



COMHAIRLE CONTAE MHAIGH EO

N60 BALLA TO CLAREMORRIS ROAD PROJECT AT HEATHLAWN

Improvements to the N60 road in the townlands of Pollavaddy, Garhawnagh, Carrowgarve, Rathduff, Knocknamoghalaun, Heathlawn, Brees, Ballintleva and Barnagreggaun in the D.E.D.'s of Balla and Mayo, County Mayo.



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Design Report

Mayo County Council
Aras an Chontae
The Mall
Castlebar
Co. Mayo

Mayo National Roads Design Office

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This Design Report has been prepared by Jacobs Engineering Ltd Ireland on behalf of Mayo County Council to describe the work undertaken on the Design of the N60 Balla to Claremorris Road Project at Heathlawn. The proposed development is an improvement to a section of existing N60 National Secondary route in County Mayo, between Balla and Claremorris. The location of the proposed scheme is detailed in Design drawing 32103901-PRD-00.

The N60 links Castlebar to Roscommon via a number of towns and villages including Manulla, Balla, Claremorris, Ballyhaunis, Ballinlough, Castlerea and Ballymoe.

The section of the N60 under consideration in this report is approximately 3.6km in length in the townlands of Pollavaddy, Garhawnagh, Carrowgarve, Rathduff, Knocknamoghalaun, Heathlawn, Brees, Ballintleva and Barnagreggaun in the D.E.D.'s of Balla and Mayo, County Mayo. The proposed cross-section is a Type 2 Single Carriageway with Cycleway which consists of 7m carriageway, 0.5m hard strips, 1.75m to 2.5m cycleway, 1.0m to 2.0m segregation (includes 0.5m hardstrip) and verges of approximately 0.75m to 3.0m. The design speed is 100km/h. Three T-junctions are being modified to accommodate local roads and a right / left stagger junction is being provided at Heathlawn providing priority to N60 traffic.

1.1 Purpose of Design Report

This report will inform the work undertaken to date developing the design, providing a description of the project detailing the key engineering issues. It will also address and present issues relating to compliance with relevant standards. The report should be read in conjunction with the Road Design drawings listed in the table below.

Drawing Number	Title
32103901/PRD/00	Design Location Plan
32103901/PRD/01	Design Plan & Long Section of Mainline Design Sheet 1 of 5
32103901/PRD/02	Design Plan & Long Section of Mainline Design Sheet 2 of 5
32103901/PRD/03	Design Plan & Long Section of Mainline Design Sheet 3 of 5
32103901/PRD/04	Design Plan & Long Section of Mainline Design Sheet 4 of 5
32103901/PRD/05	Design Plan & Long Section of Mainline Design Sheet 5 of 5
32103901/PRD/06	Design Plan & Long Section of Side Road Design Sheet 1 of 3
32103901/PRD/07	Design Plan & Long Section of Side Road Design Sheet 2 of 3
32103901/PRD/08	Design Plan & Long Section of Side Road Design Sheet 3 of 3
32103901/PRD/09	Design Typical Cross Sections

Table 1-A Road Design Drawings

1.2 Benefits of the Proposed Development

Improving road safety along the route is of paramount importance. The National Secondary Roads Needs Study states, “the historical accident data suggests accidents regularly occur along the route, particularly over the section between Castlebar and Claremorris”.

Using data extracted from the Road Safety Authority website, over the five-year period of 2005-2009 there were 9 road collisions within the scheme – one fatal, two serious and six minor. These accidents are illustrated in the figure below.

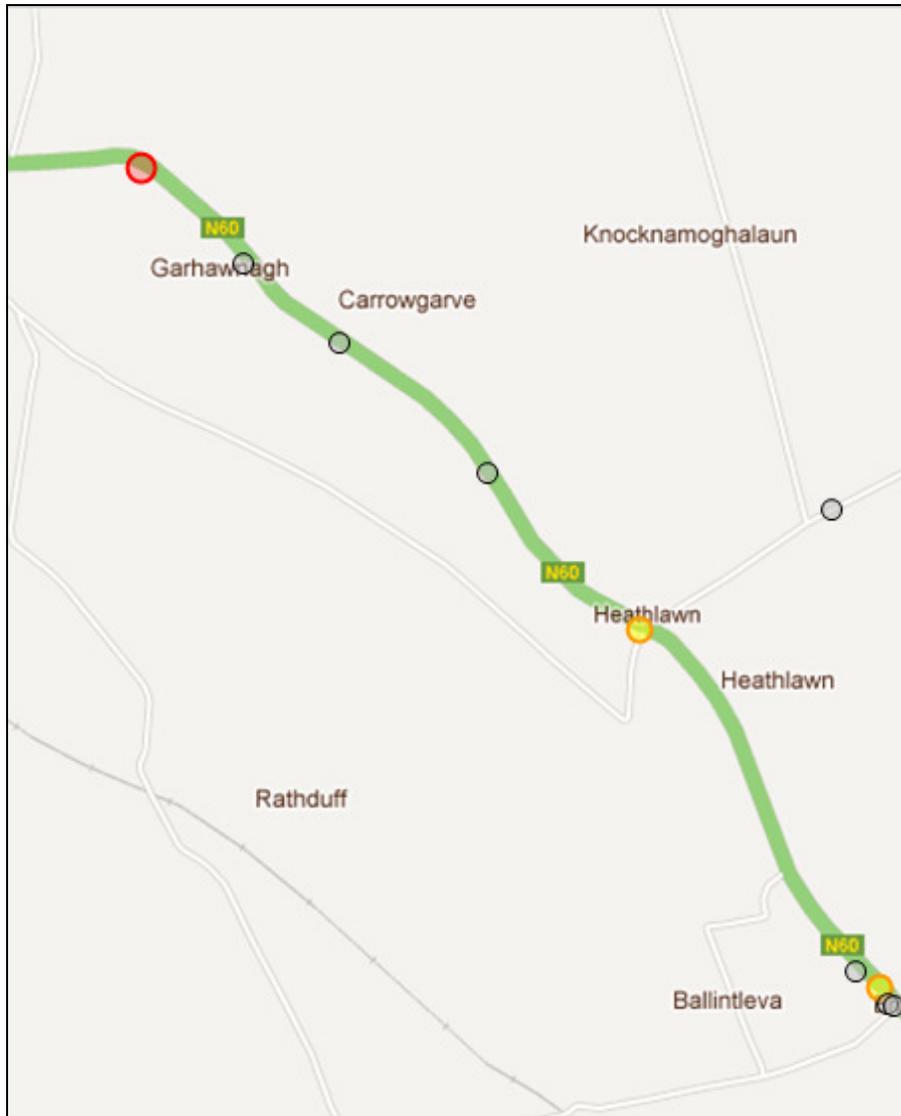


Figure 1-A - N60 Collision Data 2005-2009

- Red – Fatal
- Yellow – Serious
- Grey – Minor

There are areas of poor alignment throughout the scheme that will benefit from the provision of a consistent carriageway cross section and an improved alignment. Visibility along the mainline and from junctions and accesses will also be improved. These measures will have a positive impact on road safety.

Improving the safety for Non-Motorised Users is also a priority for the scheme. This will be achieved by the provision of a cycleway on the north side of the carriageway.

The scheme is consistent with the National Development Plan 2007-2013.

The completion of this scheme is consistent with the objectives of local policy documents such as the West Regional Planning Guidelines and the Mayo County Development Plan 2008-2014.

1.3 Traffic Data

Using data from the NRA website for Automatic Traffic Counter Statistics, the Average Annual Daily Traffic for 2010 was 5523, of which 5.1% was Heavy Commercial Vehicles.

12-hour junction turning counts for the local roads within the scheme are detailed below

- *L-65426-0 – 148 vehicles, HGV% 6.1*
- *L-55392-0 – 70 vehicles, HGV% 37.1*
- *L-5542-0 – 208 vehicles, HGV% 5.3*
- *L-55395-0 – Not available*
- *L-5539-0 – Not available*

The proposed development is approximately 3.6km in length comprising mainline road widening and realignment to upgrade the existing carriageway to a Type 2 Single Carriageway with Cycleway. This is composed of a 7m carriageway, 0.5m hard strips, 1.75m to 2.5m cycleway, 1.0m to 2.0m segregation (includes 0.5m hardstrip) and verges of typically 0.75m to 3.0m. At the northern end of the scheme the mainline alignment is adjacent to a candidate Special Area of Conservation (cSAC). To minimise impact on the cSAC, the verge width has been reduced on the south verge to 0.5m for 270m. Other associated improvements and construction related activities include:

- *Five At-Grade Priority Junctions*
- *Earthworks*
- *Drainage*
- *Landscaping*
- *Public Utilities Diversions*
- *Traffic Management*
- *Access and Accommodation Works*
- *Road Signs and Markings*

2.1 Road Closures

Where the proposed carriageway is off line it is proposed to extinguish the public right of way (permanent road closure) on the redundant carriageway.

3

Alignment Design

3.1 Standards Used

The design has been prepared in accordance with the National Roads Authority (NRA) Design Manual for Roads and Bridges (DMRB).

The following NRA DMRB standards have been used to design the mainline, side roads and accesses:

- *TD 9/11 Road Link Design*
- *TD 41/42 Geometric Design of Major / Minor Priority Junctions and Vehicular Access to National Roads*

3.2 Mainline Alignment

The design speed applied to the proposed mainline is 100 km/h in accordance with TD 9/11. A summary of the horizontal and vertical alignments are detailed in Tables 3-A and 3-B, respectively.

Element	Start Chainage	End Chainage	Length (m)	Arc Radius (m)	Direction
1. Straight	1000.000	1129.932	129.320	-	-
2. Transition	1129.932	1240.532	110.600	-	-
3. Radius	1240.532	1616.388	375.857	510.000	Right
4. Transition	1616.388	1726.988	110.600	-	-
5. Straight	1726.988	1734.354	7.365	-	-
6. Transition	1734.354	1804.354	70.000	-	-
7. Radius	1804.354	2093.364	289.010	1020.000	Left
8. Transition	2093.364	2163.364	70.000	-	-
9. Straight	2163.364	2245.025	81.662	-	-
10. Transition	2245.025	2344.025	99.000	-	-
11. Radius	2344.025	2569.278	225.253	720.000	Right
12. Transition	2569.278	2668.278	99.000	-	-
13. Transition	2668.278	2738.278	70.000	-	-
14. Radius	2738.278	3029.105	290.827	1020.000	Left
15. Transition	3029.105	3099.105	70.000	-	-
16. Straight	3099.105	3142.411	43.306	-	-
17. Transition	3142.411	3212.411	70.000	-	-
18. Radius	3212.411	3743.510	531.099	1020.000	Right
19. Transition	3743.510	3813.510	70	-	-
20. Straight	3813.510	3821.170	7.660	-	-
21. Transition	3821.170	3920.170	99.000	-	-
22. Arc	3920.170	4128.549	208.378	720.000	Left
23. Transition	4128.549	4227.549	99.000	-	-
24. Straight	4227.549	4541.543	313.994	-	-

Table 3-A N60 Mainline Horizontal Alignment Elements

A 510m radius horizontal curve is used at Ch. 1240 – 1620 which is a relaxation of one step below desirable minimum. The curve is used to avoid impact on residential

properties whilst still being able to tie into the existing carriageway at Ch. 1000. In order to achieve Stopping Sight Distance (SSD) in this area verge widening is required but this is restricted due to the adjacent cSAC. As a result SSD drops to three steps below in areas. In addition, SSD is affected by a redundant section of carriageway where vehicles could potentially park. This redundant section must be retained to allow access to adjacent residential properties.

Element	Start Chainage	End Chainage	Length (m)	Gradient (%)	K Value
1. Grade	1000.000	1063.511	63.511	2.569	-
2. Crest	1063.511	1166.340	102.828	2.569 to 1.541	100.000
3. Sag	1166.340	1201.969	35.629	1.541 to 2.504	37.000
4. Crest	1201.969	1616.433	414.464	2.504 to -0.950	120.000
5. Grade	1616.433	1864.859	248.425	-0.950	-
6. Sag	1864.859	1881.508	16.650	-0.950 to -0.500	37.000
7. Grade	1881.508	1959.184	77.675	-0.500	-
8. Sag	1959.184	2200.231	241.047	-0.500 to 1.910	100.000
9. Sag	2200.231	2220.970	20.739	1.910 to 2.471	37.000
10. Crest	2220.970	2593.401	372.431	2.471 to -1.253	100.000
11. Grade	2593.401	2748.681	155.280	-1.253	-
12. Sag	2748.681	2849.542	100.861	-1.253 to 1.473	37.000
13. Grade	2849.542	3022.921	173.379	1.473	-
14. Crest	3022.921	3134.923	112.001	1.473 to 0.353	100.000
15. Sag	3134.923	3251.196	116.273	0.353 to 3.495	37.000
16. Crest	3251.196	3526.675	275.479	3.495 to 0.740	100.000
17. Grade	3526.675	3774.102	247.427	0.740	-
18. Crest	3774.102	4016.670	242.567	0.740 to -3.670	55.000
19. Grade	4016.670	4126.305	109.637	-3.670	-
20. Sag	4126.305	4222.639	96.333	-3.670 to 0.035	26.000
21. Grade	4222.639	4464.009	241.371	0.035	-
22. Sag	4464.009	4526.717	62.708	0.035 to 1.730	37.000
23. Grade	4526.717	4565.467	38.749	1.730	-

Table 3-B N60 Mainline Vertical Alignment Elements

Ch. 3775 – 4020 has a crest K value of 55 and Ch. 4120 – 4215 has a sag K value of 26, both of which are one step below desirable minimum. Both sections are on the approach to a junction resulting in a departure from standard for the crest curvature. This section is online resulting in these sub-standard crest and sag values matching closer to the existing road for constructability purposes.

3.3 Side Roads Alignment

The proposed mainline alignment requires five adjoining local roads to be realigned to tie into the new mainline alignment. The design speed applied to these local side roads is 50km/h, although the speed limit of the roads is 80 km/h. The sections to be realigned are relatively short in length and therefore 50km/h design speed was selected as it is anticipated that the operating speed of vehicles will be greatly reduced within the vicinity of the junction with the mainline.

A staggered junction is proposed to replace a crossroads at Heathlawn. The replacement of rural crossroads with staggered junctions has been shown to reduce collisions by some 60% (NRA TD 41-42/11).

The typical cross section of the side roads is 6.0m carriageway, 0.5m hardstrips (in the junction mouth only) and 0.5m verges. The cross section tapers down to tie into the existing cross section over the length of the realignment.

Provision for right turning facilities, in the form of ghost islands, has been incorporated at two locations. The staggered junction at Heathlawn makes use of a symmetrical ghost island, whereas an asymmetrical ghost island had been utilised at the eastern end of the scheme to avoid impacting on residential properties.

3.3.1 Realignment of L-65426-0

L-65426-0 is located in the townland of Pollavaddy and forms a simple junction with the proposed mainline at approximately Ch. 1040. The length of the realignment is approximately 120m. A summary of the horizontal and vertical alignments are detailed in Tables 3-C and 3-D, respectively.

Element	Start Chainage	End Chainage	Length (m)	Arc Radius (m)	Direction
1. Straight	0.000	15.331	15.331	-	-
2. Transition	15.331	40.131	24.800	-	-
3. Radius	40.131	74.049	33.918	180.000	Right
4. Transition	74.049	98.849	24.800	-	-
5. Straight	98.849	117.473	18.625	-	-

Table 3-C L-65426-0 Side Road Horizontal Alignment Elements

There are no Relaxations or Departures from Standards relating to the horizontal alignment of L-65426-0.

Element	Start Chainage	End Chainage	Length (m)	Gradient (%)	K Value
1. Grade	0.000	15.000	15.000	4.000	-
2. Sag	15.000	54.000	39.000	4.000 to 10.000	6.500
3. Grade	54.000	64.494	10.493	10.000	-
4. Crest	64.494	107.072	42.579	10.000 to 5.742	10.000
5. Grade	107.072	117.473	10.401	5.742	-

Table 3-D L-65426-0 Side Road Vertical Alignment Elements

The existing carriageway is steep and does not have a standard dwell area. Relaxations were introduced to the proposed local road to allow for a dwell area. A Relaxation of 4% grade has been applied to the dwell area. A one step below desirable minimum sag K of 6.5m, which is a Relaxation, has been used on approach to the junction. Also a departure of 10% grade has been applied to enable the proposed carriageway to tie into the existing carriageway.

3.3.2 Realignment of L-55392-0

L-55392-0 is located in the townland of Rathduff and partly in Heathlawn. It forms a staggered junction with L-5542-0 and is sited at approximately Ch. 3160, 50m from L-5542-0. A ghost island is incorporated on the mainline at this location to allow safe right turning manoeuvres onto this local road. The length of the realignment is approximately 260m. A summary of the horizontal and vertical alignments are detailed in Tables 3-E and 3-F, respectively.

Element	Start Chainage	End Chainage	Length (m)	Arc Radius (m)	Direction
1. Radius	0.000	16.109	16.109	50.000	Left
2. Transition	16.109	41.098	24.989	-	-
3. Radius	41.098	88.777	48.157	180.000	Left
4. Transition	88.777	113.577	24.8	-	-
5. Transition	113.577	138.377	24.8	-	-
6. Radius	138.377	189.942	51.565	180.000	Right
7. Transition	189.942	214.742	24.8	-	-
8. Straight	214.742	258.484	43.742	-	-

Table 3-E L-55392-0 Side Road Horizontal Alignment Elements

Element	Start Chainage	End Chainage	Length (m)	Gradient (%)	K Value
1. Sag	0.000	168.278	168.278	-1.742 to 2.806	37.000
2. Crest	168.278	180.255	11.977	2.806 to 1.608	10.000
3. Grade	180.255	237.846	57.590	1.608	-
4. Crest	237.846	258.484	20.639	1.608 to -0.455	10.000

Table 3-F L-55392-0 Side Road Vertical Alignment Elements

There are no Relaxations or Departures from Standards relating to the horizontal or vertical alignment of L-55392-0.

3.3.3 Improvement of L-5542-0

L-5542-0 is located in the townlands of Rathduff, Knocknamoghalaun and Heathlawn. It forms a staggered junction with L-55392-0 and is sited at approximately Ch. 3210, 50m from L-55392-0. A ghost island is incorporated on the mainline at this location to allow safe right turning manoeuvres onto this local road. The length of the realignment is 86m. A summary of the horizontal and vertical alignments are detailed in Tables 3-G and 3-H, respectively.

Element	Start Chainage	End Chainage	Length (m)	Arc Radius (m)	Direction
1. Radius	0.000	19.175	19.175	50.000	Right
2. Straight	19.175	86.000	66.825	-	-

Table 3-G L-5542-0 Side Road Horizontal Alignment Elements

Element	Start Chainage	End Chainage	Length (m)	Gradient (%)	K Value
1. Grade	0.000	11.966	11.966	-2.500	-
2. Sag	11.966	50.555	38.589	-2.500 to 1.788	9.000
3. Crest	50.555	86.000	35.445	-1.788 to -1.757	10.000

Table 3-H L-5542-0 Side Road Vertical Alignment Elements

There are no Relaxations or Departures from Standards relating to the horizontal or vertical alignment of L-5542-0.

3.3.4 Improvement of L-55395-0

L-55395-0 is located in the townland of Ballintleva and forms a simple junction with the proposed mainline at approximately Ch. 3990. The length of the realignment is

approximately 22m. A summary of the horizontal and vertical alignments are detailed in Tables 3-I and 3-J, respectively.

Element	Start Chainage	End Chainage	Length (m)	Arc Radius (m)	Direction
1. Radius	0.000	12.726	12.726	50.000	Left
2. Straight	12.726	22.206	9.480	-	-

Table 3-I L-55395-0 Side Road Horizontal Alignment Elements

There are no Relaxations or Departures from Standards relating to the horizontal alignment of L-55395-0.

Element	Start Chainage	End Chainage	Length (m)	Gradient (%)	K Value
1. Grade	0.000	10.000	10.000	-4.000	-
2. Crest	10.000	13.000	3.000	-4.000 to 010.000	0.500
3. Grade	13.000	18.129	5.129	-10.000	-
4. Sag	18.129	21.173	3.044	-10.000 to -3.912	0.500
5. Grade	21.173	22.206	1.033	-3.912	-

Table 3-J L-55395-0 Side Road Vertical Alignment Elements

There are Relaxations on the dwell area length and gradient. Departures are required on crest and sag K values of 0.5 due to the existing steep ground on approach to the junction. As a consequence of the existing steep ground a grade of 10% has been applied, resulting in a Departure from standard. These Departures were adopted to tie into the existing alignment as soon as possible to avoid regrading a significant length of carriageway which would impact on a number of accesses.

3.3.5 Improvement of L-5539-0

L-5539-0 is located in the townlands of Ballintleva and Barnagreggaun. It forms a simple junction with the proposed mainline at approximately Ch. 4440. A ghost island is incorporated on the mainline at this location to allow safe right turning manoeuvres onto this local road. The length of the realignment is approximately 115m. A summary of the horizontal and vertical alignments are detailed in Tables 3-K and 3-L, respectively.

Element	Start Chainage	End Chainage	Length (m)	Arc Radius (m)	Direction
1. Radius	0.000	25.115	25.115	180.000	Left
2. Straight	25.115	113.448	88.333	-	-

Table 3-K L-5539-0 Side Road Vertical Alignment Elements

There are no Relaxations or Departures from Standards relating to the horizontal alignment of L-5539-0.

Element	Start Chainage	End Chainage	Length (m)	Gradient (%)	K Value
1.Sag	0.000	62.500	62.500	-2.500 to 10.000	5.000
2. Grade	62.500	98.259	35.759	10.000	-
Element	Start Chainage	End Chainage	Length (m)	Gradient (%)	K Value
3. Crest	98.259	113.448	15.189	10.000 to 7.663	6.500

Table 3-L L-5539-0 Side Road Vertical Alignment Elements

The existing junction mouth has very little longitudinal fall which can result in the gathering of standing water during periods of heavy rainfall. The proposed mainline is online in this section with minimal level difference from the existing carriageway to avoid impacting on the adjacent residential properties. To ensure adequate drainage runoff across the proposed junction mouth the mainline carriageway crossfall of 2.5% has been extended across the junction dwell area. Drainage runoff will be collected from gullies in the junction bellmouth.

To maintain the mainline crossfall across the junction dwell area and also allow the proposed local road to tie into the existing steep carriageway, departures from standard were introduced. Departures are required on sag and crest K values of 5 and 6.5 which are two and one step below desirable minimum, respectively, on approach to a junction. Additionally a departure is required for the application of a 10% gradient on approach to a junction.

3.4 Accesses

There are a substantial number of accesses along the length of the existing 3.6km route that require realignment in order to tie into the new mainline. The number of accesses has been reduced by relocating to more suitable and safer locations within the scheme. In addition, visibility from these accesses has been improved as part of the scheme.

A relaxation in dwell area length of 5m has been applied to all residential dwelling accesses and 10m to all other accesses. This reduces the impact on land take. Additionally a Relaxation of 4% on dwell area gradient has been applied to a number of accesses.

The minimum width applied to residential dwelling accesses is 2.5m and 3.5m applied to field accesses. These sizes may increase during landowner consultation to accommodate larger vehicles.

3.5 Access Schedule

The table below details the location of accesses to be constructed as part of the scheme.

Chainage	North / South Verge	Type	Comments
1410	North	Field	Improved
1535	North	Field	Improved
1570	South	Multiple	New
1630	North	Field	Improved
1765	North	Field	Improved
1810	South	Single	Improved
1850	North	Field	Improved
1905	North	Single	Improved
1925	South	Multiple	Improved
1925	North	Single	Improved
1930	North	Single	Improved
1935	North	Single	Improved
1940	South	Single	Improved
1965	South	Field	Improved

Chainage	North / South Verge	Type	Comments
2005	North	Field	Improved
2025	North	Multiple	Improved - access to two properties
2070	North	Single	Improved
2110	North	Single	Improved
2125	North	Single	Improved
2155	North	Single	Improved
2170	North	Single	Improved
2210	North	Single	Improved
2280	South	Single	New
2300	South	Field	New - accessed from 2280
2300	North	Field	Improved
2510	North	Field	Improved
2530	North	Field	Improved
2560	South	Field	Improved
2640	North	Field	New
2665	South	Single	Improved
2714	North	Field	New – accessed from 2715
2715	North	Field	Improved
2725	South	Field	Improved
3020	South	Field	Improved
130	South	Field	New - accessed from L-55392-0
15	North	Field	Accessed from L-5542-0
200	South	Field	New - accessed from L-55392-0
3435	South	Field	New
3470	South	Field	Improved
3535	North	Multiple	Improved
3700	South	Multiple	Improved
3700	South	Field	Accessed from 3700
3700	South	Field	Accessed from 3700
3900	North	Single	Improved
4025	North	Field	Accessed from 4030
4030	North	Field	Improved
4055	North	Single	Improved
4070	North	Field	Improved
4210	North	Single	Improved
4380	North	Field	Improved
4420	North	Single	Improved
90	South	Field	Accessed from L-5539-0
4450	North	Single	Improved
4455	North	Single	Improved
4500	North	Single	Improved

Table 3-M Access Schedule

3.6 Stopping Sight Distance (SSD)

The majority of the mainline achieves full SSD. Exceptions include a stretch of carriageway that is on a sub-standard crest curve and an area adjacent to the cSAC

which has a sub-standard verge width to minimise impact on the cSAC. Lay-bys and accesses may impact on SSD if a vehicle is stopped or parked in them.

In order to achieve visibility from some accesses verge widening is required throughout the scheme.

3.7 Overtaking Value

A sight distance analysis was undertaken on the scheme to assess any areas of Full Overtaking Sight Distance (FOSD). An Overtaking Value of 5% is achieved for the southbound carriageway and 6% for the northbound carriageway.

3.8 Relaxations and Departures from Standards

Relaxations and Departures from NRA DMRB standards that are associated with the design are summarised below. A full list of Relaxations and Departures is provided in Appendix A.

3.8.1 Mainline

There is one Relaxation on vertical curvature and one Relaxation on horizontal curvature related to the mainline. In addition, there are 10 Departures, associated with:

- *SSD (eight Departures)*
- *Cross section*
- *Vertical curvature*

3.8.2 Side Roads

(a) L-65426-0

There is one Relaxation related to dwell area and one associated with vertical curvature. Additionally there is one departure relating to vertical gradient for this local road.

(b) L-55395-0

There are two Relaxations related to dwell area and four Departures associated with:

- *Vertical curvature (two Departures)*
- *Vertical gradient*
- *Junction visibility*

(c) L-5539-0

There are three Departures consisting of two related to vertical curvature and one associated with vertical gradient.

3.8.3 Accesses

Despite the relocation of some accesses there are still Departures present throughout the scheme concerning: the close proximity of junctions to each other;

encroachment of accesses on the visibility requirements of adjoining accesses; and accesses falling within the mainline visibility envelope.

(a) Dwelling Accesses

A Relaxation on dwell area length and gradient has been applied to all dwelling accesses and there are six Relaxations associated with junction visibility.

Moreover, there are 12 Departures relating to dwelling accesses, all of which are associated with junction visibility.

(b) Other Accesses

Accesses, other than dwellings, have a Relaxation applied to dwell area length and gradient. Also there are two Relaxations and two Departures relating to junction visibility.

4 Safety Barrier Requirements

Safety barrier will be implemented at the locations outlined in the table below. NRA DMRB TD 19/09 has been utilised in the design of the barrier. Locations are subject to refinement at detailed design stage.

Location	North / South Verge	Hazard
Ch. 1740 – 1790	North	Embankment > 2m
Ch. 2300 – 2600	North	Embankment > 2m

Table 4-A Safety Barrier Locations

A detailed assessment of the location and depth of interceptor ditches will be undertaken at the detailed design stage to assess which areas may require barrier.

Safety barrier will not be implemented where the design speed of the road is less than 85kph, thus no local roads will make use of safety barrier.

Anti-dazzle fencing was considered for the area of existing carriageway to be retained at Ch 1500 – 1650 to prevent confusion for mainline users from headlights of vehicles using the small section of existing carriageway as an access track. However, in order to maintain acceptable levels of visibility this area will be kept clear.

There are existing utility poles along sections of the scheme that pose hazards to vehicles. It is proposed that the existing poles are to be removed and the utilities relocated underground, thus removing the risk of strike from vehicles. However, there may be some instances where a number of poles will have to be retained to provide supply to residential dwellings. It will be determined at the detailed design stage which poles will be retained and if safety barrier is required to protect vehicles from them.

5 Traffic Signs & Road Markings

Traffic signs and road markings will be prepared as part of the detailed design stage and will be in accordance with the NRA DMRB and the Department of Transport Traffic Signs Manual where possible.

Significant new features will include:

- *Two ghost islands*
- *Stop sign and line introduced at L55395-0*

6.1 Ground Conditions

Mayo County Council commissioned Priority Geotechnical (PGL) to carry out ground investigation for the proposed development and prepare a factual ground investigation report.

PGL reported that the scheme was characterised by glacial deposits of slightly sandy gravelly Silt with Cobbles and Boulders, to depths of 0.6m to 2.1m below existing ground level (bgl). The Silt was underlain by slightly sandy Clay with Cobbles and Boulders of Limestone lithology and very silty sandy Gravel with Cobbles and Boulders of Limestone lithology to depths of 2.6m bgl to 4.1m bgl. Very clayey very gravelly Sand was encountered at a number of locations between 2.3m bgl and 3.0m bgl. Topsoil was encountered being 200mm to 300mm thick. No bedrock was encountered.

Ground water was noted at three trial pit locations during excavation at a depth of 1.6m bgl to 2.4m bgl. The chainages of the trial pits were approximately 2230, 3480 and 3700. A stand pipe location was also implemented at a borehole location at approximately Ch. 2940.

Soil laboratory tests undertaken by PGL revealed a California Bearing Ratio (CBR) value of 1%. This value is particularly low and will require a minimum of 600mm capping and a Geotextile layer to improve the CBR to allow adequate support for the road pavement.

6.2 Earthworks

There are three areas along the mainline route that have significant cut. The total cut for the scheme is estimated to be approximately 55,000m³. The fill material to be deposited across the scheme is approximately 18,000m³. Assuming cut material is suitable to be used as fill across the scheme approximately 37,000m³ of material will be required to be disposed of off site. The capping required to be imported is approximately 28,000m³. The side slopes of the scheme have been designed as a gradient of 1 in 2.

The approximate volume of topsoil to be stripped for the development is 19,500 m³ at a depth of 0.3m. Top soil to be placed is approximately 6,000m³ at a depth of 0.15m.

7 Drainage

Adequate drainage provisions must be made for carriageway drainage on the proposed scheme if it is to offer satisfactory performance throughout its design life. The principal functions of the road drainage system are:

- *To reduce the risk of flooding of the carriageway by direct rainfall or by water flowing onto the road from adjacent properties or surrounding land*
- *To avoid the weakening of the sub-grade or pavement layers due to the presence of groundwater*
- *To minimise erosion of side slopes on embankments and cut slopes*

The road drainage system shall ensure that the surface water drains as quickly as possible from the carriageway and is collected and conveyed to the nearest outfall in order to minimise the potential for flooding or ponding on the surface. The drainage system must also ensure that groundwater is not permitted to infiltrate the sub-grade and pavement layers to the extent where it could cause a build up of excess pore water pressure capable of undermining or weakening the road foundation. Where possible, the water table shall be maintained at an adequate level below the pavement at all times. The drainage network must also ensure that the risk of flooding of the carriageway by predicted runoff from adjoining properties / land is reduced by intercepting it with suitable drains.

The drainage design has been created in accordance with the NRA DMRB HD 33/06. The current design has split the scheme into eight separate drainage runs illustrated on the drainage design drawings listed in the table below. At present there are eight proposed outfalls.

Drawing Number	Title
32103901/PDD/01	Drainage Design Sheet 1 of 5
32103901/PDD/02	Drainage Design Sheet 2 of 5
32103901/PDD/03	Drainage Design Sheet 3 of 5
32103901/PDD/04	Drainage Design Sheet 4 of 5
32103901/PDD/05	Drainage Design Sheet 5 of 5

Table 7-A Drainage Design Drawings

The carriageway runoff will be collected using Grassed Surface Water Channels (GSWC) and Filter Drains, located along the carriageway edge where necessary. GSWC have been used where practical. However, due to the large number of accesses and alignment constraints it is necessary to utilise Filter Drains in some locations. The use of GSWC will allow for the collection of surface water and collection of field runoff where interceptor ditches are not provided. Either a Fin Drain or narrow Filter Drain shall be used in conjunction with the GSWC in order to ensure that the pavement layers are adequately drained by removing any groundwater. In areas where the carriageway is on embankment, field runoff shall be collected by interceptor ditches where the surrounding land falls towards the toe of the embankment. Interceptor ditches shall also be provided at the top of road cuttings.

The drainage design ensures that carriageway runoff is subjected to three levels of treatment before being discharged. The first level of treatment shall be provided by either the GSWC or combined Filter Drains. Petrol Interceptors shall provide the

second level of treatment, before the flow is conveyed to the SuDS provision for the third level of treatment prior to discharge.

Soakaways have been implemented as the method of SuDS provision for the drainage runs with the exception of Run C which utilises a Swale prior to discharge to the unnamed Turlough. Soakaways were chosen for the outfalls as there are no watercourses present along the length of the scheme to discharge to. A number of the Soakaways are large in size which is due to a combination of large catchment areas and low soil permeability results.

In order to preserve the ecology of the unnamed Turlough, the outfall of Run C will be designed so that the rate of discharge is comparable to that of the existing "greenfield" catchment area i.e. return the runoff rate to the flows that were present in the existing scenario without the proposed scheme.

The pavement design has been undertaken in accordance with NRA DMRB HD 25-26/10. Additionally NRA DMRB HD 24/06 was used to assess the design traffic for the pavement design. Annual Average Daily Flow data for the N60 from the NRA traffic counter website was also used to assist in the assessment of design traffic. The tables below show the pavement and foundation make-up for the mainline, side roads, lay-bys and cycleway based on a 40 year design life and a sub-grade CBR value of 1%. The design traffic calculated for the mainline was 4.3msa. Sufficient traffic data is not available for the side roads but it is anticipated that the design traffic will be less than 2.8msa (the minimum pavement make-up is suitable up to 2.8msa).

Layer	Thickness
Surface Course	45mm
Binder Course	55mm
Base Course	120mm
Sub-base	150mm
Capping	600mm

Table 8-A Mainline Pavement and Foundation Make-up

Layer	Thickness
Surface Course	45mm
Binder Course	55mm
Base Course	100mm
Sub-base	150mm
Capping	600mm

Table 8-B Side Road Pavement and Foundation Make-up

Layer	Thickness
Surface Course	45mm
Binder	55mm
Base	100mm
Sub-base	150mm
Capping	600mm

Table 8-C Lay-by Pavement and Foundation Make-up

Layer	Thickness
Surface Course	25mm
Binder	90mm
Sub-base	365mm

Table 8-D Cycleway Pavement and Foundation Make-up

There are existing public utilities along the length of the scheme that will be affected by the proposed alignment. These will be required to be diverted, altered or protected to accommodate the works. Consultation on which services that are to be affected is ongoing with the suppliers but based on drawings provided by the utility companies and site observations, the utilities that are likely to be impacted by the construction of the proposed scheme include:

- *Eircom*
- *Electricity Supply Board (ESB)*
- *Mayo Council Mains Water Supply*
- *Group Water Supply Schemes*

A vast section of Eircom services are overhead cables. It is proposed that overhead cables and poles are replaced with an underground ducted system. A small number of the poles may need to be retained close to properties to maintain supply to dwellings. The locations of the Eircom services that are likely to be affected are detailed in the table below.

Location	Description	Comments
Ch. 0 - 2700	Overhead	Diversion required from existing north verge to proposed north verge.
Ch. 2700 – 3615	Overhead	Diversion required from existing south verge to proposed south verge.
Ch. 15 – 60 (L-5542-0)	Underground	Diversion required from existing south verge to proposed south verge.
Ch. 3220 - 4565	Underground	Diversion required from existing south verge to proposed north verge.

Table 9-A Eircom Utilities

Overhead power cables are intermittently spread across the scheme providing supply to residential properties and businesses. There are a number of locations where the overhead cables cross the carriageway which will need protected during construction. These locations, with the exception of one (as noted in the table below), are at grade with the existing road and should not impact clearance from the carriageway to the cables.

Location	Description	Comments
Ch. 1860	Overhead	Protection required for cross carriageway cables. Proposed carriageway is approx. 700mm higher than existing, so clearance to overheads will need to be reviewed in consultation with ESB.
Ch. 1890	Overhead	Pole in residential garden will need to be protected during construction of residential access
Ch. 2170	Overhead	Protection required for cross carriageway cables
Ch. 3200	Overhead	Diversion required for pole in field north of carriageway
Ch. 3200	Overhead	Diversion required for pole in field south of carriageway
Ch. 3200	Overhead	Protection required for cross carriageway cables
Ch. 70 (L-55392-0)	Overhead	Protection required for cross carriageway cables
Ch. 3970	Overhead	Protection required for cross carriageway cables

Table 9-B ESB Utilities

There are both Public and Group Water Scheme (GWS) water mains that are likely to be impacted by the scheme. The locations of these water services are outlined in the table below.

Location	Description	Comments
Ch. 1000 - 1230	Underground (Public & GWS)	Protection required during construction. Appears water mains will be in proposed north verge and cycleway.
Ch. 1230 – 1400	Underground (Public & GWS)	Protection required during construction.
Ch 1400-1500	Underground (Public & GWS)	Protection required during road construction for cross carriageway water main
Ch 1500 – 1970	Underground (Public & GWS)	Protection required for water main in existing south verge particularly when constructing new accesses.
Ch. 1970 - 2250	Underground (Public & GWS)	Appears from information provided that the water mains will be in the proposed carriageway. If confirmed, recommendation is to relocate to proposed south verge.
Ch. 2250 - 2400	Underground (Public & GWS)	Appears water main will be in proposed south verge and under existing lay by area. Protection required during road construction
Ch. 2700 - 3130	Underground (Public)	Appears that water main is in existing south verge. To be protected during construction.
Ch. 2930 - 3130	Underground (GWS)	Appears that water main is in existing south verge. To be protected during construction
Ch. 3130 – 3270	Underground (Public & GWS)	Cross carriageway water main required to be protected during construction
Ch. 3270 - 3600	Underground (Public & GWS)	GWS is partly under existing carriageway and partly in existing south verge. Public water main is partly in existing south verge and partly in proposed north verge. Protection required during construction.
Ch 3600 – 4040	Underground (Public & GWS)	Appears that water main is in proposed carriageway. If confirmed, recommendation is to relocate to proposed south verge
Ch. 4040 - 4220	Underground (Public)	Appears that water main is in proposed south verge. Protection required during construction.
Ch. 4040 – 4220	Underground (GWS)	Appears that water main is in proposed carriageway. If confirmed recommendation is to relocate to proposed south verge
Ch. 4220 – 4540	Underground (Public & GWS)	Appears that water main is in proposed carriageway. If confirmed recommendation is to relocate to proposed south verge
Ch. 0 – 100 (L-5539-0)	Underground (Public & GWS)	Appears that water main is partly in proposed carriageway and partly in cut slope of proposed earthworks. If confirmed, recommendation is to relocate to proposed west verge.

Table 9-C Water Utilities

As part of the design process phasing of construction works has been considered to ensure that the scheme can be constructed within the known limits.

Traffic management will be an integral component of the construction process owing to a large proportion of the scheme being online. The majority of the online sections have a small enough level difference (less than 400mm) that will allow carriageway construction whilst maintaining one lane under shuttle working. It may be necessary, in difficult circumstances, to implement convoy working.

There is one section at approximately Ch. 2220 – 2520 that will require a temporary road to be built to allow the construction of the mainline. In this section the mainline is online but significantly higher than the existing road level. A temporary single lane can be constructed on the north side in the land to be acquired for the cycleway and earthworks.

It is important during the construction phase to maintain access to properties, fields and businesses. However, due to the high number of direct accesses across the scheme there will be some disruption to accesses but it is anticipated that this will not be significant.

Road closures will be kept to a minimum but will be required to construct the single track local side roads. It is proposed that these are night time road closures to minimise disruption. All local roads have alternate routes available.

Consideration needs to be given to the utility diversions / protection and whether these will be undertaken in advance of the main works. It is anticipated that some of the utility diversions can be carried out in advance, but some will be in conjunction with the main works due to the nature of the cut and fill locations.

Land owners and property owners will be the most affected by the construction of the proposed development due to the large number of agricultural holdings and properties along the length of the scheme. The impacts may include: loss of land through acquisition; encroachment on properties and property boundaries; and alterations and relocation of direct accesses.

During the selection of the alignment route, consideration was given to the location of residential dwellings such that impacts to these were kept to a minimum, where possible, without compromising the alignment.

There are over 60 direct accesses, both residential and field, onto the existing N60. As such, agreeing and providing accommodation works, in consultation with landowners, will need to be undertaken in a considerate and efficient manner. In addition, maintaining accesses, as far as reasonably practicable during construction is a priority.

12 Environmental Mitigation

An Environmental Assessment Report (EAR) and Natura Impact Statement (NIS) was undertaken based on the design. The EAR and NIS sets out proposed mitigation to be incorporated into the design and implemented during construction to ensure that potential environmental effects are avoided or reduced in line with the findings of the EAR and NIS.

Mayo County Council assessed the proposed developed for archaeological, architectural and cultural heritage impacts. The findings of the assessment are presented below.

One archaeological site, which is classed as an enclosure and one possible moated site (Recorded Monument No. MA090:026) is located at the north western end of the scheme. It almost abuts the field boundary at the road edge to the south of the existing road. Proposed works at this point are confined to the northern side of the road and will not impact directly on the site. Groundworks in green fields on the southern side of the road are approximately 140m from the site and will not impact on it. Measures to assess and protect this archaeological site will be implemented as required. Archaeological monitoring of all groundworks adjacent to the site is recommended. Adequate fencing and signage should also be put in place prior to construction to prevent negative impact on the site.

There is no predicted impact on any other known archaeological or cultural heritage sites from this road scheme. Regarding architectural heritage, one unusual vernacular structure, known locally as 'the forge', may be impacted on by the scheme, however this is not a Recorded Protected Structure (RPS) or a Proposed Recorded Protected Structure (PRPS) and is listed here for record only. It is a relatively modern, mass concrete structure in a derelict state.

This development also impacts on narrow greenfield strips at either side of the existing road. As these areas may contain previously unidentified archaeological remains, a programme of predevelopment testing to assess their archaeological potential has been arranged, under licence from the relevant statutory bodies (Excavation Licence No. 11E0359). This will allow for archaeological mitigation, as required, prior to construction.

Balla is a historic village with early medieval ecclesiastical remains including a substantial round tower and two moated sites. These significant sites are over 2km from the development and will not be impacted upon. The scheme can be considered low risk from an archaeological, architectural and cultural heritage perspective.

Appendix A Relaxations and Departures from NRA DMRB

Location	Relaxation	NRA BMRB Ref.	Justification
Mainline Ch. 1240 – 1620	510m radius curve which is one step below desirable minimum	TD 9, table 1/3	510m curve required to tie into existing road and avoid impacting on residential properties
Mainline Ch. 4126 – 4222	Sag K value of 26 which is one step below desirable minimum	TD 9, table 1/3	A sag value less than desirable minimum has been implemented for constructability purposes as this section is online
L-65426-0	Dwell area gradient of 4%	TD 41-42, 7.17	On approach to the junction the existing ground is very steep
L-65426-0	Sag K value of 6.5 which is one step below desirable minimum	TD 9, table 11/3	On approach to the junction the existing ground is very steep
L-55395-0	Dwell area gradient of 4%	TD 41-42, 7.17	On approach to the junction the existing ground is very steep
L-55395-0	Dwell area length of 10m	TD 41-42, 7.16	On approach to the junction the existing ground is very steep. In addition shortening dwell area allows tie into existing as soon as possible to avoid impacting on adjacent accesses
Direct dwelling access Ch. 2280	Low object height of 0.6m used for east facing visibility from access	TD 41-42, 7.7d	To achieve visibility from access
Direct dwelling access Ch. 2350	Low object height of 0.6m used for east facing visibility from access	TD 41-42, 7.7d	To achieve visibility from access
Direct dwelling access Ch. 2385	Low object height of 0.6m used for east facing visibility from access	TD 41-42, 7.7d	To achieve visibility from access
Direct dwelling access Ch. 2410	Low object height of 0.6m used for east facing visibility from access	TD 41-42, 7.7d	To achieve visibility from access
Direct dwelling access Ch. 2450	Low object height of 0.6m used for visibility from access	TD 41-42, 7.7d	To achieve visibility from access
Direct access Ch. 2560	Low object height of 0.6m used for west facing visibility from access	TD 41-42, 7.7d	To achieve visibility from access
Direct access Ch. 3700	Low object height of 0.6m used for east facing visibility from access	TD 41-42, 7.7d	To achieve visibility from access
Direct dwelling access Ch. 3900	Low object height of 0.6m used for west facing visibility from access	TD 41-42, 7.7d	To achieve visibility from access

Location	Departure	NRA DMRB Ref.	Justification
All direct dwelling accesses	Dwell area length of 5m applied	TD 41-42, 7.16	To minimise impact on residential properties
All other accesses	Dwell area length of 10m applied	TD 41-42, 7.16	To minimise impact on land
All accesses	Dwell area gradient of 4%	TD 41-42, 7.17	To minimise impact on land

Table 13-A Relaxations from Standards

Location	Departure	NRA DMRB Ref.	Justification
Mainline Ch. 1090 - 1220 EB	SSD is one step below desirable minimum on approach to a junction	TD 9, 2.13	Verge width reduced in this section to minimise impact on Special Area of Conservation
Mainline Ch. 1360 – 1480 EB	SSD is one step below desirable minimum on approach to a junction	TD 9, 2.13	Sight line passes through possible parking area
Mainline Ch. 3650 – 3850 EB	SSD is one step below desirable minimum on approach to a junction	TD 9, 2.13	One step below desirable minimum crest curve in this area
Mainline Ch. 3774 – 4017	Crest K value of 55 which is one step below desirable minimum on approach to a junction resulting in one step below SSD	TD 9, table 1/3 & 4.13	This section is online. A lower crest curve has been used to match existing for constructability purposes
Mainline Ch. 4080 – 3910 WB	SSD is one step below desirable minimum on approach to a junction	TD 9, 2.13	One step below desirable minimum crest curve in this area
Mainline Ch. 1770 – 1540 WB	SSD is one step below desirable minimum on approach to a junction	TD 9, 2.13	Sight line passes through possible parking area
Mainline Ch. 1460 – 1250 WB	SSD is one step below desirable minimum on approach to a junction	TD 9, 2.13	Verge width reduced in the section to minimise impact on Special Area of Conservation
Mainline Ch. 1390 – 1270 WB	SSD is two steps below desirable minimum on approach to a junction	TD 9, 2.13	Verge width reduced in the section to minimise impact on Special Area of Conservation
Mainline Ch. 1340 – 1300 WB	SSD is three steps below desirable minimum on approach to a junction	TD 9, 2.13	Verge width reduced in the section to minimise impact on Special Area of Conservation
Mainline Ch. 1000 – 1270 WB	Verge is 0.5m wide	TD 27, table 2	Verge reduced to minimise impact on Special Area of Conservation
L-65426-0	Vertical gradient of 10%	TD 9, 4.2	On approach to junction existing ground is very steep. TD 41/42 clause 7.18 allows 10% on approach to a dwell area

Location	Departure	NRA DMRB Ref.	Justification
L-55392-0	Falls within SSD envelope of mainline	TD 41-42, 3.6	Side road sited on the inside of a bend
L-55392-0	No physical channelising island provided.	TD 41-42, 7.49	Road markings used instead
L-5542-0	No physical channelising island provided	TD 41-42, 7.49	Road markings used instead
L-55395-0	Sag K value of 0.5	TD 9, table 11/3	On approach to junction existing ground is very steep
L-55395-0	Crest K value of 0.5	TD 9, table 11/3	On approach to junction existing ground is very steep
L-55395-0	Vertical gradient of 10%	TD 9, 4.2	On approach to junction existing ground is very steep. TD 41/42 clause 7.18 allows 10% on approach to a dwell area
L-55395-0	Junction visibility is one step below desirable minimum when using a relaxation of 0.6m to low object height	TD 41/42, 7.7d & table 7/1	Side road is sited on a one step below desirable minimum crest curve. Stop sign will be implemented to achieve one step below SSD
L-5539-0	Sag K value of 5 which is two steps below desirable minimum	TD 9, 4.17	Mainline has minimal longitudinal fall in this area to match existing. Providing sufficient longitudinal fall would impact on residential properties. As a result sag value used to allow continuation of mainline cross fall across junction mouth for drainage purposes and at the same time allow tie into existing steep side road.
L-5539-0	Vertical gradient of 10%	TD 9, 4.2	As a result of continuing mainline crossfall across junction mouth 10% gradient required to tie into existing steep ground
L-5539-0	Crest K value of 6.5 on approach to a junction which is one step below desirable minimum	TD 9, 4.13	As a result of continuing mainline crossfall across junction mouth steep gradient required to tie into existing steep ground
Direct dwelling access Ch. 1570	West facing visibility from access is two steps below desirable minimum	TD 41-42, 7.7c & table 7/1	Access is sited on a 510m Radius curve
Direct dwelling access Ch. 3900	East facing visibility from access is one step below desirable minimum	TD 41-42, 7.7d & table 7/1	Access is sited on a one step below desirable minimum mainline crest curve
Direct access Ch. 4030	West facing visibility from access is one step below desirable minimum using a relaxation of 0.6m to low object height	TD 41-42, 7.7d & table 7/1	Access is sited on a one step below desirable minimum mainline crest curve
Direct dwelling access Ch. 4050	West facing visibility from access is one step below desirable minimum	TD 41-42, 7.7d & table 7/1	Access is sited immediately east of a one step below desirable minimum mainline crest curve

Location	Departure	NRA DMRB Ref.	Justification
Direct access Ch. 4070	West facing visibility from access is one step below desirable minimum	TD 41-42, 7.7d & table 7/1	Field access is sited immediately east of a one step below desirable minimum mainline crest curve
Direct dwelling accesses	20 No. accesses fall within SSD envelope of mainline	TD 41-42, 3.6	Accesses are in a similar location to existing accesses
Direct other accesses	12 No. accesses fall within SSD envelope of mainline	TD 41-42, 3.6	Accesses are in a similar location to existing accesses
Accesses	Accesses are sited such that they encroach on the visibility requirements of adjoining accesses.	TD 41-42, 3.11	Accesses are sited in a similar location to existing ones. Where possible accesses onto the mainline have been reduced.
Accesses	Accesses are sited such that they do not comply with the minimum stagger distance of 50m	TD 41-42, 2.6	Accesses are sited in a similar location to existing ones to maintain access to properties and fields. Where possible accesses have been re located to comply with the stagger distance
Accesses	Visibility from accesses and SSD for mainline may be affected if cars are stopped in lay-bys	TD 41-42, 7.13	Lay-bys are provided for visitors / delivery vehicles to park off the mainline as per existing conditions.

Table 13-B Departures from Standards