Junction Design

Scope

The guide covers all aspects of junction design, including the design of simple major/minor priority junctions through to grade separated junctions. It does **not** cover the design of roundabouts or signalised junctions.

Standards

The following standards may be applicable, the latest version of which should be used unless otherwise stated.

DMRB

- GG 101 - Introduction to the Design Manual for Roads and Bridges (DMRB) (formerly GD 01/15).
- CD109 – Highway Link Design (formerly TD9/93 & TD70/08).
- CD122 – Geometric design of grade separated junctions (formerly TD 22/06, TD 39/94, TD 40/94).
- CD123 – Geometric design of at-grade priority and signal-controlled junctions (formerly TD 41/95, TD 42/95, TD 40/94, and those parts of TD 50/04 and TD 70/08).
- CD143 – Designing for walking, cycling and horse-riding (formerly TA 90/05, TA 91/05, TA 68/96, TD 36/93).
- CD 195 - Designing for cycle traffic (formerly IAN 195/16).
- Disability Advice link to document
- LCC is currently reviewing its policy on provision for cyclists, but wherever practicable LTN 1/20 shall be applied
- Manual for Streets link to document
- Manual for Streets 2 link to document

Application

All junctions shall where practical comply with the relevant standards set out above. For all principal and classified (non estate roads) junctions should be designed to conform to the standards set out in CD109, CD122 and CD123 as appropriate.

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Roads Design Guide

For estate roads the standards set out in the development road guide shall be used. The designer should note that where the estate makes a junction with the classified road network it should be designed in accordance with CD123 or other relevant national guidance and not to the development road guide.

Notes/Guidance

Designers will need to take into account the following: -

- CD123 or any of the other documents should not be read in isolation. For example, in addition to setting out requirements, CD109 gives a great deal of advice on the application of design standards and the various criteria that need to be considered together with GG101.

- Adequate visibility is crucial to the safe operation of any junction, too great a visibility can have a detrimental impact.

- CD123, as with many of the national design guides, focuses on the design of the carriageway for motorised traffic and pays little attention to other road users such as pedestrians and cyclists. The designer will need to consider whether the junction is likely to be used by cyclist and/or pedestrians and if so the likely level of usage that will need to be taken into account. Wherever practicable, LTN 1/20 shall be applied. CD143 and CD169 provide further Standards for Non-Motorised Users.

- Particular attention to the provision of safe crossing points, especially for the less able needs to be considered. The crossing points should be located as near to the desired lines as possible. Location away from the desired lines will reduce the effectiveness of the provision.

- In addition to considering the capacity of the junction at the time of construction, the designer will also need to take into account future traffic demands. Guidance on the choice of junctions is set out in CD123. If capacity is an issue then layout capacity should be tested using the latest version of the TRL 'Junctions' assessment package, a programme that will calculate the capacity of a junction.

- Many junctions will reside on abnormal load routes. Reference to TSP structures section must be made in order to identify such constraints before finalising any design options.

- Advice should be requested from specialist engineers regarding lighting, signs etc.

Technical Services Partnership
Roads Design Guide

Highway Alignment

Scope

The Design guide covers the design of the horizontal and vertical alignment of carriageways.

Standards

The following standards may be applicable, the latest version of which should be used unless otherwise stated.

DMRB

- GG 101 - Introduction to the Design Manual for Roads and Bridges (DMRB) (formerly GD 01/15).
- CD109 – Highway Link Design (formerly TD9/93 & TD70/08).
- CD127 – Cross-sections and headrooms (formerly TD 27/05, TD 70/08).
- CD143 – Designing for walking, cycling and horse-riding (formerly TA 90/05, TA 91/05, TA 68/96, TD 36/93).
- CD 169 - The design of lay-bys, maintenance hardstandings, rest areas, service areas and observation platforms (formerly TD 69/07, TA 66/95).
- CD 195 - Designing for cycle traffic (formerly IAN 195/16).
- Disability Advice link to document
- Guidance on the use of Tactile Paving Surfaces link to document
- LCC is currently reviewing its policy on provision for cyclists, but wherever practicable LTN 1/20 shall be applied

Application

The horizontal and vertical alignment of links (the section of carriageway between junctions) shall comply where possible with the relevant standards set out above. For all principal and classified (non estate roads) all links should be designed to conform to the standards set out in CD109. Further guidance is given in the Maintenance Manual and is applicable to minor improvements of existing roads.

For estate roads the standards set out in the development road guide should be used. The designer should note that where the development forms an improvement of the existing classified road network it shall be designed in accordance with CD109 and not to the development road guide.

Technical Services Partnership
Roads Design Guide

Notes/Guidance

Designers will need to take into account the following: -

- CD109 **or any of the other documents should not be read in isolation.** GG101 and CD109 give a great deal of guidance on the application of design standards and the various criteria that need to be considered.

- Adequate visibility is crucial to the safe operation of any highway.

- CD109, as with many of the national design guides, focuses on the design of the carriageway for motorised traffic and pays little attention to other road users such as pedestrians and cyclists. The designer will need to consider whether the links are likely to be used by cyclists and/or pedestrians and if so the potential level of usage that will need to be taken into account. CD143 and CD169 provide further Standards for Non-Motorised Users.

- Particular attention to the provision of safe crossing points, especially for the less able needs to be considered. The crossing points should be located as near to the desire lines as possible. Location away from the desire lines will reduce the effectiveness of the provision.

- The designer should always consider the capacity of the links, both at time of construction, but also will need to take into account future traffic demands.

- Many links will form part of abnormal road routes. Reference to TSP structures section should be made before finalising any design.

- Advice should be requested from specialist engineers regarding lighting, signs etc.

Horizontal Design

Whilst the design of an arc can be simple, most alignments will require the application of transitions. Use of transitions will have a significant impact upon the plan location of the arc. This is an important consideration especially when assessing the feasibility of an alignment. In most cases initial alignments should be manually designed and developed using 3D modelling software (LCC's TSP design office uses Bentley 'OpenRoads'). Layouts drafted in AutoCad are **not** generally adequate and should be used only where the alterations are minor.

Manual design can be appropriate in some cases, certainly initially.

REMEMBER, the final horizontal design must tie in with the existing alignments at either end regardless of the effect this has on the new design.

Vertical Design

Some 3D modelling software uses the M value in calculating the vertical alignment of the carriageway. CD109 uses K values.

K = L/(a-b) where L is the length of the vertical curve, a = the gradient at the start of the vertical curve (expressed as a percentage) and b = the gradient at the end of the vertical curve (expressed as a percentage).

M = 100/K

For example CD109 gives the minimum crest K value for stopping sight distance (SSD) of a 100 kph road as 100.

Therefore: -

M = 100/K = 100/100 = 1

Manual design can be appropriate in some cases, certainly initially.

REMEMBER, the final vertical design must tie in with the existing alignments at either end regardless of the effect this has on the new design.

Technical Services Partnership
Roads Design Guide

Design of Roundabouts

Scope

The guide covers all aspects of roundabout design, excluding the design of mini roundabouts.

Standards

The following standards may be applicable, the latest version of which should be used unless otherwise stated.

DMRB

- GG 101 - Introduction to the Design Manual for Roads and Bridges (DMRB) (formerly GD 01/15).
- CD109 – Highway Link Design (formerly TD9/93 & TD70/08).
- CD116 – Geometric design of roundabouts (formerly TD 16/07, TD 50/04, TD 51/17, TD 54/07, TA 23/81, TA 78/97, TA 86/03, TD 70/08).
- CD143 – Designing for walking, cycling and horse-riding (formerly TA 90/05, TA 91/05, TA 68/96, TD 36/93).
- CD 195 - Designing for cycle traffic (formerly IAN 195/16).
- Disability Advice link to document
- Guidance on the use of Tactile Paving Surfaces link to document
- LCC is currently reviewing its policy on provision for cyclists, but wherever practicable LTN 1/20 shall be applied

Application

All roundabouts should comply with the standards and guidance set out above. S278 schemes shall also be subject to these standards unless a relaxation or departure is approved.

Notes/Guidance

Designers will need to take into account the following: -

- CD116 or any of the other documents should not be read in isolation. CD109 gives a great deal of guidance on the application of design standards and the various criteria that need to be considered.

- Adequate visibility is crucial to the safe operation of any roundabout, too great a visibility can have a detrimental impact.

- CD116, as with many of the national design guides, focuses on the design of the carriageway for motorised traffic and pays little attention to other road users such as pedestrians and cyclists. The designer will need to consider whether the roundabout is likely to be used by cyclists and/or pedestrians and if so the likely level of usage that will need to be taken into account. CD143 and CD169 provide further Standards for Non-Motorised Users.

- Particular attention to the provision of safe crossing points, especially for the less able needs to be considered. The crossing points should be located as near to the desire lines as possible. Location away from the desire lines will reduce the effectiveness of the provision.

- The designer should always consider the capacity of the junction, both at time of construction, but also will need to take into account future traffic demands. Guidance is set out in CD116. If capacity is an issue then layout capacity should be tested using the latest version of the TRL 'Junctions' Assessment package, a programme that will calculate the capacity of a Roundabout.

- Many roundabouts will reside on abnormal road routes. Reference to TSP structures section should be made before finalising any design options.

- Roundabouts will only operate safely if the geometric properties restrict the vehicle speeds at entry. Deflection requirements shall apply to **all** roundabout approaches; this is because it is essential to regulate vehicle speed before entry and not whilst on the roundabout.

- As a general rule it is difficult to achieve adequate deflection on roundabouts of less than 40m diameter (single carriageway approaches) and 80m (dual carriageway approaches).

- Landscape designers are particularly keen to plant up the centre of roundabouts. Designers must ensure that the **mature** size of and proposed planting is taken into account to ensure that the planting does not encroach into the visibility envelopes. Works of art, particularly mobile features should not be sited on the central islands as these can easily distract drivers.

- Safety fencing and signing should be sited with care to ensure that sight lines are not obstructed.

- Care will need to be taken with the design of the vertical alignment. Designers should be aware that sudden/steep changes in gradient are a major contributory factor to accidents at roundabouts, particular affecting large vehicles. No change in grade shall be greater than 5%.

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Roads Design Guide

Design of Footways

Scope

The design guide covers the design of new footways.

Standards

The following standards may be applicable, the latest version of which should be used unless otherwise stated.

DMRB

- CD143 – Designing for walking, cycling and horse-riding (formerly TA 90/05, TA 91/05, TA 68/96, TD 36/93).
- Maintenance Design Manual link to document
- Guidance on the use of Tactile Paving Surfaces link to document
- LCC is currently reviewing its policy on provision for cyclists, but wherever practicable LTN 1/20 shall be applied
- Disability Advice link to document
- Typical Details link to details

Application

All footways should comply with the standards and guidance set out above. For all existing county roads they shall be designed to conform to the standards set out in the Highways Maintenance Design Manual, the use of tactile pavements and, where practicable LTN 1/20.

For estate roads the standards set out in the development road guide shall be used.

Notes/Guidance

Designers will need to take into account the following: -

- Wherever practicable footways should be located to the back of the verge, with a minimum gap of 1.0m between the carriageway and the footway. Smaller gaps pose an increased safety risk and it is difficult to establish a good growth of grass

due to the effects of de-icing salts and poor drainage. Narrower widths shall be filled with a suitable material such as block paving.

- The designer will need to consider whether the footway is likely to be used by the disabled and if so the level of usage that will need to be taken into account. This may impact upon footway widths and safety provision e.g. tactile paving.

- All new footways should have concrete edgings,

- Footways should be designed to drain away from adjoining properties unless there is suitable drainage provided.

- Traditionally footways have been designed with a 1 in 30 crossfall. Current guidance recommends that 1 in 40 be used, especially where use by the disabled (e.g. electric buggies) is likely to be a regular occurrence.

- Longfall should be limited to no greater than 1 in 14.

- Details of footway construction can be found in the SD11 series of standard details.

- Care should be taken with the choice of footway materials. Designers should consider the slip resistance of materials. Falls can occur when adjacent materials have different resistance to slipping. This can be a problem when working with natural materials especially when they are being specified for their aesthetic appearance rather than their physical properties.

- Remember that any new footway facility must fit into the existing situation even if this does require Departure from Standards.

Technical Services Partnership
Roads Design Guide

Design of Cycleways

Scope

The design guide covers the design of new cycleways and the improvement of existing facilities.

Standards

The following standards may be applicable, the latest version of which should be used unless otherwise stated.

DMRB

- CD143 – Designing for walking, cycling and horse-riding (formerly TA 90/05, TA 91/05, TA 68/96, TD 36/93).
- CD 195 - Designing for cycle traffic (formerly IAN 195/16).
- Maintenance Design Manual link to document
- Guidance on the use of Tactile Paving Surfaces link to document
- LCC is currently reviewing its policy on provision for cyclists, but wherever practicable LTN 1/20 shall be applied
- Development Road and Sustainable Drainage Guide link to document
- Typical Details link to details

Application

All Cycleways should comply with the standards set out above. For all existing county roads they should be designed to conform to the standards set out in the Highways Maintenance Design Manual, the use of tactile pavements and the County Council policy on Cycle provision.

For estate roads the standards set out in the development road guide should be used.

Notes/Guidance

Designers will need to take into account the following: -

- Where possible cycleways should be located to the back of the verge, with a minimum gap of 1.0m between the carriageway and the footway. Smaller gaps pose an increased safety risk and it is difficult to establish a good growth of grass

due to the effects of de-icing salts and poor drainage. Narrower widths should be filled with a suitable material such as block paving.

- All cycleways should have concrete edgings.

- Cycleways should be designed to drain away from adjoining properties unless there is suitable drainage provided.

- The crossing of private accesses can cause difficulties. Whilst in ideal circumstances the cycleway levels should not need alteration from a smooth line to cross accesses this may not be possible. In such circumstances levels should not:
  i. form a switchback profile
  ii. produce changes in gradient that cause the risk of grounding vehicles.

- Details of cycleway construction can be found in the the kerbs, footways and paved areas series of typical details.

- Obstructions such as Bollards and signs and lighting columns should be avoided. Where an existing footway is being upgraded existing street furniture is frequently a problem and should be moved if possible. The designer must ensure that the owner of the street furniture is made aware of its removal and that any necessary replacements are provided.

- Segregation of cyclists and pedestrians should be maintained whenever possible,

- Where cycle lanes on existing carriageways are required the designer will need to establish whether the lane is mandatory or advisory. Mandatory lanes will require a Traffic Regulation Order.

Highway Construction

Scope

The Design guide covers the design of the construction of carriageways.

Standards

The following standards may be applicable, the latest version of which should be used unless otherwise stated.

DMRB

- CD 225 - Design for new pavement foundations (formerly IAN 73/06 revision 1 (2009), HD 25/94).
- CD 226 - Design for new pavement construction (formerly HD26/06).
- CD 236 - Surface course materials for construction (formerly CD 236 (rev. 3 inc. HD 36/06 and IAN 156/16), HD 37/99, HD 38/16, IAN 157/11, TA 81/16).

Application

The construction of the carriageway shall where possible comply with the relevant standards set out above.

Generally:

- Main roads improvements, including S278s, are designed to the HA design guides CD225, CD226 and CD236.
- Maintenance works are designed to the Maintenance Design Manual.
- However, the design should confirm the specific requirements with the client or Highways Asset Management Team as appropriate.