

Road Geometry Standards Updates

Danny Wicks
Arup

TII Standards Roadshow
31st May 2023

Background

- Last major review of TII Road Geometry Publications undertaken in 2017, which included:
 - DN-GEO-03031 (Rural Road Link Design)
 - DN-GEO-03060 (Geometric Design of Junctions)
 - DN-GEO-03036 (Cross Sections & Headroom)
**updated in May 2019 to include principle of Forging Roadsides*
- 4 – 6 years since last full review undertaken



Considerations for Updates

Updates to Road Geometry Standards needed to consider:

- Sustainable Transport and Roads
- Public Transport and Active Travel provision
- Approach to provision of design guidance and aspirations vs. mandatory technical requirements
- Lessons Learned and common themes from departures received by TII
- Technical queries received across the standards
- Other technical issues highlighted from industry consultation and expert knowledge



Scoping & Aspirations

- International Standards Review – UK, Australia, New Zealand, Norway, Sweden, Denmark, Germany, France
- Stakeholder Engagement:
 - Workshops with TII and National Roads Offices
 - TII Standards User Feedback Questionnaire
- Conclusions and Recommendations to inform standards update



Road Geometry Standards Updates



- Updates to 3 TII Publications
 - DN-GEO-03031 (Rural Road Link Design)
 - DN-GEO-03036 (Cross Sections & Headroom)
 - DN-GEO-03060 (Geometric Design of Junctions)



- Delivery of standards update split into six separate scope items:
 1. Active Travel
 2. Cross-section
 3. Roundabouts
 4. Junctions
 5. Alignment (Horizontal, Vertical, Superelevation)
 6. General Updates

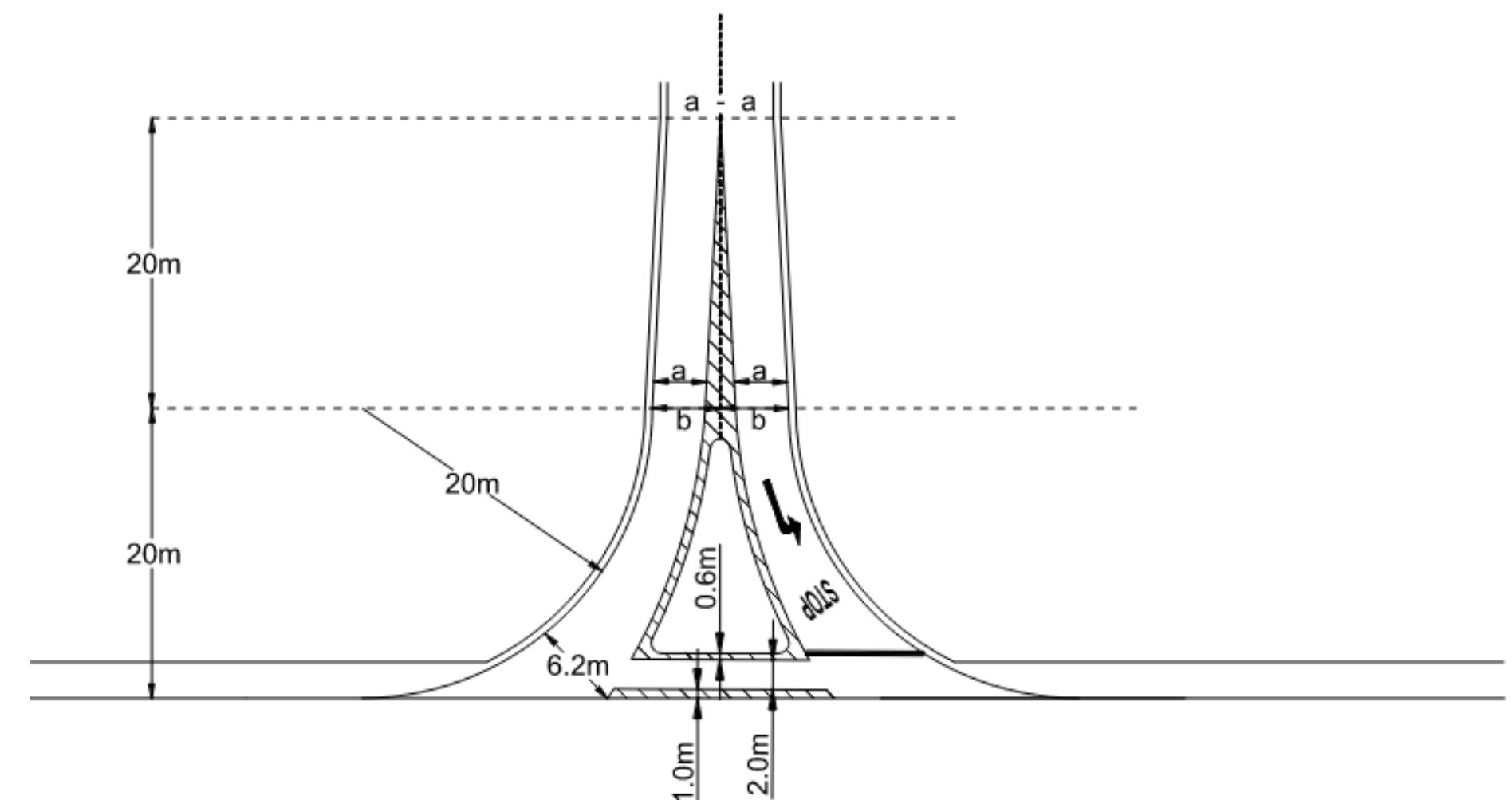
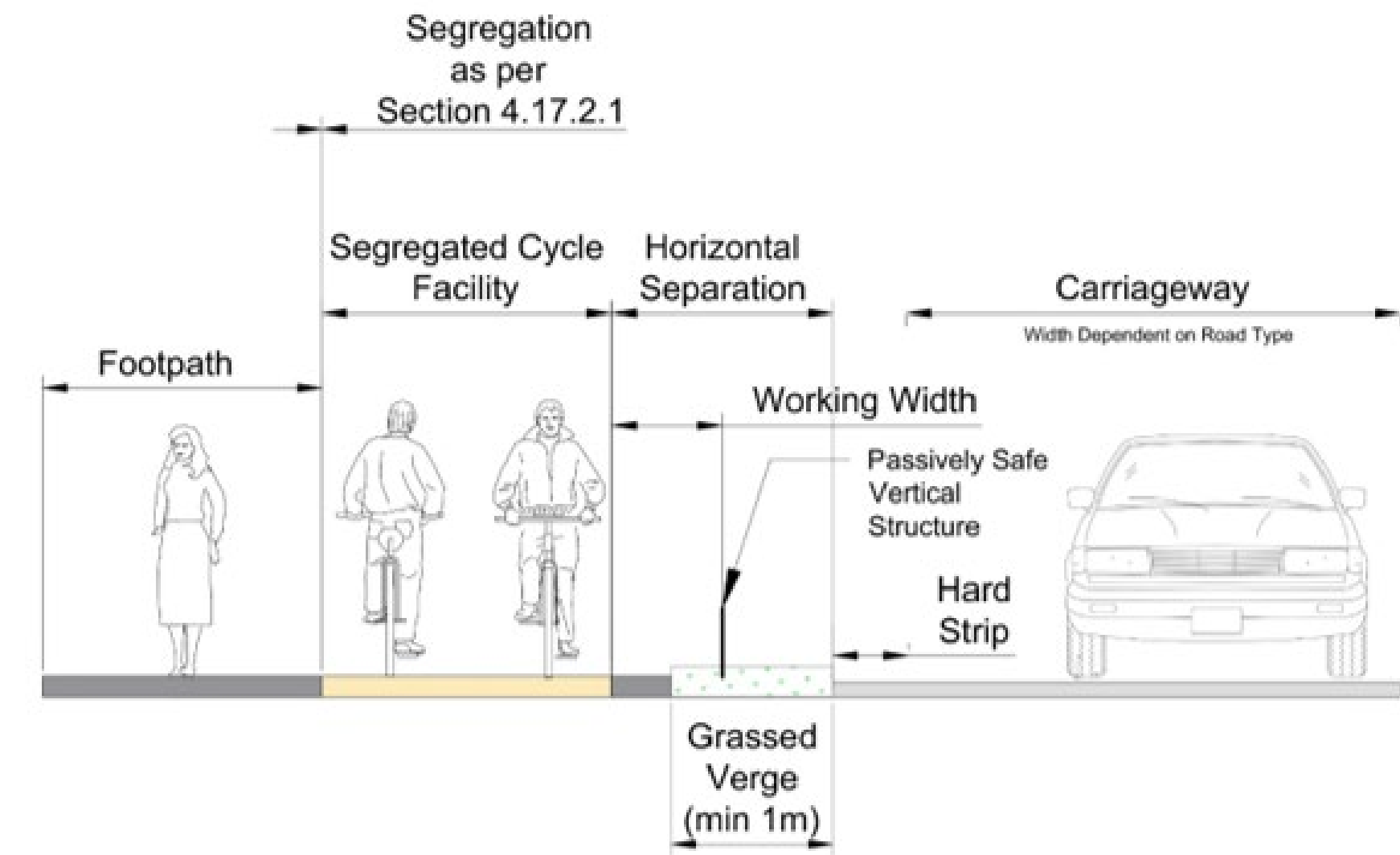


- Some tasks required substantial research on international best practice, and others involve refinements to language and presentation

Road Geometry Standards Updates

Active Travel

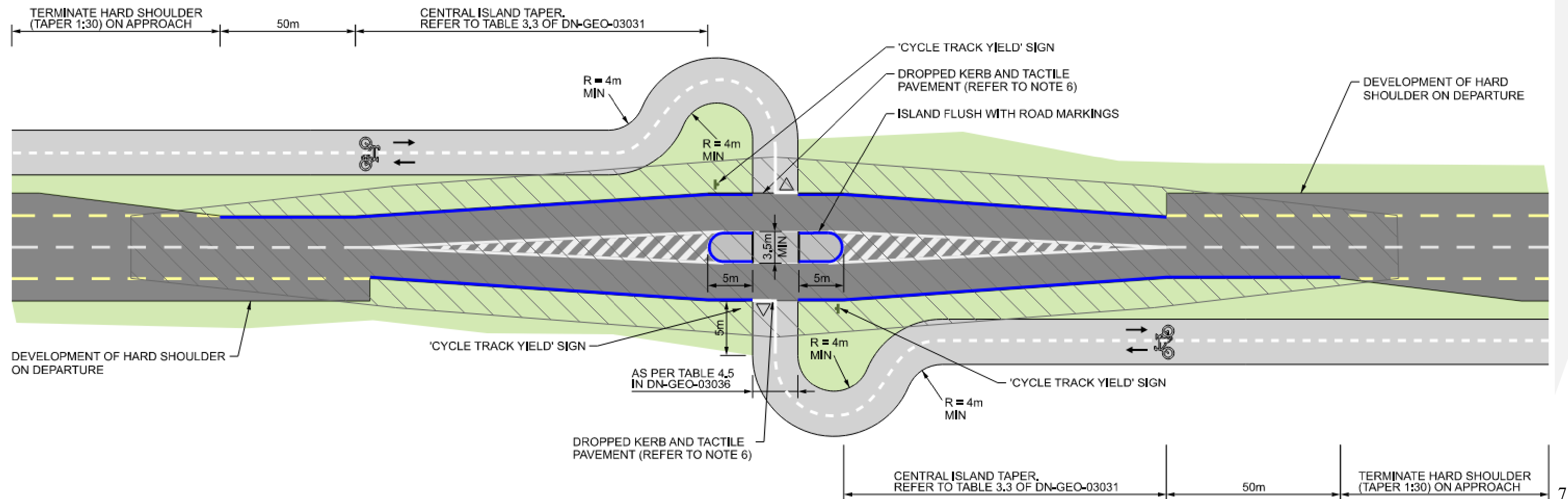
- Coordination across standards
 - *Online, Off-Road Cycle facilities* – DN-GEO-03031, DN-GEO-03036, DN-GEO-03060
 - *Offline Cycle Facilities, Greenways* – DN-GEO-03047
 - Widths of cross sectional elements, gradients, segregation, separation, lateral clearance etc.
- Gradients – removal of relaxations for steep gradients
- Updates to junction layouts - cycle friendly



Road Geometry Standards Updates

Active Travel

- Crossing treatments for Active Travel facilities remote from a junction
 - Guidance for requirements on grade separation
 - Standard Construction Detail (SCD)



Road Geometry Standards Updates

2.0 Cross Section

Review of Table 6.1 (DN-GEO-03031):

- Additional guidance on road cross section selection
- Rename Type 2/3 Dual Carriageways to Divided Roads
- Wider use of Type 3 Divided Roads (outside of retrofit schemes)
- Appraise requirement for Active Travel facilities all cross sections

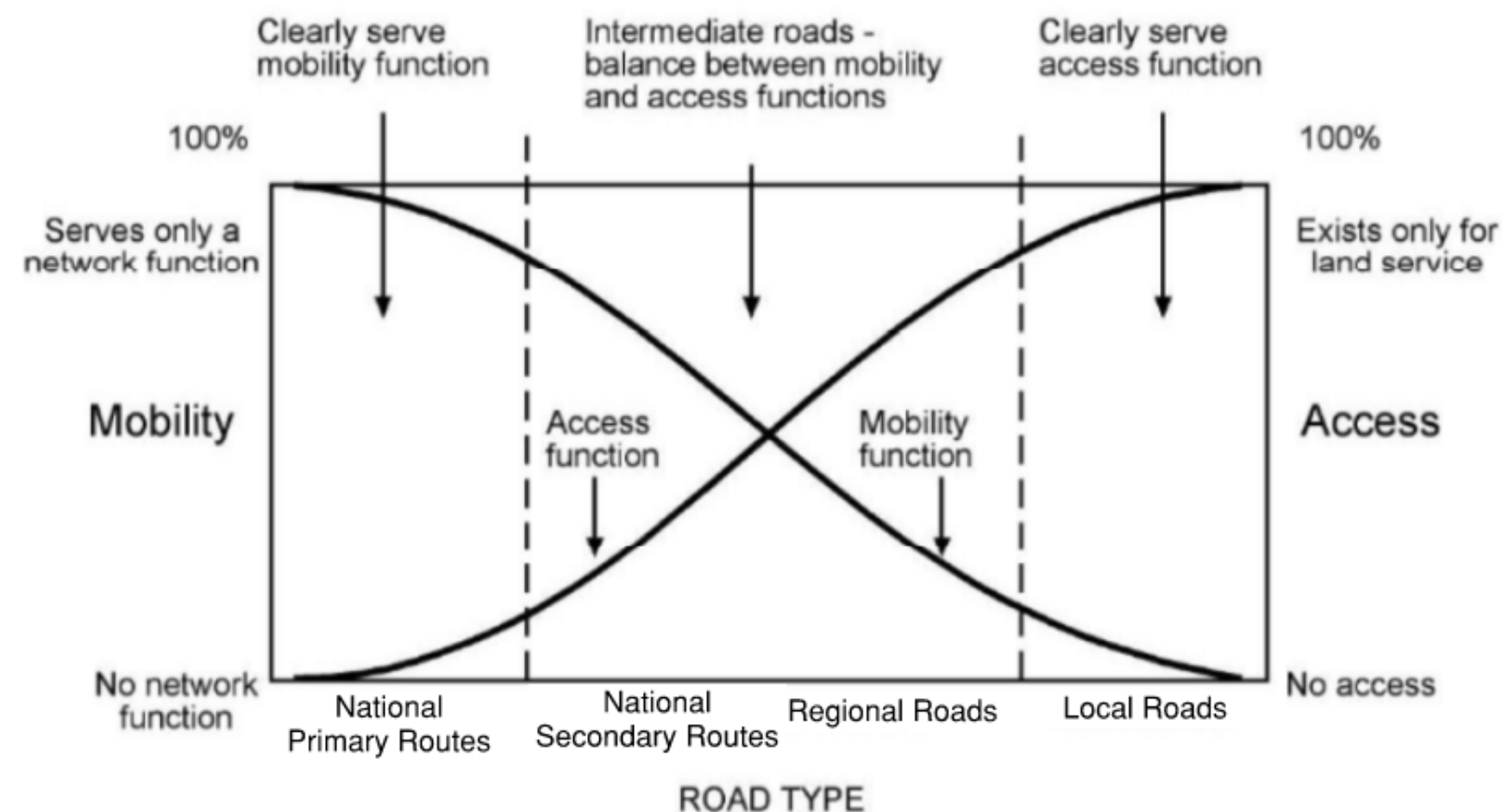


Table 6.1 Recommended Rural Road Layouts

| Type of Road 1. | Edge Treatment ⁶ | Access Treatment | Junction Treatment at Minor Road | Junction Treatment at Major Road |
|---|-----------------------------|---|---|---|
| Type 3 Single (6.0m) Carriageway (National Secondary Roads Only) | 0.5m hard strip. | Minimise number of accesses to avoid standing vehicles and concentrate turning movements. | Simple Priority Junctions ³ | Priority junctions, with ghost islands where necessary ³ or roundabouts. |
| Type 2 Single (7.0m) Carriageway | 0.5m hard strips. | Minimise number of accesses to avoid standing vehicles and concentrate turning movements. | Priority junctions, with ghost islands where necessary ³ . | Priority junctions, with ghost islands ³ roundabouts, compact grade separation where necessary. |
| Type 1 Single ² (7.3m) Carriageway | 2.5m hard shoulders | Minimise number of accesses to avoid standing vehicles and concentrate turning movements. | Priority junctions, with ghost islands where necessary ³ . | Ghost islands ³ or roundabouts or, compact grade separation where necessary |
| Type 3 Dual (7.0m + 3.5m) Divided 2+1 lanes Primarily for retro fit projects | 0.5m hard strips. | Minimise the number of accesses to avoid standing vehicles and concentrate turning movements. | Restricted number of left in/left out or ghost island priority junctions. ^{3, 5} | Priority junctions ^{3,5} , u-turn facility with right turn ³ , at-grade roundabouts, compact grade separation |
| Type 2 Dual ² Divided 2 +2 Lanes (2x7.0m) Carriageways. | 0.5m hard strips | No gaps in the central reserve. Left in / Left out | No gaps in the central reserve. Left in / Left out | At-grade roundabouts and compact grade separation |
| Type 1 Dual ² Divided 2+2 Lanes ⁴ (2x7.0m) Carriageways | 2.5m hard shoulders | No gaps in the central reserve. Left in / Left out | No gaps in the central reserve. Left in / Left out | At-grade roundabouts and full grade separation. |
| Motorway Divided 2 +2 Lane ⁴ (2X7.0m) | 2.5m hard shoulders | Motorway Regulations | No gaps in the central reserve. | Motorway standards Full-grade separation. |
| Wide Motorway Divided 2+2 Lane (2X7.5m) | 3m hard shoulders | Motorway Regulations | No gaps in the central reserve | Motorway standards Full-grade separation. |

Notes:

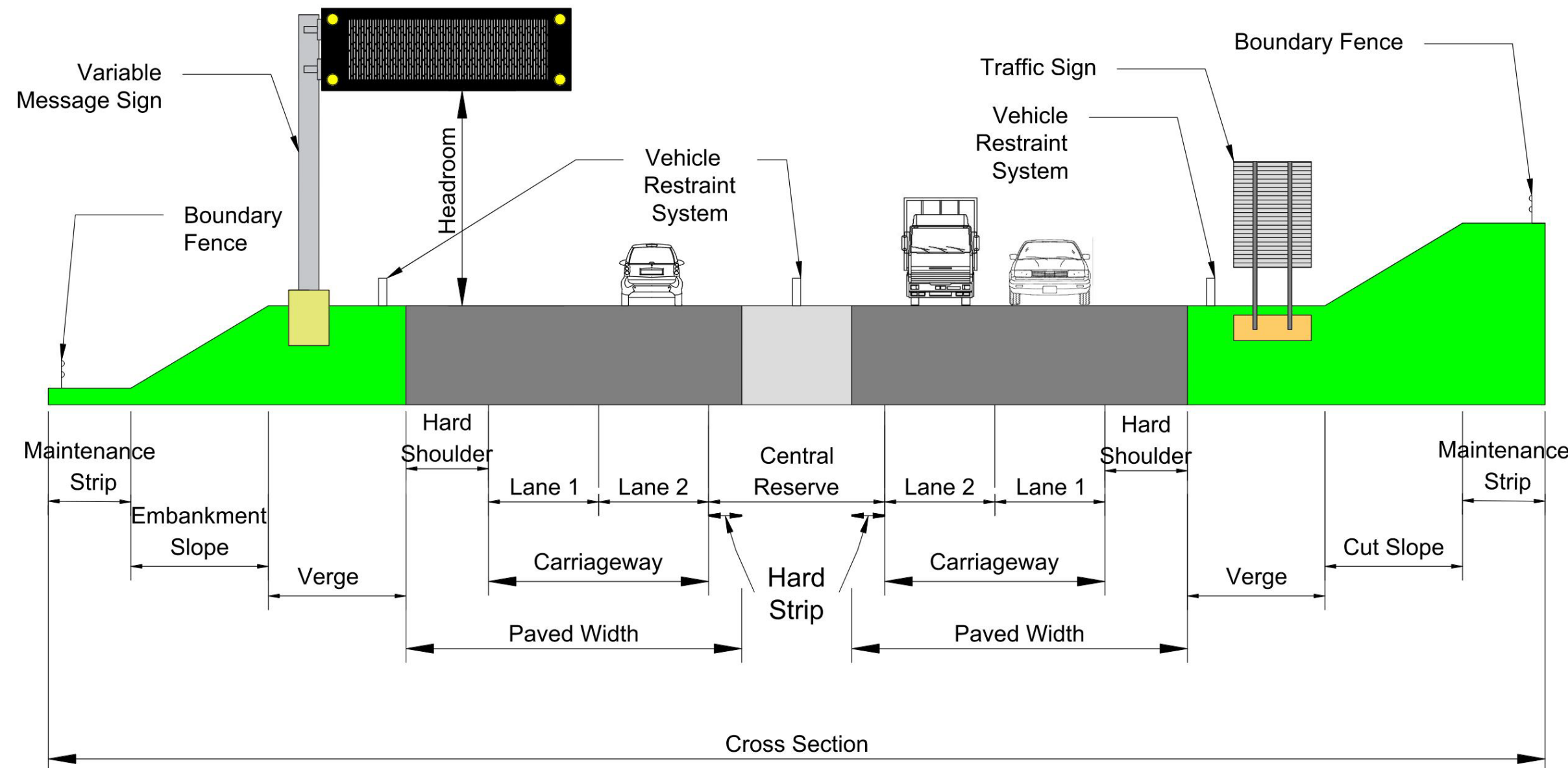
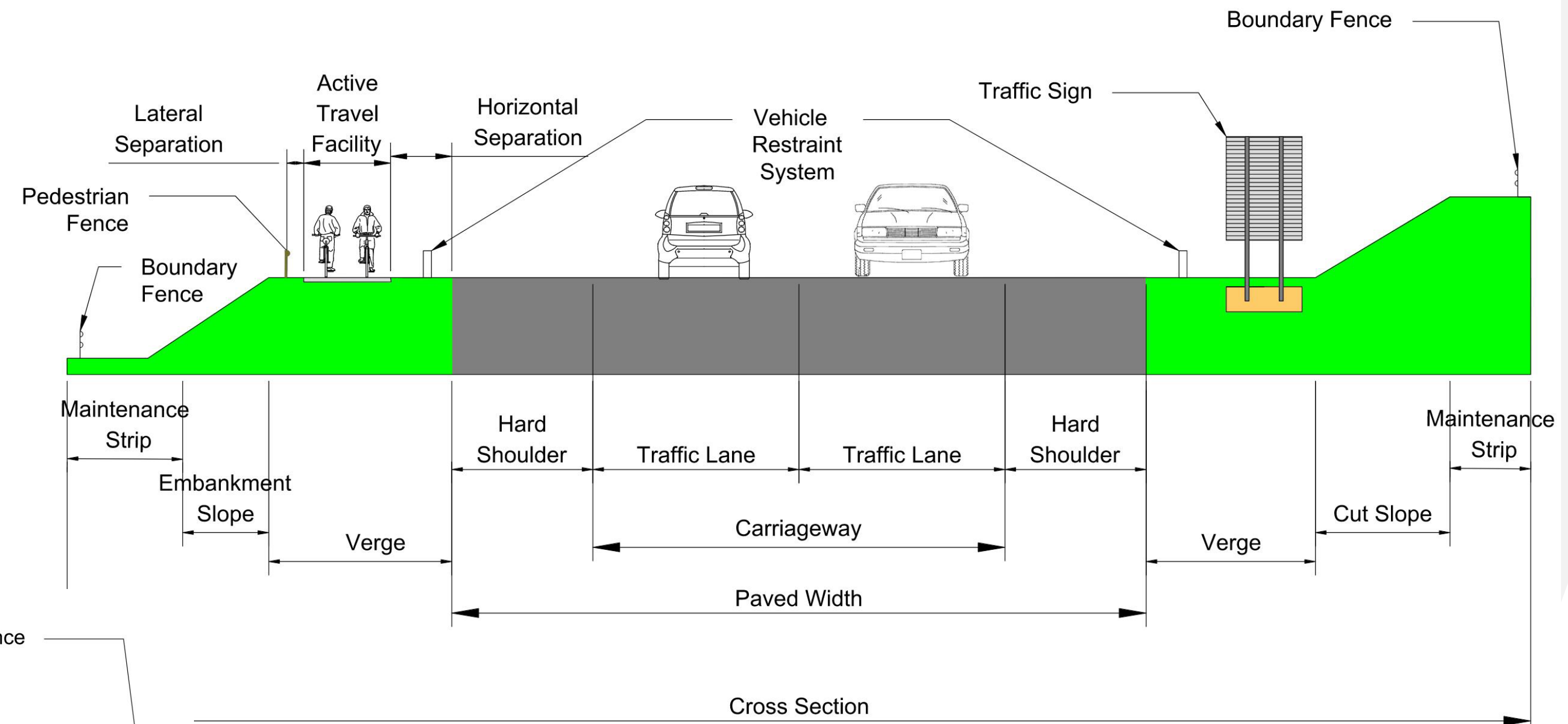
1. For details of the standard road cross-sections, see DN-GEO-03036 and the relevant TII Publications Standard Construction Details.
2. This road type may be used as an Express Road with the following conditions - access and junction control.
3. This junction type is not permitted on Express Roads.
4. Should the traffic assessment indicate that more than 2 lanes are required in each direction for a Standard Motorway or Type 1 Dual Carriageway, the additional lanes shall be a minimum width of 3.5m subject to curve widening.

Road Geometry Standards Updates

Key Updates Include:

2.0 Cross Section (continued)

- Figures of Cross Sectional Components

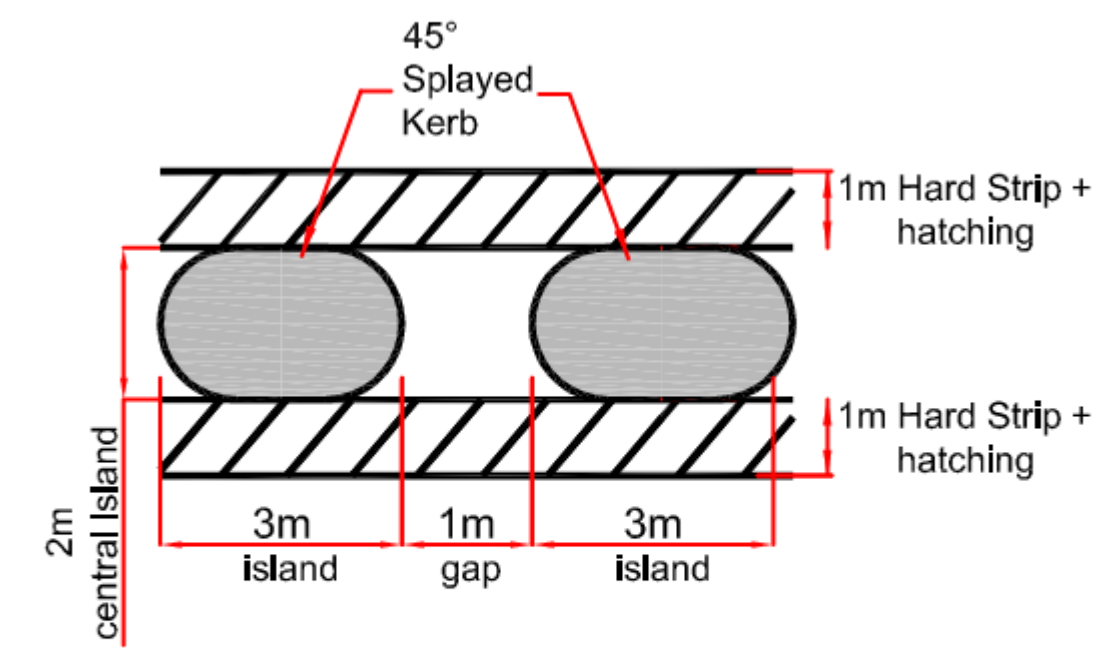
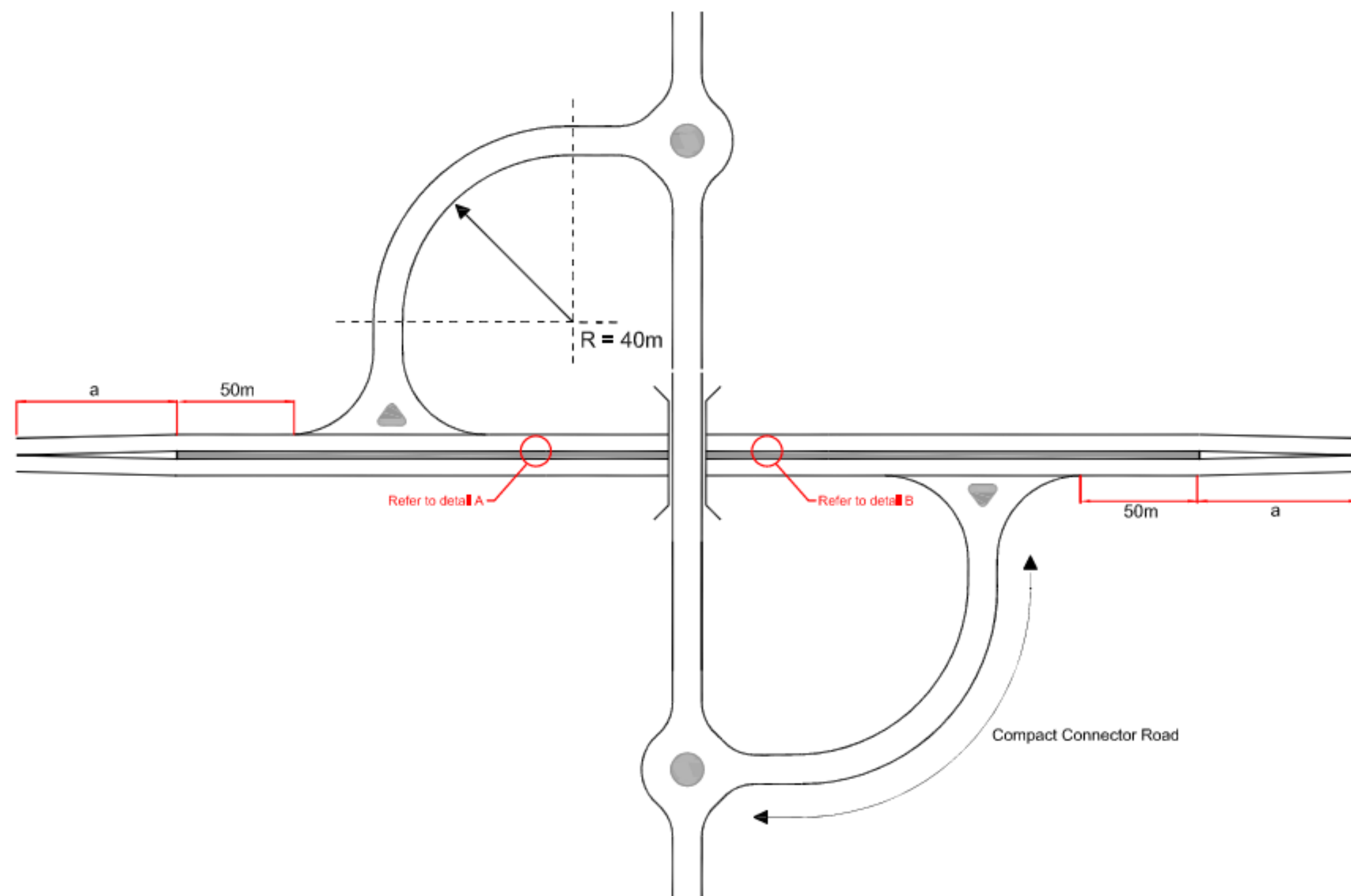


Road Geometry Standards Updates

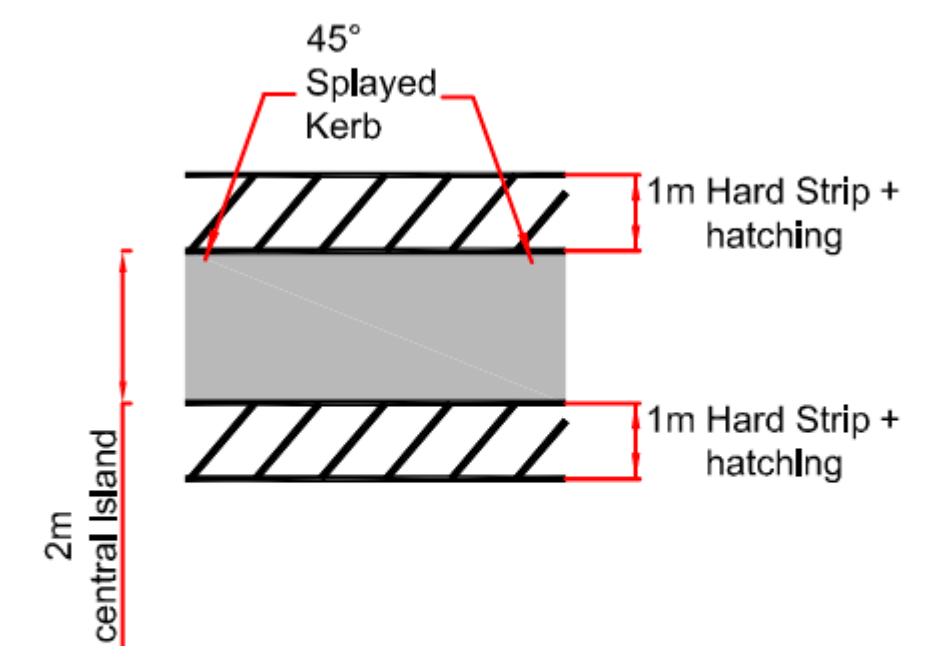
Key Updates Include:

2.0 Cross Section (continued)

- Requirement for Single Lane Dualling at Single Carriageway Compact Junctions



Detail A



Detail B

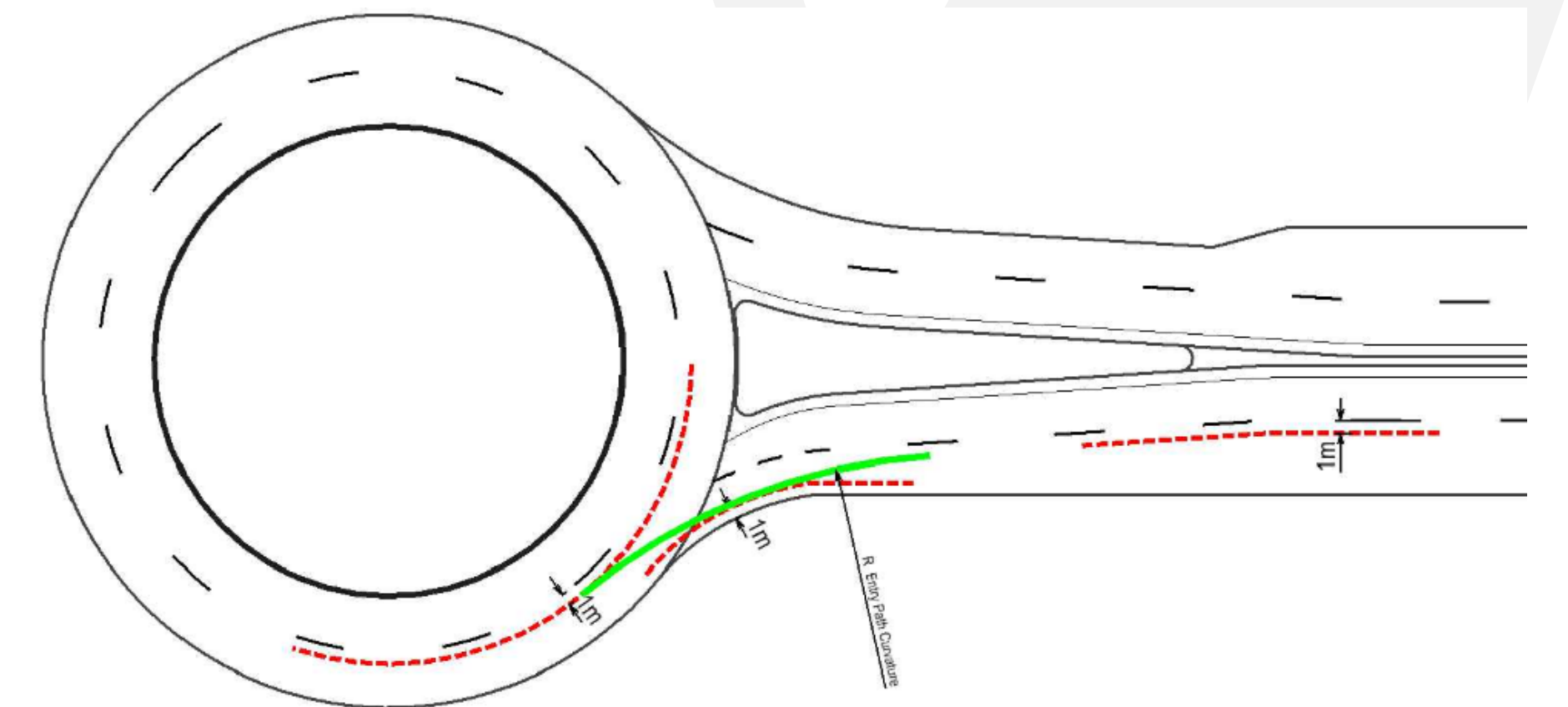
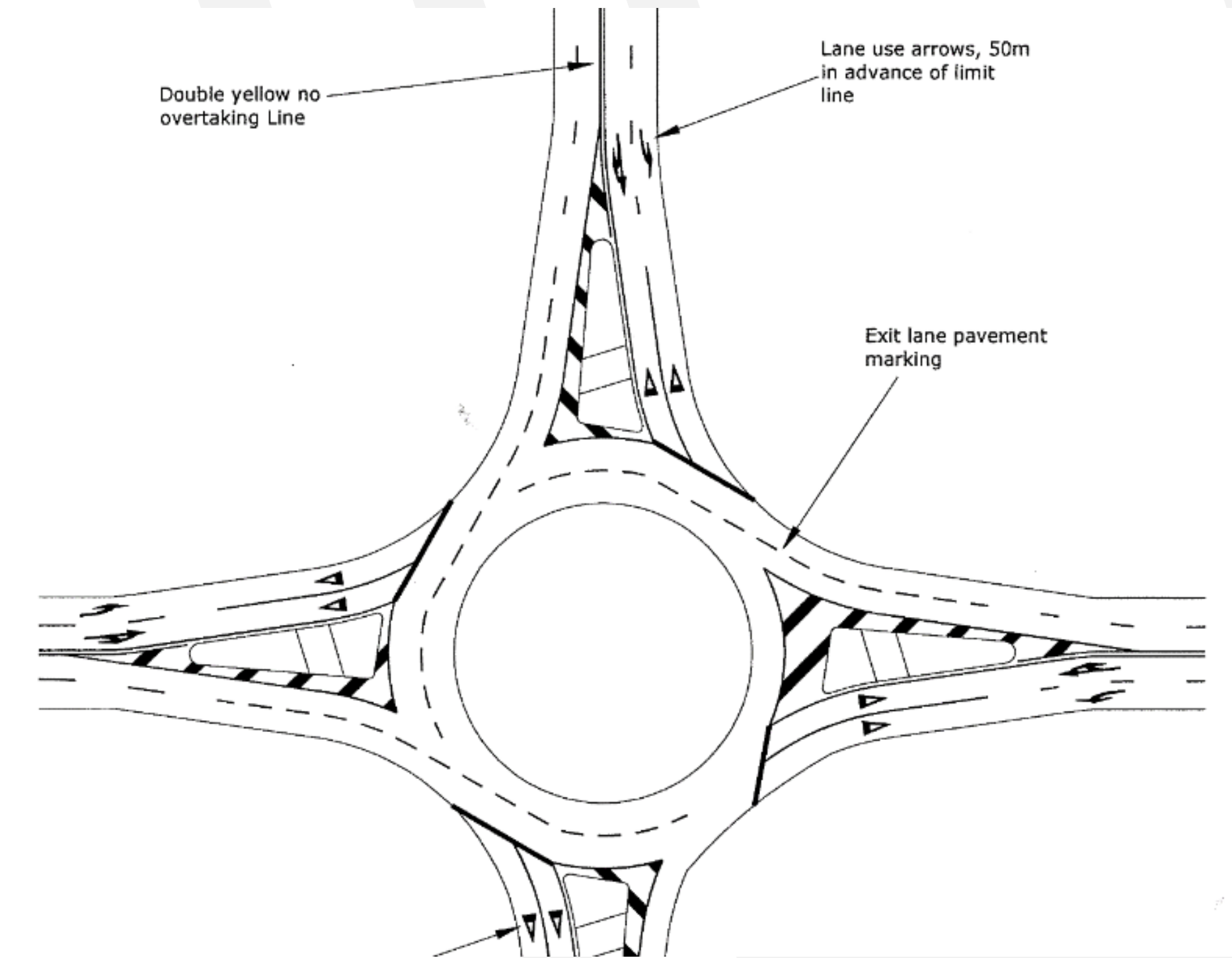
Notes: (1) The value of 'a' is equal to the taper length as per Table 5.9 of DN-GEO-03060
(2) Gap in central island required when carriageway is superelevated

Road Geometry Standards Updates

Key Updates Include:

3.0 Roundabouts

- Roundabout overrun areas
- Roundabout design – flowchart and guidance
- Requirements for:
 - Number of entry lanes
 - Number of exit lanes
 - Number of circulating carriageway lanes
- Linemarking of roundabouts
- Segregated Left Turn Lanes (SLTL) – require departure
- Updated methodology for measurement of Entry Path Radius at Roundabouts

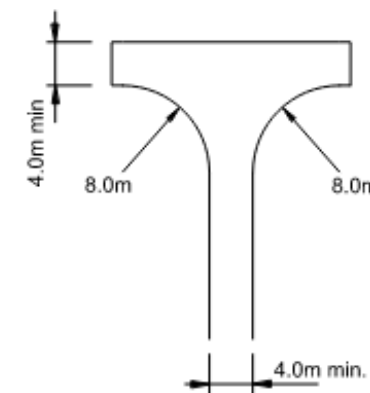
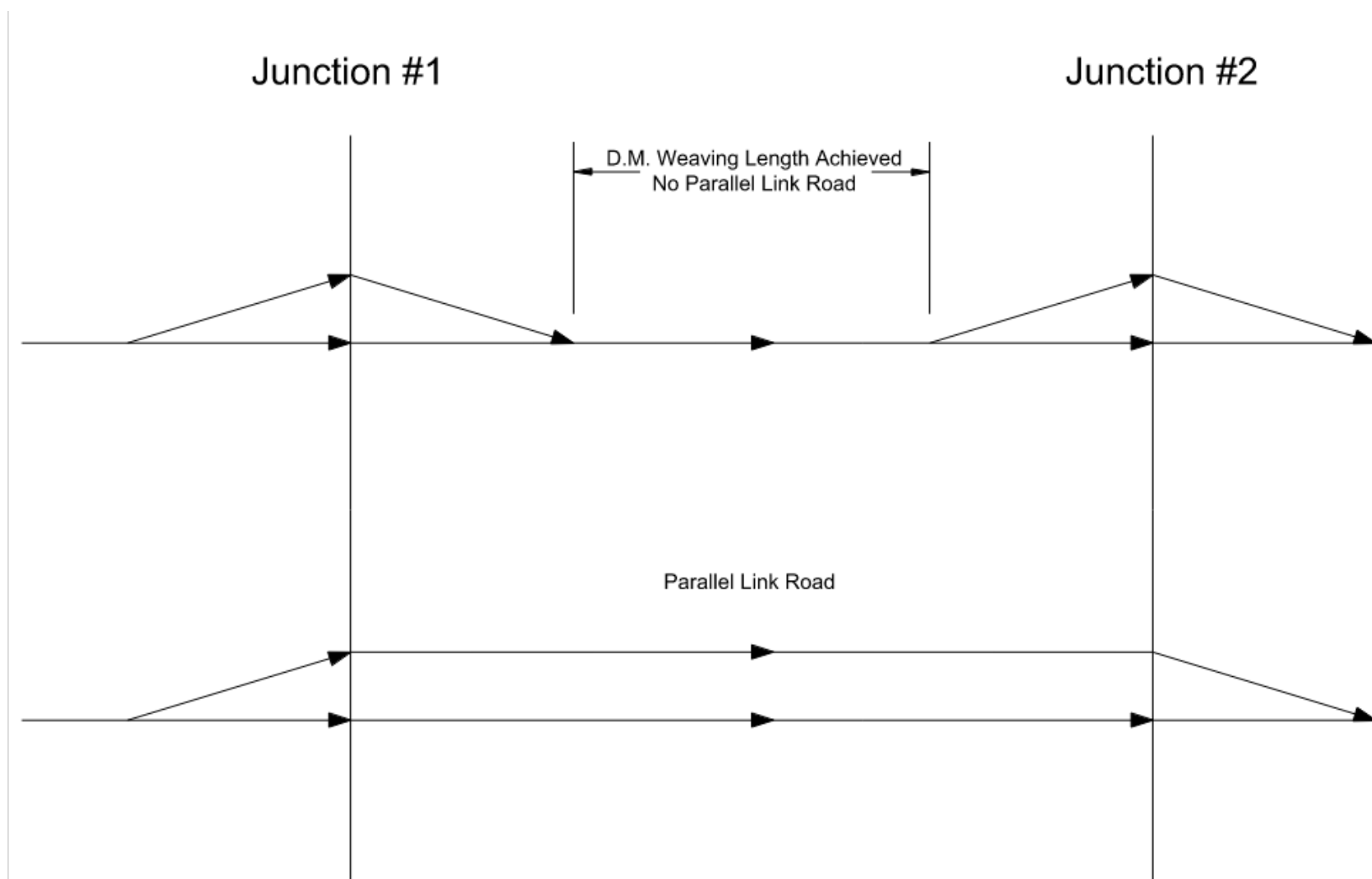


Road Geometry Standards Updates

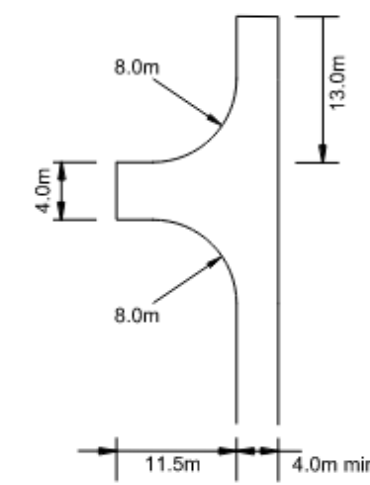
Key Updates Include:

4.0 Junctions

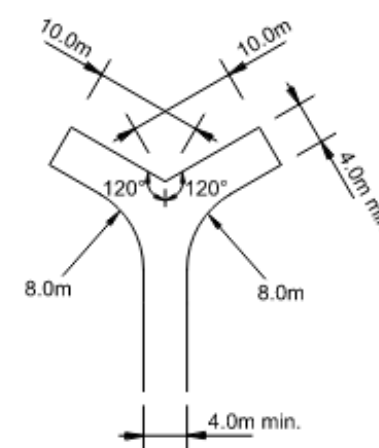
- Ghost Island Priority Junctions
- Weaving Lengths
- Guidance / requirements for Parallel link roads
- Turning Heads



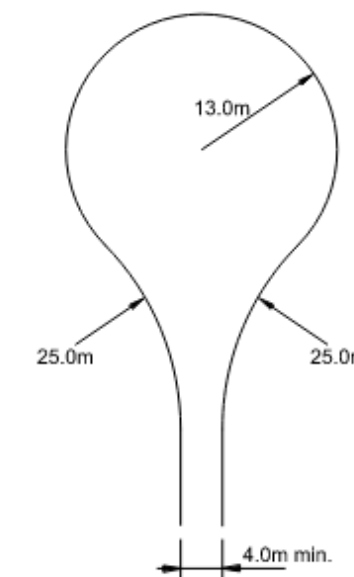
Type (i)



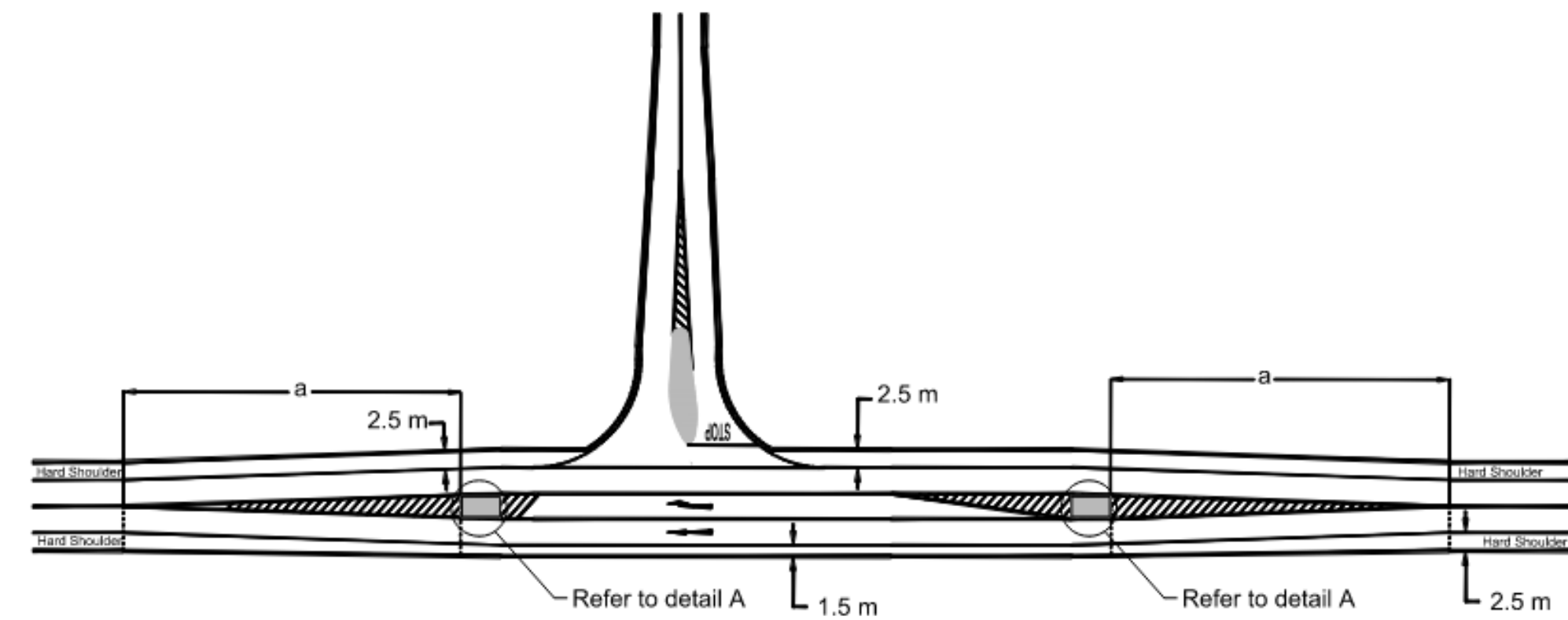
Type (ii)



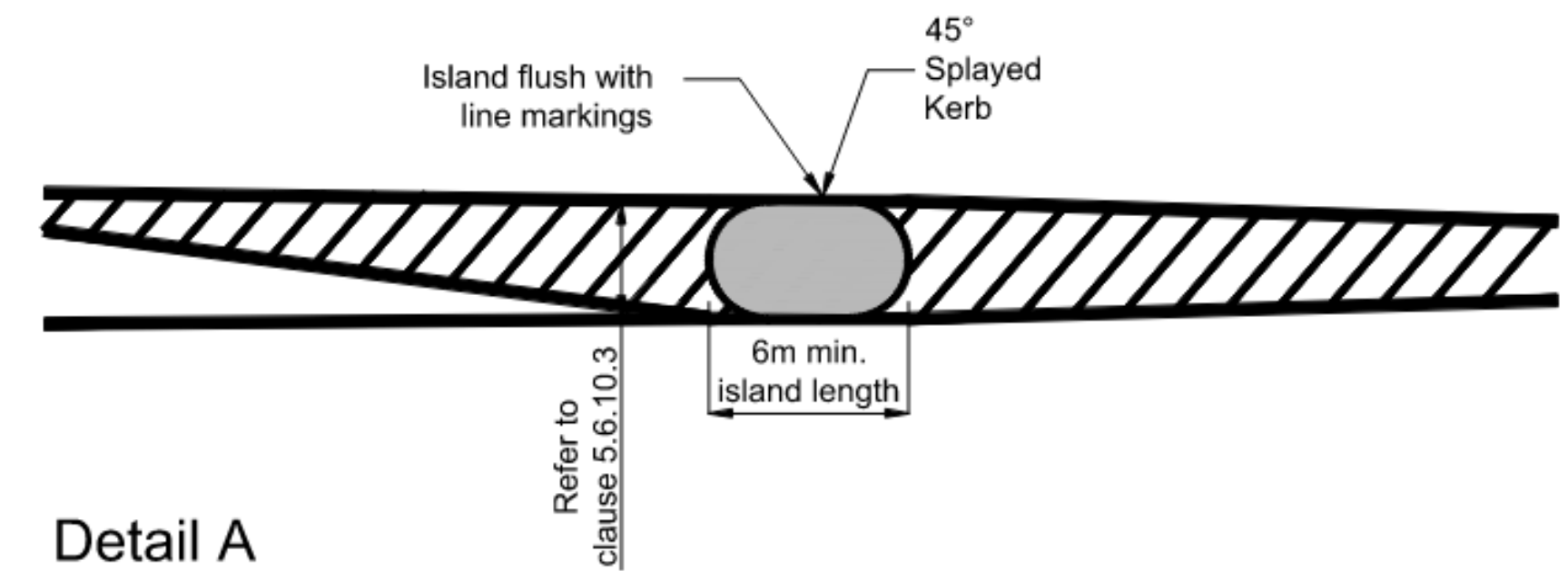
Type (iii)



Type (iv)



a Ghost Island Taper as per Table 5.9

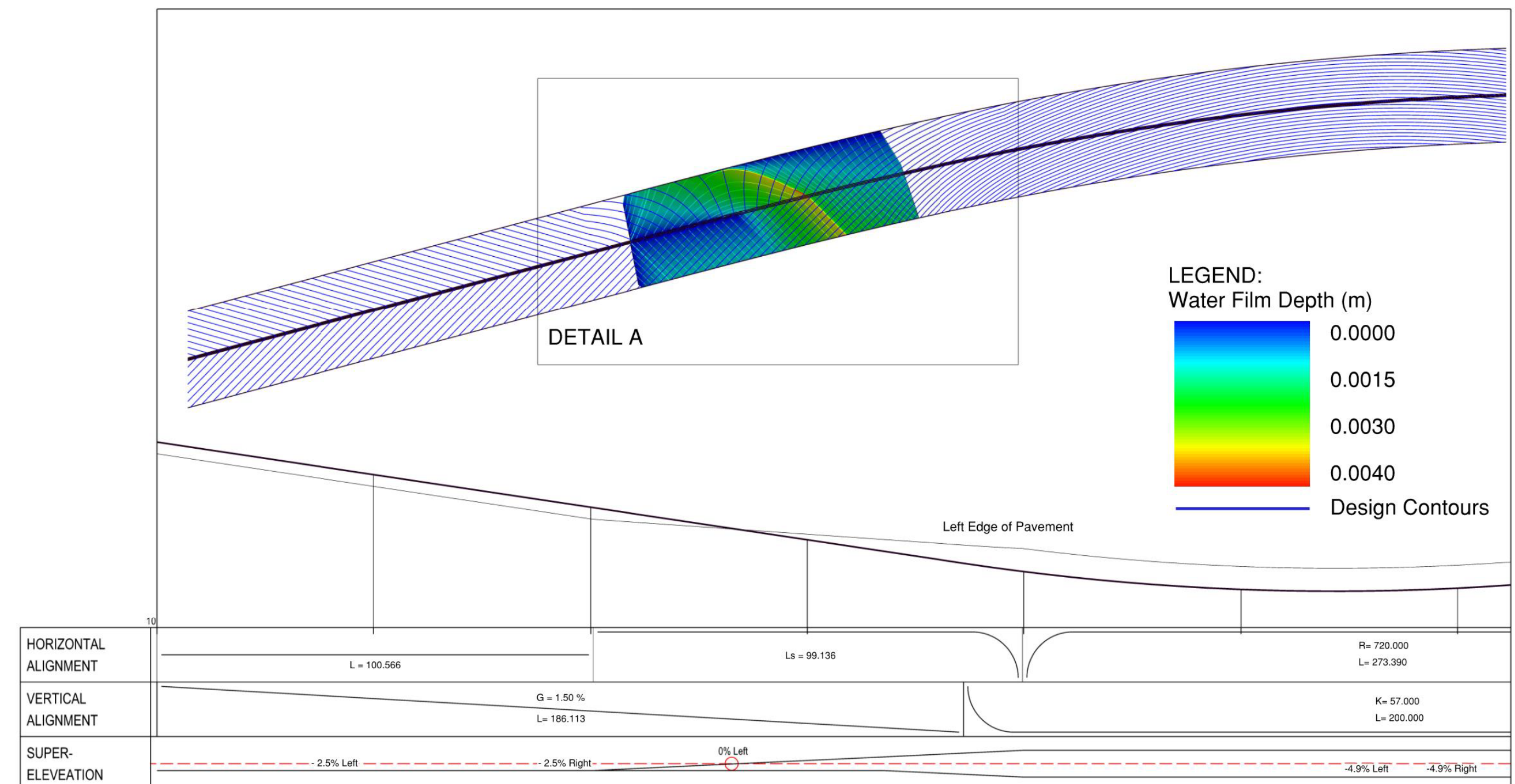
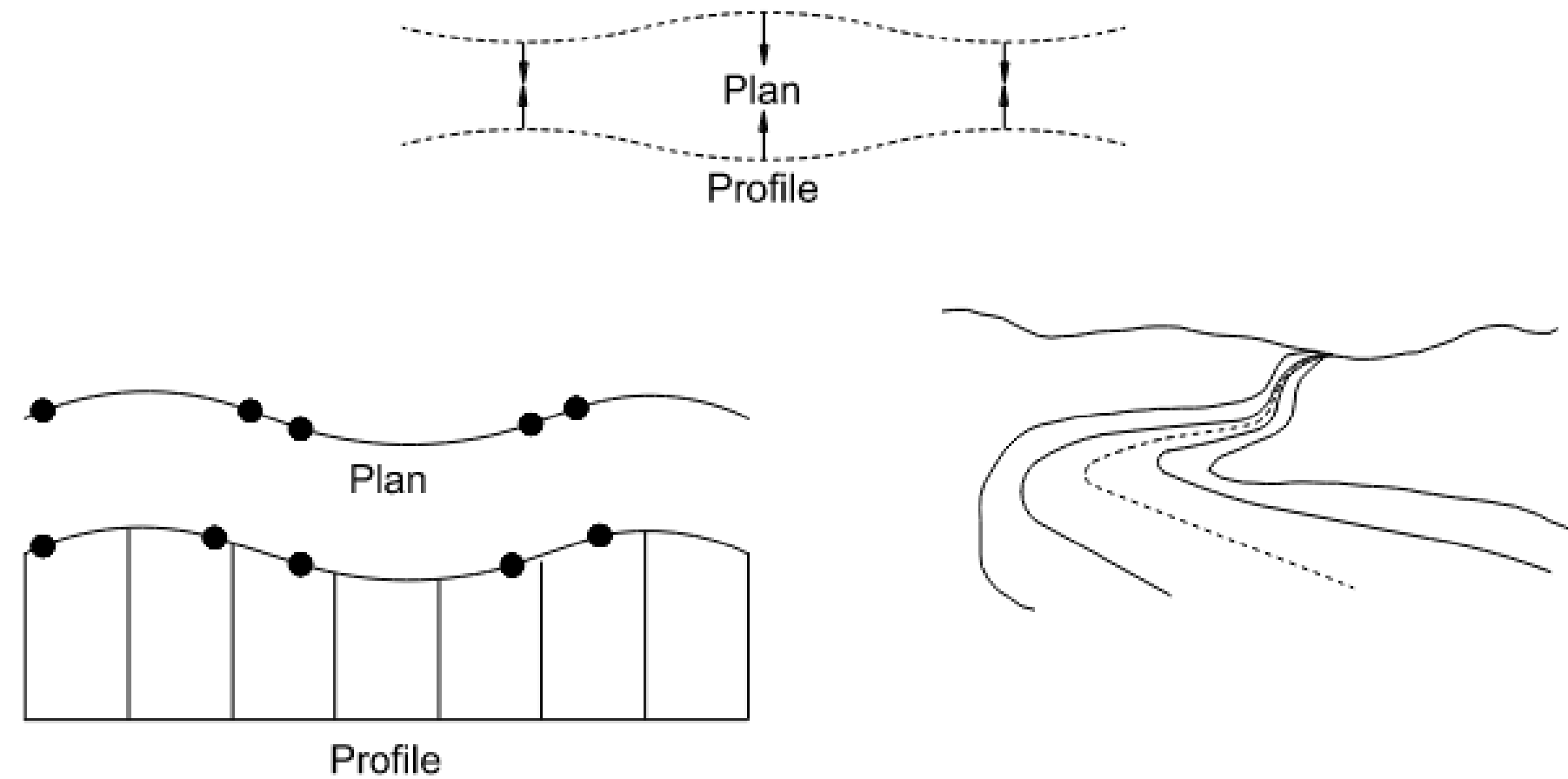


Detail A

Road Geometry Standards Updates

5.0 Alignment

- Superelevation development and avoidance of flatspots – additional guidance
- Horizontal reverse curves
- Horizontal / vertical alignment coordination / phasing
- Consolidation / simplification of relaxations / departures for vertical alignment



6.0 General Updates

- Review and update of images / graphics

Road Geometry Standards Updates

Active Travel

- Presentation of AT related material

2.4 Obstructions to Sight Distance

Care shall be taken to ensure that no substantial fixed obstructions interrupt the sightlines, including road furniture such as traffic signs. However, isolated slim objects such as lighting columns, sign supports, or slim footbridge supports of width 550mm or less can be ignored. Lay-bys shall, wherever possible, be sited on straights or on the outside of curves, where stopped vehicles will not obstruct sightlines.

Long bridge parapets, noise barriers or VRS on horizontal curves may obscure Stopping Sight Distance to the high or low object (or both) depending on the height and positioning of the obstruction. Relaxations below the Desirable Minimum Stopping Sight Distance to the high object and/or low object may be appropriate in such situations. Refer to Tables 2.1 and 2.2 for the number of steps below desirable minimum permissible.

2.5 Sight Distance for Cyclists

The distance at which a cyclist has visibility of potential hazards is an important design parameter. The greater the visibility a cyclist has, the greater their comfort and safety on the cycle facility.

Where on-line, off-road cycle tracks are provided, the visibility parameters achieved will be governed by the visibility standard achieved on the adjacent road. This is based on requirements for motorised vehicles and will exceed the visibility requirements for those of cyclists.

It is noted however, that there may be short sections of these on-line cycle tracks which deviate from the road and are therefore independently designed. 

In such cases, minimum longitudinal gradients will need to be increased to ensure net resultant gradients are achieved. Once the alignment is fixed, superelevation rollover areas shall be checked by triangulation of three-dimensional road models to ensure that no point on the road pavement has a gradient of less than 1%. These models shall take into account pavement construction tolerances. For further advice, refer to Section 3.6 and see Chapter 11.

4.2 Gradients for Cycle Facilities

The overall gradient along a cycle track is an important design consideration. The physical limitations of a cyclist to climb steep inclines and maintain speed, and their ability to stop when descending steep inclines are impacted by the gradient of the cycle facility. Comfort and attractiveness of a cycle track will therefore be greatly increased if the route follows a shallow gradient.

For on-line cycle tracks forming part of the road cross-section, the vertical geometry is likely to closely follow the vertical geometry and gradient of the adjacent road. This should be treated with caution however, as there may be scenarios where grades appropriate and optimal for the road exceed the desirable maximum thresholds for cyclists, and therefore have a negative impact on the comfort and attractiveness of the cycle facility. Where long sections of steep gradients cannot be avoided, then mitigation measures shall be considered, e.g. resting places, increased widths to mitigate conflicts, etc.


There also may be short sections of otherwise on-line cycle tracks which deviate from the road and are independently graded. The maximum vertical gradients outlined in Table 4.3 shall apply to cycle tracks in all areas, to ensure comfort and attractiveness of the facility is maintained on its entirety.

Table 4.3 presents the maximum vertical gradients on a cycle facility.

Table 4.3 Gradient Requirements for Cycle Facilities

| | Gradients |
|----------------------------------|-----------|
| Desirable Minimum | 0.5% |
| Desirable Maximum | 3% |
| One Step Below Desirable Maximum | 5%* |

Notes:

* 5% gradient is only permissible as a Relaxation over short distance (maximum 150m in length). A Departure from Standard is required where a 5% gradient is applied over a length exceeding 150m. 

4.3 Vertical Curves

4.3.1 General

Vertical curves shall be provided at all changes in gradient. The curvature shall be large enough to provide for comfort and, where appropriate, sight distances for safe stopping at the relevant Design Speed. The use of the permitted vertical curve parameters will normally meet the requirements of visibility. However, Stopping Sight Distance shall always be checked because the horizontal alignment of the road, presence of crossfall, superelevation or verge treatment and features such as signs and structures adjacent to the carriageway will affect the interaction between vertical curvature and visibility.

4.3.2 K Values

Curvature shall be derived from the appropriate K value in Table 1.3. The minimum curve lengths can be determined by multiplying the K values shown by the algebraic change of gradient expressed as a percentage, e.g. +3% grade to -2% grade indicates a grade change of 5%. Thus, for a Design Speed of 120 km/h, the length of a crest curve would be:

Road Geometry Standards Update – Programme

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Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Questions and Answers