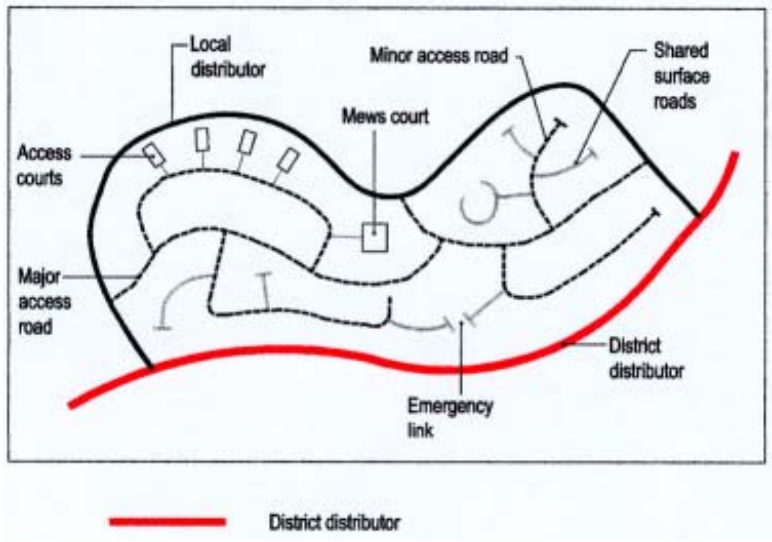
8. Hierarchy of Roads

8.1 General

8.1.1 The highway forms an integral part of any new development, and therefore cannot be considered in isolation from the overall design; all elements involved in the production of a satisfactory and pleasing final product must be considered together at as early a stage as possible.

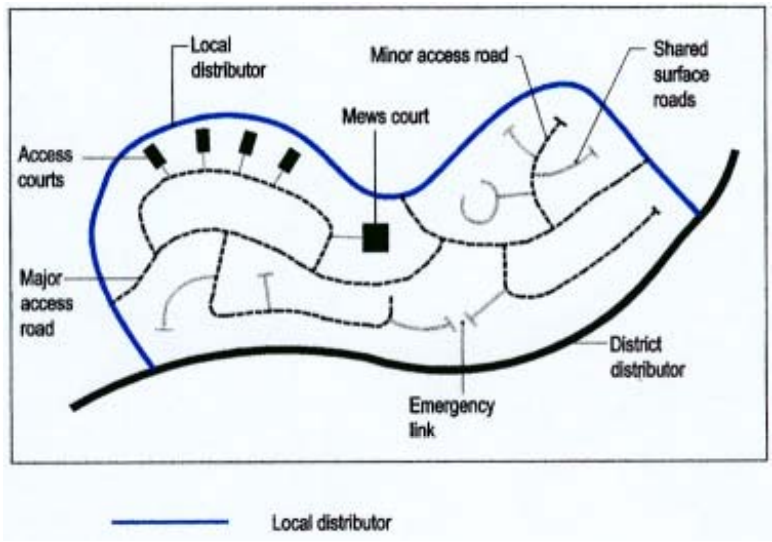
8.1.2 This section employs the concept of a hierarchy of roads within residential estates, from a small-scale cul-de-sac where pedestrian movements are predominant and vehicle speeds are restricted, to distributor roads catering for the free flow of vehicles. The design of the housing area using this hierarchy should prevent areas where people live being intruded upon by traffic from outside their immediate area whilst maintaining ease of access for residents, visitors and service vehicles to their homes.

8.1.3 The road hierarchy within the administrative district of York includes Primary Distributor Roads, District Distributor Roads, Local Distributor Roads and Residential Roads. This guide is only concerned with the lower categories of this hierarchy. However, it must be stated at this stage that access to Primary or District Distributors Roads will not be permitted except in exceptional circumstances.



Local Distributor Roads

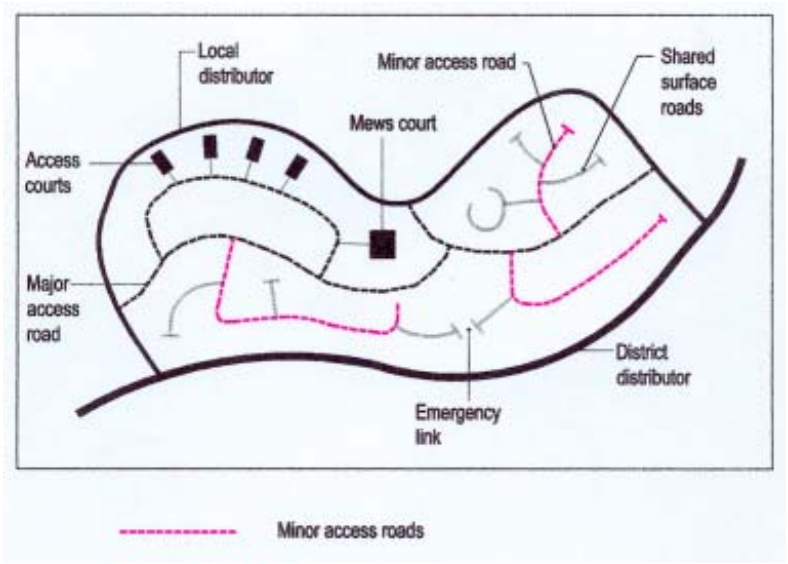
These roads together with Transition Roads are generally without direct access to properties and which, in larger developments, connect the new residential access road network to the existing distributor road network.



Residential Access Roads

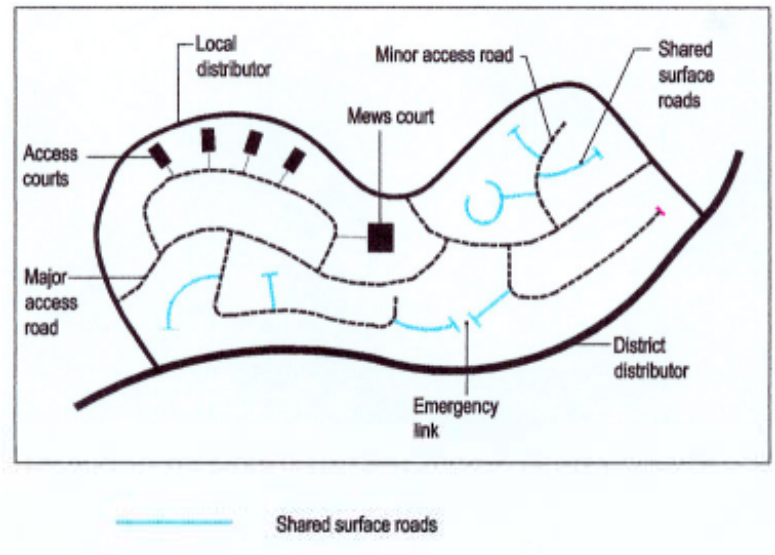
8.1.4 These are roads linking Shared Surface Roads, dwellings and parking areas to the distributor road network. The different categories are:

- Major Access Road
- Minor Access Road



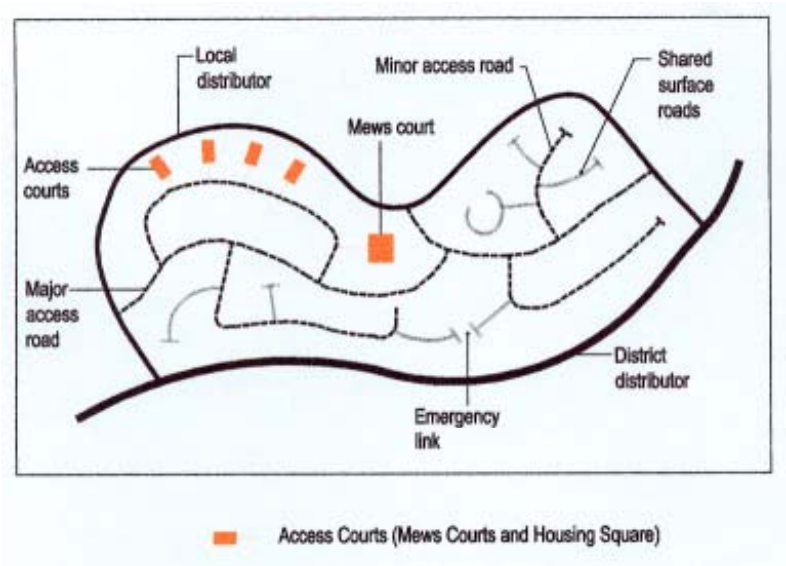
Shared Surface Road

8.1.5 The primary purpose of these roads is to provide direct access to dwellings, they are engineered with low traffic speeds and help create a sense of community.



Informal (loops & Culs de sac)

Access and Mews Courts



Minor Access Ways

8.1.6 Housing sites in York are typically small so that the need for local distributor roads will not arise in most cases. Therefore the guidance given below focuses mainly on the design of residential access roads.

8.1.7 The layout and design of roads and footpaths must be an integral part of the overall design concept. The approach adopted by this Guide is not to present a rigid set of rules to be followed in the design of residential layouts or to present standard layouts that can be applied 'off the peg' to developments in York. Rather it advises on objectives and principles while indicating minimum standards to be met where necessary.

8.2 Local Distributor Roads and Transition Roads

Local Distributor (With 'bolt on' traffic calming)

8.2.1 Local Distributor Roads are roads within larger developments carrying higher traffic flows and will be required where a residential road would serve, directly or indirectly, over 400 dwellings. Distributor Roads should have two points of access. Attention is drawn to the recommendations of *TA 20/84* that a right turning lane junction or a roundabout should be considered for new urban junctions with side road traffic flows in excess of 500 vehicles per day (2 way AADT).

8.2.2 Local Distributor Roads are designed to facilitate traffic movement and the motorist generally enjoys priority although the safe movement of pedestrians is still catered for. They will generally be designed to restrain vehicle speeds to 30mph through the alignment of the road and the use of roundabouts at significant junctions. At particular locations, such as outside schools, restraint of speeds to 20mph will be required and the use of design measures such as raised junctions and speed tables may be considered. Any speed restraint measures on Local Distributor Roads must take into account the requirements of buses and the emergency services.

8.2.3 Where a Local Distributor Road is required the visual monotony, such as the continuous views of garden fencing or walls can be reduced by a limited amount of frontage development, provided it is accessed by a specially constructed access road parallel to but separate from the main highway, or by the use of minor access ways. Where permitted, dependent upon other junctions along the local distributor road, such accesses/shared private drives shall be provided with adequate turning facilities for service vehicles, and an additional parking space shall be provided for each dwelling above the normal provision.

Transition Roads

8.2.4 Access Road network to the Distributor Road network where the access road system serves over 100 dwellings and it is impractical to provide two links to the distributor road network. As Transition Roads are short a carriageway width of 6.0 metres is acceptable. If, for particular site-specific reasons, long Transition Roads are proposed, then a 6.5 metre carriageway may be required.

8.2.5 In other respects their design characteristics are as for Local Distributor Roads.

Standards

No. of Dwellings Served	Over 400

Design Speed	30mph (48kph)
Minimum Carriageway Width	6.5 metres minimum (7.3m may be required where traffic types dictate).
Footway Width	2 No. at 2.0m minimum. Segregated from carriageway by verges.
Verges Width	Average 2 metres (variable width recommended for visual interest – 3 metres minimum where no footway provided.
Min centre line radius	60 metres
Maximum Gradients	6%
Junction Spacing	Same side 60m Opposite sides 35m

NB. Care will be needed in positioning junctions to ensure that the combination of curving alignment and visibility splays does not sterilise excessive land.

8.3 Residential Access Roads

Major Access Roads

8.3.1 Major Access Roads serve between 100 and 400 dwellings, they provide direct access to property and are intended to cater for access traffic only. In their layout, the needs of safety, security, and the creation of an attractive environment predominate over the needs of moving traffic.

8.3.2 Major Access Roads should preferably have two points of access or if a second point of access is not available a Transition Road should be provided. For properties accessed directly from Major Access Roads, serving more than 200 dwellings or within 200 metres of a junction with a Local Distributor Road, space for turning a car may be requested within the curtilage.

8.3.3 Generally Major Access Roads layouts should be such that they do not form an attractive through route and vehicle speeds are restrained. Design speeds should

generally aim for 20 mph, however, on some longer layouts 30 mph may be appropriate where the lower speed would give unacceptably long access times. Generally design for 30 mph should be considered where vehicles would have to travel over a kilometre (0.62 miles) by '20 mph' roads.

8.3.4 Target speeds will be achieved by keeping lengths of road without speed restraints to the lengths not exceeding 120 metres. Except for speed restraint bends the full range of speed restraint measures are available on Major Access Roads. Urban design considerations will, however, be important in determining the appropriate measures for specific locations.

8.3.5 It is accepted that where frontage road access is provided on-street parking will often occur. The requirement for a minimum carriageway width of 5.5 metres is designed to cater for vehicles reversing but also allow for this. Where there is no direct access to property, or for other reasons it can be demonstrated that on-street parking will not take place, widths may be reduced. Where more than 300 dwellings are served by a Major Access Road on-street parking should be provided clear of the carriageway.

Standards

No. of dwellings served	100 to 400
Design Speed	20mph (30 mph)
Minimum carriageway width	5.5m – 6.0 where a bus route may be provided.
Footway width	2 No. 2.0m minimum
Verges	May be required for roads serving over 300 dwellings.
Minimum centreline radius	20m
Maximum gradients	7%
Junction spacing	Same side 30m Opposite side 15m

Notes: Casual off street parking places may be required where a road serves more than 300 dwellings.

On plot turning spaces may be required where a road serves more than 200 dwellings or within 200 metres of a Local Distributor Road.

8.4 Minor Access Roads

8.4.1 Minor Access Roads serve up to 100 dwellings as a loop or cul-de-sac. For any cul-de-sac serving more than 50 dwellings, an alternative access for emergency use should be provided. For other culs-de-sac an emergency link may be provided where this can be accommodated within the layout proposed.

8.4.2 Minor Access Road layouts should be such that vehicle speeds are restrained to below 20mph.

8.4.3 The minimum width for minor access roads where there is no frontage access should be 4.8 metres, or 4.5 metres where less than 25 houses are served.

8.4.4 Carriageway widths should not be reduced below 5.5 metres within 20 metres of junctions with Local Distributor Roads or Major Access Roads.

8.4.5 In certain circumstances where there is minimal pedestrian demand along one side of a road it may be possible to substitute a service verge for one footway.

Standards

No. of Dwellings	up to 100
Design Speed	20mph
Minimum Carriageway Width	5.5 metres
Footway Width	2 No. at 2.0m (See note 1)
Verges	2m where only one footway is provided (See note 2)
Minimum Centreline radius	20m

Maximum Gradients	7%

Note 1: For roads serving less than 25 dwellings it may not be necessary to provide two footways

Note 2: Verges may be planted with low ground cover as described in Annex B: Approved planting.

8.5 Shared Surface Roads

8.5.1 Shared Surface Roads have been used in the United Kingdom for some 20 years and have enabled the designers to produce layouts with more innovation, due mainly to the acceptance of less rigid engineering standards. When designed with care they can create the basis for developments with a greater sense of identity. In addition when vehicle speeds are restrained by gateways, variable widths and other measures, together with a variety of building design and landscaping, statistics show that they have a very good roar safety record.

8.5.2 A shared surface is provided for use by pedestrians and vehicles and are dominated by soft landscaping and suited to low density development with buildings set back from the road.

8.5.3 Since pedestrians and drivers share the same surface it is most important that all road users are made aware of the separate and distinctive nature of these roads. The distinction between other residential estate roads must be made, not only by the presence of traffic calming measures, but also by the uses of differing carriageway surfacing materials. These roads MUST, therefore, be constructed using block paviours, or other coloured/textured materials to the approval of the Highway Authority.

Informal Shared Surface Roads

8.5.4 An informal Shared Surface Road can serve up to 25 properties as a cul-de-sac, and around 50 properties in a loop form where junctions with roads with footways are located at each end of the shared surface. No dwelling must be more than 25 properties from the access road.

8.5.5 The transition from access road to a Shared Surface Road must be made abundantly clear to drivers, usually by the introduction of a shallow level change at the entrance to the shared pedestrian/vehicle surface or by the use of distinctive surfacing rumble strips or transition ramps. The detail of a typical entrance to a shared surface is shown in Appendix 5.

8.5.6 The shared surface is flanked by a 2.0 metre wide adoptable service verge. The shared pedestrian/vehicle surface should be a variable width between a minimum of 4.5 metres and a maximum of 6.5 metres. Casual parking should be provided within the wider sections clear of the 4.5 metre core area. The width of shared surfaces adjacent to accesses to properties must be sufficient to permit vehicles to manoeuvre to and from those accesses, taking into account the alignment of the shared surface and location of parking. The width required will also depend on the kerb radii, driveway width and location of any gateways at the entrance to the access.

8.5.7 The service verge must be clearly defined in detail, and reference to it being part of the public highway must be clearly stated in the 'Deeds to the Property'. Planting or rockeries by individual householders will not be permitted; although they will be required to cut grass or maintain the planting as an extension of their garden.

8.5.8 Where landscaping is provided within an adoptable service verge it will be required to be of a high quality; either grass or dense low shrub planting may be appropriate. Guidance on landscape design is given in Section 14. Details of planting must be approved by the Highway Authority. A list of approved species for planting within the highway is contained in Annex B: Approved planting

8.5.9 It is not appropriate to provide formal footways adjacent to the shared surface road and therefore any road where footway links are required will need to be designed as Minor Access Road.

Standards

Number of dwellings	up to 25
Design Speeds	below 20mph
Carriageway Width	4.5 to 6.5m
Footways	not required
Service Verges (adoptable)	2 No. at 2.0 metre wide
Minimum centre line radius	10m (See note 1)
Maximum Gradient	10%

Note 1: Overrun areas may be required on bends

8.6 Access Courts

8.6.1 Access Courts are suitable for serving up to 25 dwellings as a cul-de-sac. Designs must restrict vehicle speeds to well below 20mph.

Mews Courts and Housing Squares

8.6.2 Mews Courts have a shared surface for use by pedestrians and vehicles and where buildings and hard landscaping dominate. Careful consideration needs to be given to how and where parking is provided and surface materials chosen to delineate the functions of different parts of the highway.

8.6.3 Housing Squares are suitable for high-density developments in an urban area, conservation area or village infill site providing it is in character. These layouts are characterised by dwellings around a central space, which allows clear access for parking and turning. Parking must not be allowed to dominate the central space. It is of considerable importance to include special features and soft landscaping to make the area distinctive and an attractive place to live

8.6.4 The transition from access road to Access Court must be made abundantly clear to drivers, usually by the introduction of a shallow level change at the entrance to the shared surface and by the use of distinctive surfacing. The detail of an entrance to a shared surface is shown in Appendix 5.

8.6.5 The shared surface should comprise a core area of minimum width 4.5 metres and a 2.0 metre service strip contiguous to the core area but delineated from it by a drainage channel. Casual parking and in some layout forms, communal residents' parking must be kept clear of the core area, and must not dominate the space.

8.6.6 In all cases a 0.5m clearance strip must be provided between the highway edge and the wall of any dwelling (to accommodate foundations and householder services if these areas are surfaced to the satisfaction of the Highway Authority they may be adopted as public highway). Boundary walls are acceptable immediately adjoining the highway.

8.6.7 It is not appropriate to provide formal footways adjacent to the shared surface of an Access Court and therefore any road where footway links are required will need to be designed as Minor Access Road.

8.6.8 The access court may take many forms. Indicative layouts are illustrated in Figures 2 and 3.

Standards

No. of dwellings	up to 25
Design Speed	15mph
Carriageway Width	6.5m (4.5m + 2.0m)
Footways	not required
Service strip	included as carriageway

Minimum centreline radius	10m (See note 1)
Maximum gradient	10%

Note 1: Overrun areas may be required on bends

8.7 Minor Accessways

8.7.1 Minor Accessways were developed in response to concerns by residents of shared private drives, where problems caused by indiscriminate parking were a particular source of complaint. They may serve up to a maximum of 5 properties, and will be adopted as public highways.

8.7.2 Minor Accessways can be used where, because of the shape of a site, parts could not be developed or could only be developed with shared private drives. They are not intended for widespread use in layout design, nor to be used as an expedient to increase the numbers of houses accommodated on a site. In general Minor Accessways will be preferred to Shared Private Drives.

8.7.3 Minor Accessways are similar in layout to Shared Surface Roads. They may connect to a Residential Access Road or a Shared Surface Road. They should have the following characteristics:

- serve up to five dwellings
- be no more than 25m long
- have a width of 4.5m
- have sufficient on-plot parking for residents and visitors
- provide at least one parking space for deliveries/casual callers, that space to be convenient for all dwellings served and clear of the driveway or turning area.
- provide a turning head for cars (see Appendix 6)
- provide approved lighting
- provide an adoptable surface water outfall

An illustrative layout is shown in Appendix 7.

8.8 Private Drives

Shared

8.8.1 Shared Private Drives are unadopted and may serve as a primary access up to a maximum of 5 dwellings. However, in view of the on-going maintenance liabilities for householders, the Council encourages developers to minimise the use of private drives for communal use and seek to extend adoptable areas wherever practical.

8.8.2 Where private drives are shared the communal area should be easily distinguished from areas associated with individual plots. Areas for individual plots should be of sufficient size to accommodate the required parking standards (an additional parking space shall be provided for each dwelling above the normal provision) to prevent blocking of communal areas. Responsibility for the future maintenance of communal areas should be established.

8.8.3 Private drives are similar in layout to minor accessways. They may connect to Minor Access Roads and Share Surface Roads. They should have the following characteristics:

- Serve up to 5 properties;
- Be no more than 25 metres long;
- carriageway width of 4.5 metres at the junction for the first 10 metres of private shared drive;
- minimum carriageway width of 3.2 metres;
- A margin of at least 0.5 metres must be provided between the edge of the drive and any boundary wall;
- Where any building (ground floor plan) is more than 45 metres from the an adopted highway, the carriageway shall be 3.7 metres wide (suitable for emergency vehicles);
- adequate sight lines ;
- a turning head will not normally be required ,but vehicles should be able to enter and leave in a forward gear;
- no shared driveway shall be located within 20 metres of a junction;
- provide approved lighting for adoption;

- Provision shall be made for the collection and disposal of surface water so as to prevent it discharging onto the public highway;
- Where properties are more than 23 metres away from a public highway, an area must be set aside within that distance for the storage of refuse bins off the main drive, on collection days;
- Discussions must take place with Public Utilities to ensure each property can be adequately served and provision is made for future access and maintenance of their services.

8.8.4 In view of the many problems caused by the nature of shared private drives the Council urges developers to reconsider their use and seek instead to provide Minor Accessways.

Single drives

8.8.5 The minimum width of a single private drive shall be 3.2 metres, which may be reduced to 2.4 metres where a separate pedestrian path is provided. The width must also be sufficient to enable vehicles to manoeuvre satisfactorily into and out of parking spaces/garages. The minimum length of the drive shall be 6.0 metres.

8.8.6 To enable a vehicle to leave or enter the highway in a forward gear, turning spaces will need to be considered when the access driveway:-

- Serves more than one property
- Is directly from a classified road
- Is more than 25m in length
- Exits onto a highway at a hazardous location

8.8.7 For turning spaces to be effective they must include adequate additional space for parking so that the turning area is free from parked cars.

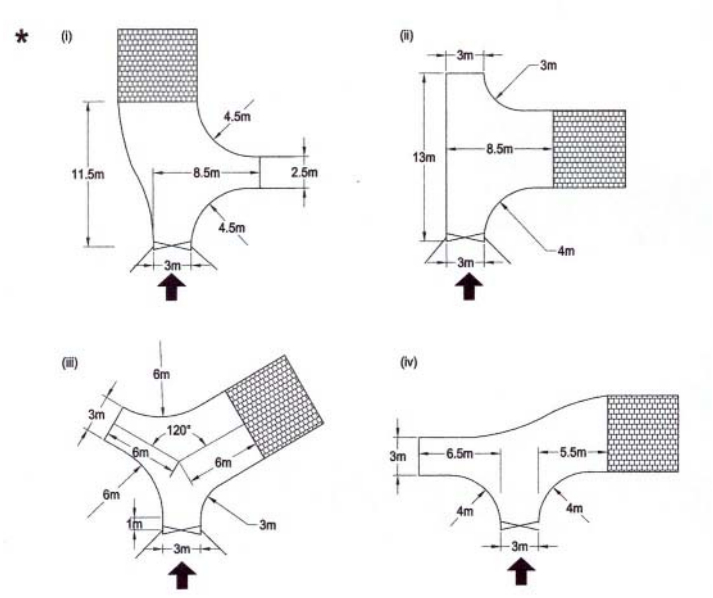


Figure 4 Turning areas

8.8.8 The entrance to a private drive should be in the form of a dropped kerb crossing and any part of the above which will lay within the public highway shall be constructed to an adoptable standard. A 2.0 wide transition strip, between the edge of the highway and the drive, must be provided in hard paving, if the drive is not to be fully paved.

Road Type	Minimum Carriageway width*	Minimum Centreline radius	Minimum footway width	Minimum verge width	Design Speeds for visibility etc	Max Gradient	Junction Alignment	Minimum Spacing junction (m)	
	(m)	(m)	(m)	(m)	(mph)	(%)	(6)	Same side	Opp side
Local Distributor	6.5[1]	60	2 x 2.0	2 x 2.0[2]	30	6	90°	60	35
Transition Road	6.0	60	2 x 2.0		30	6	90°	60	35
Residential Access Roads:									
Major	5.5	20[3]	2 x 2.0	N/A	20/30	7	90°	30	15
Minor	5.5	20	2 x 2.0	N/A	20	7	90°±10°	N/A	N/A
Shared surface roads									
Informal shared surfaces	4.5 - 6.5	10	N/A	2 x 2.0	<20	10	90°±10°	N/A	N/A
Access courts	6.5[4]	10	N/A		<20	10	90°±10°	N/A	N/A
Minor Accessway	4.5[5]	10	N/A	1 x 2.0	<20	10	90°±10°	N/A	N/A

Widening on bends required in accordance with section 8.11.

1 Greater widths up to 7.3 may be required in particular circumstances i.e. where traffic flows will be high (large development or where through traffic is likely) or where a higher proportion of heavy vehicles is expected (mixed developments).

2 A variable width is recommended for visual interest and to provide opportunities for landscaping. Verges shall be at least 3.0m wide where no footway is provided.

3 Other than at speed control bends.

4 Included in this width is a 2.0m service strip.

5 Variable width required with wider sections to incorporate casual parking

6 Junction alignment is the angle the minor road joins the major road.

8.9 Junctions

8.9.1 A high proportion of accidents occurs at junctions so it is essential that they are designed to minimise the hazards to road safety. They need to be designed to ensure that they are adequate for the vehicles likely to use them, and provide good visibility, but must not encourage high speed. In residential areas, or low trafficked routes their design can make a positive contribution to managing the speed of vehicles.

8.9.2 Junctions must be pedestrian friendly with crossing points conveniently located to encourage proper use, and situated where visibility in all directions is optimised; excessive walking distance must be avoided. Tactile paving must be provide to assist the visually handicapped

8.9.3 Off street parking facilities near junctions are essential in order to discourage on-street parking. No private access drives must enter the kerb radii or be within 15 metres of the intersection of the junction centre lines.

Geometrical Shape

8.9.4 Within new residential areas, roads should meet each other at right angles to form a single T-junction, and dependant upon the category of the major and minor roads will determine their design. Junctions with Local Distributors will be required to be built to national standards, to cater for the speed, size and nature of the traffic using then, whereas in residential estates a more restrictive approach will be taken to contain traffic but avoiding overrun.

Side Road Type	Local Distributor	Transition Road	Major Access Road	Minor Access Road	Share surface Road	Access court
Local Distributor	10.0					
Transition Road	10.0	10.0	10.0			
Major Access Road	10.0		6.0	6.0		
Minor Access Road	10.0		6.0	6.0	4.0	4.0
Share surface Road	10.0		6.0	6.0	4.0	4.0
Access court	10.0			6.0	4.0	4.0

NB Radii given in metres

Table : Minimum kerb radii at junctions

Visibility at junctions

8.9.5 The provision of adequate visibility at junctions is vital for road safety, and the dimensions of visibility splays are directly related to the anticipated traffic speeds on the major road, and the expected traffic flows on the minor road.

8.9.6 The visibility splay is made up of two components; the 'X' distance measured along the centre line of the minor road from the edge of the major road carriageway and the 'Y' distance measured along the edge of the major road carriageway from the centre line of the minor road, thus;

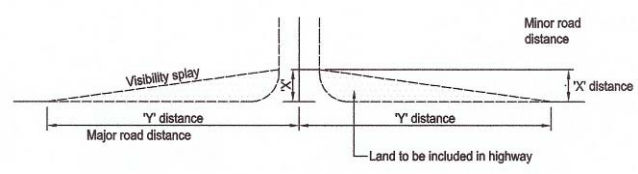


Figure 5 Visibility splays at junctions

8.9.7 On all junctions with Local Distributor Roads and Transition Roads shrubs or obstructions must not exceed 1.05 metres high (measured above the centre line of the carriageway within the visibility splay, although exceptions will be made for trees (providing they have a clear stem of 3 metres) and street lighting columns. On residential access roads a height of 600m will be required to ensure the observance of, and by children.

		Main Road Type 'Y' Distance				
Minor Road Type	**'X'Distance**	**Local distributor**	**Transition Road**	**Major Access Road**	**Minor Access Road**	**Shared Surface Courts and Accessways**
Transition Road	8.0	90	-	-	-	-
Major Access Road	4.5	90	-	70	-	-
Minor Access Road	4.5	90	-	60	45	-
Shared Surface Courts and Accessways	2.4	90	-	45	45	33

Table: Visibility splays at junctions

NB. In urban areas and conservation areas the Authority reserves the right to relax these standards providing the safety of all road users is not compromised.

Visibility zones.

8.9.8 Visibility for drivers turning left into a minor road can be problem and potentially hazardous for pedestrians and children playing, therefore visibility zones around the left hand entry radii may be required, thus:

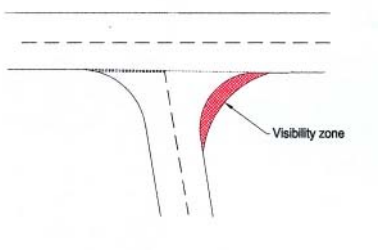


Figure 6 Visibility zones

8.9.9 The following table gives a guide to providing a visibility radius, tangential to the kerb, for different junction angles and kerb radii.

Junction deflection (degrees)	**Kerb radius (metres)**		
	4m	**6m**	**10m**
80	10	11	19
90	9	10	19
100	8	9	19

Note: Again the Authority reserves the right in Urban Areas and Conservation Areas to relax these recommendations where other features are built into the road environment and road safety is not compromised.

8.9.10 At all junctions the gradient of the minor road shall not exceed 5% for a distance of at least 10 metres back from the edge of the major road. If a junction is located where the minor road is steep special attention must be paid to the footway to ensure that its gradient does not exceed 10%.

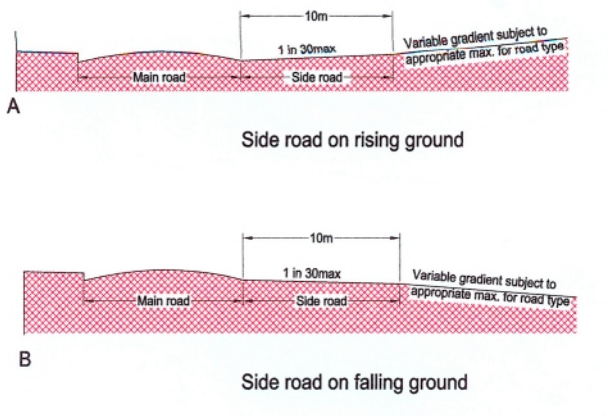


Figure 7 Side roads at a gradient

8.10 Forward Visibility

8.10.1 Bends and curves form a natural part of road design and are important both visually and for maximising the development potential of a site. But it is important that the driver has good forward visibility of any possible hazard when negotiating a bend. The forward visibility is based on the stopping distance for the average vehicle travelling under normal conditions. An allowance should however be made for icy and wet weather conditions and therefore it is recommended that the distances set out in the table should be increased by 20%.

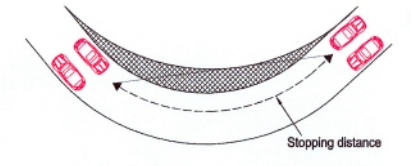


Figure 8 Stopping distances

8.10.2 A maximum clear height of 1.05m must be maintained over the forward visibility curve, but trees and lamp columns are excluded as above. The method of determining the forward visibility curve is set out in Appendix 8.

8.11 Widening on bends

8.11.1 Widening on bends is provided for safety reasons to accommodate large vehicles whose swept path is more than the width of the carriageway and is particularly important on Local Distributors and Major Access Roads. However, on internal residential roads an assessment of the likelihood of two large vehicles actually meeting on a bend needs to be considered. Where vehicle speeds are controlled and large vehicles are only infrequent i.e. refuse vehicles etc. then the need for localised widening is reduced. In such circumstances the larger vehicle can utilise the whole carriageway width available, and wait for any oncoming

vehicle to clear the way ahead, however it is important that there is good forward visibility and lamp columns etc, are clear of the swept path to avoid damage by the overhang of vehicles

8.11.2 On roads under 4.5 metres wide within the residential areas, consideration will have to be given to the swept path of large vehicles to avoid environmental damage, and the danger to young children and cyclists. Localised widening via an overrun strip will have to be provided in such circumstances, and the choice of materials is very important. Granite setts, set in mortar look attractive, but don't stand up well to heavy traffic, and easily come loose and a danger to other road users. They also provide a ready source of material for vandals.

8.11.3 As a general guide, carriageway widening is normally needed on bends curving through more than 10 degrees along roads serving over 25 dwellings.

Centre Line radius (m)	20	30	40	50	60
Min Widening (m)	0.60	0.40	0.35	0.25	0.20

Vertical design

8.11.4 Wherever possible roads should follow the topography of the site to avoid an unnatural appearance, however there are limits to the design to ensure the safety of all road users.

8.11.5 The maximum design gradient shall be 6% for local distributors increasing to 8% for Shared Surface Roads and Access Courts etc. However care should be taken when using steep gradients because of the problems they cause for pedestrians particularly the elderly in inclement weather. Where dipped crossings are used on steep gradients they can be particularly hazardous, as the 'dips' on either side of the vehicle crossing can significantly increase the gradient for pedestrians (max gradient must be 8.0%).

8.11.6 The minimum gradients for all roads, footways, footpaths and cycle ways shall be 1% to ensure adequate drainage. This may be reduced to 0.66% with the use of forced (tilted) channels in very flat areas.

8.11.7 Where gradients meet it is necessary to introduce a vertical curve; the design will depend on the actual gradients, visibility and comfort requirements and these are related to the design speed and category of the road. The visibility over the crest of the curve should be 600mm to ensure a clear view of children.

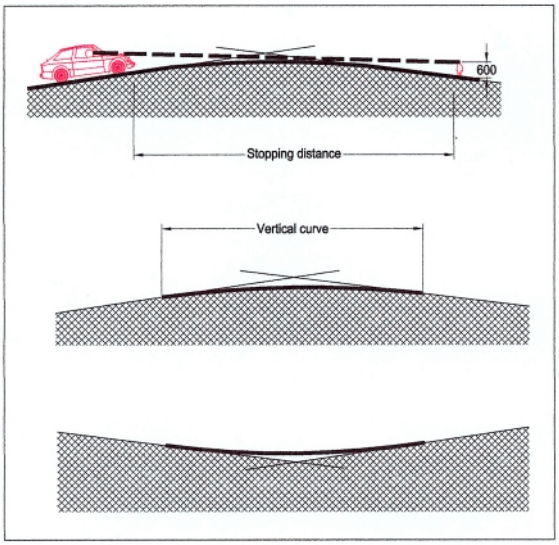


Figure 9

The length of a curve is calculated using the formula L=KA

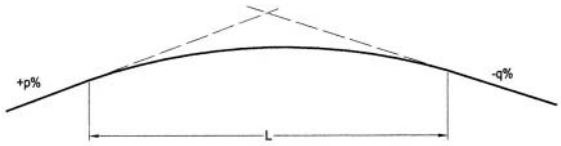


Figure 10 Length of curve

Where L is the length of the curve in metres, A is the algebraic difference in gradients [p-(-q)] and K is taken from the following table :-

Road Type K value

	Design Speeds mph	**Min K Value**	**Minimum Curve metres**
Local Distributor	30	6.5	30
Access roads	20	2.5	25
Slowed surfaces	<20	1.0	20

Different vertical curve types are indicated in Appendix 9.

8.11.8 On higher category roads it is important that the horizontal and vertical alignment are co-ordinated, both for aesthetic reasons and to improve drivers perceptions of the road alignment.

8.12 Turning Heads

8.12.1 A cul-de-sac will normally require a turning head of sufficient dimensions to enable a service vehicle to turn and leave the road in forward gear. The layouts indicated in Appendix 10 are interchangeable and may be varied to suit differing circumstances. In certain instances the Highway Authority may be prepared to relax the requirements for a turning head on an individual basis where:-

- the length of the cul-de-sac does not exceed 25 metres,
- the status of the road from which the cul-de-sac is accessed is no greater than a Minor Access Road;
- a 6 metre entry radius is available;
- the side road has good visibility ('X' dimension is 4.5 metres);and
- it is not required by refuse vehicles for a local pick up.

8.12.2 The visual layout of the turning heads must provide at least the minimum space to accommodate the lengths, widths and radii illustrated. Whilst for some shorter development roads these minimum dimensions may seem large, but standard refuse/delivery/service vehicles will still need to turn in order to minimise long reversing manoeuvres which are undesirable in terms of highway safety and convenience.

8.12.3 The turning heads illustrated in the Appendices are of a formal nature but they may be informal to suit site conditions. In these circumstances the developer must be able to demonstrate that the shape proposed encapsulates the standard dimensions shown and offers an adequate turning area by the use of vehicle swept path track plots. Where there are no footways or service strips around the perimeters of turning heads, any boundary, fence or hedge shall be set back at least 1.0 metre from the carriageway to avoid damage resulting from the overhang of manoeuvring vehicles. These distances should be increased to 2.0 metres at the ends. The space between the kerb and boundary must be paved and maintained either as public highway or by the adjacent occupier.

8.12.4 A major problem in turning heads is parked vehicles. Designs which include dwellings clustered around turning heads may therefore have to include additional off street parking for visitors, and/or the number of dwellings limited to reduce the likelihood of on street parking occurring.

8.13 Highway Structures

8.13.1 It is not uncommon in urban and rural areas for a development to include some form of highway structure, whether it is to support the highway or the ground which lies above it. If a watercourse runs through a site, a bridge or culvert may be required to carry highway loading. Elsewhere there may be proposals to construct buildings over the highway to provide a sense of enclosure or maintain an unbroken frontage yet allowing access to the rear.

8.13.2 Where a development includes one or more structures with potential highway implications, the developer is advised to consult with the Highway Authority as early as possible, regardless of the type of structure. The structure must be designed to the current standards and the developer must satisfy the Authority of

the structural integrity, and supported by plans, sections, specifications and calculations.

8.13.3 The developers attention is drawn to the publication *'Technical Approval Procedures for Developers Structures'* produced by the Directorate of Environment and Development Services, for advice and guidance on the procedures necessary for approval.

8.14 Vertical Clearance

8.14.1 Any structure of whatever type over a publicly adopted highway must have a minimum vertical clearance of 5.3 metres.

8.14.2 An archway of sufficient height for all vehicles will normally be out of scale with its surroundings, and visually unacceptable. Low archways with 2.4 metres minimum clear headroom will be acceptable as the principal car access to a housing development serving no more than 10 dwellings, provided that alternative access is available for emergency services and maintenance vehicles, and acceptable refuse carrying distances can be achieved. A carriageway width of 2.7 metres is required with 0.5 metres hardened verges either side. Archways of these dimensions will be acceptable as the sole access to a parking or garage court but not over adoptable public highways.

8.14.3 However, where the above requirements cannot be met other accesses, which would not become maintained as a public highway, require a minimum clearance relevant to their intended use:

Pedestrian/motor cars	2.4m
Small Service Vehicles	5m
Cycleways	2.7m
Touring Caravans	2.8m
Motor Caravans	3.3m
Fire appliances and large service vehicles.	4.1m

8.15 Works in the public highway

8.15.1 No developer shall undertake any works whatsoever in the public highway without the written consent of the Highway Authority. The Authority will need to be satisfied that work can be carried out in a safe and expeditious manner without danger to the public, and carried out with as little disruption and inconvenience as possible.

8.15.2 The developer must ascertain the positions and depth of Public Utilities equipment, sewers, drains, and cable TV networks and agree with their many procedures and protection necessary before any excavation is carried out in the public highway.

8.15.3 All works must have regard for the requirements of the Highways Act and must be signed and supervised in accordance with Chapter 8 of the Traffic Signs Regulations and General Directives in the Code of Practice – *'Safety at Street Works and Road Works'* February 2002.