informally where they choose).

- iii. have a height above the underlying carriageway (see note) of 75-100mm if a sinusoidal profile is used to their on/off ramps

5.5 Formal Crossings for pedestrians

NOTE: See standard DS.206 about providing Formal Crossings for pedestrians at junctions and along links in general. This includes details of the number of arms that Crossings must be provided on and how far back from the main junction space they may be located.

- a. At least one Formal Crossing for pedestrians should be provided over each Traffic Carpet. That may be either a Controlled Crossing or an Uncontrolled Crossing.

NOTE: Designers should note that, in the case of Intersection Carpets, DS.206 requirements will often dictate provision of a Formal Crossing to each arm of the junction spanned by the Table.

5.6 Structural requirements

- a. Traffic Carpets pavements should be designed as per standards DS.601 and DS.602. Edge restraints to the top of associated carriageway ramps should be designed as per drawing LBS/1100/37 and 39 (see Appendix C).
- b. See also section 4.6.3 about issues associated with levels design, many of which may apply to Traffic Carpets also. Particular thought should be given to ensuring that the height of the low upstand step at the footway interface remains consistent.

6 Design requirements for Road Humps

6.1 Dimensions and materials

- a. Road Humps should:
 - i. be designed as per drawing LBS/700/01 (see Appendix C) using the stated bituminous mixtures. As per the requirements of standard DS.338 bituminous mixtures should be natural grey/black. Coloured asphalt should not be used
 - ii. have a sinusoidal profile

NOTE: This is measured by comparison with a projected line following the centreline profile of the carriageway through the feature.

- b. Where Road Humps are located on bus routes (excluding diversionary routes) then:
 - i. their overall length (measured between the bases of its on/off ramps) should be $\geq 7\text{m}$
 - ii. their height above the underlying carriageway (see note to 'a') should be 75-100mm if a sinusoidal profile is used to their on/off ramps

6.2 Arrangement

- a. Road Humps should be positioned so that the bases of their tapered sides are 325-375mm from the edge of the carriageway. If there is kerb-side parking at a location where a Hump is introduced, then it should extend into this. However, if that parking is formalised into an Inset Parking Bay, then it should not.

NOTE: This helps avoid visual clutter due to the statutory requirement as Direction 18(1) of the TSRGD to kink yellow lines or edge of carriageway markings onto Road Humps if their edges are within 300mm of the kerb. However, it should be noted that this requirement only applies if diagram 1062 'ascent arrow' markings are used to on/off ramps.

- b. As per the requirements of standard DS.113, Splitter Islands should not normally be provided beside Road Humps to create bypasses for pedal cyclists and others around the feature.
- c. Other aspects of arrangement will be agreed with approving officers on a case specific basis. As general guidance, whilst Road Humps may occasionally be used alone as spot treatments (without other

traffic calming measures in the near vicinity), in most instances, in order for them to be effective they will need to be used in a sequence with other Road Humps or alternative traffic calming features. If the sequence consists only of Road Humps then the longitudinal spacing between instances should be informed by the speed of traffic prior to their implementation. If the pre-implementation speed is high then closer spacing is recommended. See Traffic Advisory Leaflet 2/96 “75mm high Road Humps” for further details.

7 Design requirements for Speed Cushions

7.1 Dimensions and materials

- a. All Speed Cushions should be designed as per drawing LBS/700/02 (see Appendix C) using the stated bituminous materials. As per the requirements of standard DS.338, bituminous mixtures should be natural grey/black. Coloured asphalt should not be used.
- b. Regarding dimensions (see note):
 - i. on bus routes (excluding diversionary routes) and Classified Roads (A and B roads)
 - the dimensions of Speed Cushions should be as per drawing LBS/700/02 (see note)
 - the Cushion length should be 2000mm. Other lengths requires level 1 departure
 - ii. within any row of two or more Cushions arranged across the carriageway, the dimensions of each component Cushions should be approximately identical. This includes lengths, widths, heights, and ramp gradients.

NOTE: Cushions are 65mm high and use flat profiles to their on/off ramps with a 1:8 gradient. This is all to reduce the risk of vehicle grounding. Narrower cushions provide improved comfort for bus and ambulance passengers. However, as pointed out in national guidance (see Traffic Advisory Leaflets 1/94 and 1/98), lower and narrower cushions are unlikely alone to be successful in achieving speeds of 20mph or less.

7.2 Arrangement

- a. Precise arrangements of Speed Cushions will be agreed with approving officers on a case specific basis. As general guidance:
 - i. Speed Cushions should normally be arranged in transverse rows spanning the entire carriageway. If there is kerb side parking at a location, then any row should normally extend into this. However, if the parking has been formalised into well-defined Inset Parking Bays it should not.
 - ii. in order to be effective, Speed Cushions should normally be arranged in a sequence of two or more rows. National guidance suggests that Speed Cushions alone are unlikely to achieve 85th percentile speeds lower than 20mph (see note to ‘7.1a’) but that a longitudinal spacing between rows of < 60m is most likely to achieve those lower than 25mph. However, this guidance was based on a limited study of the efficacy of humps that were generally 75mm high or greater and of a medium width. The narrower hump width required to most humps in Southwark will further limit their speed reduction effectiveness (see section 4.1). Given this, it is recommended that longitudinal spacings between rows should generally be ≤ 30 m in order to achieve speeds beneath 25mph
 - iii. within a given row, a transverse spacing of around 750-1000mm between the edges of adjacent humps is generally preferable. See Traffic Advisory Leaflets 4/94 and 1/98 for further guidance
 - iv. the impact of arrangements on pedal cyclists must be carefully considered since both they and motorists may attempt to divert from a straight line path when negotiating Speed Cushions to avoid discomfort. This might result in squeezing. This is particularly important where Cushions are located on approaches to narrow single lane pinch-points (such as where Traffic Islands are used) since this may encourage cyclists to hug the kerb line precisely when they need to be holding the lane to deter risky overtaking by motorists.

Appendix A– Background

1.1 Discussion

a. Vertical traffic calming features include:

- i. Raised Tables (sometimes referred to as Speed Tables)
- ii. Traffic Carpets
- iii. Road Humps
- iv. Speed Cushions

These are amongst a number of potential methods that might be used to attempt to control vehicle speeds (there being others that rely upon horizontal alignment or physiological impact).

b. For some of the above features their main purpose may be something other speed control, with this being an incidental benefit. For instance, the main purpose of Raised Tables and Traffic Carpets is to improve accessibility for any pedestrians wishing to cross carriageways. However, Road Humps and Speed Cushions exist only to slow vehicles. Being perceived as serving some wider purpose that might give a road user a reason to slow can be important since national research into physiological traffic calming methods suggests that this quality might improve the speed reduction effectiveness of some features (see Kenedy et al. 2007).

c. Substantial national research has been carried out over the years to determine suitable design parameters for vertical traffic calming features (see references). However, drawing conclusions from the findings is very difficult and will often depend upon the users and objectives that the designer chooses to prioritise. These are often in tension. For instance, what benefits a pedal cyclist may not benefit bus passengers. Steeper on/off ramp gradients are generally more effective at slowing vehicles and emphasising pedestrian crossing paths. However, they can cause greater discomfort for road users (and bus/ambulance passengers) and noise and vibration for residents of nearby properties. Similarly, features with rounded tops (rather than flat plateaus) cause less discomfort for many road (including pedal cyclists) yet cannot be easily crossed by pedestrians.

d. One relatively clear finding of those national studies conducted to date is that Speed Cushions alone are unlikely to be effective in achieving speeds adequate for 20mph limit streets or 20mph zones. It should be noted that these findings are based on relatively wider and higher Speed Cushions than are typically used today (the reduction in height and width being for reasons of bus and ambulance passenger comfort). Groups representing pedal cyclists also frequently raise concerns about the use of Speed Cushions owing to the fact that they tend to encourage drivers to behave erratically as they attempt to negotiate them. Raised Tables are an alternative to Speed Cushions and Road Humps that are often more popular with the public - partly perhaps as they are perceived to offer wider benefits (see 'b'). However, they can be difficult and costly to construct and maintain if they include modular unit surfaces or cross-kerbs, whilst their flush interface with the footway creates delineation issues for blind and partially sighted people which can be difficult to design out. Traffic Carpets offer a similar alternative designed to avoid many of these issues and can be thought of as a half-way-house between a Raised Table and the introducing a mere surface treatment within the carriageway. However, given their shallower on/off ramps, for traffic calming they rely to a greater extent on the visual impact of the surface treatment used to their plateau. Consequently, their overall traffic calming effectiveness is likely to be somewhat less than a Raised Table.

- e. Outside of Greater London, some aspects of the design and implementation of Road Humps (but not other features) are subject to Regulations, namely the Highways (Road Humps) Regulations 1999. However, within Greater London section 90C(A) and section 90D of the Highways Act 1980 exempt Highway Authorities from these regulations. Under section 90C(A) of the Highways Act 1980 the only requirements in respect to design and implementation of Road Humps in Greater London are broadly that the Highway Authority provides notification of their proposals to the Secretary of State for Transport (including design and signage proposals) and considers any comments they may provide in response.
- f. SSDM Strategic Design Policies commit the Highway Authority to avoiding creating needless delay and discomfort for carriageway users. As such this standard discourages using features like Speed Cushions and Road Humps that serve only to slow vehicles and which – in the case of Speed Cushions – are questionable in their effectiveness at doing even that. Instead of this, this standard encourages introducing vertical traffic calming features like Raised Tables and Traffic Carpets that provide wider benefits than speed reduction alone. Those benefits include assistance to crossing pedestrians and positive townscape value. In recognition of the fact that the majority of pedestrian and cyclist accidents occur at junctions and crossings (see Transport for London, 2011a and 2011b), this standard limits the use of these features to those locations only. This helps strike a balance between benefit to vulnerable street users and discomfort to those vehicle users who will have to negotiate the features.

1.2 References

- Department for Transport (1994a) Traffic advisory leaflet 4/94 Speed cushions
- Department for Transport (1994b) Traffic advisory leaflet 7/94 Thumps Thermoplastic Road Humps
- Department for Transport (1996) Traffic advisory leaflet 2/96 75mm High Road Humps
- Department for Transport (1998a) Traffic advisory leaflet 1/98 Speed cushion schemes
- Department for Transport (1998b) Traffic advisory leaflet 9/98 Sinusoidal, “H” and “S” Humps
- Highways Act 1980
- Highways (Road Hump) Regulations 1999
- Highways (Traffic Calming) Regulations 1999
- Kenedy et al (2007) ‘Psychological’ traffic calming
- Transport for London (2011a) Pedestrian Casualties in Greater London, 2010
- Transport for London (2011a) Pedal Cyclist Collisions and Casualties in Greater London, 2010.

Appendix B- Consultation requirements

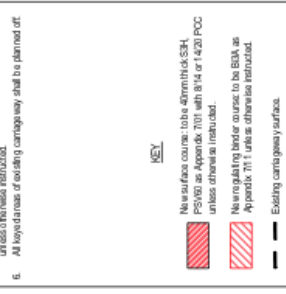
1.1 Statutory requirements

- a. Section 90C(A) of the Highways Act 1980 must be complied with at all times. This requires the Highway Authority to consult
 - the chief officer of police for the area in which the highway concerned is situated; and
 - such other persons or bodies as may be prescribed by regulations made by the Secretary of State.
- b. It is the responsibility of designers to prepare and provide the information required under the act for TMO officers.

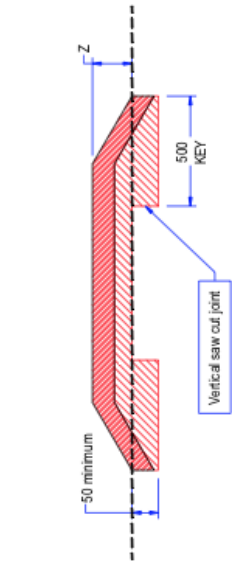
1.2 Local constitutional requirements

- a. The Southwark Constitution may also require additional consultation with local elected bodies (including Community Councils). This is updated annually. Designers are advised to check this for current requirements.
- b. The Highway Authority will consult with the public on any proposal to introduce new Road Humps at least once during *Outline Design* or *Detailed Design* of the development process. It will take into account any responses received when determining whether to proceed with or modify proposals as part of immediately subsequent Design Reviews. Individual responses will not normally be provided to those who have commented as part of the consultation. The Highway Authority will not normally consult the public on proposals to modify an existing Road Hump.

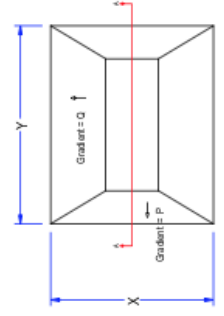
- NOTES**
1. All dimensions are in millimetres unless otherwise stated. In the event of any conflict between drawings and specifications the specification will predominate.
 2. Arrangement of multiple cushions in rows accessible to wheelchair users shall be as shown in the key. Other arrangements shall be agreed with the Design Team.
 3. Cushion type as table and dimensions with any pertinent notes shall be as required in the relevant T&K Order.
 4. The arrangement of layers and vertical joints shall be as CL 303. Track coat shall be used to the base of the regulating binder course unless otherwise instructed.
 5. All layout areas of existing carriageway shall be planned off.



SPEED CUSHION STANDARD DETAILS



SECTION A-A
NOT TO SCALE



SPEED CUSHION - PLAN
SCALE - 1:10

SPEED CUSHION DIMENSIONS

TYPE	LENGTH (X)	WIDTH (Y)	MAX. HEIGHT (Z)	MAX. SIDE RAMP GRADIENT (P)	MAX. ON-OFF RAMP GRADIENT (Q)
A	800 - 2000	1800 - 1700	65	1:4	1:3
B	800 - 2000	1700 - 2000	65	1:4	0:108:00
C	2000 - 3700	1800 - 1700	75	1:4	1:8 (15 A/E CURVED)
D	2000 - 3700	1700 - 2000	75	1:4	1:8 (15 A/E CURVED)

NOTES TO TABLE.

CUSHIONS SHOULD BE NO SHORTER THAN 800 OR LONGER THAN 3700. NARROWER CUSHIONS ARE PREFERRED WHERE LARGER COMMERCIAL VEHICLES AND BUSES. CUSHIONS SHOULD BE NO NARROWER THAN 1600 OR LONGER THAN 2000. THE AVERAGE CURVED GRADIENT OF 1:3 FOR ON-OFF RAMPS SHOULD NOT BE USED ON SHORTER RAMPS.

PROJECT: SOUTHWARK STREETScape DESIGN MANUAL STANDARD DETAILS

TYPE: SPEED CUSHION

DATE: DRAFT

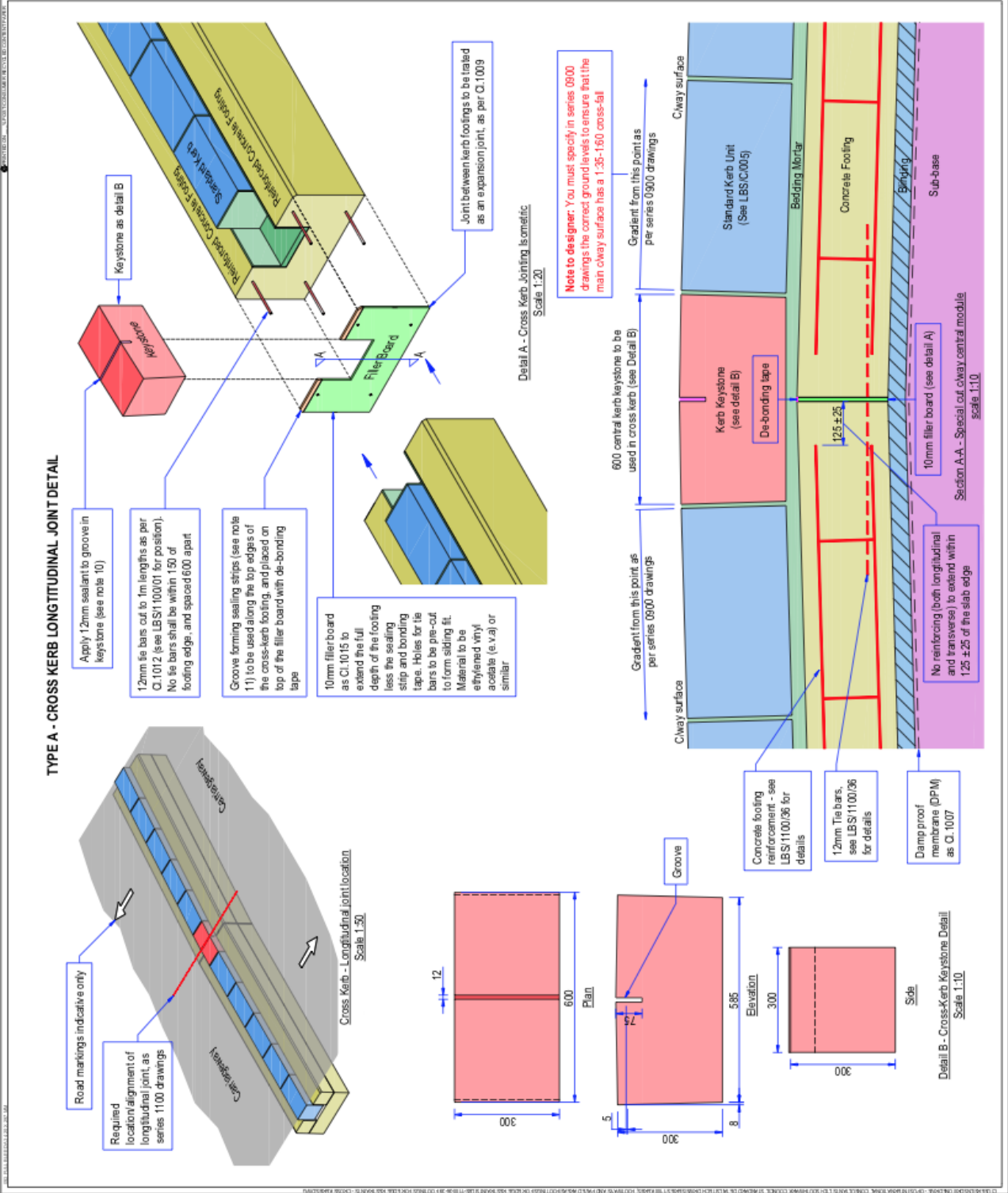
ISSUE: AS SHOWN @ A3

DATE: 18/07/2012

DATE: AUGUST 2017

DATE: 01 MONTH 2008

NOTES	
1.	All dimensions are in millimetres unless otherwise stated.
2.	Do not scale from the drawings. Use only metric dimensions.
3.	All references to Classes are references to those from the Southwark Highway Specification unless otherwise stated. In the event of any conflict between the drawings and these Classes, then the Classes shall prevail. Drawings to be used in conjunction with BS8903 and BS1100/01 in series 1100 drawings shall be used. The drawings shall be used in conjunction with the drawings to which longitudinal joints are required, along with their locations and type.
4.	Red bars used to tie cross-kerb to kerb: shall be located such that they are spaced at 1000mm.
5.	Reinforcement shall conform to BS 8898.
6.	Keystones shall be a natural stone conforming with BS EN 1343 and BS EN 12454 (C class, Dark Grey).
7.	Keystones shall be a natural stone conforming with BS EN 1343 and BS EN 12454 (C class, Dark Grey).
8.	Except as indicated materials and dimensions to be as per BS EN 12454 (C class, Dark Grey).
9.	Sealant to be as per CI 1016 & 1017, and considered a separate item to the kerb.
10.	Sealant to be as per CI 1016 & 1017, and considered a separate item to the kerb.
11.	Groove forming sealing strips (to be used along the top edges of the kerb facing, on top of the filler board as CI 1014 Pt.4).



d.

