APPENDIX JPH-F

Manual for Streets 1 and 2 Extracts

Communities and Local Government

Department for Transport

Manual for Streets

Status and application

Manual for Streets (MfS) supersedes *Design Bulletin 32* and its companion guide *Places, Streets and Movement*, which are now withdrawn in England and Wales. It complements *Planning Policy Statement 3: Housing* and *Planning Policy Wales*. MfS comprises technical guidance and does not set out any new policy or legal requirements.

MfS focuses on lightly-trafficked residential streets, but many of its key principles may be applicable to other types of street, for example high streets and lightly-trafficked lanes in rural areas. It is the responsibility of users of MfS to ensure that its application to the design of streets not specifically covered is appropriate.

MfS does not apply to the trunk road network. The design requirements for trunk roads are set out in the *Design Manual for Roads and Bridges* (DMRB).

MfS only applies formally in England and Wales.

The policy, legal and technical frameworks are generally the same in England and Wales, but where differences exist these are made clear.

7.4.6 A street with a 20 mph limit is not the same as a 20 mph zone. To create a 20 mph zone, it is a legal requirement that traffic-calming measures are installed to ensure that low speeds are maintained throughout. In such cases, the limit is signed only on entering the zone, and no repeater signs are necessary.

7.4.7 Any speed limits below 30 mph, other than 20 mph limits or 20 mph zones, require individual consent from the Secretary of State for Transport. Designers should note that such approval is unlikely to be given.

7.4.8 A speed limit is not an indication of the appropriate speed to drive at. It is the responsibility of drivers to travel within the speed limit at a speed suited to the conditions. However, for new streets, or where existing streets are being modified, and the design speed is below the speed limit, it will be necessary to include measures that reduce traffic speeds accordingly.

7.4.9 Difficulties may be encountered where a new development connects to an existing road. If the junction geometry cannot be made to conform to the requirements for prevailing traffic speeds, the installation of traffic-calming measures on the approach will allow the use of a lower design speed to be used for the new junction.

7.5 Stopping sight distance

7.5.1 This section provides guidance on stopping sight distances (SSDs) for streets where 85th percentile speeds are up to 60 km/h. At speeds above this, the recommended SSDs in the *Design Manual for Roads and Bridges*[16] may be more appropriate.

7.5.2 The stopping sight distance (SSD) is the distance within which drivers need to be able to see ahead and stop from a given speed. It is calculated from the speed of the vehicle, the time required for a driver to identify a hazard and then begin to brake (the perception–reaction time), and the vehicle's rate of deceleration. For new streets, the design speed is set by the designer. For existing streets, the 85th percentile wet-weather speed is used.

7.5.3 The basic formula for calculating SSD (in metres) is:

$$SSD = vt + v^2/2d$$

where:

v = speed (m/s)

t = driver perception–reaction time (seconds)

d = deceleration (m/s^2)

7.5.4 The desirable minimum SSDs used in the *Design Manual for Roads and Bridges* are based on a driver perception–reaction time of 2 seconds and a deceleration rate of 2.45 m/s^2 (equivalent to 0.25*g* where *g* is acceleration due to gravity (9.81 m/s^2)). *Design Bulletin 32*[17] adopted these values.

7.5.5 Drivers are normally able to stop much more quickly than this in response to an emergency. The stopping distances given in the Highway Code assume a driver reaction time of 0.67 seconds, and a deceleration rate of 6.57 m/s^2.

7.5.6 While it is not appropriate to design street geometry based on braking in an emergency, there is scope for using lower SSDs than those used in *Design Bulletin 32*. This is based upon the following:

- a review of practice in other countries has shown that *Design Bulletin 32* values are much more conservative than those used elsewhere;[18]
- research which shows that the 90th percentile reaction time for drivers confronted with a side-road hazard in a driving simulator is 0.9 seconds (see TRL Report 332[19]);
- carriageway surfaces are normally able to develop a skidding resistance of at least 0.45g in wet weather conditions. Deceleration rates of 0.25*g* (the previously assumed value) are more typically associated with snow-covered roads; and
- of the sites studied in the preparation of this manual, no relationship was found between SSDs and casualties, regardless of whether the sites complied with *Design Bulletin 32* or not.

16 Highways Agency (1992) *Design Manual for Roads and Bridges* London: TSO.
17 Department of the Environment/Department of Transport (1977; 2nd edn 1992) *Design Bulletin 32, Residential Roads and Footpaths - Layout Considerations*. London: HMSO.
18 D.W. Harwood, D.B. Fambro, B. Fishburn, H. Joubert, R. Lamm and B. Psarianos. (1995) *International Sight Distance Design Practices, International Symposium on Highway Geometric Design Practices, Boston, Massachusetts Conference Proceedings*. Washington USA: Transportation Research Board.
19 Maycock G, Brocklebank P. and Hall, R. (1998) *Road Layout Design Standards and Driver Behaviour*. TRL Report No. 332. Crowthorne: TRL

Table 7.1 Derived SSDs for streets (figures rounded).

Speed												
Speed	Kilometres per hour	16	20	24	25	30	32	40	45	48	50	60
	Miles per hour	10	12	15	16	19	20	25	28	30	31	37
SSD (metres)		9	12	15	16	20	22	31	36	40	43	56
SSD adjusted for bonnet length. See 7.6.4		11	14	17	18	23	25	33	39	43	45	59
		Additional features will be needed to achieve low speeds										

7.5.7 The SSD values used in MfS are based on a perception–reaction time of 1.5 seconds and a deceleration rate of 0.45*g* (4.41 m/s²). Table 7.1 uses these values to show the effect of speed on SSD.

7.5.8 Below around 20 m, shorter SSDs themselves will not achieve low vehicle speeds: speed-reducing features will be needed. For higher speed roads, i.e. with an 85th percentile speed over 60 km/h, it may be appropriate to use longer SSDs, as set out in the *Design Manual for Roads and Bridges*.

7.5.9 Gradients affect stopping distances. The deceleration rate of 0.45g used to calculate the figures in Table 7.1 is for a level road. A 10% gradient will increase (or decrease) the rate by around 0.1g.

7.6 Visibility requirements

7.6.1 Visibility should be checked at junctions and along the street. Visibility is measured horizontally and vertically.

7.6.2 Using plan views of proposed layouts, checks for visibility in the horizontal plane ensure that views are not obscured by vertical obstructions.

7.6.3 Checking visibility in the vertical plane is then carried out to ensure that views in the horizontal plane are not compromised by obstructions such as the crest of a hill, or a bridge at a dip in the road ahead. It also takes into account the variation in driver eye height and the height range of obstructions. Eye height is assumed to range from 1.05 m (for car drivers) to 2 m (for lorry drivers). Drivers need to be able to see obstructions 2 m high down to a point 600 mm above the carriageway. The latter dimension is used to ensure small children can be seen (Fig. 7.17).

7.6.4 The SSD figure relates to the position of the driver. However, the distance between the driver and the front of the vehicle is typically up to 2.4 m, which is a significant proportion of shorter stopping distances. It is therefore recommended that an allowance is made by adding 2.4 m to the SSD.

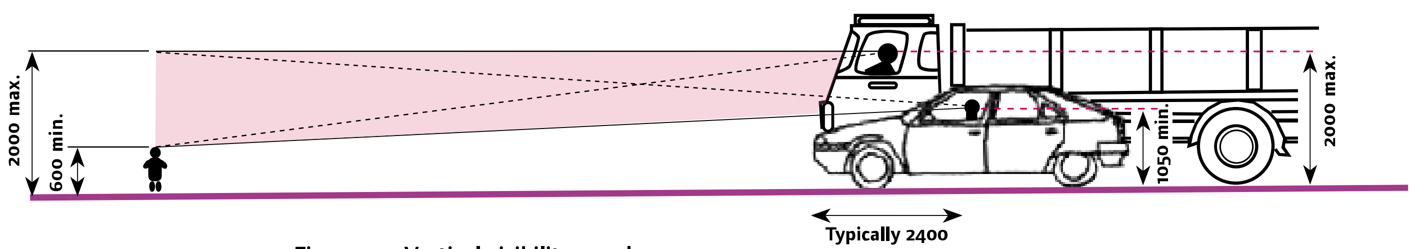


Figure 7.17 Vertical visibility envelope.

7.7 Visibility splays at junctions

7.7.1 The visibility splay at a junction ensures there is adequate inter-visibility between vehicles on the major and minor arms (Fig. 7.18).

7.7.2 The distance back along the minor arm from which visibility is measured is known as the X distance. It is generally measured back from the 'give way' line (or an imaginary 'give way' line if no such markings are provided). This distance is normally measured along the centreline of the minor arm for simplicity, but in some circumstances (for example where there is a wide splitter island on the minor arm) it will be more appropriate to measure it from the actual position of the driver.

7.7.3 The Y distance represents the distance that a driver who is about to exit from the minor arm can see to his left and right along the main alignment. For simplicity it is measured along the nearside kerb line of the main arm, although vehicles will normally be travelling a distance from the kerb line. The measurement is taken from the point where this line intersects the centreline of the minor arm (unless, as above, there is a splitter island in the minor arm).

7.7.4 When the main alignment is curved and the minor arm joins on the outside of a bend, another check is necessary to make sure that an approaching vehicle on the main arm is visible over the whole of the Y distance. This is done by drawing an additional sight line which meets the kerb line at a tangent.

7.7.5 Some circumstances make it unlikely that vehicles approaching from the left on the main arm will cross the centreline of the main arm – opposing flows may be physically segregated at that point, for example. If so, the visibility splay to the left can be measured to the centreline of the main arm.

X distance

7.7.6 An X distance of 2.4 m should normally be used in most built-up situations, as this represents a reasonable maximum distance between the front of the car and the driver's eye.

7.7.7 A minimum figure of 2 m may be considered in some very lightly-trafficked and slow-speed situations, but using this value will mean that the front of some vehicles will protrude slightly into the running carriageway of the major arm. The ability of drivers and cyclists to see this overhang from a reasonable distance, and to manoeuvre around it without undue difficulty, should be considered.

7.7.8 Using an X distance in excess of 2.4 m is not generally required in built-up areas.

7.7.9 Longer X distances enable drivers to look for gaps as they approach the junction. This increases junction capacity for the minor arm, and so may be justified in some circumstances, but it also increases the possibility that drivers on the minor approach will fail to take account of other road users, particularly pedestrians and cyclists. Longer X distances may also result in more shunt accidents on the minor arm. TRL Report No. 184[20] found that accident risk increased with greater minor-road sight distance.

Y distance

7.7.10 The Y distance should be based on values for SSD (Table 7.1).

20 Summersgill I., Kennedy, J. and Baynes, D. (1996) *Accidents at Three-arm Priority Junctions on Urban Single-carriageway Roads* TRL Report no. 184. Crowthorne: TRL.

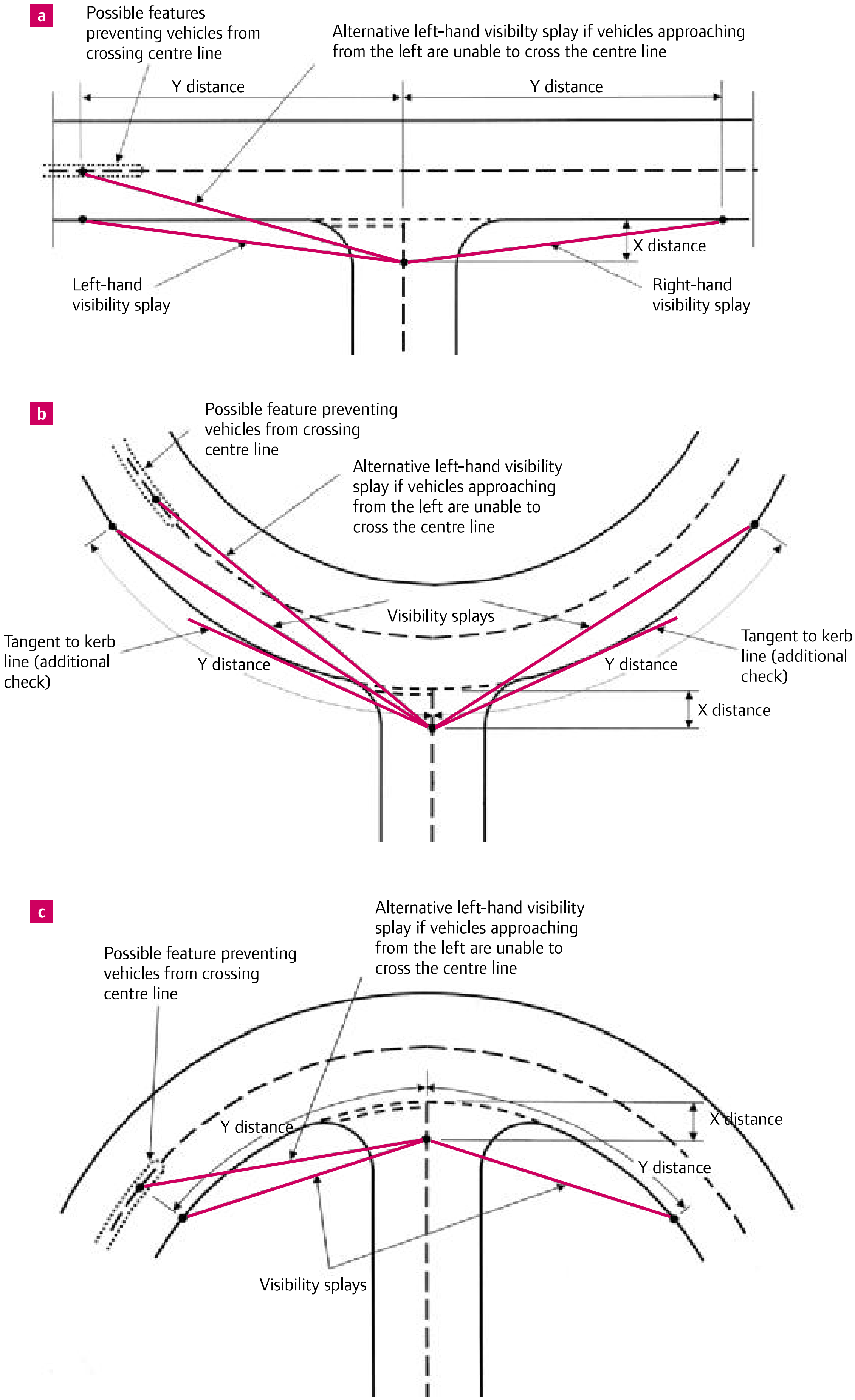


Figure 7.18 Measurement of junction visibility splays (a) on a straight road, (b) and (c) on bends.

7.8 Forward visibility

7.8.1 Forward visibility is the distance a driver needs to see ahead to stop safely for obstructions in the road. The minimum forward visibility required is equal to the minimum SSD. It is checked by measuring between points on a curve along the centreline of the inner traffic lane (see Fig. 7.19).

7.8.2 There will be situations where it is desirable to reduce forward visibility to control traffic speed – the Influence of geometry on speed box describes how forward visibility influences speed. An example is shown in Fig 7.20.

Visibility along the street edge

7.8.3 Vehicle exits at the back edge of the footway mean that emerging drivers will have to take account of people on the footway. The absence of wide visibility splays at private driveways will encourage drivers to emerge more cautiously. Consideration should be given to whether this will be appropriate, taking into account the following:

- the frequency of vehicle movements;
- the amount of pedestrian activity; and
- the width of the footway.

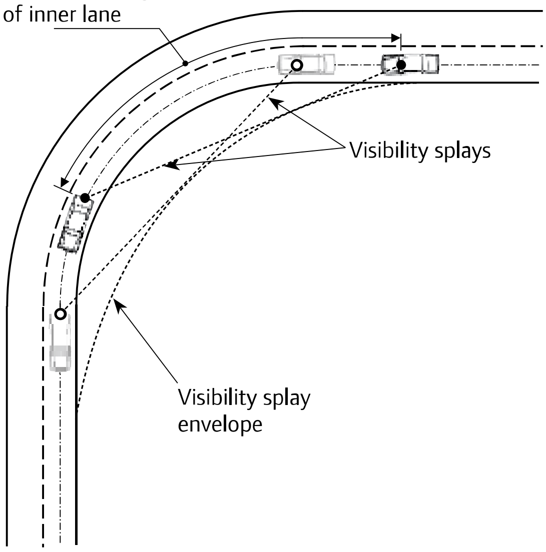


Figure 7.19 Measurement of forward visibility.

Andrew Cameron, WSP

Figure 7.20 Limiting forward visibility helps keep speeds down in Poundbury, Dorset.

7..8.4 When it is judged that footway visibility splays are to be provided , consideration should be given to the best means of achieving this in a manner sympathetic to the visual appearance of the street (Fig. 7.21). This may include:

- the use of boundary railings rather than walls (Fig. 7.22); and
- the omission of boundary walls or fences at the exit location.

Obstacles to visibility

7.8.5 Parking in visibility splays in built-up areas is quite common, yet it does not appear to create significant problems in practice. Ideally, defined parking bays should be provided outside the visibility splay. However, in some circumstances, where speeds are low, some encroachment may be acceptable.

7.8.6 The impact of other obstacles, such as street trees and street lighting columns, should be assessed in terms of their impact on the overall envelope of visibility. In general, occasional obstacles to visibility that are not large enough to fully obscure a whole vehicle or a pedestrian, including a child or wheelchair user, will not have a significant impact on road safety.

Tim Pharoah, Llewelyn Davies Yeang

Figure 7.21 Beaulieu Park, Chelmsford – low vegetation provides subtle provision of visibility at private driveway.

Tim Pharoah, Llewelyn Davies Yeang

Figure 7.22 Beaulieu Park, Chelmsford: the visibility splays are provided by railings rather than boundary walls, although the railings could have followed the property boundary.

7.9 Frontage access

7.9.1 One of the key differences between streets and roads is that streets normally provide direct access to buildings and public spaces. This helps to generate activity and a positive relationship between the street and its surroundings. Providing direct access to buildings is also efficient in land-use terms.

7.9.2 The provision of frontage vehicle access onto a street should be considered from the viewpoint of the people passing along the street, as well as those requiring access (Fig. 7.23). Factors to consider include:

- the speed and volume of traffic on the street;
- the possibility of the vehicles turning around within the property – where this is possible, then vehicles can exit travelling forward;
- the presence of gathered accesses – a single access point can serve a number of properties or a communal parking area, for example. This may be acceptable where a series of individual accesses would not be; and
- the distance between the property boundary and the carriageway – to provide adequate visibility for the emerging driver.

7.9.3 In the past, a relatively low limit on traffic flow (300 vehicles per peak hour or some 3,000 vehicles per day) has generally been used when deciding whether direct access was appropriate. This is equivalent to the traffic generated by around 400 houses. Above this level, many local-authority residential road guidelines required the provision of a 'local distributor road'.

Andrew Cameron, WSP

Figure 7.23 Frontage access for individual dwellings onto a main street into Dorchester.

7.9.4 Such roads are often very unsuccessful in terms of placemaking and providing for pedestrians and cyclists. In many cases, buildings turn their backs onto local distributors, creating dead frontages and sterile environments. Separate service roads are another possible design response, but these are wasteful of land and reduce visual enclosure and quality.

7.9.5 It is recommended that the limit for providing direct access on roads with a 30 mph speed restriction is raised to at least 10,000 vehicles per day (see box).

Traffic flow and road safety for streets with direct frontage access

The relationship between traffic flow and road safety for streets with direct frontage access was researched for MfS. Data on recorded accidents and traffic flow for a total of 20 sites were obtained. All of the sites were similar in terms of land use (continuous houses with driveways), speed limit (30 mph) and geometry (single-carriageway roads with limited side-road junctions). Traffic flows at the sites varied from some 600 vehicles per day to some 23,000 vehicles per day, with an average traffic flow of some 4,000 vehicles per day.

It was found that very few accidents occurred involving vehicles turning into and out of driveways, even on heavily-trafficked roads.

Links with direct frontage access can be designed for significantly higher traffic flows than have been used in the past, and there is good evidence to raise this figure to 10,000 vehicles per day. It could be increased further, and it is suggested that local authorities review their standards with reference to their own traffic flows and personal injury accident records. The research indicated that a link carrying this volume of traffic, with characteristics similar to those studied, would experience around one driveway-related accident every five years per kilometre. Fewer accidents would be expected on links where the speed of traffic is limited to 20 mph or less, which should be the aim in residential areas.

7.10 Turning areas

7.10.1 Connected street networks will generally eliminate the need for drivers to make three-point turns.

7.10.2 Where it is necessary to provide for three-point turns (e.g. in a cul-de-sac), a tracking assessment should be made to indicate the types of vehicles that may be making this manoeuvre and how they can be accommodated. The turning space provided should relate to its environment, not specifically to vehicle movement (see Fig. 7.24), as this can result in a space with no use other than for turning vehicles. To be effective and usable, the turning head must be kept clear of parked vehicles. Therefore it is essential that adequate parking is provided for residents in suitable locations.

7.10.3 Routeing for waste vehicles should be determined at the concept masterplan or scheme design stage (see paragraph 6.8.4). Wherever possible, routing should be configured so that the refuse collection can be made without the need for the vehicle having to reverse, as turning heads may be obstructed by parked vehicles and reversing refuse vehicles create a risk to other street users.

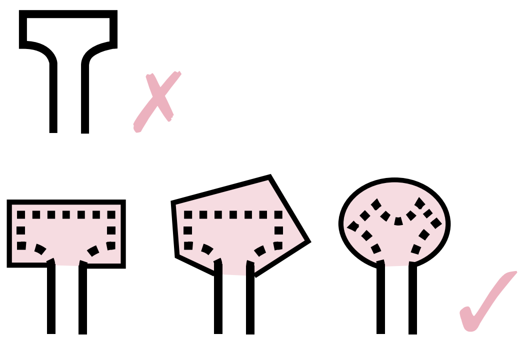


Figure 7.24 Different turning spaces and usable turning heads.

THE CHARTERED
INSTITUTION OF HIGHWAYS
& TRANSPORTATION

Manual for Streets 2

Wider Application of the Principles

www.ciht.org.uk

Presidential Foreword

By Geoff Allister
CIHT President 2010-2011

In 2007 the Department for Transport published the Manual for Streets, a landmark document that is changing the face of our residential streets. The Manual for Streets (MfS1) did not set out new policy, it reinforced a philosophy that had been growing since the late 1990s to return our residential streets to the community by engineering them to create a greater sense of place, provide an environment that is accessible and safe for all, and one that improves the quality of life.

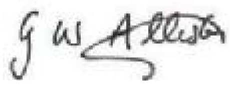
The Chartered Institution of Highways and Transportation's new guidelines builds on the advice contained in MfS1, exploring in greater detail how and where its key principles can be applied to busier streets and roads in both urban and rural locations up to, but not including, trunk roads. Manual for Streets 2 – Wider Application of the Principles will help to fill the perceived gap in design advice between MfS and the design standards for trunk roads set out in the Design Manual for Roads and Bridges.

Manual for Streets 2 is the result of a partnership between practitioners and policy makers from highway engineers and urban designers to transport planners. The quality of the advice it contains is a true testament to the knowledge and expertise of all those who have contributed to its preparation. I thank them all, particularly the members of the steering group and the editorial team for the considerable time and effort they have contributed to this project.

I would also like to thank the sponsors the Department for Transport, the Association of Directors of Environment, Economy, Planning and Transport, the Commission for Architecture and the Built Environment and the Homes and the Homes and Communities Agency who have made these guidelines possible.

On behalf of the Institution, I am pleased to commend Manual for Streets 2 – Wider Application of the Principles to all those who are involved in the planning, construction and improvement of our streets and roads. I am sure it will make a significant contribution to professional practice and, over time, to our communities and the places where people live, work and play.

Geoff Allister
President 2010-2011



Status and Application

Manual for Streets 2: Wider Application of the Principles (MfS2) forms a companion guide to Manual for Streets (MfS1). Whilst MfS1 focuses on lightly-trafficked residential streets it also states that, *'a street is defined as a highway that has important public realm functions beyond the movement of traffic…. Most highways in built up areas can therefore be considered as streets.'* MfS1 also stated that, *'many of its key principles may be applicable to other types of streets, for example high streets and lightly trafficked lanes in rural areas'*.

The following definitions apply throughout this document:

MfS1 refers to Manual for Streets (2007).

MfS2 refers to this document.

MfS refers to both documents.

MfS2 builds on the guidance contained in MfS1, exploring in greater detail how and where its key principles can be applied to busier streets and non-trunk roads, thus helping to fill the perceived gap in design guidance between MfS1 and the Design Manual for Roads and Bridges (DMRB).

DMRB is the design standard for Trunk Roads and Motorways in England, Scotland, Wales and Northern Ireland. The strict application of DMRB to non-trunk routes is rarely appropriate for highway design in built up areas, regardless of traffic volume.

MfS2 provides advice and does not set out any new policy or legal requirements.

movement unless there are overriding reasons for accepting higher speeds.

- **Using the minimum of highway design features** necessary to make the streets work properly. The starting point for any well designed street is to begin with nothing and then add only what is necessary in practice.

1.3_ Scope of MfS

1.3.1 The following key areas of advice, derived from principles contained in MfS, can be applied based on speed limits, subject to a more detailed assessment of local context, as shown below in **Table 1.1.**

1.3.2 It is clear from **Table 1.1** that most MfS advice can be applied to a highway regardless of speed limit. **It is therefore recommended that as a starting point for any scheme affecting non-trunk roads, designers should start with MfS.**

Speed Limit	20mph	30mph	40mph	50+mph
User Hierarchy	●	●	●	●
Team Working	●	●	●	●
Community Function	●	●	●	○
Inclusive Design	●	●	●	●
Ped/Cycle Support	●	●	●	●
Master Plans/Design Codes	●	●	●	●
Stopping Sight Distance	●	●	○	○
Frontage Access	●	●	●	○
Minimise Signs and Street Furniture	●	●	●	●
Quality Audits	●	●	●	●
Connectivity/Permeability	●	●	●	○

Table 1.1 Application of key areas of MfS advice

Note: ● yes ○ subject to local context

1.3.3 Where designers do refer to DMRB for detailed technical guidance on specific aspects, for example on strategic inter-urban non-trunk roads, it is recommended that they bear in mind the key principles of MfS, and apply DMRB in a way that respects local context. It is further recommended that DMRB or other standards and guidance is only used where the guidance contained in MfS is not sufficient or where particular evidence leads a designer to conclude that MfS is not applicable.

1.3.4 The application of MfS advice to all 30mph speed limits as a starting point is in keeping with MfS1.

1.3.5 Much of the research behind MfS1 for stopping sight distance (SSD) is limited to locations with traffic speeds of less than 40mph and there is some concern that driver behaviour may change above this level as the character of the highway changes. However, 40mph speed limits in built-up areas cover a wide range of contexts, from simple urban streets with on-street parking and direct frontage access to 2/3 lane dual carriageways. Furthermore, local context varies not only from street to street but also along the length of a street.
(See Figure 1.1.)

1.3.6 Where a single carriageway street with on-street parking and direct frontage access is subject to a 40mph speed limit, its place characteristics are more of a residential street or high street, with higher traffic flows, and may result in actual speeds below the limit. It is only where actual speeds are above 40mph for significant periods of the day that DMRB parameters for SSD are recommended. Where speeds are lower, MfS parameters are recommended. Where there may be some doubt as to which guidance to adopt, actual speed measurements should be undertaken to determine which is most appropriate. (See **Chapter 10** for SSD guidance.)

1.3.7 Similarly, in rural areas many parts of the highway network are subject to the national speed limit but have traffic speeds significantly below 60mph. (See **Figure 1.2**) Again in these situations where speeds are lower than 40mph, MfS SSD parameters are recommended.

1.3.8 Direct frontage access is common in all urban areas, including where 40mph speed limits apply, without evidence to suggest that this practice is unsafe. This is confirmed in TD41/95[3] (Annex 2 paragraph A2.10) which states that *'in the urban situation there is no direct relationship between access provision and collision occurrence'.* However, this is not true of rural roads (A2.5) where the research identified a *'statistically significant relationship for collisions on rural single carriageways with traffic flow, link length and farm accesses. On rural dual carriageways, the significant relationship extended to laybys, residential accesses and other types of access including petrol filling stations'* (See **Chapter 9** for further advice on direct frontage access.)

1.3.9 This approach demonstrates that the key MfS principles can be applied widely to improve the quality of highways and their application is not limited to low speed or lightly trafficked routes.

1.3.10 Any new design has to take account of local context, however adopting speed limits as a proxy to identify which elements of MfS apply provides a reasonable way forward. It is clear from **Table 1.1** that for a particular context, even though some aspects of MfS may not apply, there are still many principles which affect design quality that do.

Single Lane, Frontage Access, On-Street Parking

Wide Single Lane, Frontage Access, On-Street Parking

2/3 Lane Dual Carriageway. No frontage access. No stopping.

Figure 1.1 Typical Range of Urban 40mph Speed Limits

Figure 1.2 National speed limits apply in rural lanes but actual speeds can be much lower

1.4_ The Benefits of Better Sreets

1.4.1 It is important to take into account multiple objectives when developing transport strategies and schemes, and not simply congestion reduction. These other priorities include economic regeneration, climate change, casualty reduction, reducing air and noise pollution, minimising the impact of transport on the natural environment, heritage and landscaping, and encouraging more sustainable and healthy patterns of travel behaviour.

1.4.2 Making appropriate provision for road-based public transport, cycling and walking can help to encourage modal shift from the private car, and so contribute to the sustainability and health agendas. Enhancing street environments through a high quality public realm incorporating local materials and historic street features, removal of clutter and pedestrian barriers, use of shared space where appropriate and enhanced street lighting can help to stimulate local economic activity, reduce street crime and encourage a sense of local community; this in turn encourages more local, shorter distance travel on foot or by cycle. This will be particularly important in conservation areas, national parks, World Heritage sites and other environmentally sensitive areas.

1.4.3 Local Transport Note 3/08, 'Mixed Priority Routes: Practitioners' Guide'[1], refers to ten schemes which were among the least safe of urban roads which were transformed into safer, friendlier, more attractive and inclusive streets as discussed in the box out below.

2.8_ Context - Rural Areas

Common Street Type: Rural Roads and Lanes

2.8.1 Rural roads are an integral part of the landscape, often reflecting and preserving historic landscape features such as ancient routes or field boundaries and set within outstanding countryside. Elements such as hedges, verges, banks and fingerposts may contribute strongly to local character and historic significance.

Typical Characteristics

2.8.2 There is a considerable variation in the highway network running through rural areas from motorways to Green Lanes. The majority of other rural roads follow old pathways and boundaries and do not conform to present guidance on highway standards. Indeed to attempt to do so could be to the detriment of local character and lead to intrusion into some of our most outstanding landscapes.

In April 2008, Dorset County Council formally adopted a rural roads protocol setting out their new approach on how to manage the roads in Dorset's countryside. The protocol's main principle is to use the local setting and distinctiveness of the rural environment to guide their management decisions. All future work on rural roads and streets will:

- Balance the safety and access needs of users with care for the environment and the quality of our landscape and settlements
- Use local materials and design schemes to be sympathetic to the character of our rural settlements
- Consider the landscape adjacent to the road and address ecological and historical needs and interests
- Address sustainability and consider the potential impacts of climate change, ensuring that our management of rural roads and streets does not create or contribute to foreseeable environmental problems in the future
- Keep signs, lines and street furniture to the minimum needed for safety and remove intrusive roadside clutter
- Where signs and markings are needed, we will adapt standard designs wherever possible to make them the best possible fit with local surroundings
- Encourage and test innovative approaches and make full use of the flexibility in national regulations, standards and codes of practice

2.8.3 A number of local authorities have developed policies sensitive to local context. Dorset County Council's[18] approach to the design and management of rural highways is given in the Example below.

Movement and Place Function

2.8.4 Outside villages most rural roads connect small settlements and farms to local centres and the wider highway network. Their predominant function is movement, although there is often a leisure aspect to this; walking, cycling and equestrian. Some routes also attract car drivers on leisure routes such as in the National Parks.

2.8.5 Whilst these routes are largely subject to the national speed limit, their curvilinear nature can encourage speeds well below 60mph, the clear exception being the busier and more direct 'A' roads. However most of these routes are single carriageways where the speed of HGVs is limited to 40mph, and as a result they often act as a constraint on car speed.

2.8.6 On the more lightly trafficked rural lanes Devon County Council[19] offers the good practice advice in the Example overleaf.

There is a large network of minor roads in Devon. Most junctions are T-junctions or crossroads and on occasions, a road has a split junction, leaving a small grass area between the carriageways. Junction improvements are sometimes necessary on safety grounds or as a result of development in an area. Whilst legislation sometimes requires specific standards to be met, some regulations do allow flexibility. The design of any new scheme should use the existing topography, vegetation, buildings and other structures, so that they appear an integral part of the landscape and historic road pattern. Solutions should reinforce local identity by careful choice of detailing, materials and street furniture.

Roundabouts are normally associated with urban areas or major roads, where the volume of traffic means they are considered to be essential. Regulation requires lighting, mandatory signs and lines to a satisfactory standard at roundabouts and this can be inappropriate in rural areas. In view of this, other junction treatments are preferable.

Junction improvements will only be considered where there is a proven safety need and the introduction of a roundabout should only be considered as a last resort.

Wherever possible, the area of carriageway should be reduced and the road realigned rather than use large areas of hatching.

There should be a presumption of retaining trees, hedges and verges including any central grass areas.

If a traditional Devon hedge needs to be removed for the realignment of a road, the practicality of translocation/moving the hedgebank should be considered in the first instance. Where this is not feasible, the next option should be to carefully dismantle and reconstruct the hedge. Archaeological recording and supervision may be required.

Lighting will not be installed on roads outside settlement boundaries unless there is a proven and overriding safety reason which cannot be addressed by other means. Where considered necessary, the highway authority will consult with landscape managers during the design stage. The preferred option is to install high-reflective non-illuminated signs.

Signing will be kept to a minimum and will be located with a view to minimising the impact on the landscape and the rural character of the area, as well as with a view to safety and utility.

Detailing and choice of materials will respect the local environment and standard solutions or components will not always be appropriate. Kerbing of central grass areas should be avoided. Chevron blocks around the edge of the roundabout are not appropriate and should not be used.

2.9_ Context: Urban and Rural Settlements

Street Types: Shared Space

New Road, Brighton

Typical Characteristics

2.9.1 Shared Space is predominantly an approach to highway design and is introduced for a range of purposes including:

- improving the built environment;
- giving people freedom of movement rather than instruction and control;
- improving the ambience of places;
- enhancing social capital;
- enhancing the economic vitality of places; and
- safety.

2.9.2 Many local authorities' objectives can be addressed through pedestrianisation. However, for practical purposes and in some settings, Shared Space may be more desirable for a number of reasons.

2.9.3 A characteristic of many Shared Space schemes is the minimal use of traffic signs, road markings and other traffic management features. With less or no traffic management, or clear indication of priority, motorists are encouraged to recognise the space as being different from a typical road and to react by driving more slowly and responding directly to the behaviour of other users (including other motorists) rather than predominantly to the traffic management features. This approach takes place against a backdrop of concern at the proliferation of features such as pedestrian guardrailing, traffic signs and highway regulation which, it is argued, reduce users' understanding of the complexity of the street environment and their personal responsibility for safe and appropriate behaviour.

3_ Highway Design, Risk and Liability

3.1_ The Need For Additional Clarification

3.1.1 MfS1 sought to assuage fears of some highway authorities, when considering more innovative designs at variance with established practice, concerning liability in the event of damage or injury. Whilst this was accepted by some it is clear that there is a need for more guidance on risk and liability.

3.1.2 Since the publication of MfS1, the UK Roads Board has published a second edition of Highway Risk and Liability Claims (HRLC)[21]. All those with an interest in highway design are strongly recommended to read this comprehensive document.

3.1.3 The document is quoted below more extensively than was its predecessor in MfS1 to raise awareness of the issues and demonstrate how few cases arise due to alleged defects in design and to give greater confidence to designers to respect local context and move away from a standardised, rigid approach.

3.1.4 The HRLC document sets out the legal uses and obligations of users of the highway.

Uses of the Highway

3.1.5 When discussing the rights to use a highway, reference should be made to the following:

"the public highway is a public place which the public may enjoy for any reasonable purpose, provided the activity in question does not amount to a public or private nuisance and does not obstruct the highway by unreasonably impeding the primary right of the public to pass and repass" Lord Chancellor, DPP v Jones 1999

3.1.6 This shows that the public highway is not merely a piece of infrastructure for moving from place to place. It is a place in its own right that can be used for any purpose that does not cause nuisance or obstruction.

3.1.7 The Highway Code[22] provides a guide to the use of the highway and confirms that users must behave reasonably, taking into account other people and local conditions.

3.1.8 Key guidance from the Highway Code states that people must not drive dangerously, without due care and attention or without reasonable considerations for other road users. It goes on to say:

'Adapt your driving to the appropriate type and condition of road you are on. In particular

- *do not treat speed limits as a target. It is often not appropriate or safe to drive at the maximum speed limit*
- *take the road and traffic conditions into account. Be prepared for unexpected or difficult situations, for example, the road being blocked beyond a blind bend. Be prepared to adjust your speed as a precaution*
- *where there are junctions, be prepared for road users emerging*
- *in side roads and country lanes look out for unmarked junctions where nobody has priority*
- *be prepared to stop at traffic control systems, road works, pedestrian crossings or traffic lights as necessary*
- *try to anticipate what pedestrians and cyclists might do. If pedestrians, particularly children, are looking the other way, they may step out into the road without seeing you'* (Highway Code Rule 146)

3.1.9 It is clear that the Highway Code requires drivers to have regard for other road users particularly children, which is confirmed in the case of Russell v Smith:

"The Highway Code requires motorists to take particular care in looking out for children in built up areas and to travel at an appropriate speed. In the case of Russell v. Smith and Another 2003 EWHC, a motorist, Miss Smith collided with a young cyclist who had emerged into her path from a side road. Failure to observe a provision of the Highway Code is something which a court can take into account when assessing liability, and does not involve fault on the part of the driver. The court judged that Miss Smith had failed to observe the provisions of the Highway Code that requires drivers to have regard to the safety of children in a residential area, and was held partly liable."

3.1.10 There has been a long standing principle, as restated in the Gorringe v Calderdale ruling, that drivers are responsible for their own safety.

"The overriding imperative is that those who drive on the public highways do so in a manner and at a speed which is safe having regard to such matters as the nature of the road, the weather conditions and the traffic conditions. Drivers are first and foremost themselves responsible for their own safety".

"Many more accidents occur on the wider, and should be, safer roads than upon the so-called dangerous ones. I have in some cases, widened turns to render them safer, but more accidents have ensued owing to motorists taking the turns much faster."

H T Chapman, County Surveyor of Kent, September 1932

In 1954 in the paper 'Road Design in relation to Traffic Movement and Road Safety Proceedings of the Institution of Municipal Engineers', the author R J Smeed reported on research that had found a relationship between increased carriageway width and increases in the average speed of traffic, and conversely reductions in radius of curvature of highways and reductions in speed of traffic.

Risk Compensation

3.1.11 Risk compensation, whereby a driver is assumed to adjust behaviour in response to perceived changes in risk is reflected in MfS1 but there is evidence of this dating back to the 1930s: (See Example above).

3.1.12 The evidence based approach set out in MfS1 used the research findings of 'The Manual for Streets: Evidence and Research', TRL661[23], in concluding that a number of environmental factors influence driver behaviour to bring about this compensation.
(See **Chapter 8.**)

Design, Defects and Liability

3.1.13 Streetscape and highway design have been devolved to local authorities. However, some highway authorities do not take advantage of this and can shy away from developing local guidance for fear of litigation. However, HRLC refers to a survey it conducted to assess the scale of cases relating to defects in design.

"There have been very few cases relating to alleged defects in design. A request went out to members of the CSS [now ADEPT] in 2008 for cases that had gone against the authority on the basis of design. There was no significant history. There was a small number of live cases that were tending to focus on trip hazards resulting from design. There is of course nothing stopping an individual making a claim for a design defect, however the instances seem rare and the chances of success remote."

3.2_ Design Guidance and Professional Judgement

3.2.1 For some time there have been concerns expressed over designers slavishly adhering to guidance regardless of local context. Local Transport Note 1/08 specifically advises:

"Regulations and technical standards have a key role in the delivery of good design, but, if used as a starting point, they may serve to compromise the achievement of wider objectives. A standards-based template view of road junction design, for example, is inappropriate". LTN 1/08 3.2.1[24]

3.2.2 In reality, highway and planning authorities may exercise considerable discretion in developing and applying their own local policies and standards.

"Designers are expected to use their professional judgement when designing schemes, and should not be over-reliant on guidance". LTN 1/08 3.2.3[24]

"Available guidance is just that, guidance, and cannot be expected to cover the precise conditions and circumstances applying at the site under examination." LTN 1/08 3.2.2[24]

3.2.3 On this issue HRLC states:

"The authors of guidance, how ever accomplished, will not be cognizant of the site and situation in question. It would be neither reasonable nor rational to presume that anyone could produce an optimal design in abstract. The informed judgement of trained professionals on-site, should logically take precedence over guidance."

Section B

Detailed Design Issues

Section B of MfS2 provides guidance on geometric and other parameters for new and improved highways. Although numerical values are given in this section, designers are encouraged to take a flexible approach to its interpretation and application, thinking through for themselves the likely outcome of any course of action based on experience and local circumstances.

This section is divided into chapters by area of the highway (carriageway, footway etc) and by design elements (junctions, street furniture etc).

However, in preparing schemes, designers should consider the layout in totality, including the relationship of the highway to its surroundings, both in urban and rural areas.

The highway should not be seen in isolation or simply as a piece of infrastructure. The best highway designs respect their surroundings - the buildings, open space and pedestrian/cycle routes that pass through an area.

9.3.20 Pedestrian crossings at traffic signals are typically across each arm of the junction, but when an all-red (to traffic) phase is provided, consideration can be given to providing diagonal crossing facilities. These enable pedestrians to cross to the opposite corner of the junction in one movement instead of two, which is much quicker and more convenient. A high-profile scheme has recently been installed at Oxford Circus in London, but there are long-standing examples elsewhere, such as in Balham, at the junction of Bramford Road and Yarmouth Road in Ipswich, and in Wellingborough at the junction of Croyland Road, Doddington Road and Broadway near a school.

Diagonal crossing, Balham

Diagonal crossing, Oxford Circus

9.4_ Priority and Uncontrolled Junctions

9.4.1 The simplest junctions are where two or more streets meet at a point. These junctions may have marked priority so that there is a major route through the junction, or the junction may have no marked priority and is therefore uncontrolled. Uncontrolled junctions tend to increase driver uncertainty and lead to reduced speeds and are therefore appropriate to low volume and low speed environments, including in urban centres.

9.4.2 Detailed guidance on the design of priority junctions is given in TD42/95[54] but (as with all sections of DMRB) this is written specifically for trunk roads and, where used in other situations, should not be applied uncritically.

9.4.3 T and Y junctions have the fewest conflicting traffic movements. Where there is a straight or nearly straight through route drivers will tend to regard this as the major movement, and so even without road markings or signs, a natural priority will tend to develop.

9.4.4 Crossroads and multi-armed junctions have much higher numbers of conflicting traffic movements and therefore tend to perform worse in terms of road safety. However, grid-type networks with crossroads junctions are extremely legible and therefore encourage walking and cycling, and it is therefore important to strike the right balance. Well-connected street grids can also disperse traffic flows, which will tend to reduce the level of conflict at any particular point.

9.4.5 Reducing traffic speed will also improve safety, and one way of achieving this at the conflict point is to raise the junction onto a speed table.

Tabled crossroads

9.4.6 Keeping the number of approach lanes to the minimum will make the junction safer and easier to negotiate for pedestrians and cyclists. Research into cycle safety at T-junctions found that higher cycle collision rates are associated with two lane minor road approaches[55].

9.4.7 TD 42/95[54] recommends that consideration should be given to providing a right turning lane at priority junctions where the side road flow exceeds 500 vehicles per day, but this advice relates to trunk roads, where there is an emphasis on providing an unimpeded route for through traffic. It is a relatively low flow, and junctions without right turn lanes will often be able to cater for higher levels of turning traffic without resulting in significant congestion.

9.4.8 Right turning lanes make it more difficult for pedestrians to cross major roads and lead to higher traffic speeds and authorities should therefore consider carefully

10_ Visibility

10.1_ Introduction

10.1.1 This section of MfS2 incorporates Section 7.5 of MfS1. It is based on a combination of the research carried out by TRL[23], the research carried out by TMS Consultancy for MfS2[66], a review of recent research and international standards and the outcome of public inquiries since MfS1 was published (see Example below).

10.1.2 Sight distance parameters can be based on various models, such as stopping sight distance, overtaking distance or gap acceptance. UK practice generally focuses on Stopping Sight Distance (SSD). The effect of sight distance on the capacity of priority junctions is discussed in **Chapter 9** above.

10.1.3 This section provides guidance on SSDs for streets where 85th percentile speeds are up to 60 kph (37mph). This will generally be achieved within 30mph limits and may be achieved in some 40mph limits.

Inspectors at public inquiries have accepted that SSD guidance in MfS1 applies to non-residential streets. At an appeal into a development of some 100 dwellings, accessed from the B5215 Leigh Road in Wigan, the Inspector concluded that MfS1 did apply, notwithstanding the volume of traffic (approximately 1,700vph peak times) or the classification of the highway (part of the Strategic Route Network).

10.1.4 Stopping sight distance (SSD) is the distance drivers need to be able to see ahead and they can stop within from a given speed. It is calculated from the speed of the vehicle, the time required for a driver to identify a hazard and then begin to brake (the perception-reaction time), and the vehicle's rate of deceleration. For new streets, the design speed for the location under consideration is set by the designer. For existing streets, the 85th percentile wet-weather speed is used.

10.1.5 The basic formula for calculating SSD (in metres) is:

$$SSD = vt + v^2/2(d+0.1a)$$

where:

v = speed (m/s)

t = driver perception-reaction time (seconds)

d = deceleration (m/s^2)

a = longitudinal gradient (%)
(+ for upgrades and - for downgrades)

10.1.6 The Desirable Minimum SSDs in general use prior to MfS1 were based on a driver perception-reaction time of 2 seconds and a deceleration rate of 2.45 m/s^2 (equivalent to 0.25g, where g is acceleration due to gravity (9.81 m/s^2)). The Absolute Minimum SSD values kept the same reaction time of 2 seconds, but assumed a deceleration rate of 3.68 m/s^2 (0.375g).

10.1.7 The SSD values recommended in MfS1 were based on a perception-reaction time of 1.5 seconds and a deceleration rate of 0.45g (4.41 m/s^2). This value is appropriate for cars and other light vehicles, but heavy goods vehicles and buses have different deceleration characteristics. When deciding whether to carry out separate checks for cars, HGV and bus SSDs, highway authorities should consider the following factors:

- Volume of HGVs and buses
- Proportion of HGVs and buses
- Presence of priority lanes which may enable higher bus/HGV speeds

10.1.8 As a guide, it is suggested that bus/HGV SSD should not need to be assessed when the combined proportion of HGV and bus traffic is less than 5% of traffic flow, subject to consideration of local circumstances.

10.1.9 Based on international vehicle standards (see Example) HGVs must be able to achieve peak deceleration rates of at least 0.509g. However, allowing for the delay in the maximum effectiveness of air braking systems, overall minimum stopping distances are also specified which reduce the minimum overall deceleration rate[A] under the regulations to some 0.36g. Real life tests carried out by ROSPA (also see Example) indicate that these values are likely to be exceeded in practice and therefore the pre-MfS1 Absolute Minimum value of 0.375g is recommended for HGVs. These average deceleration rates already allow for the time taken for air braking systems to apply and therefore the same reaction time of 1.5 seconds should be used.

10.1.10 For buses, the limiting design factor is passenger comfort and safety rather than the ability of the vehicle to stop, and therefore for buses, the recommended maximum deceleration rate is the same as the pre-MfS1 Absolute Minimum value of 0.375g, as used for the pre-MfS1 Absolute Minimum SSD values.

[A] The minimum overall deceleration rate means the deceleration rate, expressed as a uniform value, from the instant when the brakes begin to be applied when the vehicle stops, required by the standards.

10.1.11 Where designers wish to determine different SSD values for HGVs and buses it will be necessary to use appropriate design speeds for these classes of vehicle. Where SSD is being calculated for existing highways, actual 85th percentile values for these types of vehicles should be measured and the worst case SSD be used for horizontal measurements of visibility.

10.1.12 Based on free flow vehicle speeds travelling in 30mph limits given in Transport Statistics Bulletin 2008[45], buses travel at 90% of the average speed for all vehicles.

HGV Braking Performance

Minimum standards for lorry braking systems are set out in the UNECE Vehicle Regulation 13[67], which requires that the mean fully developed deceleration rate achieved by the braking system (with the engine disconnected) should be at least $5.0m/s^2$ (0.509g). In addition, the stopping distance of the vehicle must be no more than $0.15v+v^2/130$, where v=vehicle speed in kph (up to 60kph), and $0.15v+v^2/103.5$ (v up to 90kph).

At 50kph the maximum allowable stopping distance is therefore 26.7m, and this is equivalent to a minimum overall braking rate of $3.6m/s^2$ or 0.37g.

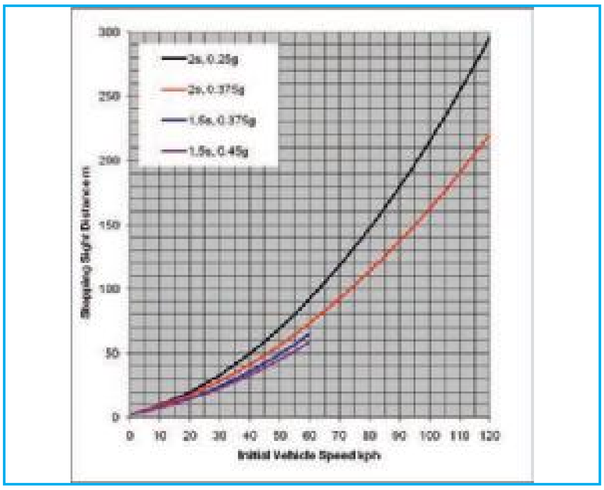
A series of real life braking tests were carried out by ROSPA using a wide range of vehicles in 2001, as reported in http://www.rospa.com/RoadSafety/AdviceAndInformation/Driving/hgv-truck-braking-systems.aspx

Deceleration rates have been calculated from the results of these tests which show that the minimum overall braking rate achieved was 0.44g, for a 36 tonne Foden vehicle, which stopped in 20.68m from 30mph. (One vehicle did take longer to stop, at 27m, but this was on a down slope). Cars were also tested by ROSPA, and the best performing of these was a Ford Mondeo, which stopped from 30mph in 7.14m, an overall deceleration rate of 1.27g.

10.1.13 In summary, recommended values for reaction times and deceleration rates for SSD calculations are given in **Table 10.1** below and the resulting SSD values for initial speeds of up to 120kph are shown on the graph beneath.

Design Speed	Vehicle Type	Reaction Time	Deceleration Rate	Comments
60kph and below	Light vehicles	1.5s	0.45g	
	HGVs	1.5s	0.375g	See 10.1.9
	Buses	1.5s	0.375g	See 10.1.10
Above 60kph	All vehicles	2s	0.375g (Absolute Min SSD)	As TD 9/93
	All vehicles	2s	0.25g (Desirable Min SSD)	As TD 9/93

Table 10.1: Summary of Recommended SSD Criteria



Graph showing recommended SSD values, allowing for bonnet length.

10.2_ Visibility Requirements

10.2.1 Visibility should be checked at junctions and along the street. Forward visibility is measured horizontally and vertically.

10.2.2 Using plan views of proposed layouts, checks for visibility in the horizontal plane ensure that views are not obscured by vertical obstructions.

10.2.3 Checking visibility in the vertical plane is then carried out to ensure that views in the horizontal plane are not compromised by obstructions such as the crest of a hill, or a bridge at a dip in the road ahead. It also takes into account the variation in driver eye height and the height range of obstructions. Eye height is assumed to range from 1.05m (for car drivers) to 2m (for bus and HGV drivers).

10.2.4 Drivers need to be able to see obstructions from 2m high down to a point 600 mm above the carriageway. The latter dimension is used to ensure small children can be seen.

10.2.5 The SSD figure relates to the position of the driver. However the distance between the driver and the front of the vehicle is typically up to 2.4m, which is a significant proportion of shorter stopping distances. It is therefore recommended that for assessments of SSD, an allowance is made by adding 2.4m to the distance calculated using the formula.

10.3_ Forward Visibility

10.3.1 The minimum forward visibility required is equal to the minimum SSD, based on the design speed at the location being considered. It is checked by measuring between points on a curve along the centreline of the inner traffic lane (see Fig.10.1).

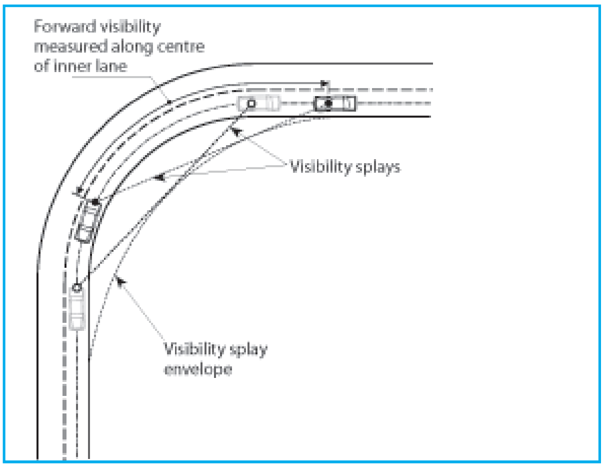
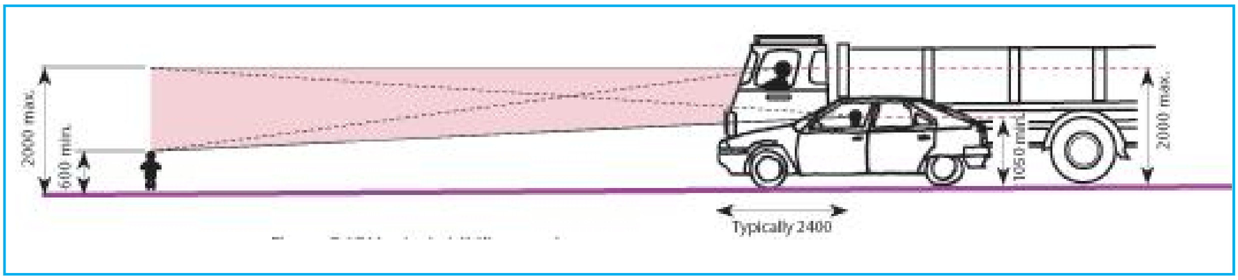


Figure 10.1 - Measurement of forward visibility

10.3.2 However there will be situations in locations with design speeds of 60kph or less where it is desirable and appropriate to restrict forward visibility to control traffic speed - research carried out for MfS1 describes how forward visibility influences speed. An historic example is shown below.

Spaniards Inn, Hampstead – historic building restricting forward visibility and carriageway width



10.4_ Visibility At Priority Junctions

10.4.1 The visibility splay at a junction ensures there is adequate inter-visibility between vehicles on the major and minor arms.

10.4.2 It has often been assumed that a failure to provide visibility at priority junctions in accordance with the values recommended in MfS1 or DMRB (as appropriate) will result in an increased risk of injury collisions. Research carried out by TMS Consultancy for MfS2[66] has found no evidence of this (see research summary below). Research into cycle safety at T-junctions found that higher cycle collision rates are associated with greater visibility[55].

High Risk Collision Sites and Y Distance Visibility

Introduction

The accepted approach to visibility at priority junctions has been to provide a minimum stopping sight distance value appropriate to a particular design speed. The assumption made by some designers and road safety auditors is that this value provides a minimum road safety requirement, and that collision risk will increase if the SSD is not achieved.

The purpose of this research was to examine this assumption and to identify whether or not a direct relationship can be established between variations in Y distance SSD and collision frequency at priority junctions.

Methodology

Site Selection

A series of "high risk" priority junctions was identified as the basis for research. Uncontrolled crossroads and T- junctions were selected for all classes of road throughout all 20, 30 and 40mph speed limits in Nottinghamshire, Sandwell, Lambeth, and Glasgow. For each area a list of all non-pedestrian collisions was ranked in descending order of collision total for a recent five-year period, with over 1500 collisions listed in total. Each location was then analysed in detail to identify specific collision characteristics.

Collision Analysis

Collisions involving vehicles emerging from junctions into the path of vehicles on the main road, together with nose-to-tail shunts on the minor road were identified as the type of incident that could have been caused by "poor visibility". The locations were then ranked in descending order of these types of crashes, and site visits were carried out at the "worst" sites.

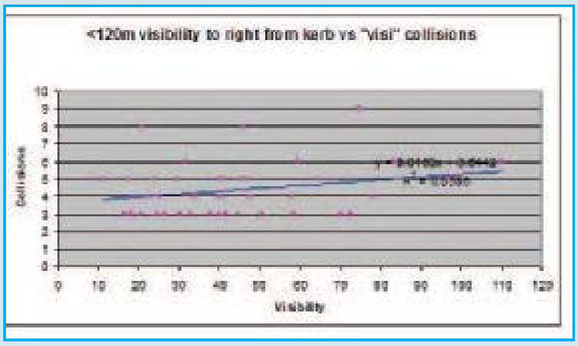
In addition to the 626 potential "poor visibility" collisions, a record was made of 203 collisions involving main road shunts, 46 collisions involving main road bus passengers, 22 collisions involving main road large goods vehicles, and 216 collisions involving main road two-wheeled vehicles. There is a concern that these types of collisions could be over-represented at locations with poor visibility.

Site Visits

Two investigators visited each location, and measured visibility to the left and right, from a point on the side road, 2.4m back from the main road channel line. Visibility was measured from a height of 1.05m, to a point at the kerb edge and a second point 1m out from the kerb edge, where observations showed that visibility increased.

Summary of Findings

- "High risk" sites were defined as locations that had three or more potential poor visibility collisions - in a five year period (94 in total). Of these 90 were on 30mph roads, with 3 on 40mph roads. At 55 of the 94 locations the worst case visibility (either to the left or right) was restricted to less than 120m. Thus in relation to the total number of uncontrolled junctions that exist, the proportion of "high risk" sites where visibility is less than that recommended for 70kph in DMRB is likely to be very low. It is possible that some former high risk priority junctions have been converted to other forms of junction control.
- In two thirds of the cases where visibility was less than 120m, the restriction was due to parked vehicles or street furniture. It is not possible to determine whether the parking was present at the time of the collision.
- Linear regression to compare potential poor visibility collisions with Y distance has a very low R^2 value, which shows that the variation in collision frequency was explained by factors other than Y distance visibility, for a large number of different situations. Therefore Y distance cannot be seen as a single deterministic factor at these high-risk collision locations (see example graph below).



- A series of collision types at high risk locations where Y distance was less than 45m were compared with locations with more than 45m visibility. There were no statistically significant differences between the two sets of data. The data analysed included main road bus and large goods vehicle collisions, and the research did not find high numbers of collisions involving these types of vehicles at low visibility sites.

Collision type	No & % in sites <45m vis	No & % in sites >45m vis
Potential visi collisions in dark	40 (31.75%)	90 (30.3%)
Main road shunts	24 (8.79%)	50 (9.11%)
Bus passenger	10 (3.66%)	10 (1.82%)
Main road HGV	1 (0.37%)	5 (0.91%)
Main road two-wheeled.	38 (13.92%)	85 (15.58%)

Conclusions

- This study has been unable to demonstrate that road safety concerns regarding reduced Y distance are directly associated with increased collision risk at "high-risk" urban sites;
- Previous research for MfS1 demonstrated that main road speed is influenced by road width and forward visibility. Many of the locations in this study were straight roads with good forward visibility. The ability of the driver to stop is likely to be affected by more than just what is happening in the side road and an understanding of the factors influencing main road speed is important when assessing visibility requirements.

Visibility measured to right, to nearside kerb.

	No. of sites	No. collisions	Collisions per year	Collisions per site per year
0-20m	4	16	3.2	0.80
20-40m	14	58	11.6	0.83
40-60m	15	64	12.8	0.85
60-80m	5	24	4.8	0.96
80-100m	2	11	2.2	1.10
100-120m	1	6	1.2	1.20
120m+	48	208	41.6	0.87

10.5_ X and Y Distances

Measurement of X and Y distances

10.5.1 The distance back along the minor arm from which visibility is measured is known as the X distance (Figure 10.2). It is generally measured back from the 'give way' line (or the main road channel line if no such markings are provided).

10.5.2 This distance is normally measured along the centreline of the minor arm for simplicity, but in some circumstances (for example where there is a wide splitter island on the minor arm) it will be more appropriate to measure it from the actual position of the driver.

10.5.3 The Y distance represents the distance that a driver who is about to exit from the minor arm can see to the left and right along the main alignment. For simplicity it has previously been measured along the nearside kerb line of the main arm, although vehicles will normally be travelling at a distance from the kerb line. Therefore a more accurate assessment of visibility splay is made by measuring to the nearside edge of the vehicle track. The measurement is taken from the point where this line intersects the centreline of the minor arm (unless, as above, there is a splitter island in the minor arm).

10.5.4 When the main alignment is curved and the minor arm joins on the outside of a bend, another check is necessary to make sure that an approaching vehicle on the main arm is visible over the whole of the Y distance. This is done by drawing an additional sight line which meets the kerb line at a tangent.

10.5.5 Some circumstances make it unlikely that vehicles approaching from the left on the main arm will cross the centreline of the main arm - opposing flows may be physically segregated at that point, for example. If so, the visibility splay to the left can be measured to the centreline of the main arm.

Recommended values for X and Y distances

10.5.6 An X distance of 2.4m should normally be used in most built-up situations, as this represents a reasonable maximum distance between the front of a car and the driver's eye.

10.5.7 Longer X distances enable drivers to look for gaps as they approach the junction. This increases junction capacity for the minor arm, and so may be justified in some circumstances, but it also increases the possibility that drivers on the minor approach will fail to take account of other road users, particularly pedestrians and cyclists. Longer X distances may also result in more shunt collisions on the minor arm. TRL Report No. 184[68] found that collision risk increased with greater minor-road sight distance.

10.5.8 A minimum X distance of 2m may be considered in some slow-speed situations when flows on the minor arm are low, but using this value will mean that the front of some vehicles will protrude slightly into the running carriageway of the major arm, and many drivers will tend to cautiously nose out into traffic. The ability of drivers and cyclists to see this overhang from a reasonable distance, and to manoeuvre around it without undue difficulty, should be considered. This also applies in lightly-trafficked rural lanes.

10.5.9 The Y distance should be based on the recommended SSD values. However, based on the research referred to above, unless there is local evidence to the contrary, a reduction in visibility below recommended levels will not necessarily lead to a significant problem.

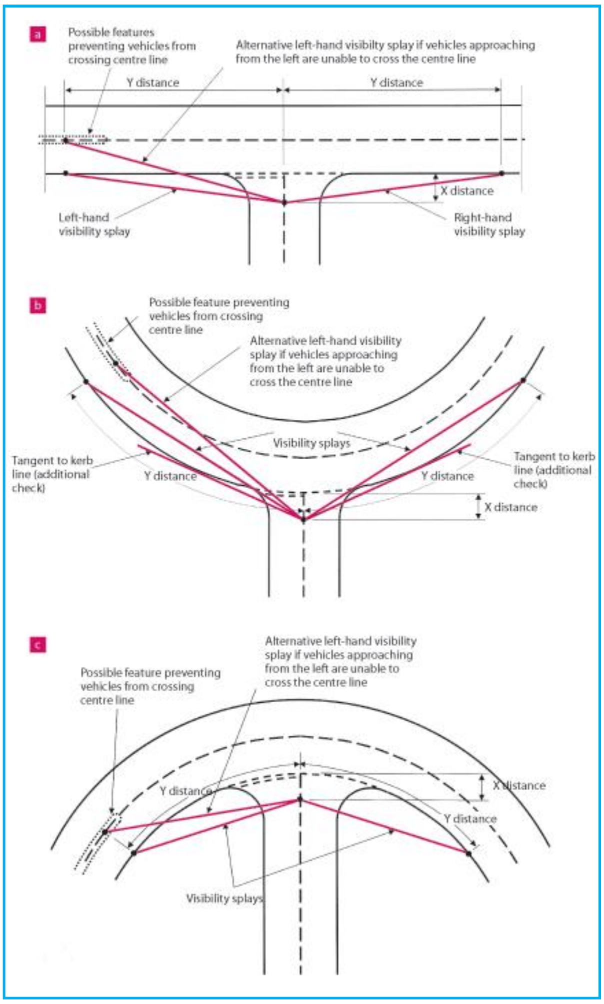
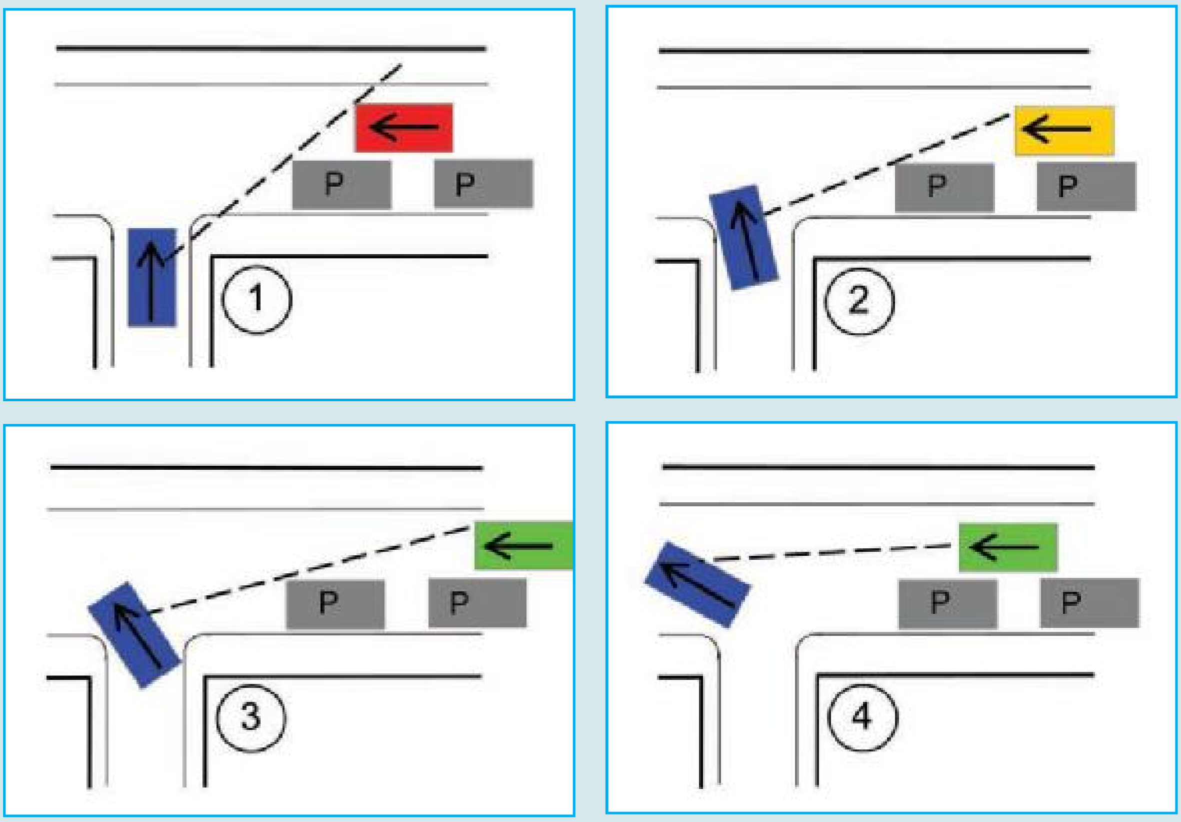


Figure 10.2

10.7_ Obstacles To Visibility

10.7.1 Parking in visibility splays in built-up areas is quite common, yet it does not appear to create significant problems in practice. Ideally, defined parking bays should be provided outside the visibility splay. However, in some circumstances, where speeds are low, some encroachment may be acceptable. (See Example below.)

10.7.2 The impact of other obstacles, such as street trees and street lighting columns, should be assessed in terms of their impact on the overall envelope of visibility. In general, occasional obstacles to visibility that are not large enough to fully obscure a whole vehicle or a pedestrian, including a child or wheelchair user, will not have a significant impact on road safety.



At urban junctions where visibility is limited by buildings and parked cars, drivers of vehicles on the minor arm tend to nose out carefully until they can see oncoming traffic, and vice-versa.

In the images above, the blue car moves forward slowly until it can see far enough past the parked vehicles to see that the gap to the next oncoming vehicle is long enough for it to pull out. Drivers on the major route will also be able to see the vehicle pulling forward slowly and may slow down or stop to allow it to pull out.