

Highway Design Report

Preliminary / detailed design – geometric design, junction layout and cross-section

Project	A999 Example Junction Improvement, Fictional Town	Document no.	RRD-SMP-XX-XX-RP-C-0001
Client	None – illustrative capability sample	Revision / status	P02 / S3
Originator	RoadRail Design (NRDMG Yapı Sistemleri A.Ş.)	Date	09/10/2026
Discipline	Highways – geometric design	Security	Public – sample
Prepared by	Senior Highway Engineer	Checked by	Principal Highway Engineer
Approved by	Associate Director – Highways	Classification	Report (RP)

Rev	Date	Status	Description	Prepared	Checked	Approved
P01	14/09/2026	S3	First issue for review and comment	Snr Hwy Eng	Prin. Hwy Eng	Assoc. Dir.
P02	09/10/2026	S3	Updated following client review comments; departure D-001 added	Snr Hwy Eng	Prin. Hwy Eng	Assoc. Dir.

Illustrative sample. This document describes a fictional scheme prepared solely to demonstrate RoadRail Design's report structure, technical approach and standards knowledge. Locations, data, chainages, survey information, traffic figures and collision records are invented. It is not a client project and must not be relied upon for design. References are to the Design Manual for Roads and Bridges (DMRB) documents current at the date of issue; the applicable version of each standard would be confirmed with the Overseeing Organisation on a live project.

1. Introduction

This report records the geometric design basis for the fictional **A999 Example Junction Improvement, Fictional Town**. It sets out the scheme description, design speed derivation, the CD 109 design criteria matrix, the junction and cross-section design, relaxations and departures from standard, design assumptions and the drawing register. It is intended to be read with the Departure from Standard application (RRD-SMP-XX-XX-RP-C-0002), the Road Safety Audit Stage 2 Response Report (RRD-SMP-XX-XX-RP-C-0003) and the Drainage Design Calculation Summary (RRD-SMP-XX-XX-CA-C-0001).

2. Scheme description

2.1 Existing situation

The existing A999 is a rural all-purpose single carriageway (nominal 6.7–7.0 m, no hard strips) subject to the national speed limit (60 mph). At the fictional B9999 Fictional Lane a simple priority T-junction serves Fictional Town to the north. The illustrative collision record (5 years) shows 7 personal injury collisions, 2 serious, of which 5 involved vehicles turning right into the minor road and being struck from behind or by overtaking vehicles. Forward visibility over the existing crest at Ch 1+180 is approximately 90 m.

2.2 Proposed scheme

- Online and partly offline realignment of the A999 between Ch 0+000 and Ch 1+350 (1.35 km) to a standard S2 single carriageway cross-section (CD 127).
- Conversion of the B9999 junction (Ch 0+560) to a **ghost island priority junction** with a protected right-turn lane in accordance with CD 123.
- Proposed reduction of the speed limit to 50 mph through the scheme extent, subject to a Traffic Regulation Order (TRO) by the highway authority.
- 3.0 m shared-use path on the northern verge between the junction and Fictional Town (CD 143 / CD 195).
- New positive drainage with attenuation and a vegetated SuDS swale before outfall (CG 501, CD 532); see RRD-SMP-XX-XX-CA-C-0001.
- Road restraint systems, signing, road markings and lighting at the junction (CD 377, TSRGD 2016, Traffic Signs Manual).

2.3 Traffic

Illustrative base-year (2026) AADT 11,400 vehicles with 9% HGV; design year (2041) AADT 13,600. Junction capacity was checked with a priority-junction capacity model; the design-year PM peak ratio of flow to capacity (RFC) on the right-turn movement is 0.62, below the 0.85 practical threshold.

3. Design standards

Document	Title / application on this scheme
GG 101	Introduction to the DMRB – departures from standard process
GG 104	Requirements for safety risk assessment
GG 119	Road safety audit (Stage 1, 2, 3 and 4)
CD 109	Highway link design – design speed, SSD, horizontal and vertical alignment
CD 123	Geometric design of at-grade priority and signal-controlled junctions
CD 127	Cross-sections and headrooms
CD 143 / CD 195	Designing for walking, cycling and horse-riding / designing for cycle traffic
CD 377	Requirements for road restraint systems
CG 501 / CD 526 / CD 532	Highway drainage design (see separate calculation summary)
TSRGD 2016 / TSM	Traffic signs, road markings and Traffic Signs Manual chapters 3, 4 and 5

4. Design speed

Design speed has been derived in accordance with CD 109 Section 2 from the alignment constraint (A_c) and layout constraint (L_c) for the proposed alignment over a 2 km assessment length.

Parameter	Value	Basis
Bendiness, B	38 °/km	Sum of deflection angles over assessment length
Harmonic mean visibility, VISI	230 m	Measured from proposed alignment model
Alignment constraint, A_c (single carriageway)	$12 - \text{VISI}/60 + 2B/45 = \mathbf{9.9 \text{ kph}}$	CD 109 equation for single carriageways
Layout constraint, L_c	21 kph	7.3 m carriageway, 1.0 m hard strips, 2.5 m verges, medium access frequency
Proposed mandatory speed limit	50 mph	Subject to TRO
Design speed adopted	85A kph	CD 109 design speed relationship for A_c , L_c and speed limit

5. Design criteria matrix (CD 109 / CD 123 / CD 127)

Desirable minimum values and values one step below are those of CD 109 Table 2.10 for an 85 kph design speed. SSD is measured from a driver's eye height of 1.05 m to an object height of 0.26 m. K values are expressed as curve length (m) per 1% algebraic change of gradient.

Parameter	Desirable min / max	One step below (relaxation)	Design value	Location	Status
Stopping sight distance (SSD)	160 m	120 m	$\geq 165 \text{ m}$	Ch 0+000-1+120, 1+240-1+350	Compliant
SSD over crest VC3	160 m	120 m	106 m	Ch 1+120-1+240	Departure D-001
Min. R without elimination of adverse camber and transitions	1440 m	-	HC1, HC2 below	HC1, HC2	Superelevation + transitions provided
Min. R with superelevation of 5%	1020 m	-	720 m (e = 3.5%)	HC1 Ch 0+180-0+410	Compliant ($\geq 510 \text{ m}$)
Desirable min. R with superelevation of 7%	510 m	360 m	400 m (e = 6.4%)	HC2 Ch 0+700-0+920	Relaxation R-01
Crest K value	55	30	60	VC1 Ch 0+180-0+420	Compliant
Crest K value	55	30	24	VC3 Ch 1+120-1+240	Departure D-001
Sag K value	20	-	28	VC2 Ch 0+715-0+845	Compliant
Maximum gradient (single carriageway)	6% desirable max	-	3.2%	Ch 0+845-1+120	Compliant
Minimum gradient, kerbed sections	0.5%	-	1.5%	Junction Ch 0+480-0+640	Compliant
Superelevation, rural (max)	7%	-	6.4%	HC2	Compliant
Full overtaking sight distance (FOD)	410 m	-	28% of length $\geq$ FOD	Ch 0+000-0+420	Recorded
Junction visibility x / y distance (minor road)	x = 4.5 m, y = 160 m	-	x = 4.5 m, y $\geq$ 175 m	B9999 arm	Compliant
Lane width / hard strip (S2)	3.65 m / 1.0 m	-	3.65 m / 1.0 m	Throughout	Compliant

Parameter	Desirable min / max	One step below (relaxation)	Design value	Location	Status
Verge width	≥ 2.5 m	-	2.5 m S; 3.0 m path + 0.5 m N	Throughout	Compliant
Crossfall (normal camber)	2.5%	-	2.5%	Straights	Compliant

Superelevation is calculated from $S = V^2 / (2.828 \times R)$ with $V = 85$ kph and is developed over the transition curves; for HC1 ($R = 720$ m) $S = 3.5\%$ and for HC2 ($R = 400$ m) $S = 6.4\%$, within the 7% rural maximum. Vertical curve lengths: VC1 $L = 60 \times 4.0 = 240$ m; VC2 $L = 28 \times 4.7 = 132$ m; VC3 $L = 24 \times 5.0 = 120$ m.

6. Junction design (CD 123)

- Ghost island layout with 3.5 m right-turn lane, 3.65 m through lanes and hatched ghost island taper; turning length and deceleration length sized to the CD 123 values for an 85 kph major road design speed.
- Minor road (B9999) widened to 6.75 m with entry radius 15 m; tracked for a 16.5 m articulated vehicle and a 12 m rigid vehicle using swept-path analysis software.
- Junction located on straight (Ch 0+480-0+640) on a 1.5% gradient, clear of HC1 and HC2 and outside the influence of departure D-001 (crest at Ch 1+180, 620 m east).
- No overtaking through the ghost island (TSRGD hatching with warning line and double white line on approaches).

7. Cross-section (CD 127)

Standard rural single carriageway (S2): 2 × 3.65 m lanes, 1.0 m hard strips each side, 2.5 m southern verge and 3.5 m northern verge accommodating a 3.0 m shared-use path with 0.5 m buffer; kerbed only at the junction. Earthworks side slopes 1V:2.5H in cut and 1V:3H in fill (subject to geotechnical confirmation). Pavement construction is assumed at 620 mm (subgrade CBR 3% with capping).

8. Relaxations and departures summary

Ref.	Standard / clause	Description	Justification	Status
R-01	CD 109, horizontal curvature (Table 2.10)	$R = 400$ m at HC2, one step below desirable minimum radius (510 m) with 6.4% superelevation	Avoids land take from fictional Grade II listed farmstead curtilage; SSD on curve ≥ 165 m; no coincident relaxations; recorded in the design file in line with CD 109	Recorded – within designer's remit
D-001	CD 109, SSD and crest K (Table 2.10)	Crest $K = 24$ and SSD = 106 m at VC3, below one step below desirable minimum	Fixed vertical constraint from fictional gas main at Ch 1+195; improves on existing SSD of c. 90 m; mitigation proposed	Submitted to Overseeing Organisation (RRD-SMP-XX-XX-RP-C-0002)

No relaxations or departures are combined at the same location. A GG 104 safety risk assessment has been carried out for D-001 and is included in the departure application.

9. Assumptions and limitations

- Topographical survey (fictional) to OS National Grid / ODN; accuracy ±20 mm in level.
- Traffic data and collision history are illustrative and have not been validated.
- The 50 mph speed limit TRO will be promoted by the highway authority prior to opening.
- Statutory undertakers' apparatus is based on desktop records (PAS 128 survey category D); the intermediate-pressure gas main at Ch 1+195 is assumed to remain in place.
- Ground conditions assumed suitable for earthworks reuse; geotechnical design per CD 622 to follow.
- Outfall consent to Fictional Brook (ordinary watercourse) to be obtained from the Lead Local Flood Authority.
- Departure D-001 is assumed approved for the purposes of this issue; design to be reviewed if rejected.

10. Drawing register

Drawing no.	Title	Scale	Rev	Status
RRD-SMP-XX-XX-DR-C-0001	Location plan and key plan	1:10 000	P02	S3
RRD-SMP-XX-XX-DR-C-0002	General arrangement – sheet 1 of 2 (Ch 0+000-0+700)	1:1000	P02	S3
RRD-SMP-XX-XX-DR-C-0003	General arrangement – sheet 2 of 2 (Ch 0+700-1+350)	1:1000	P02	S3
RRD-SMP-XX-XX-DR-C-0004	Mainline plan and profile – sheet 1 of 2	1:1000 H / 1:100 V	P02	S3

Drawing no.	Title	Scale	Rev	Status
RRD-SMP-XX-XX-DR-C-0005	Mainline plan and profile - sheet 2 of 2	1:1000 H / 1:100 V	P02	S3
RRD-SMP-XX-XX-DR-C-0006	B9999 junction - general arrangement and setting out	1:500	P02	S3
RRD-SMP-XX-XX-DR-C-0007	Visibility envelopes and SSD assessment	1:1000	P02	S3
RRD-SMP-XX-XX-DR-C-0008	Typical cross-sections	1:50	P01	S3
RRD-SMP-XX-XX-DR-C-0009	Swept-path analysis - B9999 junction	1:500	P01	S3
RRD-SMP-XX-XX-DR-C-0010	Road markings and traffic signs - sheet 1 of 2	1:500	P01	S3
RRD-SMP-XX-XX-DR-C-0011	Road restraint systems layout	1:1000	P01	S3
RRD-SMP-XX-XX-DR-C-0501	Drainage general arrangement and long sections	1:1000	P02	S3

ISO 19650 naming: Originator (RRD) - Project (SMP) - Functional breakdown (XX) - Spatial breakdown (XX) - Form (RP report, DR drawing, CA calculation) - Role (C civil) - Number. Status S3 = suitable for review and comment; revision P = preliminary.