

Appendix A.14.1

Road Safety Audit Stage F Part 2

A.14.1

National Roads Authority
Galway City Transport Project
Road Safety Audit Stage F (Part 2)

Issue 2 | 3 September 2015

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 233985-00

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Document Verification

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Appendix A

Information Received

Appendix B

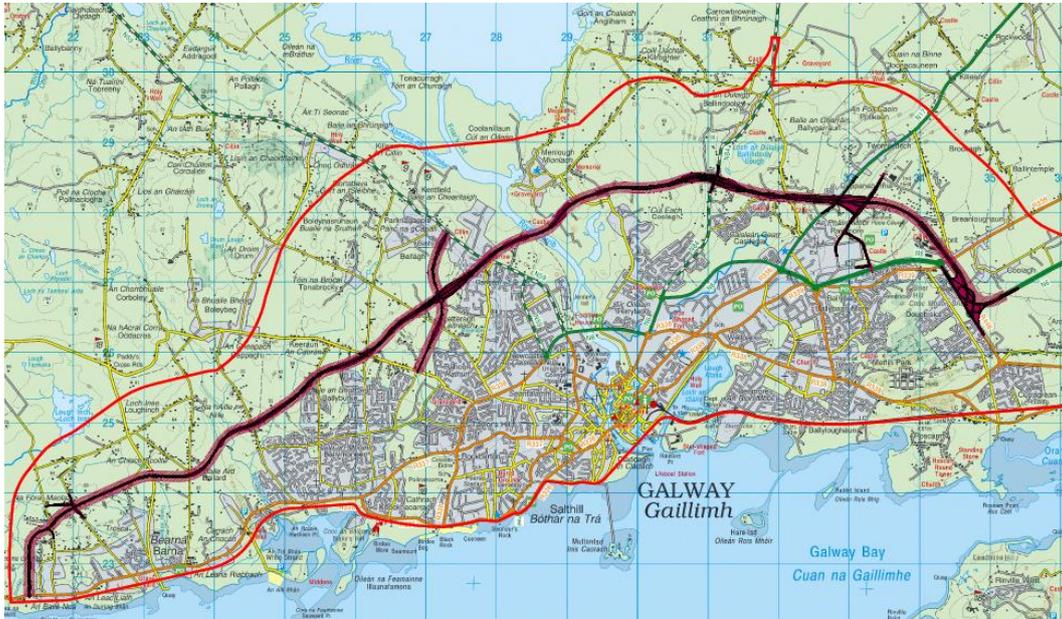
Auditor Approval

Appendix C

Designers Response Form

1 Introduction

Arup Dublin has been appointed to conduct a Stage F (Part 2) Road Safety Audit on the preferred route corridor of the proposed N6 Galway City Transport Project. A plan showing the location of the proposed scheme in the context of the surrounding road network is presented in Figure 1.



Ordnance Survey Ireland EN 0002815 © Ordnance Survey Ireland/Government of Ireland

Figure 1: Preferred Route Corridor

The audit was completed on the 24 August 2015 in the Arup Dublin office and included a site visit on the 12 August 2015.

The weather during the site visit was dry and sunny and the road surface was dry.

The audit team members were as follows:

- Thomas Connell (Team Leader)
- Edel Casserly (Team Member)

An Audit Team Statement and feedback form is included at the end of the report.

This Stage F audit has been carried out in accordance with the relevant sections of NRA HD 19/15. The team has examined only those issues within the design relating to the road safety implications of the scheme, and has therefore, not examined or verified compliance of the design or any other criteria.

2 Items raised during this audit

2.1 Problem: Accesses to realigned side roads

Location: Throughout the Scheme

Issue: The proposed scheme includes various realignments to side roads which will be impacted by the N6 mainline. These realignments will change the side roads both horizontally and vertically and there is concern that a number of domestic and agricultural accesses will have excessively steep vertical gradients particularly at Trusky West and the N59 Link road. This may lead to vehicles slowly exiting these accesses and has the potential to result in collisions between vehicles exiting the accesses and passing traffic on the local roads.

Recommendation: Accesses affected by the realigned local roads should be assessed to confirm that appropriate vertical geometry is provided.

2.2 Problem: Roundabout approaches

Location: The western portion of the scheme

Issue: The proposed scheme includes for three number roundabouts on the western portion of the proposed N6. Road users on the local road approaches to each of these roundabouts may not expect a roundabout ahead due to their rural location. It is also noted that, on the mainline, the westbound approach to each of these roundabouts is generally a steep vertical gradient. The combination of rural settings and steep approach gradients could lead to sudden braking or junction overshoot which could result in various types of collisions.

Recommendation: Advance warning should be provided on all approaches to these roundabouts and street lighting should be installed.

2.3 Problem: Western tie-in

Location: Roundabouts proposed on the N6

Issue: Both the proposed R336 roundabout and Bearna Moycullen Road roundabout include no proposed alignment upgrades on the local roads. There is concern that this will result in uneven gradients, inadequate flaring of the approach/exits and potential ponding within the carriageway and roundabout. These factors could lead to various collision hazards and could increase the potential for serious injury to road users, pedestrians and cyclists.

Recommendation: The tie ins to the local road network should be clearly shown on the design drawings.

2.4 Problem: Roundabout entry/exit

Location: Furrymelia West roundabout and the dumb-bell roundabouts on N59 Grade Separated Junction

Issue: There are no radii shown on the link from the existing local road to the Furrymelia West roundabout and on the merge and diverge roads of the N59 Grade Separated Junction. The Auditors are concerned that large vehicles and vehicles towing trailers will be unable to enter/exit the roundabout safely which could increase the likelihood of rear end shunt type collisions.

Recommendation: Entries to and exits from all roundabouts should be designed to include the appropriate radii.

2.5 Problem: Junction type unclear

Location: Furrymelia West (Link Road)

Issue: As part of the proposed works, a link road is proposed from the Furrymelia West roundabout to the local road to the south in order to maintain access for local residents. The Auditors are concerned with the proposed local road junction layout with a cul-de-sac road created by the mainline as it is unclear if sufficient visibility to the north can be provided for road users exiting the cul-de-sac to join the link road. This could lead to collisions between vehicles attempting to turn onto the link road and vehicles already on the link road.

Recommendation: The access arrangements and junction type for the houses on the cul-de-sac should be clearly defined.

2.6 Problem: Transition from dual carriageway to single carriageway

Location: Mainline chainage 4+350

Issue: Westbound road users will be presented with a sudden change from dual carriageway to single carriageway at chainage 4+350. This could lead to confusion amongst road users and could result in sudden braking or lane changes which could increase the likelihood of rear end shunt or side-swipe type collisions at this location. The change from single carriageway to dual carriageway for eastbound road users could also present various collision hazards.

Recommendation: A transition in the form of a junction should be provided at this location.

2.7 Problem: Junction location relative to accesses

Location: West of the proposed R336 roundabout

Issue: There is a domestic and agricultural access located in close proximity to the proposed R336 roundabout (refer to figures 2 and 3). The Auditors are concerned that vehicles exiting the roundabout will be gaining speed and may not expect vehicles to enter/exit these accesses. This may lead to sudden braking which could

result in rear end shunt or side swipe type collisions with the vehicles exiting the accesses.



Figure 2: Domestic Access on R336



Figure 3: Agricultural Access on R333

Recommendation: The existing accesses should be relocated in order to improve visibility to and from the accesses.

2.8 Problem: Junction radii

Location: Ragoon Road, Trusky West, N17 GSJ

Issue: No junction radii have been shown at a number of proposed T-junctions. The Auditors are concerned that large vehicles may have insufficient room to exit/enter these junctions safely. This may lead to drivers reversing and/or carrying out dangerous manoeuvres in order to exit/enter these junctions. Actions such as these have the potential to result in various types of collisions at these locations.

Recommendation: Junction radii should be provided at all junctions.

2.9 Problem: Carriageway width

Location: Local Roads

Issue: A number of local roads will be upgraded as part of the works (eg. Trusky West) with single carriageways proposed. The realigned sections will tie in to local roads which are currently wide enough to cater for a single vehicle only. Road users could potentially increase their speed on the upgraded sections of local road and may not expect the carriageway width to reduce at the tie-ins. This could result in head-on or rear-end shunt type collisions at these locations.

Recommendation: Advanced warning should be provided to warn drivers of the reduced carriageway width and the proposed carriageway should be designed to include a taper to the existing carriageway width.

2.10 Problem: Visibility

Location: Throughout Scheme

Issue: The Auditors are concerned that road users attempting to turn on to local roads from existing accesses adjacent to underbridges will not have sufficient visibility due to the presence of adjacent structures. This could lead to collisions between road users attempting to turn on to the local roads and passing road users on the local road.

Recommendation: The designer should confirm that the required visibility is provided at all such locations.

2.11 Problem: Crossroad type junction

Location: Ragoon Road

Issue: A crossroad type junction is proposed at Ragoon Road. The Auditors are concerned that junctions of this type can pose a serious collision risk to road users due to the see through issue. This junction may also be complicated due to the reduced visibility from the north as a result of the proposed underbridge. A junction of this type could potentially lead to sudden braking which could result in rear end shunt type collisions or may also lead to side swipe type collisions between passing road users.

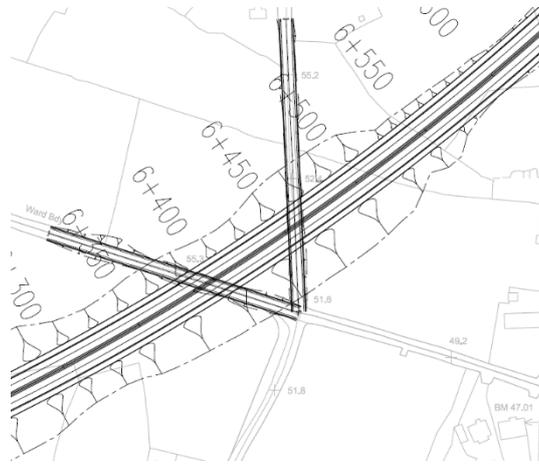


Figure 4: Proposed junction at Ragoon Road

Recommendation: The junction type should be changed to a staggered junction.

2.12 Problem: Tie in levels at junction

Location: Cappagh Road

Issue: The design as presented includes no works to an existing junction to the south of the N6, on the eastern side of Cappagh Road. The proposed works on Cappagh Road will result in a level difference at the junction. This will present a collision hazard for road users exiting/entering this junction and will potentially result in various type of collisions.

Recommendation: The designer should ensure that the tie in levels at the junction match.

2.13 Problem: Ballymoneen roundabout

Location: Ballymoneen Road

Issue: An at-grade roundabout is proposed at Ballymoneen Road which is within the dual carriageway section of the proposed N6. The Auditors are concerned that motorists will not expect a roundabout on this section in particular travelling from the eastern side after travelling through 4 grade separated junctions. This could potentially lead to sudden braking on the N6 carriageway resulting in rear-end shunt type collisions.

Recommendation: A grade separated junction should be provided.

2.14 Problem: Junction consistency

Location: Ballymoneen Road, N59, N84, N17 and N6 Grade Separation Junctions

Issue: The proposed major junction types along the scheme varies at each location as follows:

- Ballymoneen Road – at grade roundabout;
- N59 – dumb bell grade separated junction;
- N84 – a diamond grade separated junction;
- N17 – two half diamond grade separated junctions;
- N6 – a free flow junction.

A lack of consistency in the types of junctions provided in just over 10km could potentially lead to confusion amongst road users. This could lead to hesitation, sudden braking and lane changes which could potentially increase the likelihood of collisions at these locations.

Recommendation: The designers should reassess the junction types across the proposed scheme with a view to minimising the current variation.

2.15 Problem: Available options to road users

Location: Parkmore Road and N17 Grade Separated Junction

Issue: There are two options available to road users travelling southbound on Parkmore Road which can be used to access the westbound carriageway of the N6; the direct merging lane from Parkmore Road or the link road between Parkmore Road and the N17 and subsequently the direct merging lane from the N17. This could potentially cause confusion amongst road users and could lead to hesitation at either junction, sudden braking or late lane changes which could result in various types of collisions.

Recommendation: The options to access the N6 westbound from Parkmore Road should be simplified.

2.16 Problem: Proximity of signalised junctions

Location: Parkmore Road

Issue: The Auditors are concerned with the number of signalised junctions in close proximity; four in under 1km length of road. Road users could potentially increase their speed to make a green light in the distance due to the see through effect of the junctions and the number of junctions adjacent to each other. This could result in sudden braking which could potentially increase the likelihood of rear end shunt type collisions.

Recommendation: The designer should rationalise the number of signalised junctions in this area. The detailed design of the signalised junctions should allow for the steady flow of traffic.

2.17 Problem: N6 free flow interchange

Location: N6 at Coolagh/Doughiska

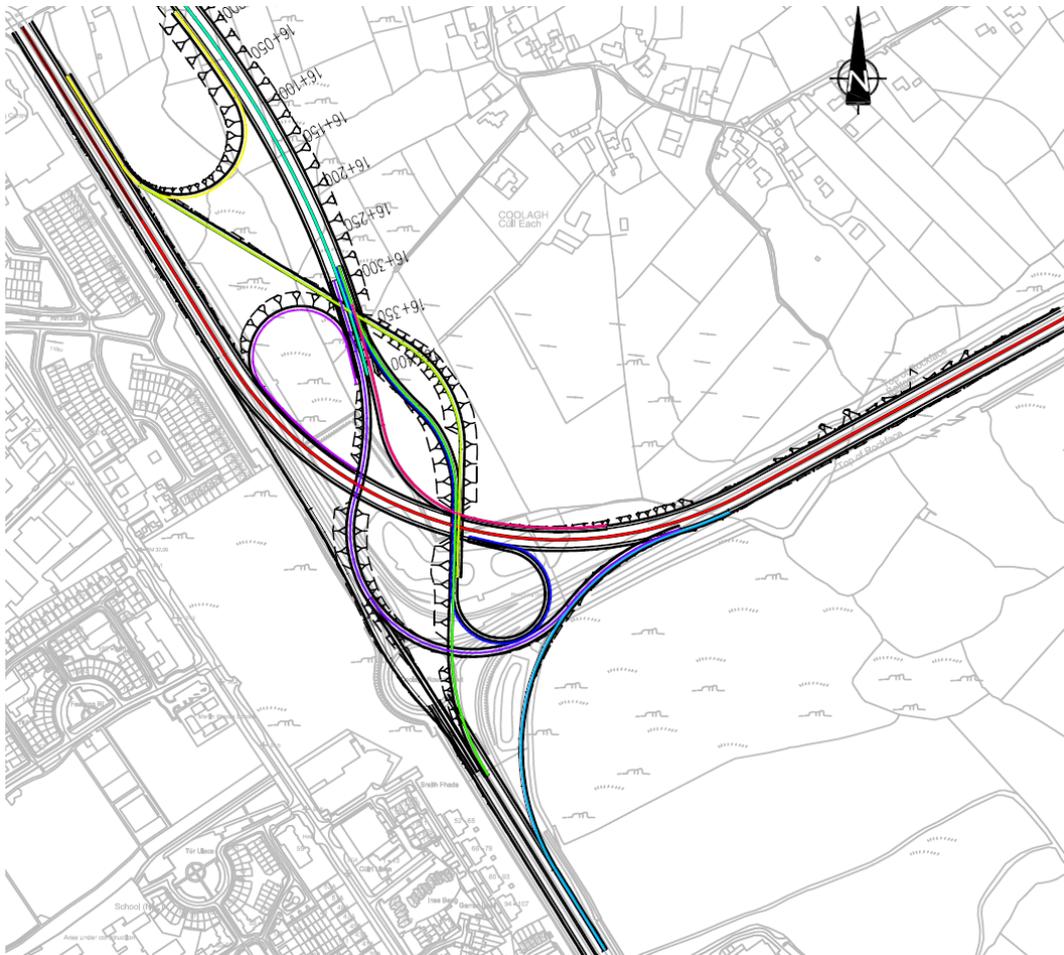


Figure 5: Proposed N6 Interchange

Issue A: The design presented for audit shows the existing N6 at Coolagh being realigned and terminating at the existing signalised junction at Briarhill (see figure 5 – red route). Road users will not expect the N6 to terminate at a signalised junction which could increase the likelihood of rear end shunt type collisions at this location.

Issue B: It is the Auditors opinion that the reduction of the expressway to a single lane in order to join the eastbound N6 (see figure 5 – pink route) could cause a collision hazard as road users will not expect the expressway to reduce to a single lane having travelled unobstructed for ~12km.

Issue C: The merge lane to the N6 westbound from the existing N6 (see figure 5 – yellow route) begins in close proximity to the signalised junction at Briarhill. This could increase the likelihood of rear end shunt or side swipe type collisions on the approach to the merge should a road user attempt to change lanes within the distance available.

Issue D: The merge lane to the N6 eastbound from the existing R446 (see figure 5 – purple loop route) is in close proximity to the expressway merge to the eastbound

N6 (see figure 5 – pink route). Successive merges such as these can pose collision risks to road users on the N6 mainline as well as those joining the N6 mainline.

Issue E: The Auditors are unsure as to how the proposed expressway link to the R446 south, proposed expressway link to the N6 west and proposed N6 at Briarhill to the R446 south (see figure 5 – green, dark blue and lime green routes) will operate as the design includes various lane gains, lane drops and level differences. A combination of all of these factors could prove confusing for road users which could increase the likelihood of collisions throughout the interchange.

Issue F: The design of the R446 northbound merges with the westbound expressway (see figure 5 – purple route) and northbound N6 (see figure 5 – red route) do not appear to have been completed and the merge with the purple route appears to be quite severe and on a curve.

Recommendation: The design of the N6 free flow junction should be readdressed in order to minimise its complexity and to decrease the potential confusion that may be caused to road users.

3 Audit Team Statement

We certify that we have examined the drawings listed in Appendix A to this report. The examination has been carried out with the sole purpose of identifying any features of the design that could be removed or modified in order to improve the safety of the scheme. The problems identified have been noted in this report, together with associated safety improvement suggestions, which we recommend should be studied for implementation. The Auditors have not been involved with the scheme design.

Mr. Thomas Connell; BE, MCIHT

Signed *Thomas Connell*

Date *25-08-2015*

Ms. Edel Casserly, CEng, MIEI

Signed *Edel Casserly*

Date *25-08-2015*

Appendix A

Information Received

A1

Information received for this Stage F (Part 2) of the Galway City Transport Project

Overall Layout (Discovery Mapping)

Figure 7.8.1_I1 – Emerging Preferred Route Corridor

Preliminary Alignment Layouts (OS Mapping)

GCOB-SK-R-312_I1 – N6 Cyclic Junction Rev A

GCOB-SK-R-404_I2 – Bearna to Trusky East

GCOB-SK-R-405_I2 – Trusky East to Ragoon Road

GCOB-SK-R-406_I2 – Ragoon Road to Menlo

GCOB-SK-R-407_I2 – Manlo to Castlegar

GCOB-SK-R-408_I2 – Castlegar to Coolagh, Briarhill

GCOB-SK-R-409_I2 – Junctions (Sheet 01 of 02)

GCOB-SK-R-410_I2 – Junctions (Sheet 02 of 02)

GCOB-SK-R-412_I2 – Side Road Profiles (Sheet 01 of 02)

GCOB-SK-R-413_I3 – Side Road Profiles (Sheet 02 of 02)

GCOB-SK-R-417_I1 – Coolagh Junction Profiles

Phase 2 Traffic Modelling Report

GCOB-4.04-10.1 (Phase 2 TM Report)_I1

Public Consultation No. 3 Material

Brochure

Display Material

Visualisation

Councillor Briefing Note

Appendix B

Auditor Approval

B1

*Paul Batty
Corporate House
Ballybrit Business Park
Ballybrit
Galway*

Date: 10/05/2015

Our Ref: 676439/4287/Stage F

re: N6 M/N6 Galway City Outer By-Pass

APPROVAL OF ROAD SAFETY AUDIT TEAM, Stage F

Dear Paul Batty,

The following members of the proposed road safety audit team are approved to carry out the Stage F road safety audit of N6 M/N6 Galway City Outer By-Pass.

1. Thomas Connell - Arup - Leader
2. Edel Casserly - Arup - Member

A copy of all audit reports, design team response and exception reports must be uploaded through RSAAS. Successful upload of these reports and completion of the audit approval process is necessary for any further audit approval on this scheme.

Yours sincerely,

Lucy Curtis

Regional Road Safety Engineer
roadsafetvaudits@nra.ie

Appendix C

Designers Response Form

C1

Scheme: Galway City Transport Project	Route Nos.: All affected by the scheme
Audit Stage: Stage F (Part 2)	Date Audit Completed: 26 August, 2015

Problem	To be completed by Designer				Describe Alternative Measure	To be completed by Audit Team Leader	
	Problem Accepted		Recommended Measure Accepted			Alternative Measures Accepted	
	Yes	No	Yes	No		Yes	No
2.1	Y	-	Y	-	Access arrangements and tie-ins to local roads will be examined in detail during Phase 3: Design.	✓	
2.2	Y	-	Y	-		✓	
2.3	Y	-	Y	-		✓	
2.4	Y	-	Y	-	Roundabouts shall be designed to include appropriate radii in accordance with the NRA DMRB during Phase 3 Design.	✓	
2.5	Y	-	Y	-		✓	
2.6	Y	-	Y	-	The transition from single to dual carriageway has been relocated in the Preferred Route Corridor and now occurs at the location of the proposed roundabout at the Ballymoneen Road. Refer Problem 2.13.	✓	
2.7	Y	-	Y	-		✓	
2.8	Y	-	Y	-		✓	
2.9	Y	-	Y	-		✓	
2.10	Y	-	Y	-		✓	

Problem	To be completed by Designer				Describe Alternative Measure	To be completed by Audit Team Leader	
	Problem Accepted		Recommended Measure Accepted			Alternative Measures Accepted	
	Yes	No	Yes	No		Yes	No
2.11	Y	-	Y	-		✓	
2.12	Y	-	Y	-		✓	
2.13	Y	-	N	-	The transition from single to dual carriageway has been relocated in the Preferred Route Corridor and now occurs at the location of the proposed roundabout at the Ballymoneen Road. This marks the transition from dual to single carriageway. Refer problem 2.6.	✓	
2.14	Y	-	Y	-	During Phase 3 Design, the scheme junction consistency shall be assessed with a view to minimising the number of variations.	✓	
2.15	Y	-	Y	-		✓	
2.16	Y	-	Y	-		✓	
2.17	Y	-	Y	-	During Phase 3 Design the junction layout will be examined and simplified as appropriate.	✓	

Signed Eileen McCarthy Designer Date 26.08.2015
 Signed Thomas Connell Audit Team Leader Date 26.08.2015
 Signed Employer Date 3/9/2015