

Appendix A – HS2 Rural Road Design Criteria

A.1 Introduction

- A.1.1 In many cases, published design standards are not fully relevant to rural roads (especially minor ones).
- A.1.2 The Design Manual for Roads and Bridges (DMRB) is only directly applicable to motorways and all-purpose trunk roads, although most local highway authorities adopt DMRB standards and advice notes (either wholly or in part) for their major rural roads.
- A.1.3 In many cases, local authorities will have a design guide (or similar document) which is used by developers when planning new local distributor roads and housing / industrial estate road networks. However, these are not generally applicable to the rural road network.
- A.1.4 Whilst some of the principles for low-speed roads contained in the Manual for Streets (MfS) can be applied to minor rural roads, care needs to be taken as this document was primarily aimed at those designing for the estate road environment. The gap between this and the DMRB was partially addressed by the publication of the Manual for Streets 2 (MfS2), but that document is principally focussed on busier urban streets.
- A.1.5 A set of design criteria have therefore been developed for works on rural roads where no other design basis is suitable, and it is intended to provide a safe, consistent and proportionate approach to help ensure that the character and distinctiveness of such routes is retained as far as is reasonable practicable.

A.2 Requirements and guidance

- A.2.1 Requirements are differentiated from the main text of this document by use of the DMRB convention of placing a 'black box' around the mandatory elements. Any variation or waving of a requirement will require a Departure from Standard.

NOTE – Guidance is differentiated from the paragraph to which it relates by use of italic type.

A.3 Guiding principles

- i) All works – both temporary and permanent – affecting rural roads must provide route continuity for non-motorised users (NMUs) as well as vehicular traffic.
- ii) Potential adverse impacts of HS2 on the existing rural road network should be 'designed out' where reasonable practicable to do so.

Design approach statement - Roads

iii) Where adverse impacts on rural roads are unavoidable, appropriate and proportionate mitigation measures must be incorporated into the design.

iv) All works – both temporary and permanent – affecting a rural road should aim to retain the existing character and distinctiveness of the route wherever feasible.

v) Therefore, as a general rule, the starting point for design should be the existing engineering parameters when a rural road is diverted or reinstated.

vi) For new routes, the requirements should be based on other similar rural roads in the area.

vii) All works should be designed to minimise, as far as is reasonably practicable, future maintenance requirements.

A.4 Design year

A.4.1 The design year shall be taken as 15 years after the expected date of the new or altered road being brought into use.

A.5 Design life

Permanent works

A.5.1 The design life of highway structures on rural roads shall be 120 years.

A.5.2 The design life of rural road pavements shall be 20 years.

Temporary works

A.5.3 The design life of any temporary structures, pavements or other works shall be 12 months longer than their expected period of use.

A.6 Carriageway width

A.6.1 Separate requirements are given for diversions of existing two-lane and single-track roads.

A.6.2 Widths for new rural roads should generally match those found on adjacent routes of a similar type, subject to the limits given below.

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Two-lane roads

- A.6.3 Rural road widths for diversions should generally match the existing, subject to a minimum of 5.5 metres (the minimum for two cars to pass in safety at low speed). This minimum width shall be increased to 6.0 metres for lengths with occasional use by buses or heavy goods vehicles and 6.8 metres for roads where buses or heavy goods vehicles are likely to pass each other on a regular basis.
- A.6.4 The need for any increased lane width at bends shall be determined on a case-by-case basis using vehicle tracking design tools.
- A.6.5 The maximum carriageway width for two-lane roads shall be 7.3 metres (plus any widening on bends that may be required).
- A.6.6 Hardstrips shall not be provided on minor two-lane rural roads.

Single-track roads

- A.6.7 For safety reasons, the normal width of single-track roads shall be 3.5 metres (above which the risk of uncertainty increases about whether two vehicles can pass each other over a length without passing places). However, the need for local widening at bends must be determined on a case-by-case basis using vehicle tracking design tools.
- A.6.8 Inter-visible passing places must be provided on single-track roads at a maximum spacing of 200 metres.
- A.6.9 The combined width of single-track road plus passing bay shall be 5.5 metres over a length of 5 metres (or 15 metres where likely to be used by buses or heavy goods vehicles). Tapers 5 metres long shall be provided at each end.
- A.6.10 The carriageway width across overbridges and through underbridges on single-track roads shall be 5.5 metres, using road markings to give a centred 3.5 metre running lane to discourage a sudden increase in traffic speed or unsafe overtaking manoeuvres. Inter-visible passing places must be provided at each end of the structure.

A.7 Verges and footways

Verges

- A.7.1 Verge widths for rural road diversions should generally match the existing, subject to a minimum of 1.5 metres, or 2.5 metres where a road restraint system is installed.

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- A.7.2 New rural road verge widths should generally match those found on adjacent roads of a similar type, subject to the limit above.

NOTE – Greater verge widths may be required for visibility reasons or to accommodate highway drainage systems and/or statutory undertakers' apparatus.

Footways

- A.7.3 In order to prevent 'creeping suburbanisation' of the countryside, paved footways should normally be considered on rural roads only where necessary to retain existing paved pedestrian route continuity.

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| A.7.4 | Where a footway is provided within the verge, the paved width shall be in accordance with DMRB standard HD 39. |
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Alternative provision for non-motorised users

- A.7.5 On 'quiet lanes' where traffic speeds are inherently low due to physical constraints, it will usually be appropriate for pedestrians, cyclists and equestrians to walk/ride along the carriageway on an informal shared-use basis (especially where remote from built-up areas).

- A.7.6 However, on higher speed roads with regular pedestrian, cyclist or equestrian use, it may be preferable to provide a wider verge on one or both sides of the road with a parallel path (or paths, as appropriate to the level of demand) comprising an unbound surface separated from the carriageway by a grass verge.

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| A.7.7 | Where provided, separate paths for non-motorised users shall have a desirable minimum width of 2.0 metres if intended for pedestrians only or 3.0 metres if mixed use (with absolute minimum values of 1.3 and 2.0 metres respectively). |
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| A.7.8 | The grass verge between edge of carriageway and path shall have a preferred width of 1.5 metres (1.8 metres if path is to be used by equestrians) and an absolute minimum width of 0.5 metres. |
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| A.7.9 | A further grass verge shall normally be provided between and path and boundary feature, with a minimum width of 0.5 metres. However, as an alternative, the minimum width of the path can be increased by 0.25 metres to allow for 'kerb shyness' for boundary feature heights up to 1.2 metres (or by 0.5 metres if the boundary feature is higher). |
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Design approach statement - Roads

A.8 Headroom

- A.8.1 Headroom at HS2 underbridges shall be 5.7 metres, plus any allowances for vertical sag curvature and deflection, over the paved width and 'structure free zone' in accordance with DMRB standard TD 27.
- A.8.2 Headroom to other structures shall be in accordance with DMRB standard TD 27.

A.9 Design speed

- A.9.1 For existing rural roads with an 85th percentile speed greater than 40 mph, the design speed shall be selected using DMRB standard TD 9.
- A.9.2 For lower-speed roads, the design speed shall be selected using Table A.1 where 85th-percentile speed data is available.

Table A.1: Selection of design speed for lower-speed rural roads

85 th -percentile speed (mph)	Design speed (kph)
34-40	60
28-34	50
22-28	40
16-22	30

NOTE – Lower speeds are not recommended for design purposes.

- A.9.3 In the event that 85th-percentile speed data is either unavailable or not applicable (e.g. for lengths of new road), engineering judgement shall be used to select a suitable design speed given the particular circumstances of the site.

A.10 Horizontal alignment**Curvature**

- A.10.1 For rural roads with a design speed greater than 60 kph, horizontal radii shall be in accordance with DMRB standard TD 9.
- A.10.2 For rural roads with a design speed of 60 kph or less, horizontal radii shall be greater than or equal to the values given in Table A.2.

Design approach statement - Roads

Table A.2: Minimum horizontal radius for lower-speed rural roads¹

Design speed (kph)	Minimum radius (m)
60	64
50	44
40	28
30	16

NOTE – Lower speeds are not recommended for design purposes.

Crossfall / superelevation

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| A.10.3 | For rural roads with a design speed of 50 kph or more, crossfall / superelevation shall be in accordance with DMRB standard TD 9. |
| A.10.4 | For rural roads with a design speed less than 50 kph, crossfall / superelevation shall be provided in accordance with Table A.3. |

Table A.3: Crossfall / superelevation for low-speed rural roads

Road type	Crowned cross-section	Cambered cross-section
Two-lane	2.5% down from centreline	2.5% up / down from centreline (non-adverse on bends)
Single-track	Not applicable	

NOTE – Superelevation above 2.5% should not be necessary with low traffic speeds.

Transitions

- A.10.5 In addition to providing a smooth horizontal alignment without abrupt changes in direction, changes of width and crossfall / superelevation are usually applied over transition lengths in order to provide a satisfactory visual appearance and to help avoid drainage problems such as ponding.

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| A.10.6 | For rural roads with a design speed of 50 kph or more, transitions shall be provided in accordance with TD 9. |
| A.10.7 | For rural roads with a design speed less than 50 kph, transitions of an appropriate length shall be provided where the horizontal alignment results in a change from crowned to cambered cross-section or at changes of camber from one direction to the other. |

¹ Source: Section 8.3 of Manual for Streets 2.

Design approach statement - Roads

Tie-ins

A.10.8 Changes of width, radius and crossfall / superelevation at rural road tie-ins shall be achieved over a transition of appropriate length.

A.11 Vertical alignment**Curvature**

A.11.1 For rural roads with a design speed of 50 kph or more, K values for vertical curvature shall be in accordance with DMRB standard TD 9.

A.11.2 For rural roads with a design speed less than 50 kph, K values for vertical curvature shall be greater than or equal to the values given in Table A.4.

Table A.4: Minimum K values for low-speed rural roads²

Design speed (kph)	Minimum crest K value (m)	Minimum sag K value (m)
40	4.0	4.0
30	2.5	3.0

NOTE – Lower speeds are not recommended for design purposes.

Gradient

A.11.3 Maximum and minimum gradient for rural roads shall be less than or equal to the values given in Table A.5.

Table A.5: Maximum gradient for low-speed rural roads³

Gradient	Usage by cyclists	
	Significant	Not-significant
Desirable maximum	3%	6%
Absolute maximum	5% (100 metres maximum) 7% (30 metres maximum)	8%
Minimum	0.5% (except where an 'over the edge' approach is adopted to dissipate carriageway runoff)	

² Source: TD 9 for 50 kph, values adopted on Channel Tunnel Rail Link (High Speed 1) for 40 and 30 kph.

³ Source: Section 8.7 of LTN 2/08 for roads where use by cyclists is significant, TD 9 elsewhere.

Design approach statement - Roads

A.12 Visibility

Stopping Sight Distance (SSD)

- A.12.1 For rural roads with a design speed greater than 50 kph, minimum stopping sight distance values shall be in accordance with DMRB standard TD 9.
- A.12.2 For rural roads with a design speed of 50 kph or less, minimum stopping sight distance shall be greater than or equal to the values given in Table A.6.

Table A.6: Minimum stopping sight distance for low-speed rural roads⁴

Design speed (kph)	Minimum SSD (m)
50	50
40	36
30	24

NOTE – Lower speeds are not recommended for design purposes.

Visibility splays at junctions and private accesses

- A.12.3 For rural roads with a design speed greater than 50 kph, visibility splays shall be in accordance with DMRB standards TD 42 for road junctions and TD 41 for private accesses.
- A.12.4 For rural roads with a design speed of 50 kph or less, visibility splays shall be in accordance with DMRB standard TD 42 or TD 41, as appropriate, except that a maximum 'X' distance of 2.4 metres shall be provided and the 'Y' distance shall equal the minimum SSD distance given in Table A.6.

A.13 Junction and private access layout

- A.13.1 For rural roads with a design speed greater than 50 kph, major-minor junction layouts shall be in accordance with DMRB standard TD 42.
- A.13.2 For rural roads with a design speed of 50 kph or less, major-minor junction layouts shall normally be in accordance with DMRB standard TD 41 Layout 6 except where no long vehicles are predicted in which base Layout 3 shall be used.
- A.13.3 Roundabout layouts shall be in accordance with DMRB standard TD 16.

⁴ Source: Sections 7.5 and 7.6 of Manual for Streets and Section 10 of Manual for Streets 2, using values of 1.5 seconds for reaction time, deceleration rate of 3.68 m/s² (0.375g) and bonnet length of 2.4 metres.

Design approach statement - Roads

- A.13.4 DMRB standard TD 41 Layout 1 shall be used for field accesses; Layout 2 for accesses from single dwellings; and Layout 3 or 6, as appropriate, for other types of private access.
- A.13.5 However, in all cases, layouts shall be modified on a case-by-case basis using vehicle tracking design tools if necessary to accommodate larger vehicles.

A.14 Pavement design

- A.14.1 The traffic assessment for pavement design shall be undertaken in accordance with DMRB standard HD 24.
- A.14.2 Pavement foundations shall be designed in accordance with Interim Advice Note (IAN) 73 until such time as DMRB standard HD 25 is re-issued.
- A.14.3 Road pavements shall be designed in accordance with DMRB standard HD 26.
- A.14.4 Any widening of existing roads shall be designed in accordance with DMRB standard HD 27.
- A.14.5 Surfacing materials shall be bituminous and comply with DMRB standards HD 36 and HD 37.

NOTE – Horses can experience difficulty using certain recently-laid bituminous surfaces so care needs to be taken to specify appropriate materials for rural roads with significant equestrian use.

A.15 Kerbing and drainage

- A.15.1 In order to retain the rural character of roads in the countryside, kerbs shall not normally be provided on rural roads except in the following circumstances:
- To maintain continuity with adjacent kerbed lengths
 - Where new footways are being provided
 - Where a positive drainage requiring kerbing is installed

A.15.2 Kerbs shall be the 45°-splay type except along footways where half-batter kerbing shall be used.

- A.15.3 On embankments, it will often be possible to adopt an 'over the edge' approach to dissipate carriageway runoff unless surface contours or any footway kerbing result in large areas draining to a single point.
- A.15.4 Similarly, if the road is nominally at grade then an 'over the edge' approach can still be adopted provided that verge levels are kept slightly (typically 25 mm) below the edge of carriageway.

Design approach statement - Roads

A.15.5 In cuttings, it may also be possible to adopt an 'over the edge' approach to collect carriageway and slope runoff by means of filter drains or linear soakaways (where ground conditions permit).

A.15.6 A positive drainage system shall be provided at the end(s) of overbridges as necessary to collect runoff from the structure surface.

A.15.7 A positive drainage system shall be provided from any low points located within underbridges and their immediate approaches as necessary to collect runoff from the carriageway, footway and paved verge surfaces.

A.15.8 Wherever feasible, underbridge drainage systems should be designed to operate by gravity in order to avoid the need for pumping systems requiring maintenance.

A.15.9 Drainage pipes shall be designed to ensure self-cleansing flow rates.

A.15.10 Where a positive drainage system requiring kerbing is used, it may be preferable to use kerbed offset gullies rather than installing long lengths of kerbing on rural roads. This arrangement also benefits any non-motorised users who may be walking or riding along the carriageway edge (where no separate path is provided).

A.15.11 Trapped gullies shall be used to minimise the risk of pollution from highway drainage systems. Similarly, catchpits shall be used rather than conventional manholes on highway drainage carrier drain systems.

A.16 Errant vehicle protection

A.16.1 In order to retain the rural character of roads in the countryside, passively-safe street furniture compliant with BS EN 12767 shall be used wherever reasonably practicable in order to avoid unnecessary lengths of road restraint systems.

A.16.2 Road restraint systems shall be provided on routes with AADT flows above 5000 and a speed limit of 50 mph or more in accordance with TD 19.

A.16.3 For routes with AADT flows below 5000 and/or a speed limit of less than 50 mph, all bridges over (and roads alongside) HS2 shall be considered 'Higher Priority Sites' in accordance with the UK Roads Liaison Group document entitled 'Provision of Road Restraint Systems on Local Authority Roads'. Such sites shall be provided with the appropriate road restraint system(s) unless the risk assessment demonstrates that other interventions reduce the risk to a level where the road restraint system(s) can be omitted.

Design approach statement - Roads

A.16.4 In other locations on routes with AADT flows below 5000 and/or a speed limit of less than 50 mph, road restraint systems shall only be provided where deemed necessary following a risk assessment undertaken in accordance with the 'Provision of Road Restraint Systems on Local Authority Roads' guidance.

A.16.5 A standard set-back of 1.2 metres shall be adopted for road restraint systems used on rural roads, except where wider verges are necessary to provide the required stopping sight distance.

A.16.6 In visually-sensitive locations, wooden-faced safety fences compliant with BS EN 1317 may be an appropriate solution.

A.17 Traffic signs and road markings

A.17.1 In order to retain the rural character of roads in the countryside, the design should aim to eliminate (where possible), and at least minimise, the need for large numbers of traffic signs and extensive road markings. For example, by adopting similar layout parameters to those found on adjacent roads of a similar type, warning signs for features that are the norm in the vicinity should not be necessary and inappropriate 'sign clutter' can be avoided.

NOTE – Although road markings can themselves be considered a suburbanising feature (especially on the smaller lanes), in some situations their use can reduce or eliminate the need for signage which may be more visually intrusive.

A.17.2 There may be the need for visibility splays in front of certain signs (typically advance direction signs on busier rural roads) that are significant enough to require extra landtake, and potential sites where this may be required must be identified at an early stage.

A.17.3 Existing features such as bespoke cast-iron and wooden fingerpost signs can be highly valued by communities, enhancing the sense of local distinctiveness and heritage. Therefore, if affected by HS2 works to rural roads, historic signage should be retained or relocated wherever feasible⁵.

A.18 Lighting

A.18.1 Apart from on some busier 'A' roads and other roads in and around larger communities, few rural roads have existing street lighting systems.

A.18.2 In recent years, there has been also been a move in many parts of the country to minimise energy costs and 'light pollution' effects by reducing existing street lighting in various ways. These include:

- Taking a proportion of columns out of service

⁵ Further advice is given in TAL 6/05.

Design approach statement - Roads

- Switching off lighting for a period in the middle of the night and early morning
- Decommissioning systems entirely

- A.18.3 Existing street lighting systems affected by HS2 works to rural roads shall only be replaced on a 'like-for-like' basis, subject to any planned reductions to those systems.
- A.18.4 New street lighting systems shall not be installed on rural roads affected by HS2 works unless an assessment demonstrates that it would be economically justified.

NOTE – Aspects of DMRB advice note TA 49 – modified as necessary where applied to non-Highways Agency roads – can be used as a basis for assessment, but a full Project Appraisal Report (PAR) is unlikely to be appropriate for minor roads in most rural locations.

- A.18.5 The design should also seek to avoid the need for traffic signs on rural roads to be illuminated (except where this is required by the Traffic Signs Regulations and General Directions 2002 (TSRGD), as amended).

A.19 Other street furniture

- A.19.1 In order to maintain the character of rural roads, other street furniture – such as bus stops and shelters, litter bins and pedestrian railings – shall only be provided on a like-for-like basis (re-using the existing materials, where appropriate).

A.20 Highway structures

- A.20.1 All highway structures shall be designed in accordance with the applicable standards and advice notes contained in DMRB volumes 1 to 3.

A.21 Earthworks

- A.21.1 All road embankments and cuttings shall be designed in accordance with DMRB advice note HA 44.

A.22 Boundary treatments

- A.22.1 Apart from on motorways, roads are not required to have features such as fences, hedges or walls on the highway boundaries. However, in practice, most roads have boundary features on both sides but these are the responsibility of the adjacent landowner rather than the highway authority.

Design approach statement - Roads

NOTE – Most new or replacement highway boundary features on rural roads affected by HS2 will thus be accommodation works agreed with the relevant landowners, but it will always be beneficial for these to be of a type and appearance consistent with the character of those found on adjacent roads of a similar type.

- A.22.2 For security reasons, fencing between roads and HS2 shall be designed to prevent, as far as reasonable practicable, the risk of trespass onto railway land.
- A.22.3 Secure gates shall be provided in HS2 boundary fencing as necessary to enable maintenance access.

A.23 Landscaping

- A.23.1 In addition to adoption of appropriate boundary treatments (see above), it may be appropriate in certain circumstances for areas of landscaping to be provided (or re-provided) within the highway boundaries.

NOTE – Opportunities for landscaping may occur on highway land where existing roads are realigned but any ‘surplus’ areas are not stopped up.

- A.23.2 All landscape areas require ongoing maintenance and none shall be provided without the specific acceptance of the local highway authority.

A.24 Temporary diversions and traffic management

- A.24.1 The geometric layout of temporary diversions shall be as for permanent works, subject to any reduced requirements where a mandatory temporary speed limit is to be applied.
- A.24.2 Traffic management shall be in accordance with Chapter 8 of the Traffic Signs Manual.

A.25 Safety

- A.25.1 Road safety audits (RSAs) shall be carried out for all permanent road layout alterations in accordance with DMRB standard HD 19 in order to help ensure motorised user safety.
- A.25.2 Similarly, temporary road layout alterations shall be subject to a road safety review with a scope proportionate to the nature and expected duration of the works.

Design approach statement - Roads

A.25.3 Non-motorised user audit reports shall also be prepared in accordance with DMRB standard HD 42 in order to help ensure pedestrian, cyclist and equestrian safety.