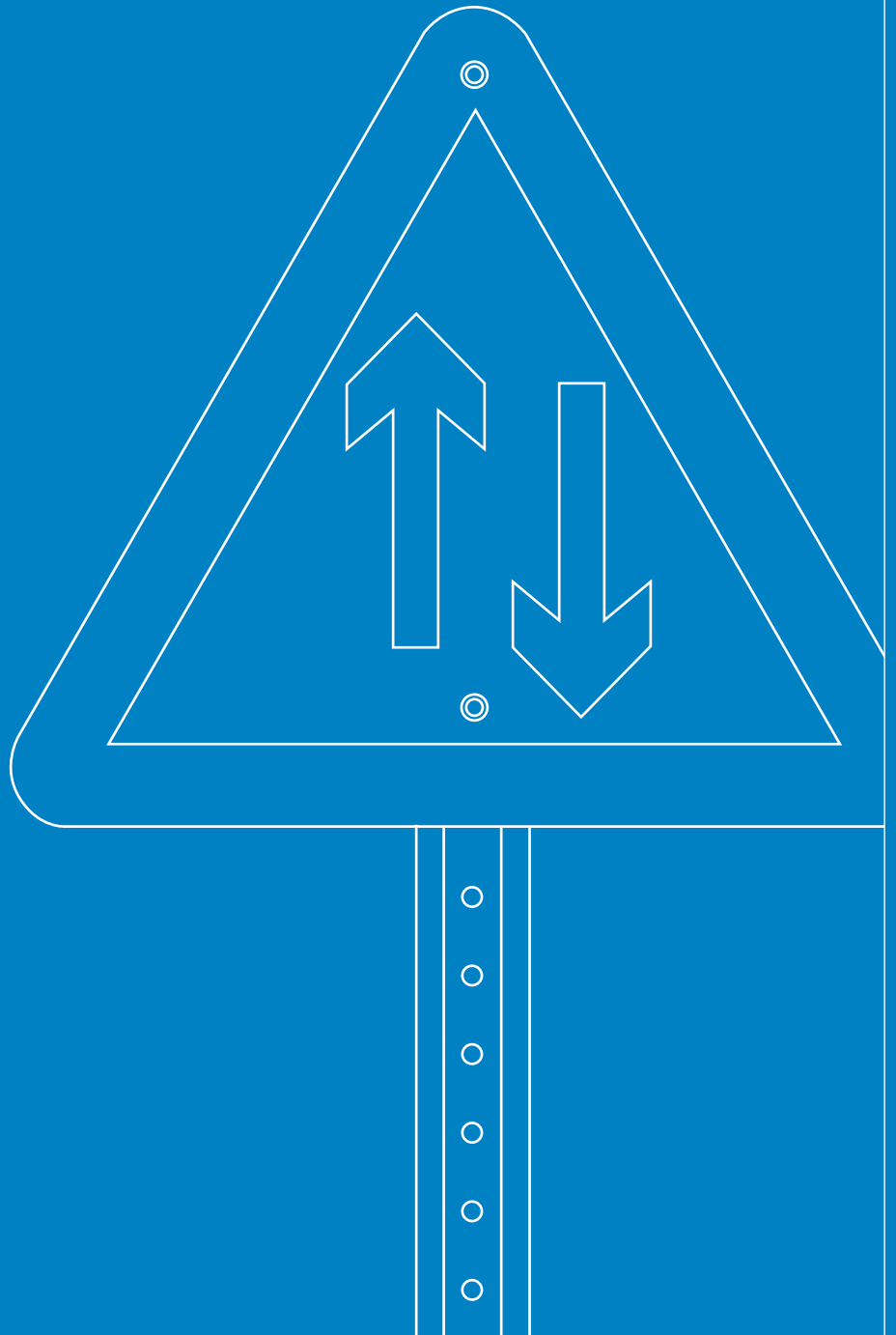


Carriageway Details



Index

- 2.01** Changing Traffic Flow
- 2.02** Footway Build-outs & Road Entry Narrowing
- 2.03** Bus Boarders
- 2.04** Speed Humps & Speed Cushions
- 2.05** Raised Entry Treatments & Speed Tables
- 2.06** Pedestrian Refuges
- 2.07** Carriageway Materials
- 2.08** Drainage
- 2.09** Road Markings

Changing Traffic Flow

- Historically, carriageways were designed with two-way traffic.
- Alterations in traffic flow can be made to improve traffic management and road safety by restricting movement of different carriageway users.
- Restrictions can apply separately to motor vehicles, HGVs, buses, cycles and powered two-wheelers, with preference now given to the movement of pedestrians, cycles and buses.
- Any changes in traffic flow direction and restrictions must be accompanied by clear signage. See TSR&GD 2002.
- Common changes to the road network include:
 - Creation of one-way streets (possibly with cycle contra-flow);
 - “Plugged” no-entry (possibly with cycle exemption);
 - Restricted motor vehicle entry;
 - Banned turns.
- Be aware that traffic speeds may increase, if and when traffic volumes are decreased.
- Consider the effects of displaced traffic on nearby or adjacent roads, which may cause more problems than at the original location. In these situations, a traffic management study should cover a wider area, to look at alternative routes.
- Carriageway and footway layout can be altered to reinforce any changes in traffic flow. Options include:
 - Changing footway widths (section 3.01);
 - Adding footway build-outs (section 2.02);
 - Installing traffic calming (section 2.04 and 2.05).
- However, wherever possible, try to maintain the original geometry and symmetry of a street, usually along the central road axis.
- Effects on carriageway drainage must be considered at the preliminary stages of design (section 2.08).



Plugged 'no entry' with cycle exemption at Red Lion Square



Traffic signal for cycles

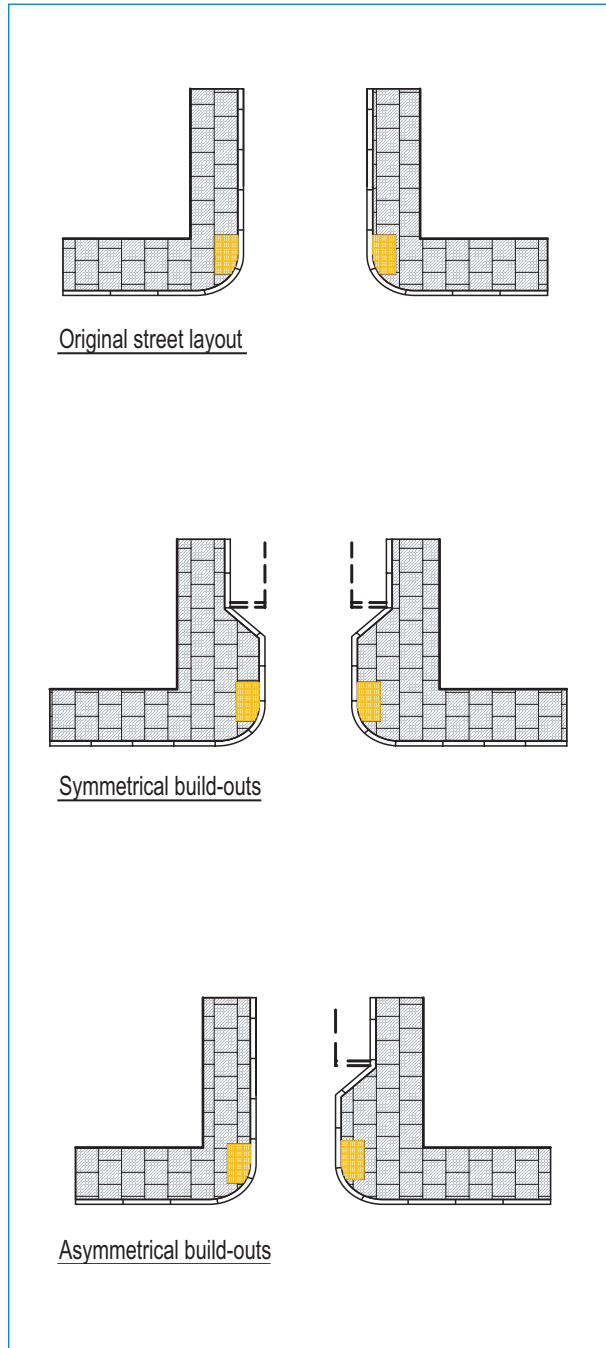
2.02

Footway Build-outs & Road Entry Narrowing

- Footway build-outs can be used to narrow a side road, provide mid-road crossings or bus boarders.
- Narrowing the carriageway has a traffic-calming effect and provides shorter crossing points for pedestrians.
- Build-outs can be used to re-align the carriageway, so that roads meet at perpendicular angles for straight pedestrian crossings and traffic calming.
- Build-outs can either be symmetrical both sides of the carriageway or asymmetrical, depending on location.
- **Advantages of equal build-outs:** Better visibility for pedestrians on two-way roads; aesthetically pleasing and maintains symmetry of road.
- **Advantages of asymmetrical build-outs:** Cheaper construction and drainage; more room for street furniture on build-out; better for enforcing banned turns.



Footway build-out with cycle stands in Grafton Terrace



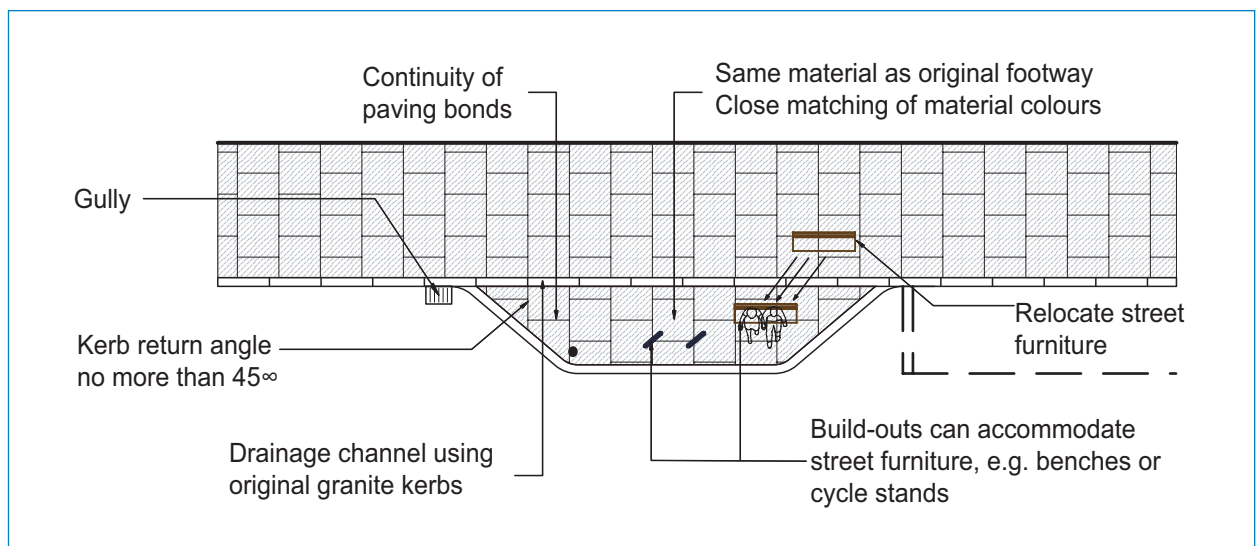
Options for build-outs at a road entry

Drainage Considerations

- Build-outs have a significant effect on drainage, as normal kerb line drainage is disrupted. The new kerb will often be higher, so a drainage channel will be needed along the existing kerb line. Refer to section 2.08 (Drainage) for more details.
- Drainage channels in the footway can be constructed in several ways, providing a smart delineator between new and old footway. Possible materials include concrete paving, original granite kerbs, flush granite setts or a concrete channel.
- Build-outs should be constructed of the same materials as the original footway, with continuity of paving bonds and close matching of material colours.
- The kerb 'return' angle should be no more than 45° to ease vehicle access to kerb-line parking and to allow easier carriageway cleaning and drainage.
- Build-outs can be used to accommodate street furniture, such as cycle stands (section 4.11), benches (section 4.15) and trees (section 1.09). However, care must be taken not to obstruct pedestrian desire lines and sight lines.
- When constructing build-outs, any street furniture left 'stranded' in a wider footway and causing obstruction to the desire line, must be relocated in accordance with the DDA1995.



Footway build-out in John Street



Considerations for a build-out

2.03

Bus Boarders

- Bus boarders are essentially footway build-outs at bus stops. They enable easier access to the bus by allowing it to draw up next to the new kerb. The required bus cage can therefore be shorter.
- Though it is preferable for the new kerb line to run parallel to the original kerb, an obtuse-angled kerb can be considered if bus operations are compromised.
- Build-outs should be made of the same materials as the original footway, with continuity of paving bonds and close matching of material colours.
- Drainage is affected on the footway as well as the carriageway, as new kerb often needs to be higher than the original kerb to meet the height of the bus door. See section 2.08 (Drainage) for more details.
- Bus boarders can be any width, with 1-2m being most common. Wider bus boarders can be used to accommodate bus shelters with advertising panels without blocking the pavement. See section 4.12 (Bus Shelters).
- Refer to “Bus stop layout for Low Floor Bus Accessibility”, by LBI Partnership 2002, for more information about designing bus stops and bus boarders.



Bus boarder in Belsize Road



Obtuse bus boarder in Adelaide Road

Speed Humps & Speed Cushions

- Speed humps and speed cushions are installed to physically enforce a speed limit in an area and reduce speeds generally.
- Speed cushions should be installed on roads used by emergency services and buses, as these vehicles are largely unaffected by them.
- Refer to TAL 3/91 and 1/98 for details on cushion profiles and lengths, ramp widths, gaps between parallel cushions and spacing along a road.
- Speed humps are more effective in slowing traffic and cover the width of the road, falling short of the kerb line.
- Refer to TAL 3/91 and 7/96 for details on hump profiles and lengths, ramp widths and spacing along the road.
- Round top humps and cushion profiles are preferred for consistent construction. Refer to the Highway Works Contract for more details.
- Construction in black asphalt is preferred for humps and cushions, with a white triangle(s) marked on the approach ramp. White markings around speed cushions should not be added.
- For roads used by low floor buses, refer to “Traffic Calming measures for Buses – Technical Information” (Bus Priority & Traffic Unit) for more details.



Speed cushions



Speed humps

2.05

Raised Entry Treatments & Speed Tables

- Raised entry treatments are designed to slow down vehicular traffic entering a side road, while providing a level crossing point for pedestrians.
- The 'front' ramp of raised entry treatments must start 'in line' with the main road kerb line. If possible, tighten the kerb radius so that the plateau is on the pedestrian desire line for ease of use, particularly for the visually impaired.
- Ramp gradients can vary between 1:10 (max) and 1:20 (min), depending on speed and vehicle types. Ramps on routes used by buses or emergency services should have minimum gradients, while all other roads should have steeper ramps for greater traffic calming.
- Preferred tabletop length is 5-6m.
- 'Half-height' raised entry treatments with semi-dropped kerbs can be used in exceptional circumstances where the main road traffic speeds are particularly high, e.g. TLRN.
- Raised entry treatments have a significant effect on drainage, as normal kerb line drainage is disrupted. Refer to section 2.08 (Drainage) for more details.

Construction Materials

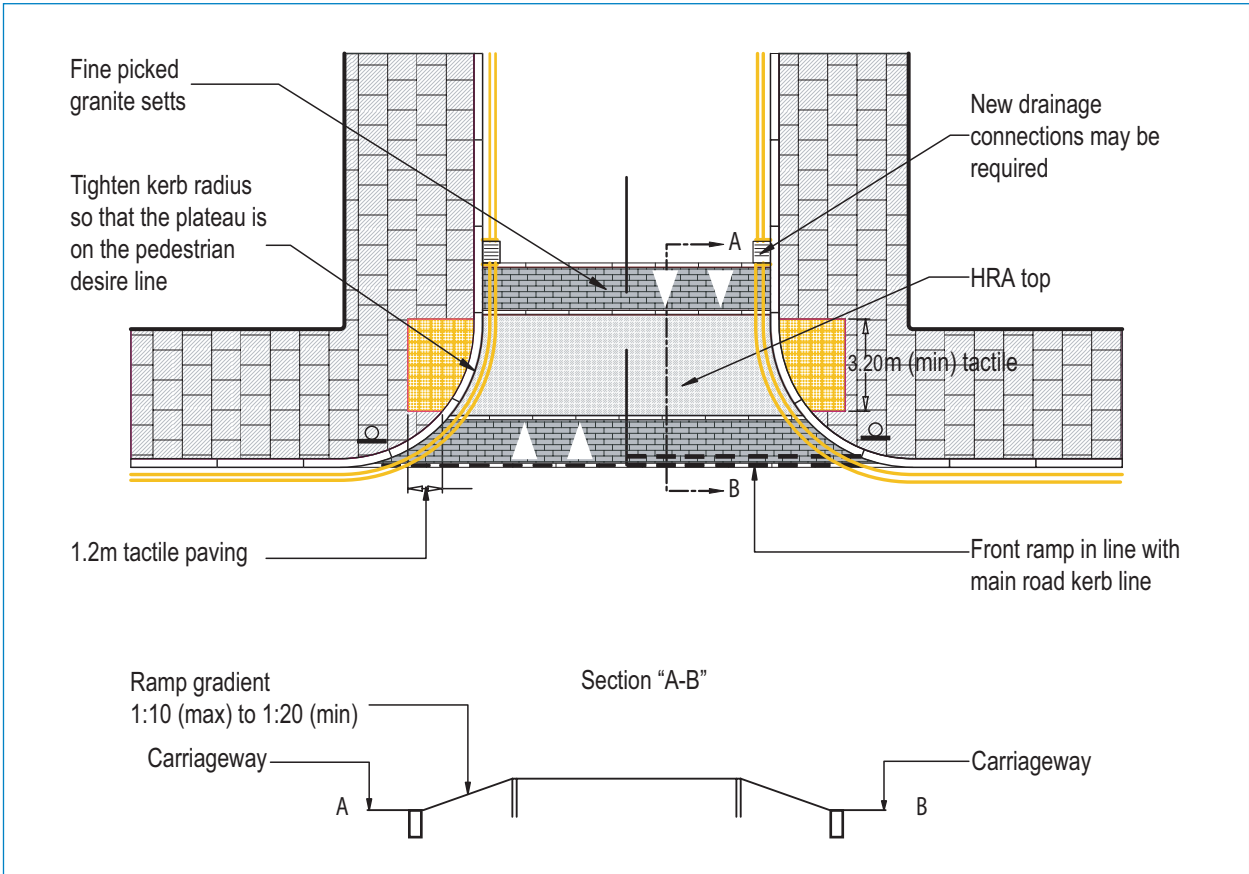
- Level tabletop: Black hot rolled asphalt (or same as carriageway).
- Ramps: Fine picked granite setts (200 x 100mm).
- Other materials should only be used where there is local precedence.
- Refer to section 2.07, (Carriageway Materials) and section 3.05 (Granite Setts) for more details on materials.



Raised entry treatment in St Cuthberts Road



Raised entry treatment in Red Lion Square



Considerations for a raised entry treatment

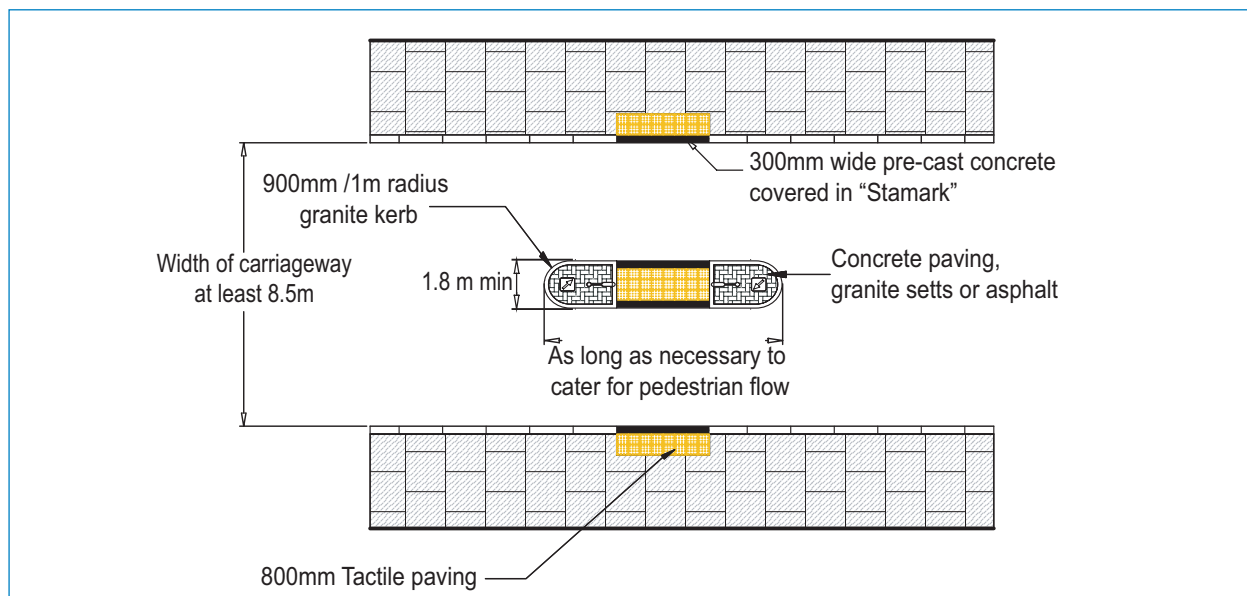
2.06

Pedestrian Refuges

- A pedestrian refuge can be installed on a road to improve crossing facilities where there are relatively low traffic flows and the carriageway is at least 8.5m wide. They can also be installed as a traffic calming measure.
- Preferable minimum width of a refuge is 1.8m, to accommodate wheelchairs, PEV's and buggies. The pedestrian refuge should be made as long and as wide as is necessary to cater for pedestrian flow.
- Traffic islands should be created using 900mm/1m radius granite kerbs. Where space is limited, 450mm granite quadrants, separated by straight granite kerbing, can be used.
- Infill to traffic islands should be either granite setts, asphalt or concrete paving. Herringbone block work can be used in circumstances such as small areas or level changes.
- At either end of the refuge the illuminated guard posts (IGPs) must be in the same style. See section 4.08 (Street Lighting) for more details.
- Consider the installation of additional lighting over the pedestrian refuge to improve safety after dark. See section 4.08 (Street Lighting) for more details.
- For the dropped kerb, pre-cast concrete channel, (300mm) should be laid and covered in white 'Stamark', or similar approved marking.
- Tactile paving must be added to every refuge, with the appropriate colour for controlled or uncontrolled crossings. See section 3.07 (Tactile Paving) and 3.08 (Dropped Kerbs).



Pedestrian refuge on Haverstock Hill



Considerations for a pedestrian refuge

Carriageway Materials

- High specification, durable materials are to be used on the carriageway. Effective and regular maintenance is also required to maintain good carriageway surfacing.
- Two wearing courses are to be used, either:
 - 1 Hot Rolled Asphalt (HRA)
 - 2 Stone Mastic Asphalt (SMA)
- Site-specific conditions must be taken into account to decide material specification.
- Three factors influence the design, particularly when deciding the thickness of carriageway layers:
 - 1 Estimated type and flow of vehicles
 - 2 Bearing capacity of the sub-soil
 - 2 Water conditions – CBR
- HRA is to be used in most locations.
- SMA can be considered in areas of heavy vehicular traffic.
- For specialised surfacing including anti-skid, and bus lanes, see the Highway Works Contract.



Carriageway in Marchmont Street

2.08

Drainage

- Surface water drainage may be affected by road layout changes, particularly footway build-outs and raised entry treatments.
- Drainage can greatly increase project costs so must be carefully examined as part of project initiation.
- Prior to the start of any works, a site visit must be arranged with the project engineer, the drainage engineer and all contractors involved.
- The Highway Works Contract must be referred to for gully specification and other details.
- Carriageway gully cover specification is 'Double Triangular D400 Ductile Iron', 500 x 500 x 150mm.
- Footway gully cover specification is 'Ductile Iron Hinged D400', 440 x 440 x 100mm.
- Connecting pipe work must be 150mm diameter vitrified clay. Plastic piping is not acceptable. Minimum pipe gradient is 1:60.
- Investigate whether connections to the main sewer system are adequate to cope with any additional water that it may have to cope with.
- New gullies will be subject to a 12-month emptying cycle, so consider the size of the catchment area (>200m²), high leaf fall and street cleansing regimes when deciding how many gullies are needed.
- Gully pots must be made of concrete, 1050mm deep, 450mm diameter with 150mm outlet. They must also be surrounded in 150mm concrete.
- New gullies should not be connected to old gully systems if the distance is more than 4-5m. Longer distances require a new direct connection to the sewer system. This must be arranged through Highway Engineering, as term contractors can only work to depths of 1.5m.
- With distances less than 4-5m, the new pipe should be connected to the existing outlet pipe with a Y-pipe junction, not directly into the pot.
- As the position of the grate is critical for cleansing purposes, make sure the gully frame is placed directly over the gully pot so cleansing and access to the rodding eye is possible.

Catch Pits and Chutes

- Where there is not enough depth to install a pot, catch pit or chute gullies can be used, but must not connect to another catch pit. Advice from the Drainage Engineers must be sought in every circumstance.
- Chutes must not be installed in areas subject to excessive leaf fall or areas prone to flooding.

Gully Pots

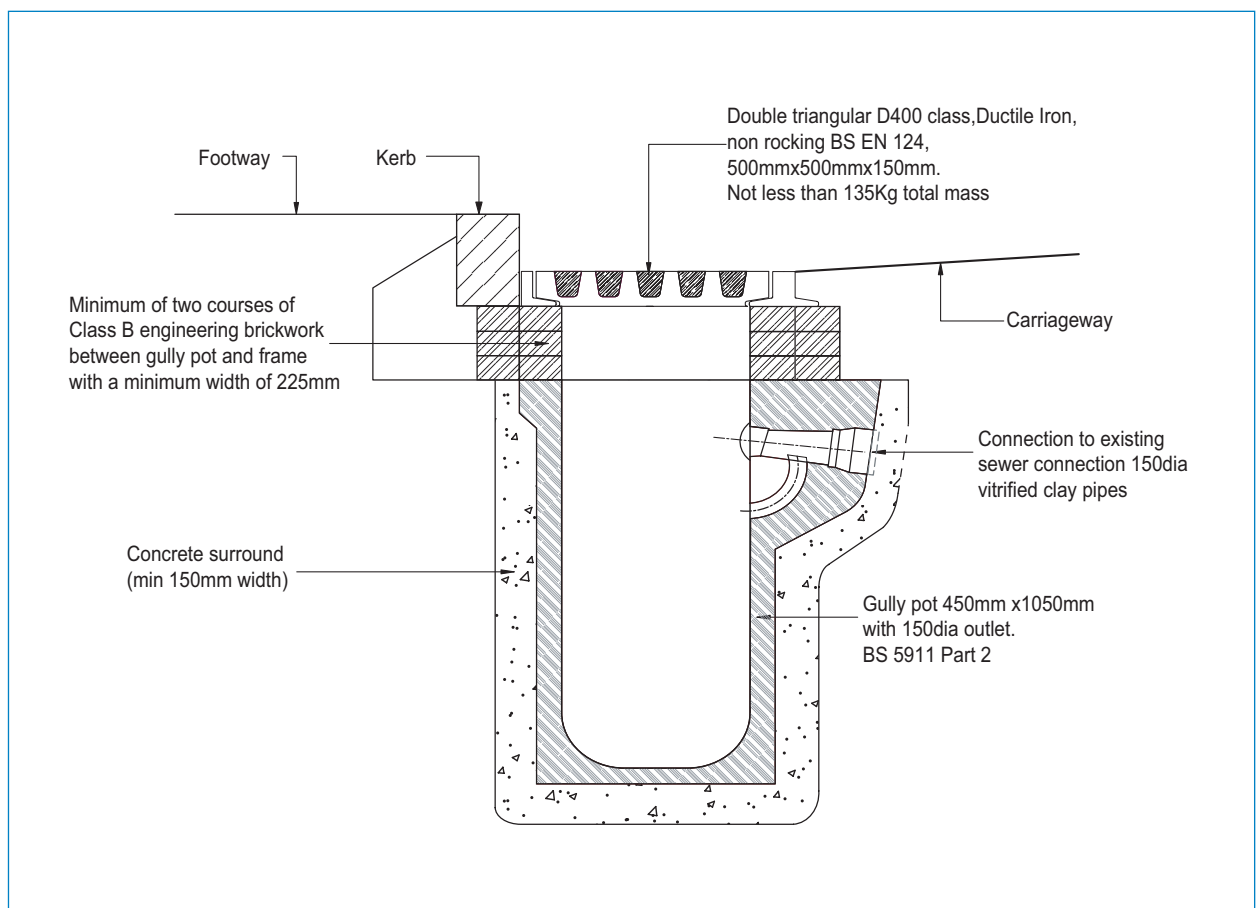
- Trapped gully pots should be used in all circumstances except where depth problems prevent installation.



Carriageway gully cover – Double triangular D400

Further Considerations

- Be aware of protracted timescales for drainage works, prior to scheme implementation. On average, 10 weeks are required from initial site visit to the start of drainage works, followed by one week (average) per new gully connection and two days per gully move.
- Try to design schemes with safe and accessible gully cleansing and maintenance. If possible, avoid locations where a traffic order or parking suspension is needed to clean the gully.
- Try to position gully covers slightly 'away' from speed humps to avoid initial vehicle impact.
- Take care not to align gully grates so as to be a danger to cyclists.
- Try to keep gullies away from pedestrian desire lines, on the footway or carriageway.
- Highway Engineering must be informed of any changes in highway drainage to be entered into the maintenance database, particularly the creation of new critical gullies.
- All new gully connections require Thames Water Authority approval.



Trapped gully pot detail

2.09

Road Markings

Yellow Lines

- Refer to the TSR&GD 2002 for more details on yellow line markings.
- When resurfacing roads, yellow lines must be reinstated with 50mm width on all roads in the following situations:
 - On full road resurfacing;
 - On substantial stretches of long roads;
 - On short, separate sections, 'cut off' by other types of marking, e.g. Parking bays, bus lanes, hatching, etc.
- A 50mm gap is required between 50mm width lines.
- Care must be taken when reinstating lines, making sure new markings lie directly on top of old markings.
- When reinstating yellow lines, 'primrose yellow' (BS 310) must be used in all Conservation Areas. It can also be used in other areas, subject to approval by DfT.
- Canary yellow (BS 309 – traditional bright yellow) should only be used when re-marking existing lines of the same colour.
- Where rows of granite setts or cobbles lie adjacent to the kerb (forming a drainage channel), yellow lines must be marked 'outside' rather on top of them.
- For more information, contact Signs & Lines Team, Parking Solutions.



Primrose yellow lines at 50mm width



Canary yellow lines at 100mm width

Parking Bays

- Refer to the TSR&GD 2002 for more details on parking bay markings.
- Preferred width of standard parking bays is 2m.
- Preferred minimum width of loading bays is 2.4m.
- Disabled bay width should be maximised, given existing road width (min. width 2m, ideal width 2.7m). Disabled bays should ideally be located near to a dropped kerb for wheelchair access onto the footway.
- Doctor parking bays should not be wider than adjacent parking bays.
- Legend letter x-height should be 350mm for specified bays.
- After resurfacing, the following procedures must be followed:
- **Resident, Pay & Display and 'specified use' bays:**
 - Longitudinal markings of 600mm lines with 600mm gaps.
 - Single transverse markings at end of bay.
 - Individual (subdivided) bay markings should *not* be re-instated.
- **Meter bays:**
 - Longitudinal markings of 600mm lines with 600mm gaps.
 - Double transverse markings at end of bay.
 - Maintain individual bays with 'T-bar' markings.
- Where problems of visibility are evident, a minimum of 5m is recommended between junction corner and the first parking bay, protected with double yellow lines.
- For more information, contact Signs & Lines Team, Parking Solutions.



Disabled parking bay near a dropped kerb



Motorcycle bay

2.09 Continued

Hatching

- TSR&GD 2002 allows for local discretion in white hatch markings.
- Hatching delineates areas of carriageway that should not be entered unless absolutely necessary and advises drivers of their road position.
- Extensive or excessive use of hatching undermines its validity and compliance, as well as being visually obtrusive.
- New highway schemes should be designed without the need for carriageway hatching.
- After road resurfacing, carefully consider whether any existing hatching needs to be reinstated. If possible, reduce the area of hatching, or eliminate through improved design.
- Rather than add central hatching to a road, consider the addition of cycle lanes to visually 'narrow' the road.



New hatching in Gray's Inn Road

Bus Lanes

- Bus lanes are important for providing bus priority on street, enabling services to be quicker and more reliable.
- Refer to TSR&GD 2002 for more details on bus lane markings.
- Preferred width of bus lanes is 4m, with a minimum width of 3m.
- Consideration should be given so that bus lanes can accommodate cyclists.
- Red surfacing should be laid within the bus lane, (see section 2.07, Carriageway Materials) except in some Conservation Areas.
- White line markings 250mm width should be used.
- Bus stop cages should be 3m in width, and marked in yellow to show mandatory compliance. They can vary in length according to bus design, service frequency and parking pressures.



Bus lane in Theobald's Road

Cycle Markings

- On-road cycle markings perform several functions; indicating or advising of a cycle route or facility, as well as informing other road users of the likely presence of cyclists.
- Refer to the revised London Cycle Network Plus (LCN+) manual for clarification on all details relating to cycle markings.
- Segregated cycle lanes and mandatory cycle lanes (continuous white line) are preferred on roads with fast or heavy traffic as they are designated for sole use by cyclists.
- Alternatively, advisory cycle lanes (intermittent white line) can be used to 'recommend' a route for cyclists and inform drivers.
- Green surfacing should be added to all cycle lanes, See section 2.07 (Carriageway Materials) and the Highway Works Contract.
- Repetitive cycle logos can be used on their own or within cycle lanes to denote a cycle route. Intervals of 60-100m are appropriate, depending on visibility. Cycle logos should be placed immediately after a junction to confirm the route.
- Cycle 'advance stop lines' (ASL) help cyclists through signalled junctions, ahead of motor vehicles. If space allows, they should be added to each arm of a junction. The box should be 4m deep with a 1.78m high cycle logo and a feeder lane. See the LCN+ manual for more design details.



Segregated cycle lane in Torrington Place



Cycle advanced stop line in Cromer Street

Notes and Amendments