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BUS STOP INFRASTRUCTURE STANDARDS

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1. Introduction

The objective of this document is to provide highways engineers, transport planners and bus operators with an easily understandable bus stop improvement “toolkit”, in order to assist in the development and implementation of high quality, fully accessible bus stops throughout West Yorkshire.

The document is a further revision of Metro’s “Bus Stop Infrastructure Standards” initially produced in May 2001 in response to the requirements of the Disability Discrimination Act 1995 (DDA) and subsequently updated in May 2003, May 2005 and October 2006. This latest revision has been produced on the basis of further experiences obtained and lessons learned from scheme implementation, particularly as a result of the development since 2003 of corridor improvement initiatives as part of Local Transport Plan programmes for West Yorkshire.

A key objective of the document is to ensure, so far as is practicable given any localised site constraints and taking into account other considerations such as road safety, that all bus stops are made fully accessible for all low floor buses and all types of bus passenger, including wheelchair users, the elderly and people with pushchairs. The ideal bus stop should therefore:

- allow the bus to easily reach the bus stop and line up close to, and parallel with, the kerb edge
- allow easy passenger access onto and off the bus, incorporating measures to prevent/dissuade other vehicles from parking or stopping within the stop area
- facilitate unobstructed passenger movement within, and pedestrian movement past, the bus stop waiting area, including wheelchairs and push-chairs
- facilitate easy passenger access to and from the stop position, including wheelchairs and push-chairs

The benefits that ensue from the provision of ‘accessible for all’ bus stops are demonstrated by the results of an impacts survey commissioned by Metro in 2007. This revealed increased passenger confidence, satisfaction and usage resulting from the implementation of bus stop accessibility improvements. For example:

- 98% of all respondents considered raised kerbs to be a good idea
- 63% of all respondents, and 84% of pushchair users, said that raised kerbs make boarding buses easier
- 10% of all respondents, and 58% of pushchair users, reported that they now travel by bus more often as a result of the introduction of raised kerbs

2. Bus Stop Accessibility Improvement Measures

Bus stops can be made fully accessible to buses and passengers through the use of the following available “tools”:

- Raised kerbs to provide near level boarding with low floor buses
- Bus stop clearway boxes
- Removal or narrowing of bus lay-bys to ease bus approach and assist in re-joining traffic flow
- Kerb build-outs (“bus boarders”) to maintain kerbside access in parking areas

- Relocating bus stops to more accessible locations
- Ability to easily deploy bus platform ramps

Selection of one or more of the listed options will be dependent on the local situation at the individual stop under investigation. It is important to recognise that it may not always be possible to make a stop accessible, for example because of site constraints or because introduction of a particular measure may result in road safety disbenefits. Road safety considerations must always be paramount, with each scheme and individual site subject to risk assessment and safety audit procedures as standard. For larger schemes, early involvement of a qualified CDM Co-ordinator should be encouraged.

2a Raised Kerbs

(i) Types and heights of kerb

The special 180mm kerb profile detailed in Drawing No.1 has been approved as the “one size fits all” raised kerb type suitable for use by all types of low floor buses (including vehicles fitted with guide-wheels.)

Highway Authorities in West Yorkshire should therefore now provide this kerb profile, or similar subject to trial, as a standard component of all future bus stop improvement projects, together with other minor highways schemes affecting bus stop locations and infrastructure.

A variation to the design of the raised kerb specification is now available from kerb manufacturers that incorporates a recessed lifting anchor within the top face of the kerb. This lifting anchor enables the kerb to be attached to lifting equipment during installation, thereby facilitating safe handling by operatives. It is essential, however, that the lifting anchor recess is filled in after installation to avoid the creation of a potential trip hazard. In this regard the kerb manufacturers are able to supply a suitable epoxy resin, alternatively a rapid setting mortar should be used.

Use of a raised kerb design variation incorporating integral marker bumps is not considered to be appropriate because of the adverse effect on the quality of the passenger ride as buses manoeuvre into the stop, particularly for standees. This specification should therefore not be requested by the highway authorities.

In order to minimise the potential for the special access kerbs to be installed at bus stops which might become obsolete as a result of future bus service withdrawals, it is recommended that District Council engineers should always discuss proposals with Metro prior to arranging the installation of the kerbs as part of delivery of any schemes where bus stops are affected.

It should be noted that there may be a risk at certain sites of buses grounding on their approach into stops as a result of the provision of raised kerbs. It is therefore essential that the height of the kerb face above the carriageway surface does not exceed 180mm. It is also important that consideration be given to the re-siting of drainage gullies situated within the bus stopping area and the re-instatement of defective carriageway surfaces (see Section 5c) in order to minimise this risk. The provision of features designed to make stops fully accessible for low floor buses, in particular to avoid the need for buses to have to approach at an acute angle and over-ride the kerb in order to correctly pull into the stop, is therefore essential (see Sections 2b-2e below).

The installation of kerbs in excess of 125mm may not always be desirable for the following reasons:

- To avoid the creation of highway drainage or other specific engineering problems
- To ensure that any backfall on the footpath does not exceed the preferred maximum of 1 in 20
- Where the necessary approvals are unlikely to be obtained for the provision of bus stop clearways

In such situations alternative options should be explored, such as kerb build-outs or stop relocations (see Sections 2d and 2e below).

Highway Authorities are recommended to provide 125mm half batter kerbs at sites where alternative options are not considered to be available. The 125mm kerb is recommended on the basis of being the minimum height required in order to ensure an absolute maximum 1 in 12 gradient for the deployment of bus platform ramps. This will cover a situation where a bus is not able to pull to a stop directly alongside the kerb at a particular location but is able to get close enough to deploy the ramp onto the footway.

In order to avoid the potential for any passenger inconvenience, established stops positions should not be withdrawn at locations where it is not possible to implement accessibility improvement measures, unless specific road safety issues are identified that cannot be reasonably resolved in terms of practicability and cost.

(ii) Lengths of Raised Kerb

At bus stops with no shelter provision, four high kerbs should be provided wherever possible. The bus stop pole should be positioned so that three high kerbs (not including the transitions) should be provided on the approach side of the pole and one high kerb on the leaving side of the pole. Drawing No. 2 illustrates the required setting out details.



Where a standard length shelter is installed, eight high kerbs should be provided, with the raised kerb section commencing two kerb lengths on the approach to the shelter, and continuing along the front of the shelter to a point two kerb lengths beyond the end of the shelter.



This arrangement, which is illustrated in Drawing No. 3, is valid for all standard length shelters, irrespective of queuing arrangements, shelter type and position within the footway.

Elongated shelters will need to be provided with additional kerbs as determined by the extended shelter length.

Extended lengths of raised kerbs should also be considered for town and city centre stop locations where there is likely to be a frequent requirement for more than one bus to set down and pick up passengers at the same time. The possibility of providing minimum raised kerb lengths of 15 metres (21 metres for stops served by articulated buses) should be investigated wherever possible in order to ensure that passengers boarding and alighting a second bus arriving at a stop will be able benefit from near level access.

(iii) **Detailed Positioning of Raised Kerbs**

The raised access kerbs, together with transitions, must be installed with the rear of the kerb in a position directly parallel to the rear of the adjacent half batter kerbs in order to minimise the horizontal gap from the kerb edge to the bus platform, thereby ensuring that close bus docking takes place. Installing the raised kerbs in positions where the edge of the front profile is situated parallel with the adjacent half batter kerbs at carriageway level will increase the horizontal gap by approximately 100mm. This may well have considerable significance, particularly with regard to:



- Stops used by guided buses where the guide-wheel needs to engage with the vertical section of the kerb face
- Constrained sites where the loss of 100mm footway width may preclude cantilever or enclosed shelter provision

Drawing No. 1 illustrates the required setting out details.

2b **Bus stop clearway boxes**

It is recommended that bus stop clearway boxes are provided at all stops in order that the area defined by the box remains unobstructed to facilitate safe manoeuvring of the bus into and away from the stop. Bus tests have demonstrated that a minimum 37m of clearway is required in order to ensure correct kerb docking at locations where on-street parking takes place immediately on the approach and leaving sides of stops. Within a 37m length of clearway, the stop position should be 28 metres from the start and 9 metres prior to the end of the clearway to allow buses safe access into, and egress away from, the stop. Drawing Nos. 4-8 show the required details for “clear” (non-shelter) facilities and stops provided with enclosed and cantilever shelters with normal and reverse queuing arrangements.



Where two or more bus stops are adjoining, the absolute minimum distance between them should be 28m. Anything less should be the subject of a trial of the arrangement proposed. In such situations 28 metres of clearway should be provided on the approach to the first stop and 9m on the leaving side of the second stop, i.e. a bank of two adjacent stops will require 65m of clearway, as shown in Drawing No. 9.



Clearway lengths can be reduced where site conditions permit, so long as it can be demonstrated that buses can achieve full access into the stop. For example, positioning stops on the exit sides of side roads and pedestrian crossings assists bus access whilst minimising the length of kerbside to be kept clear for the stop. This is recommended as an appropriate option for investigation with regard to sections of route characterised by continuous residential development with no off-street parking (e.g. Victorian terraced housing).



Clearway markings should always be provided at bus boarder locations (see Section 2d), although the lengths of the clearways can be restricted to the dimensions of the boarder.

It is recommended that consideration be given to the provision of two clearway signs (to Diag 974) and carriageway markings (to Diag 1025.1 at each stop in the positions shown on the attached drawings, although it is acceptable for the signs to be affixed to shelters, bus stop poles and other items of street furniture in order to reduce street clutter.

Hours of enforcement of bus stop clearways should preferably be 24 hours but, as a minimum, must cover the hours that service buses are scheduled to call at the stop.

It is important to note that clearways can only be effective if the associated regulations are properly and rigorously enforced by the appropriate authorities.

2c Removal or narrowing of bus lay-bys

Bus lay-bys often create serious difficulties for bus operations, both in terms of achieving full access into the stop position and in manoeuvring out of the lay-by, particularly during periods of heavy traffic.

There are currently many bus lay-bys in West Yorkshire, a large number of which are of a sub standard design that prevent buses from achieving full access into the kerb. Drawing No.10 details the required manoeuvring “envelopes” that engineers should incorporate into bus lay-by designs in order to address entry and egress obstructions of various widths.



Drawing Nos. 11A and 11B illustrate six suggested different design solutions, based on the manoeuvring envelopes detailed in Drawing No.10, to making an existing 3.3m deep lay-by fully accessible to buses.

Potential road safety and traffic flow implications must, however, always be given a high priority in reaching individual site decisions.

New full width (+1.5m) bus lay-bys should not be provided unless there are compelling road safety, traffic flow or operational reasons. In circumstances where full width lay-bys are required the layout detailed in Drawing No. 12 should be provided.

It should be noted that on high frequency routes, where two or more buses are likely to arrive at any one time, the stop area will require lengthening accordingly. Consideration may need to be given to providing two stops set at appropriate distances apart (see Sections 2b and 6).

Raised kerb lengths within lay-bys should be in accordance with the details given in Drawing No. 13, with the leaving side transition kerbs positioned at the start of the exit splay.

Drivers are often tempted to use bus lay-bys as unofficial parking areas. This should be discouraged through the provision of 24 hour clearways, as detailed in Section 2b. The clearways should be extended to cover the sections of through carriageway immediately on the approach to the entry splay, and immediately beyond the exit splay, in order to protect the manoeuvring envelopes detailed in Drawing No.10 .



Lay-bys should continue to be provided for stops within bus lanes in order to prevent stationary buses from delaying other buses using the bus lane.

2d Bus boarders

Kerb build-outs or bus boarders are particularly useful at bus stop locations where either legal or illegal on-street parking takes place. Bus boarders enable the bus to stop close to the footway for improved access by moving the kerb line out into carriageway.

Bus boarders are particularly effective where road widths are not constrained and where difficulties are encountered in achieving minimum required lengths of clearway and/or adequate separation distances at a bank of two or more stops, including bus point locations.

Bus Boarders can be either full width or half width. Although the provision of bus boarders will help to discourage indiscriminate parking, it is still important that bus clearways are still provided in order to provide additional deterrence.

Full Width Boarders

A full width 2.0m boarder, has the following benefits:

- Minimises the take-up of kerb space
- Deters illegal parking
- Allows approaching buses to line up parallel to the kerb
- Deters indiscriminate parking
- Provides sufficient space for a shelter

In order to ensure that buses are able to pull to a stop in close proximity to the kerb at full width bus boarder locations it is recommended that the kerb length is set at a minimum of 9m for both shelter and non shelter sites. It is also recommended that all bus boarder locations with shelter provision should incorporate a facility with the boarding point on the leaving end of the structure (i.e “reverse” queue) in order to minimise the kerb space required. Drawing No. 14 illustrates the required setting out arrangements.



(i) Half Width Boarders

A half width boarder should be considered where carriageway widths or traffic flow considerations preclude consideration of a full width facility. This type of build-out will necessitate some manoeuvring by the bus past adjacent parked cars that will protrude beyond the width of the boarder kerblines, hence the facility will need to be of a greater length than a full width feature as shown in Drawing No. 15.

(ii) Saw-tooth Boarders

Sawtooth boarders are an option to be considered where available kerb space is constrained. This type of feature requires less kerb space between stops situated on a parallel section of kerb and is particularly worthy of consideration in locations such as City Centres where demand for stops is high and kerb space is at a premium. Drawing No. 16 shows a typical detail, although exact dimensions are dependent on local conditions, particularly available carriageway widths and additional highway demands such as any parking provision on the opposite side of the carriageway.

2e Bus Stop Relocations

In situations where implementation of the measures detailed in section 2a-2d above proves to be difficult, an alternative approach to achieve full stop accessibility is to investigate whether an alternative stop position that is suitable for the provision of accessibility measures is available in the near vicinity. For example, moving a stop away from a position within a designated on-street parking area to an adjacent location where parking restrictions are already provided would avoid objections about loss of parking and obviate any need for bus boarder provision. However, it is imperative that passengers are not inconvenienced by any stop move and that no road safety or frontager intrusion issues are created.

3. Special Requirements for Guided Bus Routes

A number of bus routes in West Yorkshire are operated by vehicles fitted with guide-wheels. It is essential that bus stops located on guided bus routes are able to cater for the following specific docking requirements of these vehicles:

- The high kerb should commence on the approach to the stop some 12 metres prior to the boarding point. The different raised kerb requirements for clear sites and locations provided with shelters are shown in Drawings 17-21. A frangible bollard (Glasdon Neopolitan 150 or similar) should be installed at a point 2m beyond the start of the high kerb section (i.e. 10m from the boarding point) in order to indicate to the driver the point at which it is safe to engage the guide-wheel onto the vertical section of the high kerb. However, as a result of concerns about future maintenance issues arising from installation of the visibility bollards, an alternative approach involving the installation of yellow 200mm x 200mm blocks has been adopted on the A641 Bradford Road in Huddersfield and Brighouse.



- The presence of a visibility marker confirms to the drivers of guided buses that a bus stop is dockable. Visibility marker should therefore not be provided at guided bus stops where the minimum length of raised kerb section cannot be provided or where docking is not possible for other reasons such as the presence of statutory undertakers furniture (e.g. a BT pole) less than 600mm from the kerb edge.



- Bus boarder lengths for guided bus routes should match the guided bus minimum raised kerb section requirements detailed above.
- It is essential that the height of the kerb face above the carriageway surface does not fall outside the 170mm-180mm range throughout the raised kerb section, in order to respectively avoid (i) potential over-ride of the guide-wheel above the kerb (and loss of steering control that would then result) and (ii) potential bus bodywork collision with the top of the kerb.
- The selected raised kerb profile detailed in section 2a above has the advantage of being suitable for use at normal on-street bus stop locations by buses fitted with guide-wheels and also other types of low floor buses. However, at stops located within purpose built bus guideway sections, which can only be used by guided buses (e.g. York Road, Leeds and Manchester Road, Bradford), it is acceptable to use vertical faced bull nose kerbs.

4. Special Requirements for ftr articulated vehicles

The First bus company introduced the innovative “ftr” articulated bus onto the Service 4 bus route in Leeds in April 2007, with the formal launch of the new service taking place in August 2007.

General ftr vehicle highways and infrastructure design principles, are detailed in Appendix 1.

The following more detailed highways infrastructure specifications, which are based on the outcomes of bus tests undertaken along the Service 4 bus route and also within a specially marked out test area, will be required on any routes observed in the future by ftr vehicles in order to ensure that full accessibility is achievable at bus stop locations:

- Raised kerb area of 8m for normal kerbside stops provided with standard length shelters, preceded by 4 no. half batter 125mm kerbs (see Drawing No. 22)
- Raised kerb area of 4m for normal ‘clear site’ (non-shelter) kerbside stops, preceded by 4 no. half batter 125mm kerbs
- 51m bus stop clearways at sites where parking/loading is permitted on the approach and leaving sides of the bus stop (see Drawing No. 23)
- 54m bus lay-bys comprising 20m entry splay, 19m straight section, 15m exit splay (see Drawing No. 24)
- 12m long x 2m wide boarders, based on 10m dim. between front door left hand perimeter and middle door right hand perimeter (see Drawing No.25)

5. Passenger Waiting Area Specifications

5a General

The minimum desirable distance between street furniture and the kerb face is 600mm (see Drawing No.2). 450mm should be regarded as the absolute minimum, in particular for narrow footway locations.

As part of joint corridor initiatives, any local authority items of street furniture (e.g. lighting columns, highways signs, litter bins) which are located within the bus stop access/egress area and which are less than 600mm from the kerb edge must be re-positioned accordingly. Similarly trees should either be removed or, if not practicable, alternative approaches should be considered. The local authority should include all related costs in their scheme budget at consultation stage.

Bus stop plates must always be fitted to kerb edge poles and shelter brackets facing away from the carriageway, in order to avoid potential collision by buses observing the stop and thereby assist correct docking.

The bus stop waiting area should be designed so that passenger access to the stop, and onto and off the bus, is not impeded by obstructions such as lighting columns and litter bins. Sufficient clear space should be provided to allow the free movement of wheelchair users, people with pushchairs and the correct deployment of bus platform ramps. Under normal circumstances a minimum footway width of 1.5m is required in order to enable a wheelchair user to turn before boarding/after alighting and also to proceed past a bus stop pole. At narrow footway locations the bus stop pole should be located at the rear of the footway in order to provide the

maximum clear space for the passage of pedestrians and wheelchair users. At locations where the footway width is less than 1.5m the possibility of widening the footway to achieve minimum requirements should be investigated.

Every attempt should be made to minimise street clutter within the bus stop area, for example by fixing TRO plates to existing items of street furniture (see Section 2b). Litter bins, however, should be of a free-standing design, sited at least 1.2m from bus stop poles or shelters and 600mm (450mm absolute minimum) from the kerb edge. Ideally the installation of litter bins should be co-ordinated by the district councils to take place at the same time as bus stop improvement works, with funding resourced from appropriate corridor improvement scheme budgets.

5b Passenger Shelters

Details of typical dimensions of the shelters currently being procured by Metro from Trueform Engineering Ltd are detailed in Appendix 2.

The position and configuration of shelters at individual sites are dependent on the local characteristics and constraints of the individual sites. Emphasis should be placed, subject to footway space and sight-line considerations, on maximising enclosure through the provision of enclosed units and the fitting of side panels to cantilever structures. Shelters should be positioned so as to maximise the level of weather protection from the prevailing westerly winds, although the potential splash effect of fast moving traffic on busy roads should also be taken into consideration. Detailed shelter specifications for individual sites are agreed on site by representatives from the relevant Highway Authority, Metro and the shelter supplier.

Required minimum footway widths for the basic dimensions and configurations of the various types of shelter typically procured by Metro are detailed in Appendix 3.

New shelters should be normally considered at existing non shelter sites where the number of passengers boarding daily is identified through usage surveys of 50 or over. Suitability of a site for shelter provision, including approval as regards unit type, configuration and position, needs to be agreed through a site inspection involving Metro and Local Authority representatives.

A minimum clear footway space of 1.5m should be retained in front of shelters situated towards the back of the pavement, or at the rear of kerb edge shelters, to facilitate safe pedestrian movement. However, 1.2m may be acceptable at locations with very low pedestrian movement.

All new shelters will be supplied in Metro's corporate red RAL 3003 colour (with cream RAL 075 90 20 mid and base rails) unless located within town and city centres where alternative finishes have been approved on amenity grounds to match in with Local Authority street furniture.

Other Considerations

(i) Ancillary Highways Measures

It is important that passenger access to and from, as well as within, the bus stop waiting area, is addressed as part of schemes to improve bus stop locations. Measures such as the provision of dropped tactile kerbs at adjacent side roads, the introduction of new crossing facilities in the near vicinity of stop positions and the provision of alternative parking areas situated away from stop locations should always be investigated.



(ii) Positioning of Bus Stops

Site lines for vehicular traffic and the location of traffic islands in the vicinity of bus stops need to be taken into account when agreeing new bus stop locations, together with any visual intrusion impacts.

(iii) Street Lighting

All new shelters are supplied with integral lighting unless electrical connection costs prove to be prohibitive. However, in terms of personal safety and security, it is important that high quality street lighting is provided on access routes to stops as a standard component of bus stop upgrade schemes.

(iv) Drainage

Drainage gullies situated within the bus stopping area often have an adverse effect on the passenger ride, particularly for standing passengers ready to alight the bus, as a result of localised sinking of the carriageway. Under normal circumstances therefore bus stops should not be located within 10 metres of a drainage gully positioned in the carriageway channel. Investigations should be carried out into the feasibility of relocating existing gullies at stop locations when required.

Care should be taken to ensure that the provision of raised kerbs and associated footway re-instatements does not result in any ponding within the bus stop waiting area.

Carriageway re-instatements need to be undertaken where defective surfaces results in ponding and resulting splash onto waiting passengers.

(v) Tactile warning surfaces at Bus Stops

The DfT does not recommend the provision of tactile warning surfaces at raised bus stops. At the present time, therefore, it is not proposed to use any type of tactile surfacing at bus stop locations. However, tactile warning surfaces are provided at bus stop platforms situated within bus guideway sections.

(vi) Statutory Undertakers' Equipment

The presence of surface boxes, service covers and underground apparatus within the passenger waiting area can create problems both in installing bus stop infrastructure in optimum positions and future access requirements for utility company personnel. Consideration should be given to the positional adjustment of the waiting area if statutory undertaker equipment is present. An absolute minimum dimension of 1.2m should be provided between any undertakers' equipment and bus stop infrastructure in order to provide sufficient working space for utilities staff and avoid the need for temporary removal of the stop infrastructure.

(vii) Traffic Calming Schemes

Any schemes involving the introduction of traffic calming measures on bus routes must conform with the requirements of the "Guidelines for Traffic Calming and Buses" document that was jointly approved and issued by Metro and the five District Councils in West Yorkshire in December 2003.

6. Bus Stop Spacing/Frequencies of Services at Bus Stops

Bus stop spacing should be in the region of every 200-300 metres in built-up areas and every 400 metres in rural locations.

Consideration of the provision of more than one stop at any location should be subject to the bus frequencies that apply. There should not be any problems with accommodating up to 10 services per hour at an individual bus stop. Between 10 and 20 services per hour can be accommodated with careful and efficient operational management, depending on the extent of passenger movement. A greater frequency than 20 buses per hour will necessitate the provision of an additional adjacent stop if sufficient kerb space is available. Conversely, consideration should be given to removing adjacent stops and shelters if frequencies determine that one stop is sufficient.

7. Driver Training

Operators will use their best endeavours in ensuring that all drivers are conversant with the varying styles of bus stops, kerbings and bus boarding facilities; together with a knowledge of the requirement to stop a bus as close to a kerb as is safe, so as to allow passengers the opportunity to easily alight/board between bus platform and kerb.

8. Planning Applications affecting Bus Stop Locations

Metro should be fully consulted on what improvements might be required with regard to any bus stops or shelters situated within 400 metres of a proposed development. Any proposals to move bus stops should be discussed with Metro at an early stage and any costs incurred should be met in full by the developer. For further guidance please refer to the individual West Yorkshire District Council Local Development Frameworks and Public Transport Contribution Supplementary Planning Documents which are currently in various stages of development. A Highways Design Guide currently being prepared by Leeds City Council is an alternative source of information.

REFERENCES

- a. DfT "Inclusive Mobility: A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure". September 2002.
- b. London Bus Initiative Partnership: "Bus Stop Layouts for Low Floor Bus Accessibility". June 2000.

ACKNOWLEDGEMENTS

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First "New Concept" Articulated Bus

Agreed Design Principles

- a) **Raised kerbs/level access will be provided at the front door position only.** This minimises risks relating to any future decisions not to introduce, or to withdraw, articulated buses from the selected routes whilst still complying with DDA requirements. It is considered unlikely that wheelchair users, the mobility impaired and people with pushchairs would seek to access via the second door because appropriate on-bus facilities appear from the specification drawings to be situated in the front car of the vehicle.
- b) **A suitable hardstanding/landing area will be provided** adjacent to the second door stop position in order to avoid passenger access/egress via an unsuitable or unsafe area.
- c) Stop designs need to ensure **parallel kerb edge docking for both front and second doors.**
- d) The potential for **bus boarder provision**, covering front and middle doors, as an alternative to kerbside clearways will be investigated on a site-by-site basis. At lay-by locations, **lay-by narrowing or full /infill** will be investigated as a preferred option to lengthening (21m minimum parallel section +20m entry splay required for a full width lay-by).
- e) There is no requirement to radically alter **established considerations with regard to decisions on shelter dimensions, configurations and positions.** These need to be taken on a site-by site basis and involve individual location characteristics including prevailing wind direction. Cantilevers with front panels at the kerb edge and with side panels are appropriate as passengers are easily able to access the second doors because the rear and sides of the shelter are open fronted. At sites where there is space for enclosed shelters, positioning a double opening facility at the rear of the pavement maximises two door access opportunities and therefore should be considered, together with installation of an extended unit (subject to usage levels). However where this is not possible, for example due to intrusion issues, a kerb edge single front access enclosed unit is acceptable as long as the average loading per bus is light.
- f) Existing guidelines with regard to the **lengths of raised kerbs and stop positions within the raised kerb section** can be retained. However it is proposed that a **kerb edge marker** is provided at all stops observed by articulated buses in order to provide guidance to the driver on the position where the front of the bus should pull to a stop in order to ensure that the front doors are directly in line with the designated stop position.
- g) All affected bus stations should be capable of accommodating articulated buses. However further investigations are required on detailed re-design requirements and operational issues.

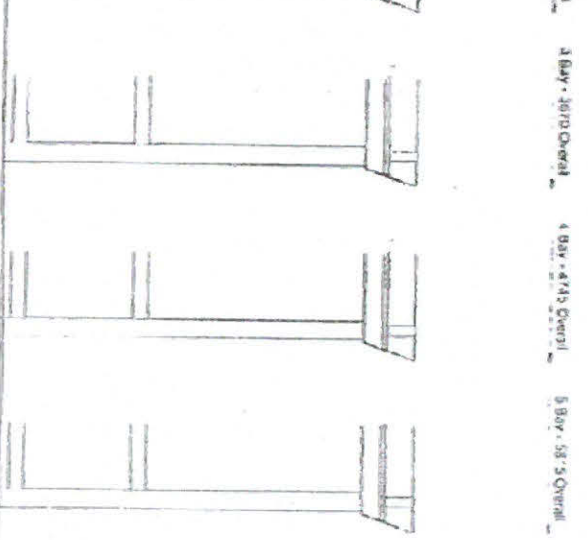
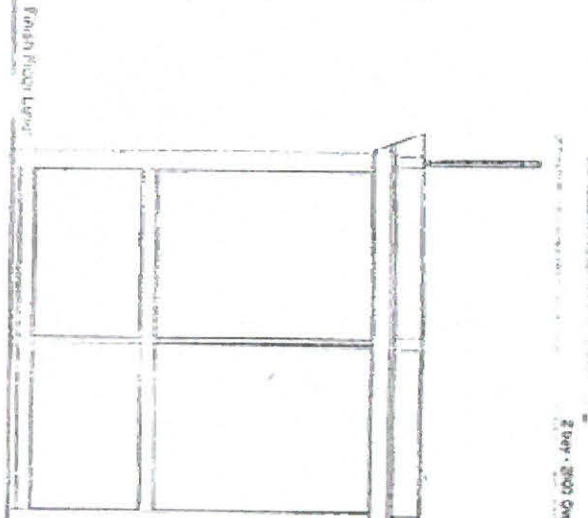
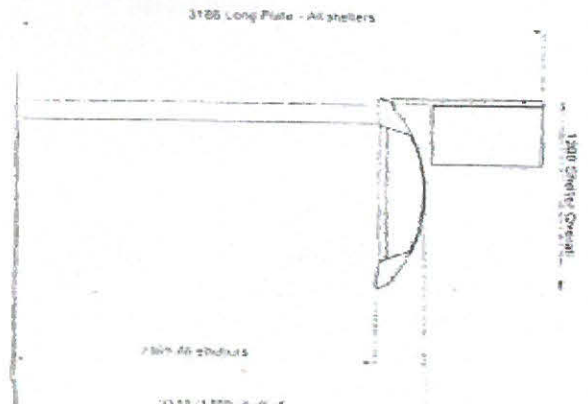
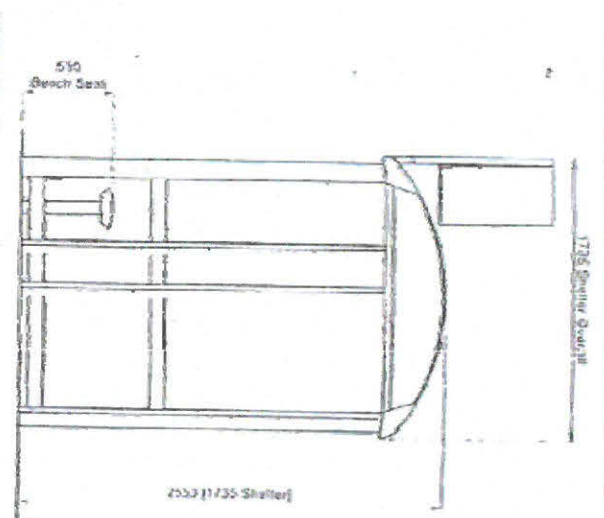
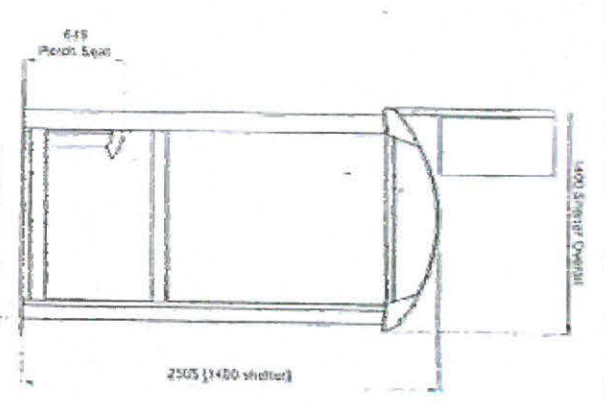
Design: Architecture + Interiors

 Engineering: Engineering

 Contract: 0000000000000000

Item	Quantity	Unit	Notes
1	1	EA	1200 Overall (1400)
2	1	EA	1200 Overall (1400)
3	1	EA	1200 Overall (1400)
4	1	EA	1200 Overall (1400)
5	1	EA	1200 Overall (1400)

APPENDIX 2



Item	Quantity	Unit	Notes
1	1	EA	1200 Overall (1400)
2	1	EA	1200 Overall (1400)
3	1	EA	1200 Overall (1400)
4	1	EA	1200 Overall (1400)
5	1	EA	1200 Overall (1400)

SHELTER INSTALLATIONS: FOOTWAY SPACE REQUIREMENTS

1M CANTILEVER

At Kerb Edge

600mm k/e+ 114mm Leg diameter + 1.2m minimum footway = 1.914m

600mm k/e + 114mm Leg diameter + 1.5m minimum footway = 2.214m

At Rear`

250mm (adj building) + 1m roof + 600mm k/e = 1.850m

100mm (adj open area) + 1m roof + 600mm k/e = 1.700m

1.2M CANTILEVER

At Kerb Edge

600mm k/e+ 114mm Leg diameter + 1.2m minimum footway = 1.914m

600mm k/e + 114mm Leg diameter + 1.5m minimum footway = 2.214m

At Rear`

250mm (adj building) + 1.2m roof + 600mm k/e = 2.050m

100mm (adj open area) + 1.2m roof + 600mm k/e = 1.900m

1.735 CANTILEVER with Quarter End Panels

At Kerb Edge

600mm k/e + 543mm e/p + 1.2m minimum footway = 2.343m

600mm k/e + 543mm e/p + 1.5m minimum footway = 2.643m

At rear

250mm (adj building) + 1.735m roof + 600mm k/e = 2.585m

100mm (adj open area) + 1.735m roof + 600mm k/e = 2.435m

1.735 CANTILEVER with Half End Panels

At Kerb Edge

600mm k/e + 803mm e/p + 1.2m minimum footway = 2.603m

600mm k/e + 803mm e/p + 1.5m minimum footway = 2.903m

At rear

250mm (adj building) + 1.735m roof + 600mm k/e= 2.585m

100mm (adj open area) + 1.735m roof + 600mm k/e = 2.435m

1.4M WIDTH ENCLOSED (at roof level)

At Kerb Edge

600mm + 1.3m (ground level) + 1.2m minimum footway = 3.100m

600mm + 1.3m (ground level) + 1.5m minimum footway = 3.400m

At rear

250mm (adj building) + 1.3m (ground level) + 1.2m min footway = 2.750m

250mm (adj building) + 1.3m (ground level) + 1.5m min footway = 3.050m

100mm (adj open area) + 1.3m (ground level) + 1.2m min footway = 2.6m

100mm (adj open area) + 1.5m (ground level) + 1.5m min footway = 3.1m

1.735 WIDTH ENCLOSED (at roof level)

At Kerb Edge

600mm + 1.641 ground level + 1.2m minimum footway = 3.441m

600mm + 1.641 ground level + 1.5m minimum footway = 3.741m

At Rear

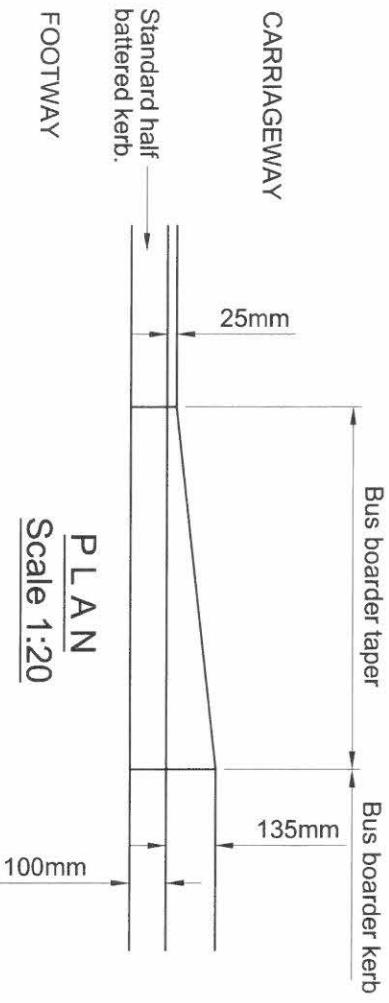
250mm (adj building) + 1.641 ground level + 1.2m min footway = 3.091m

250mm (adj building) + 1.641 ground level + 1.5m min footway = 3.391m

100mm (adj open area) + 1.641m ground level + 1.2m min footway = 2.941m

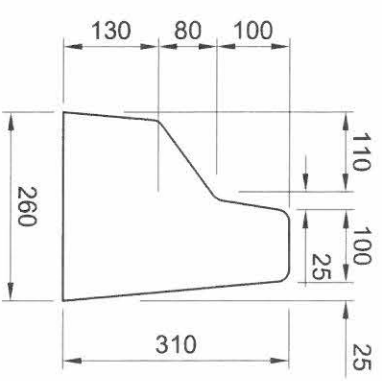
100mm (adj open area) + 1.641m ground level + 1.5m min footway = 3.241m

Bus stop infrastructure standards document.



PLAN
Scale 1:20

DETAIL OF BUS BOARDER/RAISED KERB SHOWING
CORRECT LAYING ALIGNMENT AND SECTION.

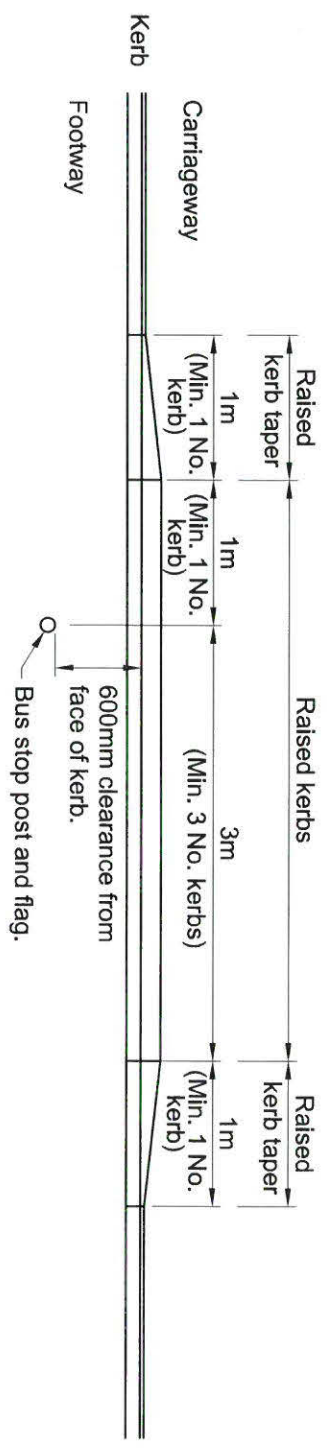
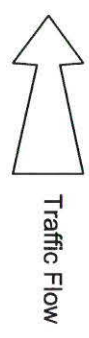


SECTION

REF.	DATE	REVISION

Dwg. No.01

Bus stop infrastructure standards document.

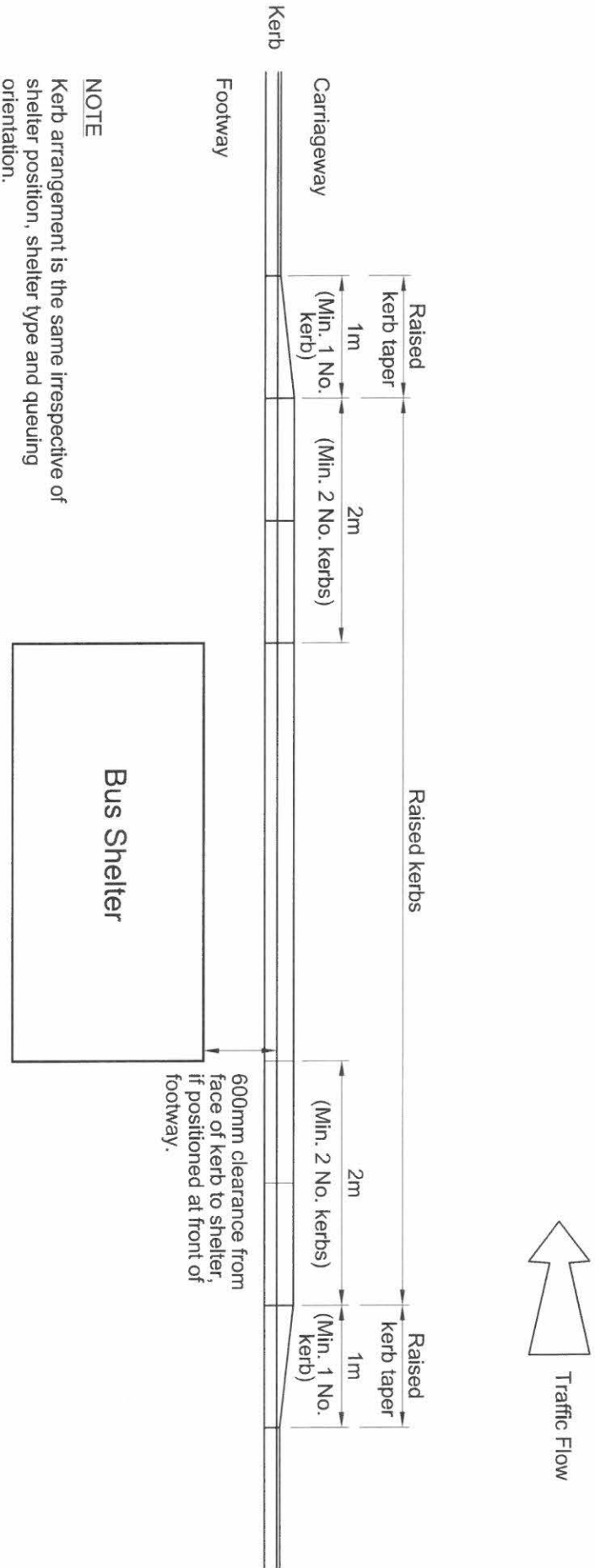


PLAN
Scale 1:50

RAISED KERBS AT CLEAR SITE (NO SHELTER - FLAG/POST AT FRONT OF FOOTWAY)

REF.	DATE	REVISION
Dwg. No.02		

Bus stop infrastructure standards document.



NOTE

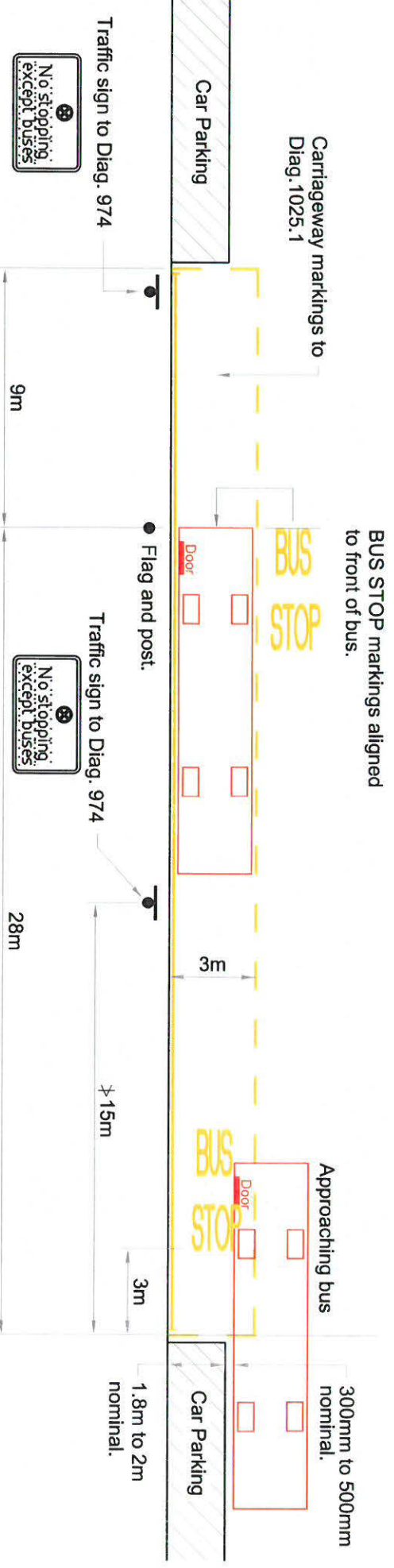
Kerb arrangement is the same irrespective of shelter position, shelter type and queuing orientation.

PLAN
Scale 1:50

RAISED KERBS AT SHELTER SITE

REF.	DATE	REVISION
Dwg. No.03		

Bus stop infrastructure standards document.



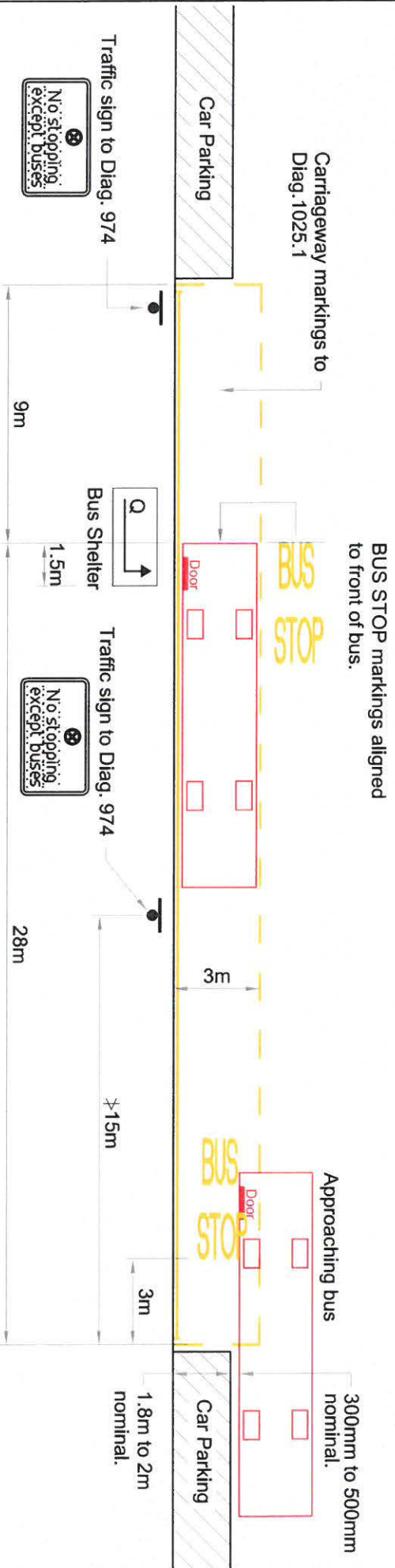
CLEAR SITE WITH FLAG/POST AND 37m CLEARWAY.

PLAN
Scale 1:200

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.04

Bus stop infrastructure standards document.



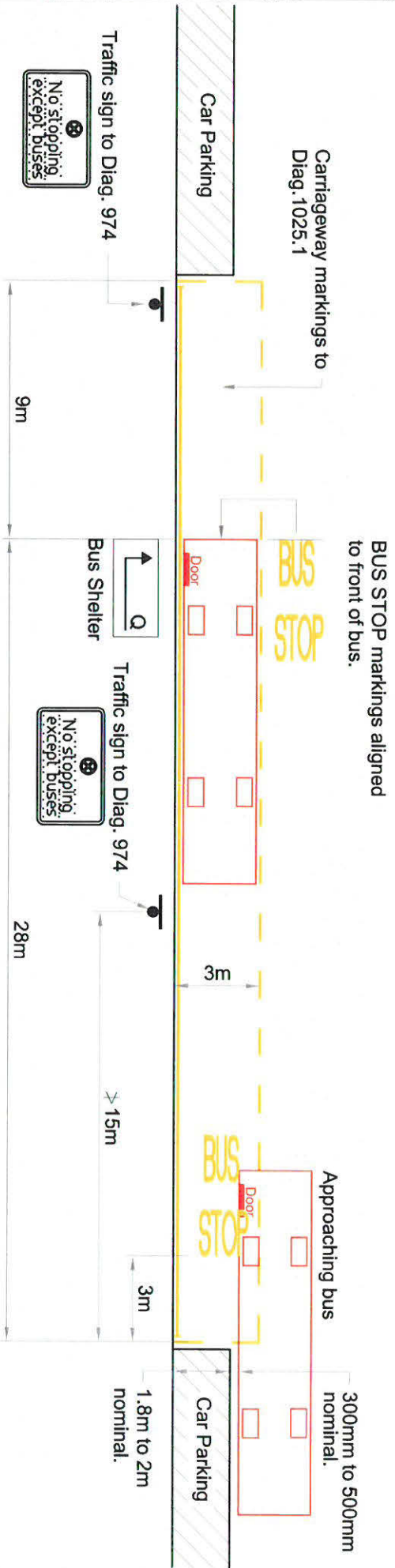
PLAN
Scale 1:200

ENCLOSED NORMAL QUEUE SHELTER SITE WITH 37m CLEARWAY.

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.05

Bus stop infrastructure standards document.



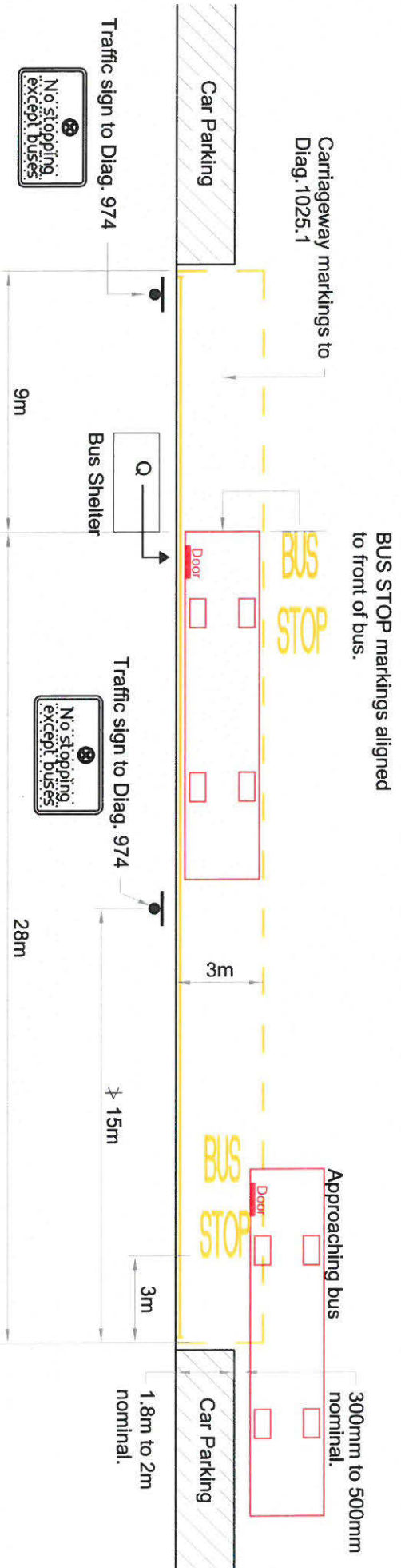
PLAN
Scale 1:200

ENCLOSED REVERSE QUEUE SHELTER SITE WITH 37m CLEARWAY.

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.06

Bus stop infrastructure standards document.

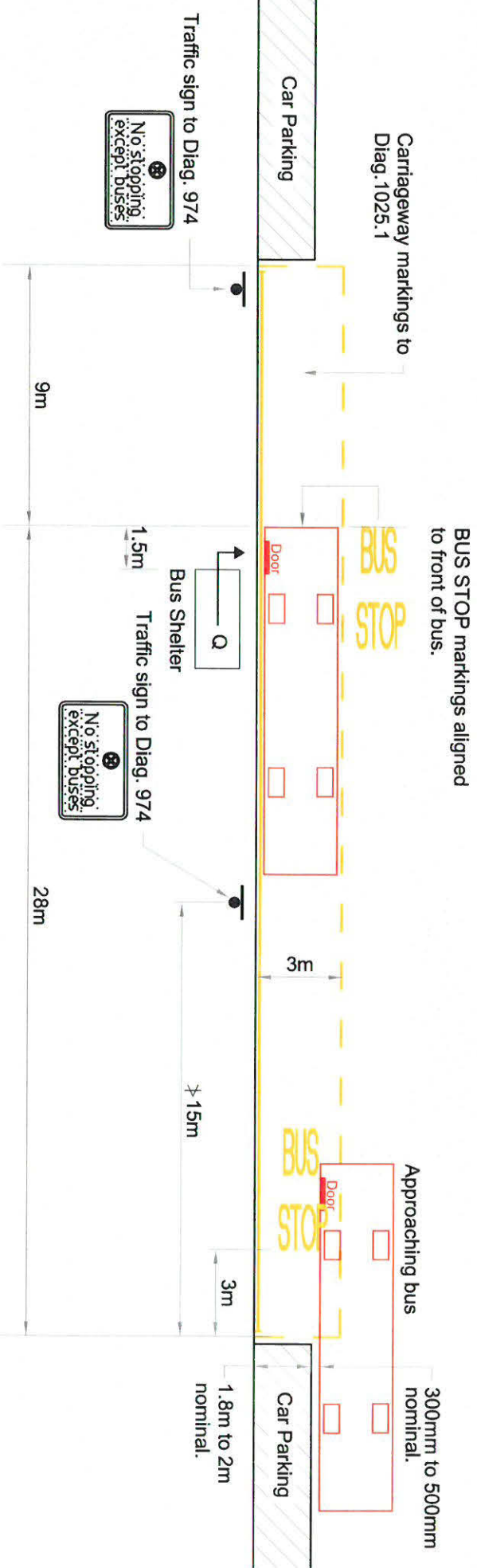


PLAN
Scale 1:200

CANTILEVER NORMAL QUEUE SHELTER SITE WITH 37m CLEARWAY.

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added. Diag.974 sign face shown
A	Oct.06	
Dwg. No.07		

Bus stop infrastructure standards document.

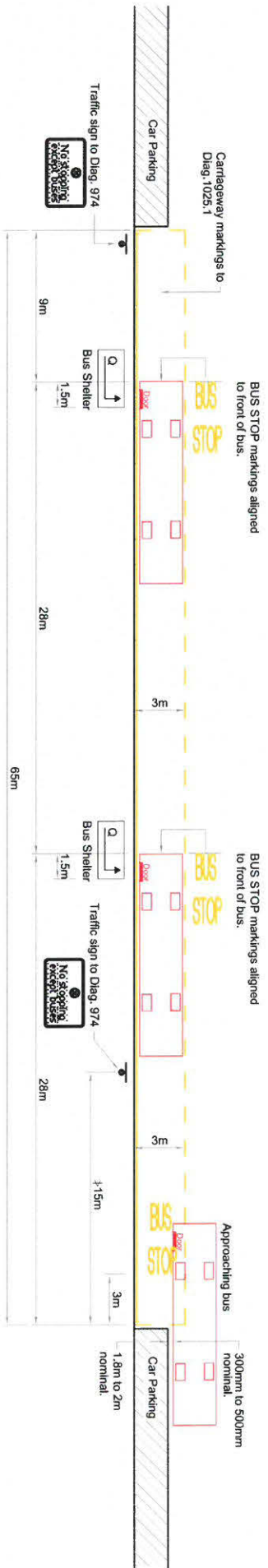


PLAN
Scale 1:200

CANTILEVER REVERSE QUEUE SHELTER SITE WITH 37m CLEARWAY.

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.08



PLAN
Scale 1:250

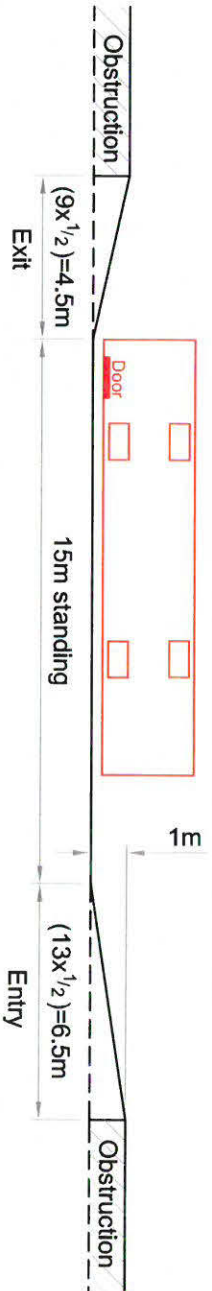
TYPICAL LAYOUT FOR TWO ADJACENT ENCLOSED NORMAL QUEUE SHELTERS

REF.	DATE	REVISION
B	Nov.07	Third bus stop marking added.
A	Oct.06	Diag. 974 sign face shown

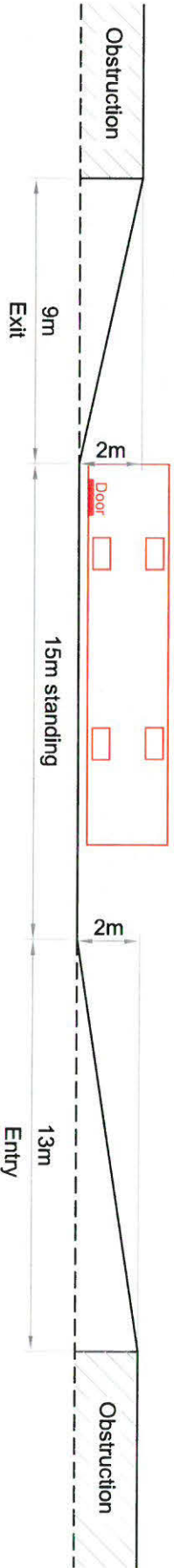
Dwg. No.09

Bus stop infrastructure standards document.

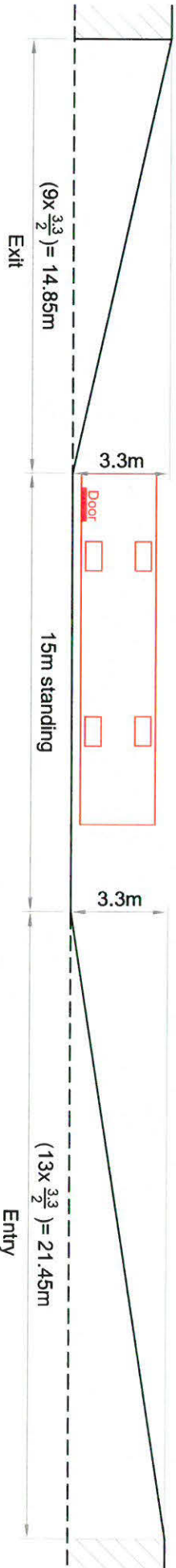
Theoretical simplified envelope for 1m obstruction to ensure accessibility:



Theoretical simplified envelope for 2m obstruction to ensure accessibility:



Theoretical simplified envelope for 3.3m obstruction to ensure accessibility:



PLAN

Scale 1:200

BUS MANOEUVRING ENVELOPES

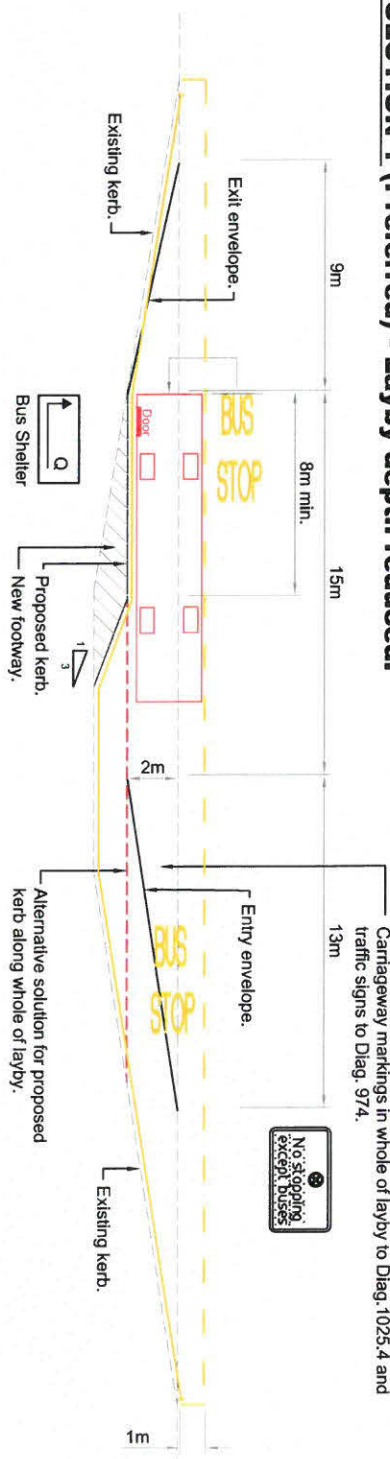
REF.	DATE	REVISION

Dwg. No.10

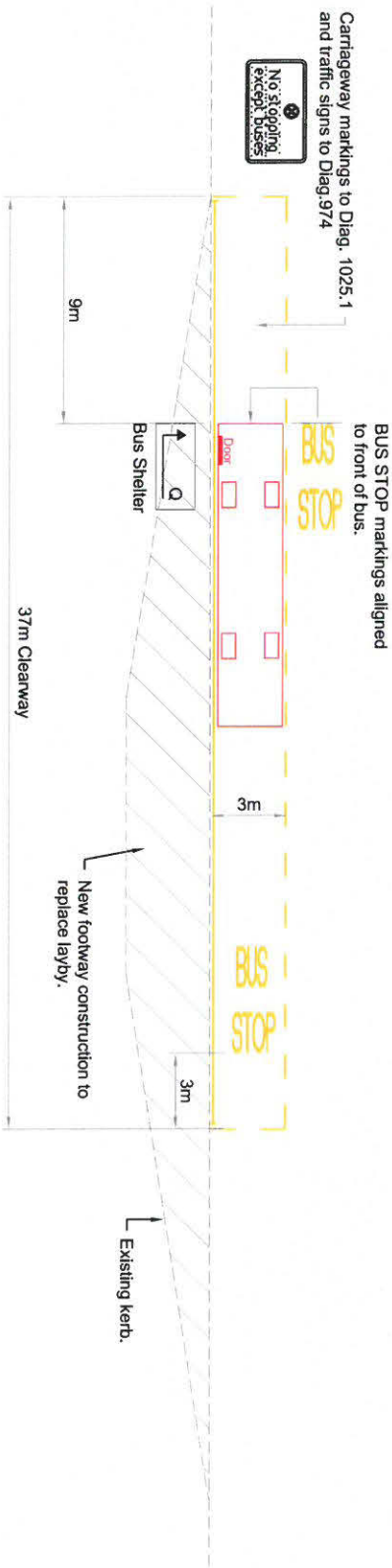
Bus stop infrastructure standards document.

**6 DIFFERENT SOLUTIONS TO MAKE A BUS STOP ACCESSIBLE IN AN EXISTING 3.3m DEEP LAYBY
PLANS - SCALE 1:200**

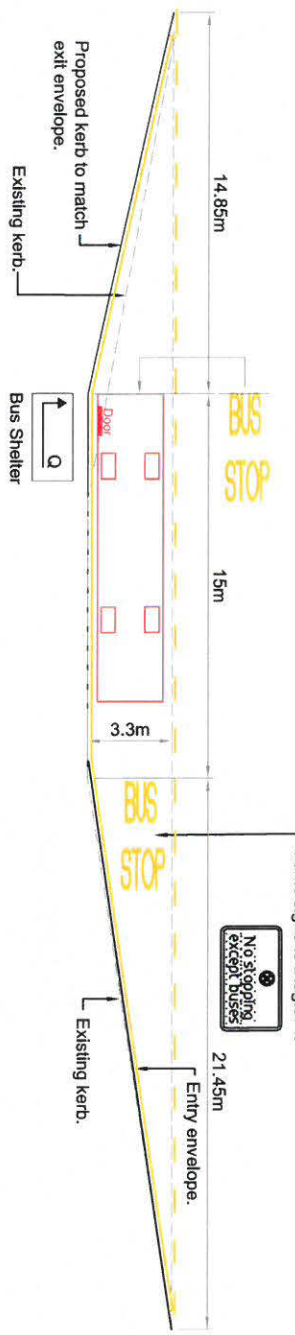
SOLUTION 1 (Preferred) - Layby depth reduced.



SOLUTION 2 - Whole of layby removed and bus stop moved onto main carriageway.



SOLUTION 3 - Layby shape amended on exit.

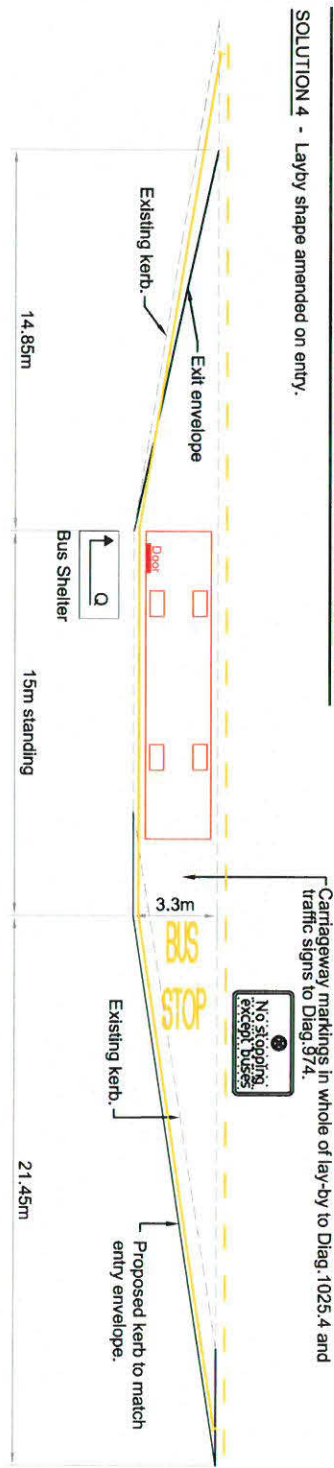


REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

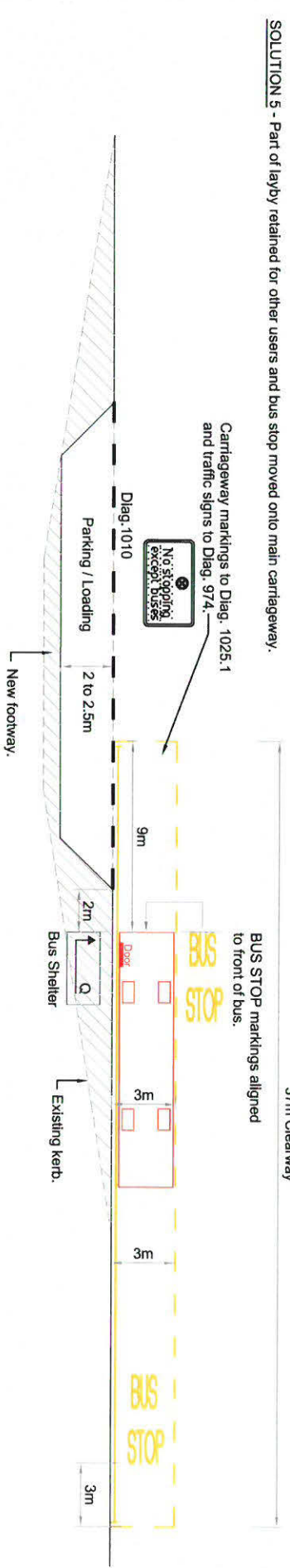
Dwg. No.11A

Bus stop infrastructure standards document.

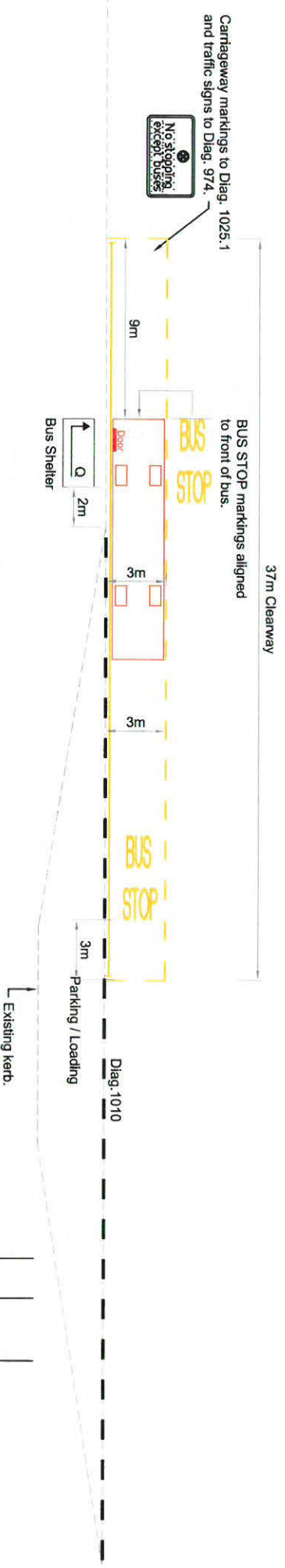
SOLUTION 4 - Layby shape amended on entry.



SOLUTION 5 - Part of layby retained for other users and bus stop moved onto main carriageway.



SOLUTION 6 - Whole of layby retained for other users and bus stop moved onto main carriageway.

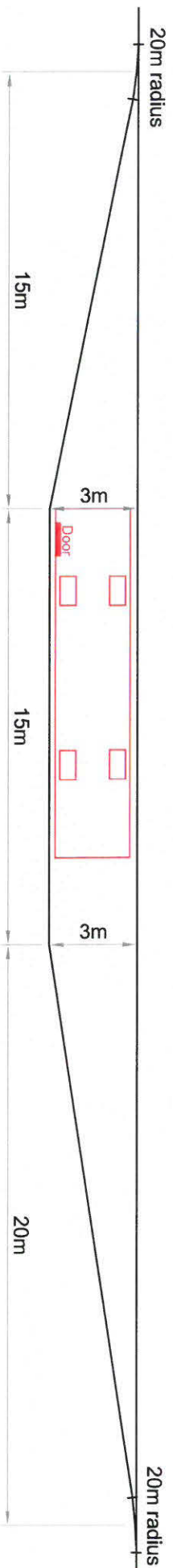


6 DIFFERENT SOLUTIONS TO MAKE A BUS STOP ACCESSIBLE IN AN EXISTING 3.3m DEEP LAYBY PLANS-SCALE 1:200

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.11B

Bus stop infrastructure standards document.



PLAN

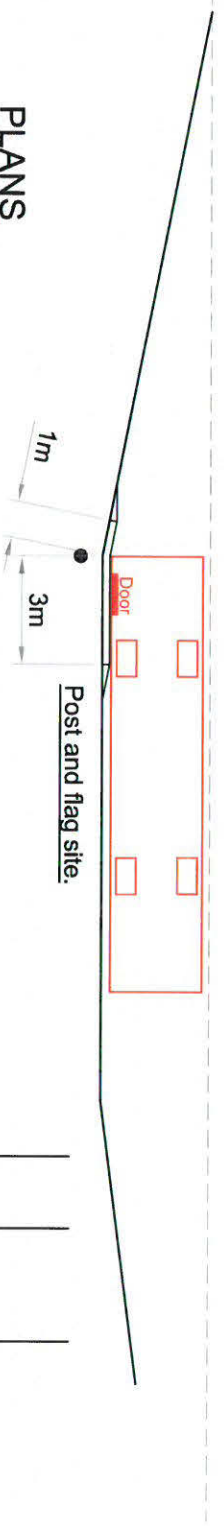
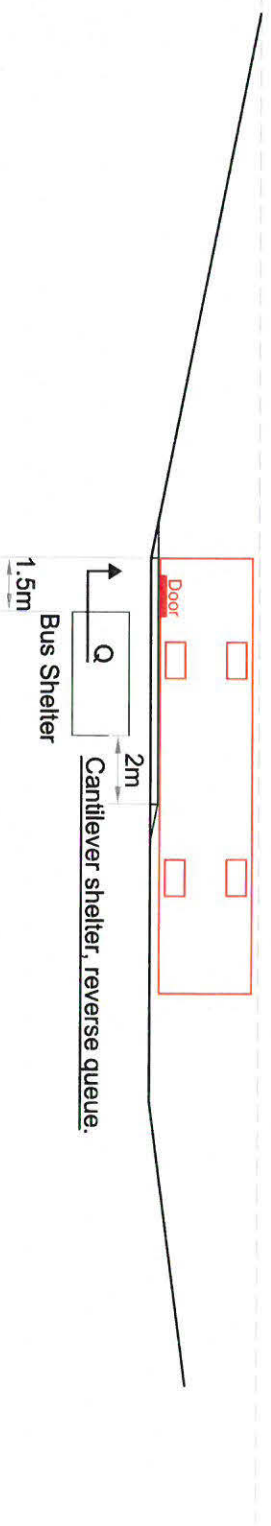
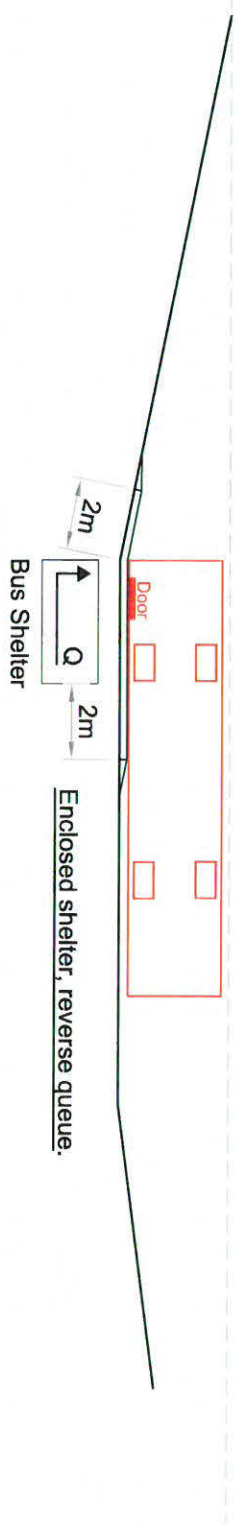
Scale 1:200

DIMENSIONS FOR NEW LAYBYS

REF.	DATE	REVISION

Dwg. No.12

Bus stop infrastructure standards document.

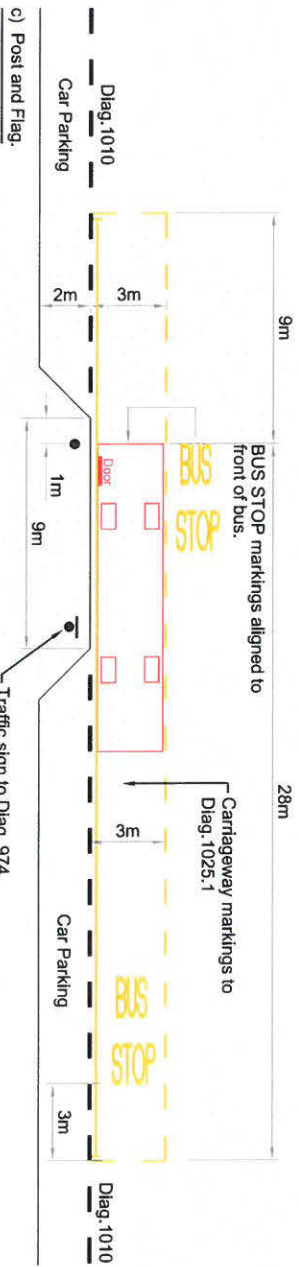
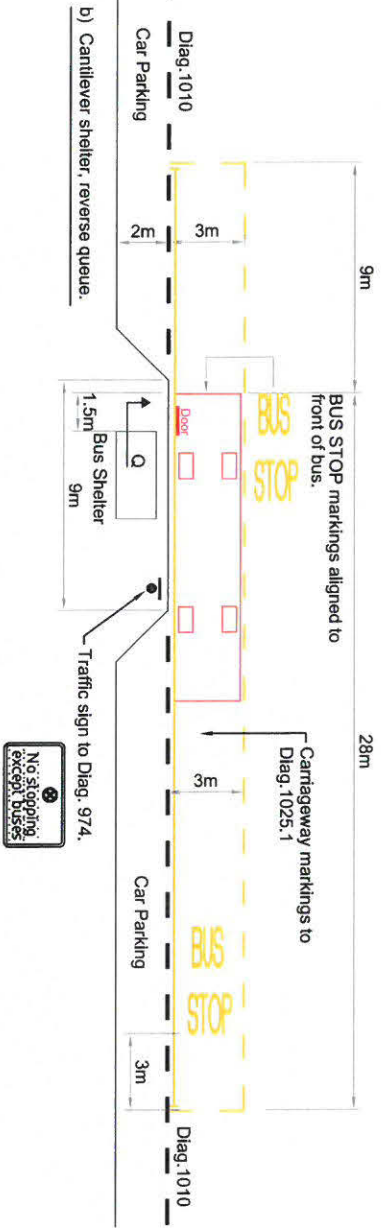
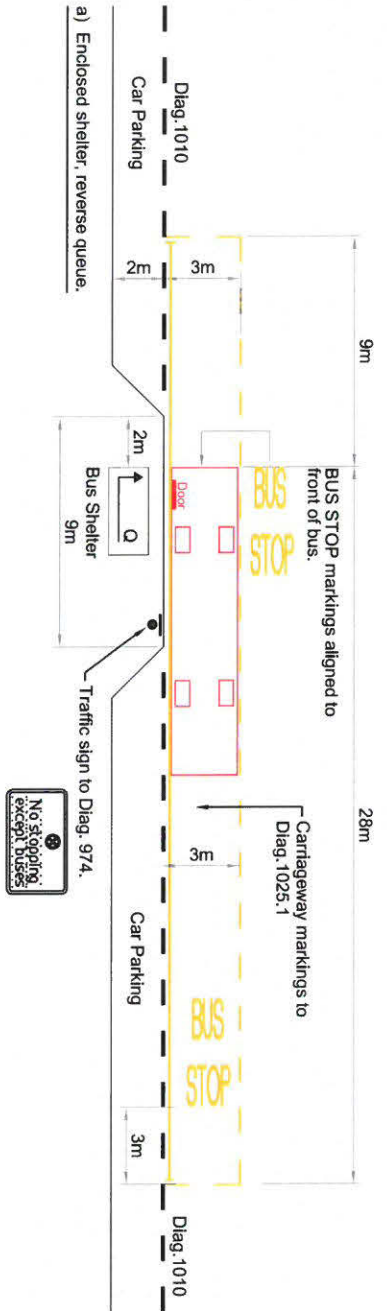


PLANS
Scale 1:200

BUS STOP TYPES AND RAISED
KERB ORIENTATIONS IN LAYBYS

REF.	DATE	REVISION
Dwg. No.13		

Bus stop infrastructure standards document.



PLANS.
Scale 1:200

BOARDER TYPES, 2m WIDE

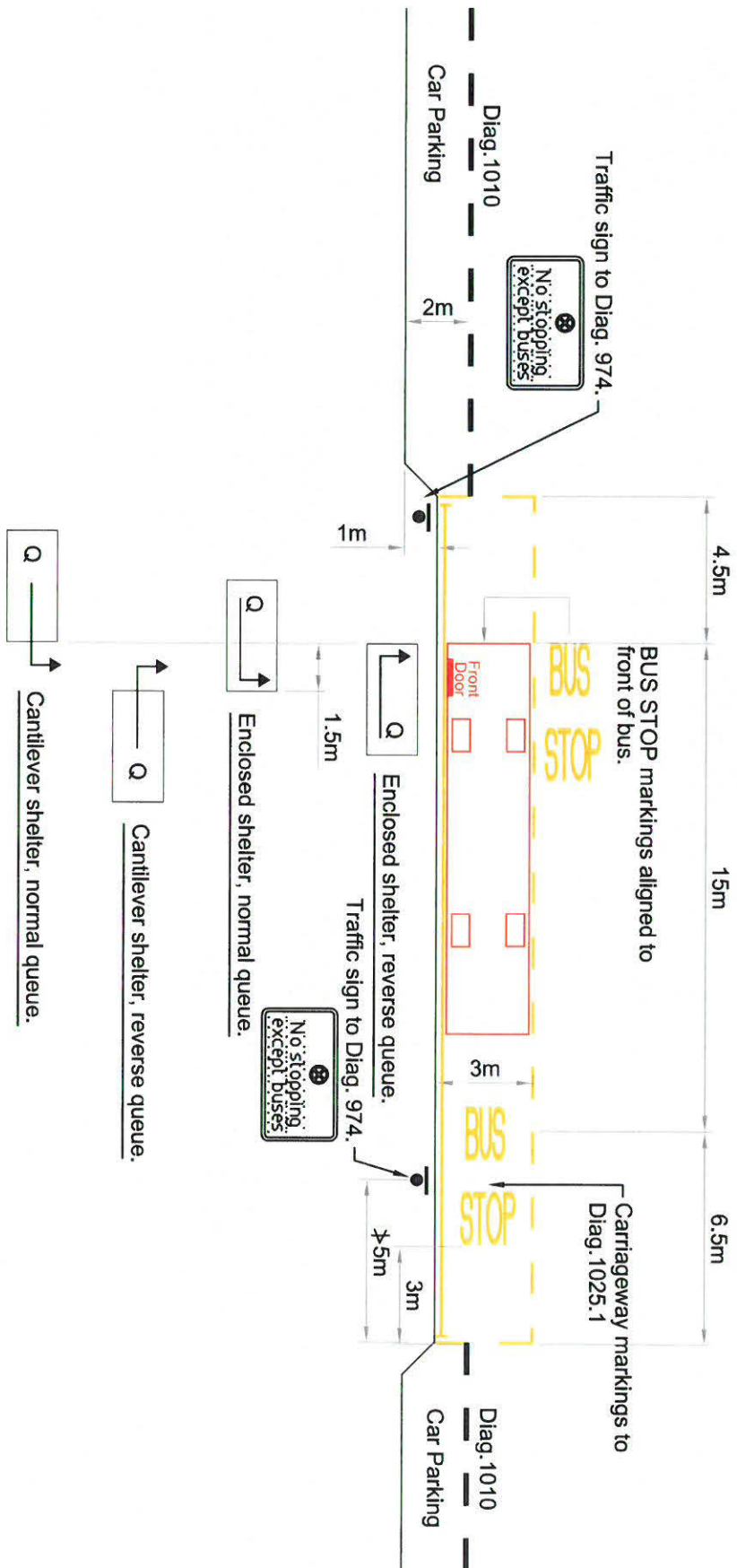


NOTE
This layout should only be used with reverse queue shelters or at post/flag sites.

REF.	DATE	REVISION
B	Nov. 07	Second bus stop marking added.
A	Oct. 06	Diag. 974 sign face shown

Dwg. No. 14

Bus stop infrastructure standards document.



PLANS
Scale 1:200

BOARDER TYPES, 1m WIDE

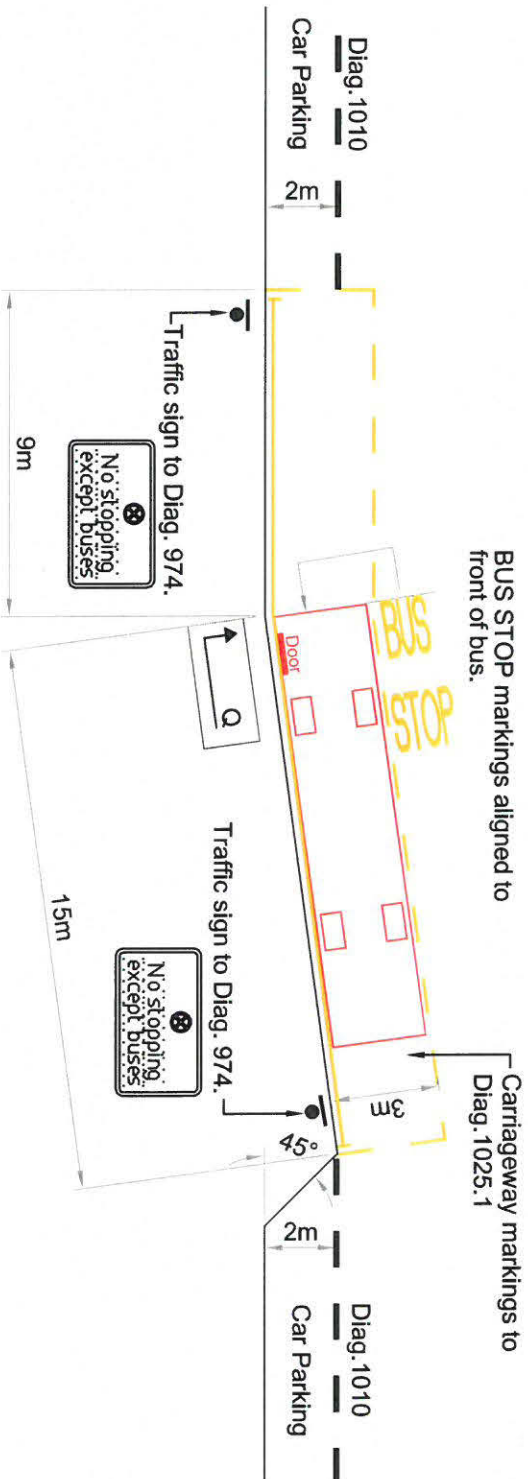
REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.15

Bus stop infrastructure standards document.

NOTE

Layout and dimensions vary depending on individual site characteristics. Layout and dimensions for sawtooth arrangements at multiple bus stop sites need to be determined using a suitable swept path analysis tool.

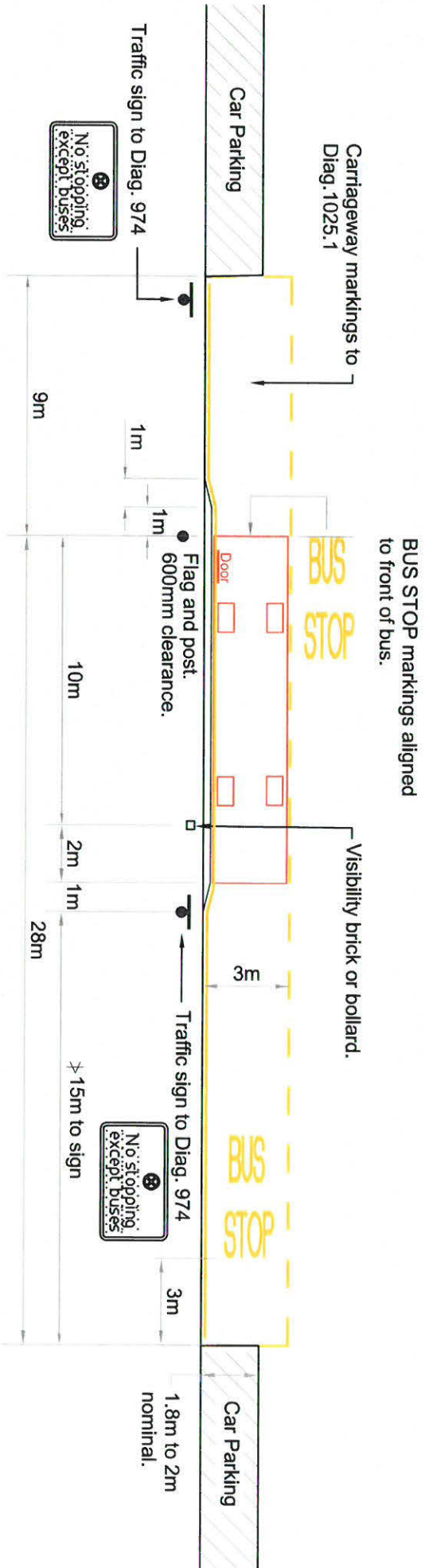


PLAN
Scale 1:200

EXAMPLE OF 'SAWTOOTH' ARRANGEMENT FOR SINGLE BUS STOP SITE WITH ENCLOSED REVERSE QUEUE SHELTER

REF.	DATE	REVISION
A	Oct.06	Diag.974 sign face shown
Dwg. No.16		

Bus stop infrastructure standards document.



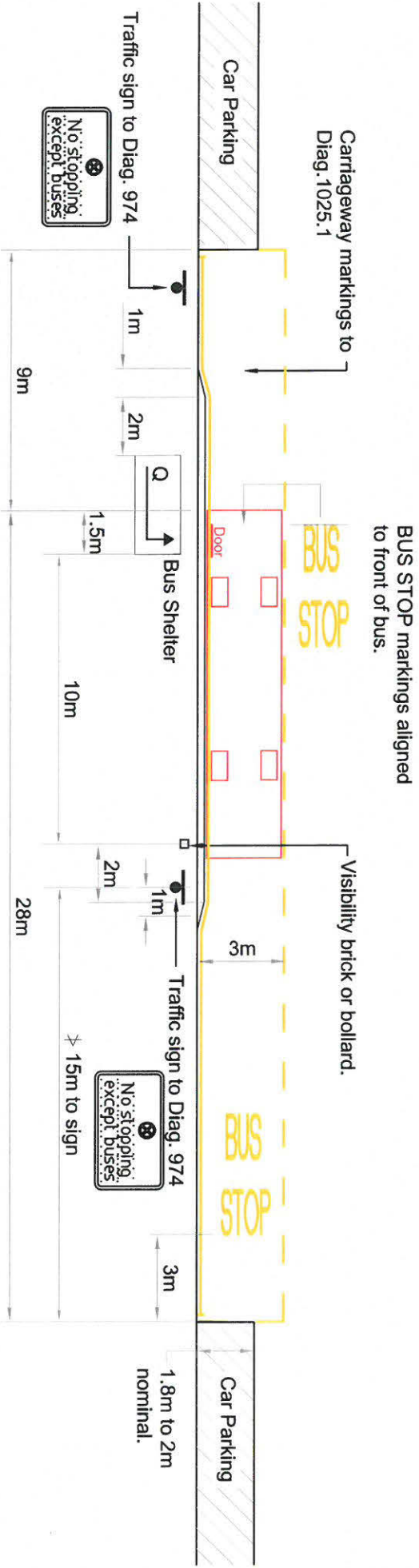
PLAN
Scale 1:200

**CLEAR SITE WITH FLAG/POST AND 37m CLEARWAY.
FOR USE BY GUIDED BUSES.**

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.17

Bus stop infrastructure standards document.



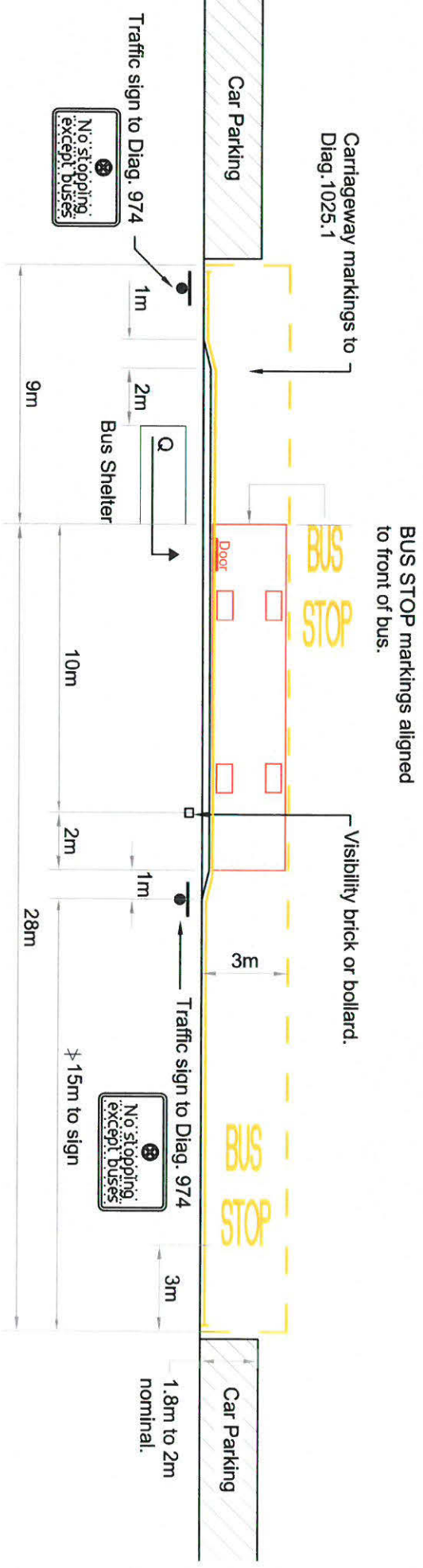
PLAN
Scale 1:200

ENCLOSED NORMAL QUEUE SHELTER SITE WITH 37m CLEARWAY.
FOR USE BY GUIDED BUSES.

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.18

Bus stop infrastructure standards document.



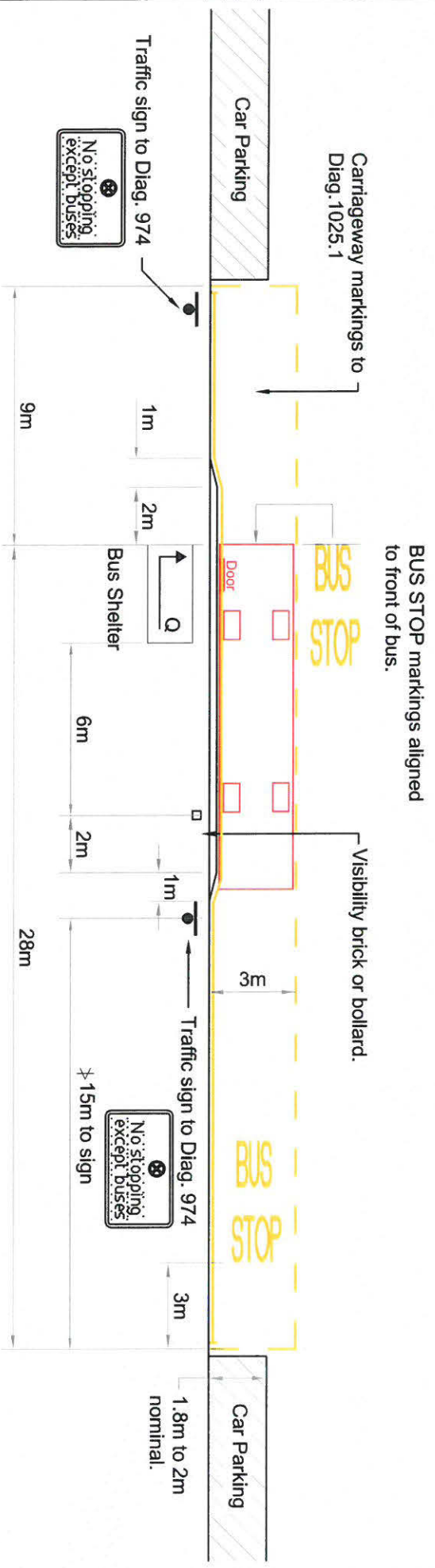
PLAN
Scale 1:200

**CANTILEVER NORMAL QUEUE SHELTER SITE WITH 37m CLEARWAY,
FOR USE BY GUIDED BUSES.**

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag. 974 sign face shown

Dwg. No.19

Bus stop infrastructure standards document.



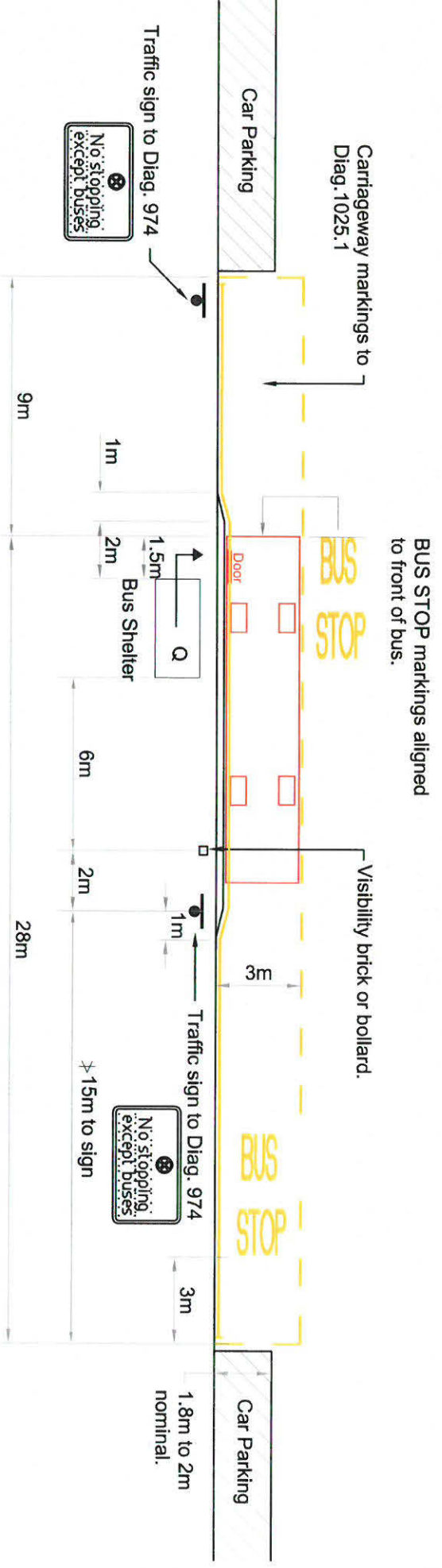
PLAN
Scale 1:200

ENCLOSED REVERSE QUEUE SHELTER SITE WITH 37m CLEARWAY,
FOR USE BY GUIDED BUSES.

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag.974 sign face shown

Dwg. No.20

Bus stop infrastructure standards document.



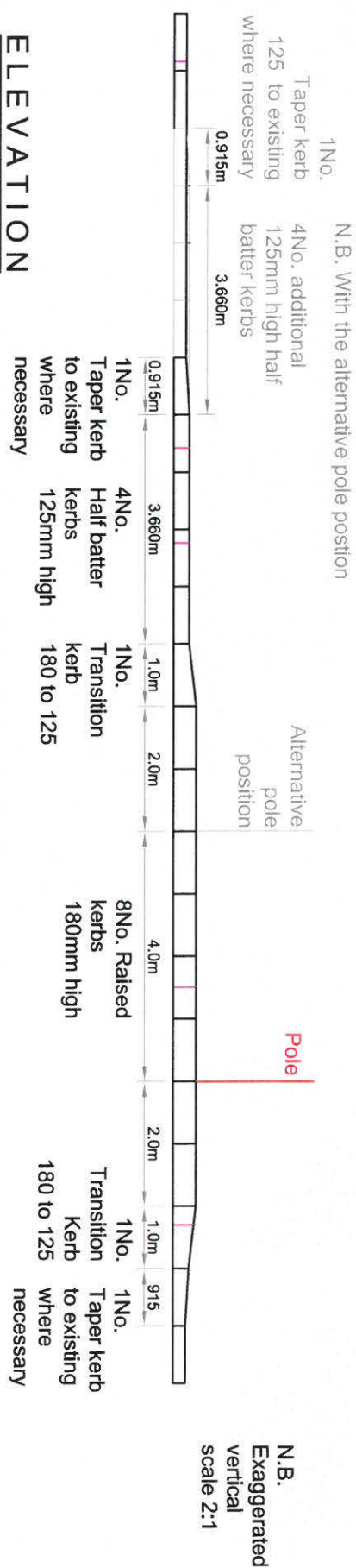
PLAN
Scale 1:200

**CANTILEVER REVERSE QUEUE SHELTER SITE WITH 37m CLEARWAY,
FOR USE BY GUIDED BUSES.**

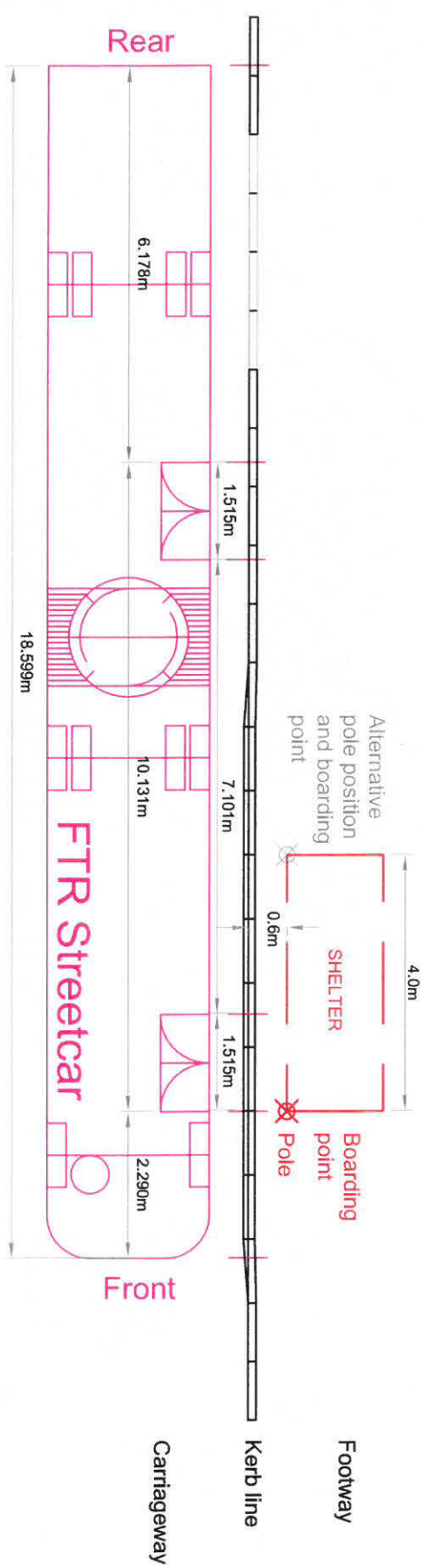
REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Diag. 974 sign face shown

Dwg. No.21

Bus stop infrastructure standards document.



ELEVATION



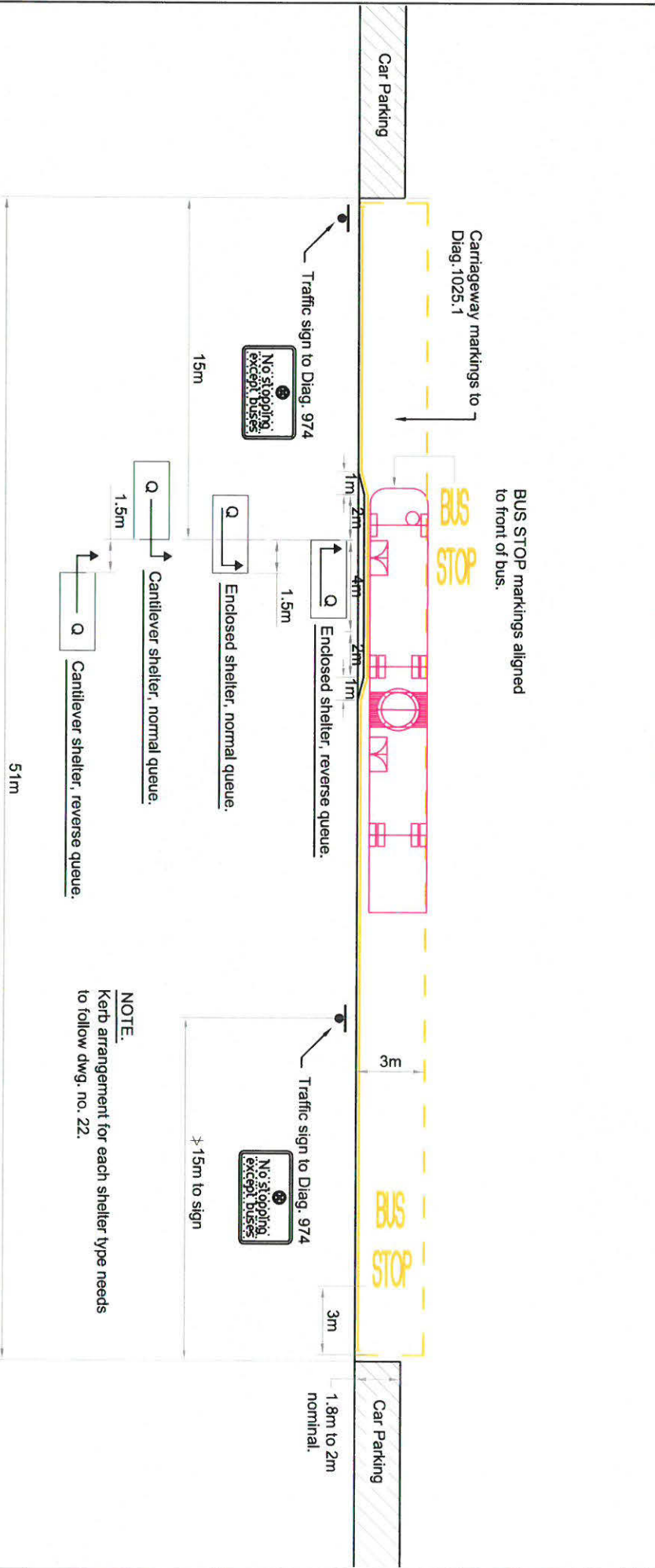
PLAN

Scale 1:100

FTR ARTICULATED VEHICLE, KERB AND SHELTER/POLE ARRANGEMENT.

REF.	A	DATE	Oct.06	REVISION	Added to standard
				Dwg. No.22	

Bus stop infrastructure standards document.



PLAN
Scale 1:250

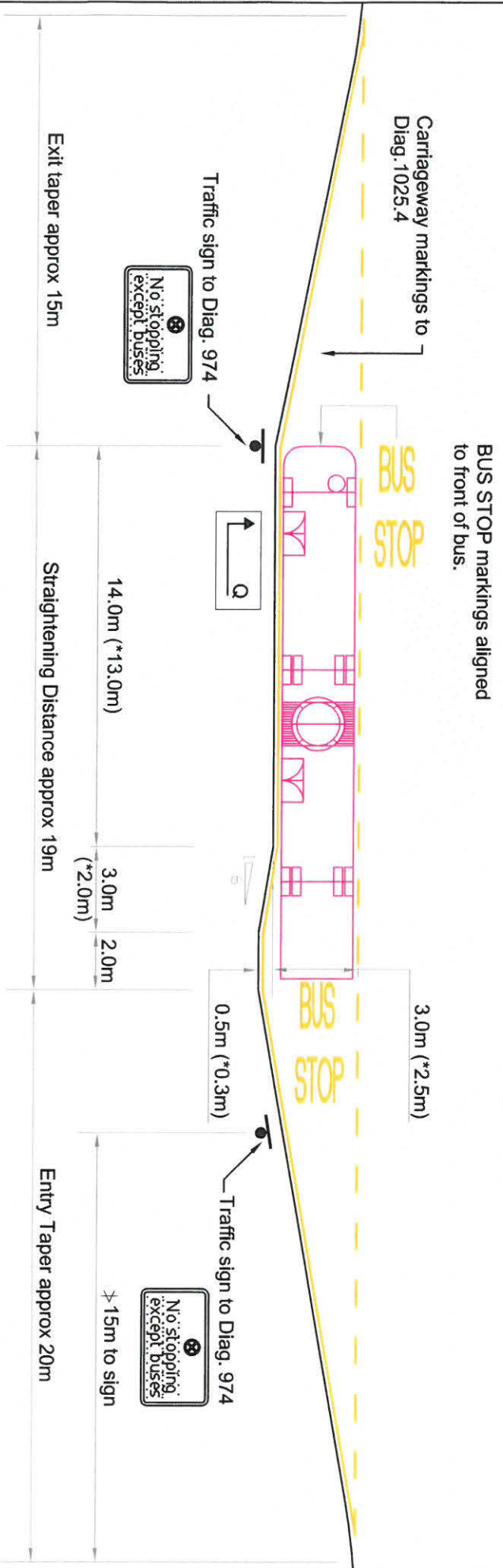
FTR ARTICULATED VEHICLE, VARIOUS SHELTER TYPES WITH 51m CLEARWAY,

NOTE.
Kerb arrangement for each shelter type needs to follow dwg. no. 22.

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Added to standard

Dwg. No.23

Bus stop infrastructure standards document.



(* Absolute minimum distance)

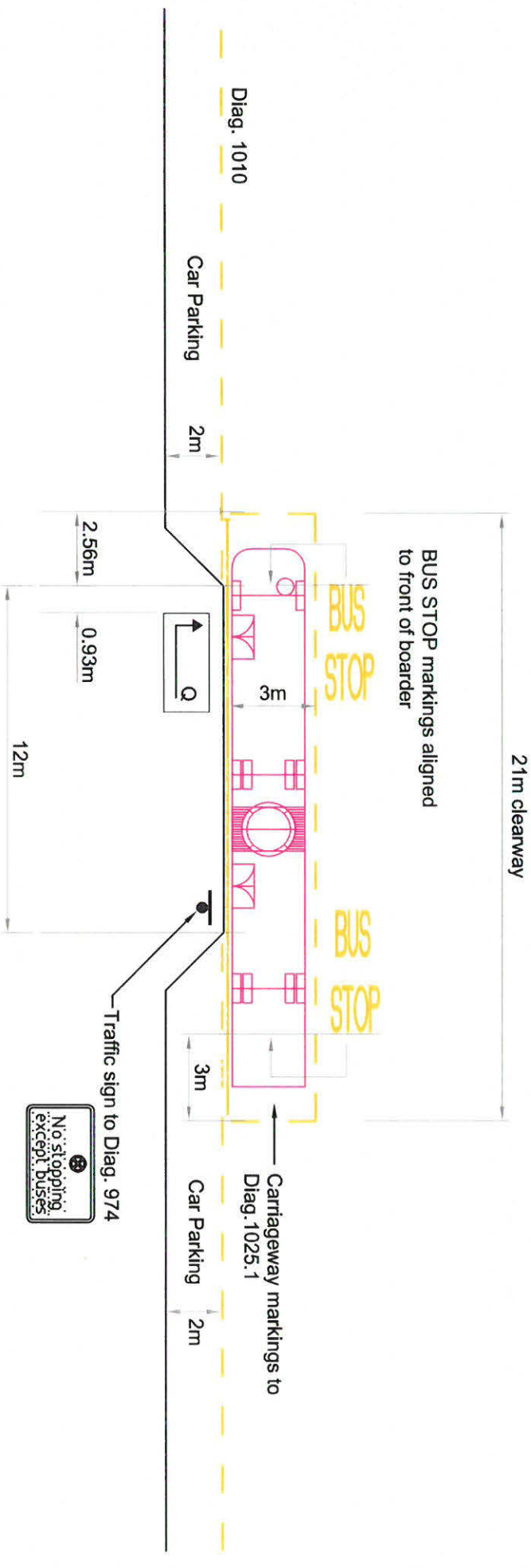
PLAN
Scale 1:200

FTR ARTICULATED VEHICLE, 54m LAY-BY
(with typical enclosed reverse queue shelter)

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Added to standard

Dwg. No.24

Bus stop infrastructure standards document.



PLAN

Scale 1:200

FTR ARTICULATED VEHICLE, 2m WIDE BOARDER.
(with typical enclosed reverse queue shelter)

REF.	DATE	REVISION
B	Nov.07	Second bus stop marking added.
A	Oct.06	Added to standard

Dwg. No.25