27 October 2008

Kent Design Guide Review: **Interim Guidance Note 2**

visibility

Kent Design
c/o Kent Highways service
1st Floor, Invicta House
County Hall
Maidstone
Kent
ME14 1XX

Tel: 08458 247 800
email: kdconsultation@kent.gov.uk

Photo credits: All images supplied by KCC and 'astonesthrow'.
Design: www.astonesthrowdesign.co.uk

introduction

The distance that drivers and riders need to be able to see ahead of them to avoid crashing into someone or something (or to reduce the risk of causing a crash), known technically as Stopping Sight Distance (SSD) and commonly as "visibility", can have a significant influence on the design of streets in new developments. Recent research has demonstrated what the Highway Code has long suggested: visibility distances in guidance spanning many years are unreasonably high. The **Kent Design Guide** (KDG – Kent Design Initiative, December 2005) uses these distances.

Manual for Streets (MfS – Department for Transport, Communities & Local Government and Welsh Assembly Government, March 2007) has captured the output from this research to examine:

a) the relationship between SSD, street widths and vehicles speeds, and
b) more appropriate levels of visibility.

MfS is directly relevant to lightly trafficked residential streets, albeit encouragement is given to apply its principles to busier and mixed use environments. SSD, on the other hand, is derived from three distinct factors which are not bound by this cautious approach.

In assessing planning proposals to make 'highway' recommendations, Development Planning Engineers (DPEs) have not applied visibility guidance consistently. Some have been flexible and others have adhered rigidly to what they regard as "the standards". While there is no clear evidence that connects substandard visibility with personal injury crashes in residential and mixed use environments, rigid application has often been driven by inadequate understanding (sometimes through a lack of training) and/or an exaggerated perception of risk

This Interim Guidance Note seeks to summarise SSD from first principles and then point those involved in the design and assessment of new developments towards a flexible yet safe approach to visibility in the public realm. This will help them in their "placemaking" role, which includes participation in the carrying out of Quality Audits (see Interim Guidance Note 1). Sections 7.4 – 7.8, and pages 89-94 in particular, of MfS are the basis for what follows, hence it is important that users should familiarise themselves with the detailed background. Section 7.6.3 covers driver and object heights, and how to have regard for sight line influences in the vertical plane. This aspect of visibility is unchanged, hence such aspects are not considered in this Note.

'Old standard' forward visibility curve which requires planting (except individual trees) to be maintained below reasonable growing height.

THE STOPPING SIGHT DISTANCE EQUATION

SSD is calculated using the following equation:

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

v = speed (or velocity) (m/s)

t = driver perception-reaction time (s)

d = deceleration (m/s^2)

Speed is either a design parameter or a measured value. Driver perception-reaction time has been measured in tests. Deceleration depends on road surface and conditions as well as the braking capabilities of motor vehicles.

It is inappropriate for designers to 'experiment' with driver perception-reaction times (t), but they can use lower figures supported by credible rationale for risk assessment in difficult situations. MfS uses 1.5s, this being based on test values with a 67% increase as a factor of safety. It is over twice the value used for Highway Code distances, but the point is made that the Code reflects emergency stopping scenarios. Table 7.1 of MfS (see later) goes up to 37 mph (60 kph), hence it is reasonable to have confidence in the use of 1.5s for measured and design speeds below this figure. It is argued by some that times increase on higher speed roads because there are fewer visual influences, but it difficult to justify anything over 2s for situations where the Design Manual for Roads and Bridges (Highways Agency, 1992) is not directly applicable.

Deceleration (d) of 4.41m/s2 (0.45g) in MfS is based on a reasonable assessment of wet weather skid resistance. The Highway Code assumes 50% greater deceleration. As is the case for reaction times, there is little to commend adopting the highest possible value, but greater skid resistance due to surface type or use of the Highway Code figure can be applied for risk assessment purposes. Adjustment for gradient is necessary, to the tune of $0.98m/s^2$ for 10%, plus or minus according to the situation.

It follows from the above that for design purposes it is only speed (v) that really needs to be considered as a variable in the SSD equation. Difficult designs or tight existing situations can be tested against credible alternative values for reaction time and deceleration (derived from published research and the Highway Code). Good design should not rely on the least possible visibility. Equally, there is now no excuse for seeking excessive distances, especially when the relationship between speed, width and visibility is considered.

Acceptable forward visibility achieved without creating false building lines and/or widened footways.

SPEED RESTRAINT

Careful consideration of Figure 7.16 in MfS shows that for the kind of roads designers will normally be considering, positive speed restraint measures and/or layouts will be needed to create sub-20mph places. What the figure does indicate is that without such measures drivers tend to drive faster if there is more visibility available to them. The graphs do not encourage the use of very low visibility, in isolation, to achieve lower speeds.

Movement areas should be designed to restrain speeds to the target figure. The graphs offer reassurance that buildings and other physical influences (such as boundary treatment) can, and perhaps should, be used to reinforce such restraint. This will help with creating the built environment first and then identifying the public realm within it.

THE PROS AND CONS OF THE SSD TABLE

It has been argued that the publication of Table 7.1 (a simplified version of which is given below) in MfS simply replaces one set of "standards" with another. The authors of MfS were keen that designers should think about the equation and not rely upon a set of values: the table was imposed upon them. However, the table is a useful guide to the equation. Used properly, it indicates safe levels of visibility for a range of design speeds, without precluding reductions assessed in more detail using the equation. By definition, it also tells DPEs that they should not even consider recommending refusal of proposals which achieve the values shown, unless they have clear evidence of negative influences. As such, the values used in KDG, as shown in the DB32 (Design Bulletin 32) row of the table, are superseded.

STOPPING SIGHT DISTANCE GUIDANCE TABLE

SPEED	mph	10	12	15	16	19	20	25	28	30	31	37
	kph	16	20	24	25	30	32	40	45	48	50	60
SSD (nil gradient)	m	11	14	17	18	23	25	33	39	43	45	59
DB32 (superseded)	m	14		23			33	45		60		

(For measured speeds above 37 mph refer to the equation and earlier comments on the driver perception-reaction time)

False widening' of footway to meet junction visibility requirement.

JUNCTIONS

SSD is the 'major road distance' for junction visibility. The 'minor road distance', based on drivers being able to see along the street without their vehicles intruding into the trackway, does not need to be greater than 2.4m for the kind of environments to which MfS applies. In certain constrained situations, 2.0m will be acceptable subject to an assessment of the risks associated with longer bonnet vehicles using the junction (- for example, road debris will show how close to the channel line traffic normally passes). The key is to let the built form and placemaking lead the design: these distances will allow junctions to be tighter, in terms of appearance and use.

It will often be the case that 'visibility splays' can be wholly contained within the areas needed for safe, functional and attractive streets, without the need for awkward building arrangements or skewed boundary treatment. Designers, working with other development partners, should avoid obvious splays, since over-engineered designs are likely to be challenged through the Quality Audit process.

As regards the visibility available to drivers turning into junctions, low speeds and tight layouts will seldom warrant forward visibility envelopes beyond the public realm. However, this does mean that pedestrian crossing routes must not be set back where they might be hidden from view.

Examples of sight lines being achieved within necessary highway area, allowing for strong and flexible frontage treatment of properties.

"PEDESTRIAN VISIBILITY"

Pedestrians walking (and children riding) along a street, whether on a footway or a shared surface, should not be hidden from the view of drivers emerging onto that street from driveways. This "pedestrian visibility" has historically been provided as triangular splays on both sides of the driveway, starting at 2.4m by 2.4m but reducing some years ago to 2.0m by 2.0m. Such splays have often been very obvious and unnecessarily intrusive.

Railings, planting and carefully designed walls and fences can provide drivers with a reasonable view of pedestrians, including young children, without appearing to have been imposed on the street layout. MfS (Sections 7.8.3 and 4) recommends initial assessment of need, careful design of necessary pedestrian visibility, and proper regard for the actual driver to pedestrian (and vice versa) line of sight scenarios rather than old style splays.

CONCLUSIONS

'Visibility' is a significant safety issue. However, values used over many years have been found to be excessive. Furthermore, there is no direct correlation between inadequate visibility and personal injury crashes in residential developments. Indeed, excessive visibility can result in increased vehicle speeds. A more flexible and carefully considered approach to design, and the application of 'visibility standards', is now required.

The visibility equation has been used to produce a guidance table. Where values below those shown in the table are being proposed the equation can be used to test them. Good design will avoid making visibility requirements obvious. Refusals because of inadequate visibility should be tested against the equation.

This is a relatively simple subject, but one which requires intelligent interpretation. It is also one which can be allowed for in the design process without impacting upon the quality.

A Checklist is included below to assist with the use of this Guidance in the design and planning processes.

Minimum interference with established hedge to achieve adequate visibility at junction.

CHECKLIST

- What are the design speeds for each part of the development?
- Have speeds on existing streets been measured?
- What are the basic SSD distances for these speeds?
- Are gradients going to influence these distances?
- Are vertical curves going to have an impact?
- Is the layout 'design led' and subject to Development Team consideration?
- If visibility less than the 'table values' is shown, what are the risks, having regard for the equation and layout characteristics?
- Are junction sight lines accommodated within the public realm without imposing awkward arrangements of buildings and/or boundary treatments?
- When a layout is recommended for approval at the planning application stage, is it clear that it can be progressed to adoption if such is appropriate? (See Quality Audit Interim Guidance Note regarding post-planning continuation of the process)
- If refusal is recommended because of inadequate visibility, does the deficiency represent a significant risk to users of the street?
- Where "pedestrian visibility" is needed, is it accommodated unobtrusively in the design of boundary treatments?