

## **Appendix A.7.1**

### **BD02 Standard Overbridges**

## A.7.1

---

Galway County Council  
**N6 Galway City Ring Road**  
Standard Overbridges Preliminary  
Design Report

GCOB-4.04-020-002

Issue 3 | 23 October 2017

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.

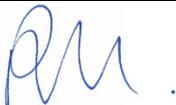
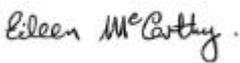
Job number 233985

**Arup**  
Corporate House  
City East Business Park  
Ballybrit  
Galway  
H91 K5YD  
Ireland  
[www.arup.com](http://www.arup.com)

**ARUP**

# Document Verification

# ARUP

<b>Job title</b>		N6 Galway City Ring Road		<b>Job number</b>		233985	
<b>Document title</b>		Standard Overbridges Preliminary Design Report		<b>File reference</b>		GCOB-4.04-020-002	
<b>Document ref</b>		GCOB-4.04-020-002					
<b>Revision</b>	<b>Date</b>	<b>Filename</b>	GCOB-4.04-20-002 (PDR Standard Overbridges)_I1.docx				
Issue 1	28 Oct 2016	<b>Description</b>	Issue 1				
			Prepared by	Checked by	Approved by		
		Name	Yalda Acar	Pat Moore	Eileen McCarthy		
		Signature					
Issue 2	30 Jun 2017	<b>Filename</b>	GCOB-4.04-20-002 (PDR Standard Overbridges)_I2 not issued yet.docx				
		<b>Description</b>	Issue 2				
			Prepared by	Checked by	Approved by		
		Name	Yalda Acar	Pat Moore	Eileen McCarthy		
		Signature					
Issue 3	23 Oct 2017	<b>Filename</b>	GCOB-4.04-20-002 (PDR Standard Overbridges)_I3_not yet issued.docx				
		<b>Description</b>	Issue 3				
			Prepared by	Checked by	Approved by		
		Name	Yalda Acar	Pat Moore	Eileen McCarthy		
		Signature					
		<b>Filename</b>					
		<b>Description</b>					
			Prepared by	Checked by	Approved by		
		Name					
		Signature					

Issue Document Verification with Document



# Contents

---

	Page
<b>1 Introduction</b>	<b>1</b>
1.1 Design brief given to the authors, including dates	1
1.2 Background information covering the origins for the need for the structure	1
1.3 Previous studies and their recommendations	1
<b>2 Site and function</b>	<b>2</b>
2.1 Site location	2
2.2 Function of the structure and obstacles crossed	2
2.3 Choice of location	2
2.4 Site description and topography	3
2.5 Vertical and horizontal alignments	5
2.6 Cross sectional dimensions on the alignments	7
2.7 Existing underground and overground services	8
2.8 Geological summary	9
2.9 Hydrology and Hydraulic summary	10
2.10 Archaeology summary	10
2.11 Environmental summary	10
2.12 Sustainability	10
<b>3 Structure and aesthetics</b>	<b>11</b>
3.1 Structural Options Considered	11
3.2 General description of recommended structures	11
3.3 Aesthetic considerations	23
3.4 Proposals for the recommended structure of family of structures	23
<b>4 Safety</b>	<b>26</b>
4.1 Traffic management during construction including land for temporary diversions	26
4.2 Safety during construction	26
4.3 Safety in use	26
4.4 Lighting	26
<b>5 Cost</b>	<b>27</b>
5.1 Budget Estimate in current year, including whole life cost	27
<b>6 Design Assessment Criteria</b>	<b>28</b>
6.1 Normal Loading	28
6.2 Abnormal Loading	28

6.3	Footway live loading	28
6.4	Provision for exceptional abnormal loads	28
6.5	Any special loading not covered above	28
6.6	Heavy or high load route requirements and arrangements being made to preserve route	28
6.7	Minimum headroom provided	28
6.8	Authorities consulted and any special conditions required	29
<b>7</b>	<b>Ground Conditions</b>	<b>30</b>
7.1	Description of the ground conditions and compatibility with proposed foundations	30
<b>8</b>	<b>Drawings and Documents</b>	<b>31</b>
8.1	List of all documents accompanying the submission	31

## Appendices

### Appendix A

Drawings

### Appendix B

Extract from ground investigation data

# 1 Introduction

---

## 1.1 Design brief given to the authors, including dates

This report has been produced by Arup, who have been appointed by Galway County Council to provide multi-disciplinary engineering consultancy services for the N6 Galway City Transport Project. Galway County Council, Galway City Council, Transport Infrastructure Ireland (formerly known as the National Roads Authority) and the National Transport Authority are collaborating in developing a solution to the existing transportation issues in Galway City and its environs. The solution will include a smart mobility component, public transport component and a road component. The road component of the solution is known as N6 Galway City Ring Road (GCRR).

## 1.2 Background information covering the origins for the need for the structure

The standard overbridges are required as part of the proposed N6 Galway City Ring Road to preserve regional routes, local routes and access across lands impacted by route of the mainline.

## 1.3 Previous studies and their recommendations

Previous studies and documents relevant to this Outline Structures Report are listed below.

- Galway County Council. Project Brief. Phase 1, Scheme Concept and Feasibility Studies (REF/14/11222, 2 May 2015).
- Galway County Council. Project Brief. Phase 2, Route Selection (REF/14/11222, 6 November 2015).
- GCOB-4.04-009 Route Selection Report, Issue 1, 16/03/2016
- Galway Transport Strategy, An Integrated Transport Management Programme for Galway City and environs, Technical Report, September 2016

## 2 Site and function

### 2.1 Site location

The proposed standard overbridges are located at chainages stated in **Table 1** below, along the mainline of the proposed road development.

Table 1 Standard overbridge mainline chainages.

Name of Structure	Chainage
S01/01- Forai Maola to Troiscaigh Link Overbridge	01+380
S03/01 - Barr Aille Overbridge	03+325
S12/02 – Castlegar Wildlife Overbridge	12+700
S13/01 - School Road Overbridge	13+170
S14/01 - Parkmore Link Road Overbridge	14+375
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	16+420
S16/02 - Coolagh Junction Overbridge (EB merge from R446)	16+860

### 2.2 Function of the structure and obstacles crossed

Structure S01/01, S03/01, S13/01 and S14/01 are overbridges required to carry local roads over the proposed road development.

Structure S12/02 is required as a wildlife crossing over the proposed road development.

Structures S16/01 and S16/02 are required at Coolagh junction to provide free flow access between the R446 and the proposed road development.

### 2.3 Choice of location

S03/01 and S13/01 are located at the position of the crossing between existing local roads with the proposed road development. S14/01 is located at the position of the proposed Parkmore Link Road, and S01/01 is located at the proposed Forai Maola to Troiscaigh Link Road.

An ecological assessment was undertaken to determine the location of S12/02 to facilitate the crossing of the proposed road development by bats and is located in an area currently used by bats at Ch. 12+700.

The position of structures S16/01 and S16/02 are determined based on the junction design for the interchange at Coolagh.

## 2.4 Site description and topography

Table 2 Site description and topography

Name of Structure	Site description and Topography		Archaeology at Structure	Ecology at Structure
	N6 Mainline	Road over		
S01/01 Forai Maola to Troscaigh Link Overbridge	At grade or shallow cut of approx.. 1m.	On embankment approx. 6.5m fill.	None.	Ecological constraint Annex Code 4030 Fosset Code HD1, Local Importance (lower value) Fosset Code HH1, National Importance
S03/01 - Barr Aille Overbridge	In cut – approx.. 4.5m	On embankment approx. 3.7m fill	Site of cultural heritage listed in Appendix 13 of the EIS as CH18 – Vernacular cottage, now extended. Marked on the 1895-1900 mapping. A townland boundary listed in Appendix 13 of the EIS as TB8 – Local road. Boundary between Ballard West and East not extant	None

Name of Structure	Site description and Topography		Archaeology at Structure	Ecology at Structure
	N6 Mainline	Road over		
S12/02 – Castlegar Wildlife Overbridge	In cut – approx. 7.0m	On embankment approx. 1m fill	None	None
S13/01 – School Road Overbridge	In cutting – approx. 11.3m	At grade or shallow cutting.	None	None

Name of Structure	Site description and Topography		Archaeology at Structure	Ecology at Structure
	N6 Mainline	Road over		
S14/01 - Parkmore Link Road Overbridge	In cutting – approx.. 11.3m	At grade	None	None
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	In cutting – approx.. 1m	On embankment approx. 7.5m fill	None	None
S16/02 Coolagh Junction Overbridge (EB merge from R446)	In cut – approx 10.0m	Approx. at grade	A townland boundary listed in Appendix 13 of the EIS as TB32	None

## 2.5 Vertical and horizontal alignments

Table 3 Vertical and horizontal alignments

Name of Structure	N6 Mainline		Overbridges	
	Vertical Alignment	Horizontal Alignment	Vertical Alignment	Horizontal Alignment
S01/01 Forai Maola to Troiscaigh Link Overbridge	Gradient 1.92%	Curve R=720	R=1075	R=510
S03/01 - Barr Aille Overbridge	Gradient 1.20%	Curve R=1020	R=1000	R=Straight

Name of Structure	N6 Mainline		Overbridges	
	Vertical Alignment	Horizontal Alignment	Vertical Alignment	Horizontal Alignment
S12/02 – Castlegar Wildlife bridge	Gradient 0.75%	Curve R=2040	R=650	R=Straight
S13/01 - School Road Overbridge	Gradient 0.9%	Curve R=20000	R=1700	R=Straight
S14/01 – Parkmore Link Road Overbridge	Curve R=10000	Curve R=1020	Gradient 1.2%	R=1020
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	Curve R=11000	Curve R=720	R=1700	R=255
S16/02 Coolagh Junction Overbridge (EB merge from R446)	Curve R=70000	Curve R=720	R=5500	R=Straight

## 2.6 Cross sectional dimensions on the alignments

The proposed cross section of the road under the underbridge structures is given in Table 4 below.

Table 4: Cross section dimensions below bridge deck

Name of Structure	Carriageway Width[1] (m)	Verge Width (m) [Left]	Verge Width (m) [Right]
S01/01 Forai Maola to Troiscaigh Link Overbridge	12.4	3.0	3.0
S03/01 - Bar Allie Overbridge	12.3	3.0	3.0
S12/02 – Castlegar Wildlife Bridge	31.0	3.0	3.0
S13/01 - School Road Overbridge	29.5	3.0	3.0
S14/01 – Parkmore Link Road Overbridge	Varies 42min	3.0	3.0
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	Varies 28 min	4.0	3.0
S16/02 Coolagh Junction Overbridge (EB merge from R446)	Varies 28 min	4.0	3.0

[1] Carriageway measured from running edge of verge to running edge of verge.

The following cross section details is proposed for the side roads.

Table 5: Dimensions above bridge deck

Name of Structure	Carriageway Width (m)	Raised Verge Width (m) [Left [1]]	Raised Verge Width (m) [Right [2]]	Parapet width (m) [Left]	Parapet width (m) [Right]	Total (m)
S01/01 Forai Maola to Troiscaigh Link Overbridge	6.0	Varies 1.8min	Varies 1.8min	0.5	0.5	11.2
S03/01 - Bar Allie Overbridge	6.0	1.8	1.8	0.5	0.5	10.6

Name of Structure	Carriageway Width (m)	Raised Verge Width (m) [Left [1]]	Raised Verge Width (m) [Right [2]]	Parapet width (m) [Left]	Parapet width (m) [Right]	Total (m)
S12/02 – Castlegar Wildlife Bridge	6.0	11.5[2]	11.5[2]	0.5	0.5	30.0
S13/01 - School Road Overbridge	6.0	Varies 1.8min	Varies 1.8 min	0.5	0.5	11.5
S14/01 – Parkmore Link Road Overbridge	11.235	Varies 1.85min	Varies 1.85min	0.5	0.5	17.25
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	9.3	2.5	0.6	0.5	0.5	13.4
S16/02 Coolagh Junction Overbridge (EB merge from R446)	9.3	Varies 1.5min	Varies 3.0 min	0.5	0.5	Varies 14.8min

[1] Based on direction of increasing chainage along the side-road alignment.

[2] Wildlife bridge: Space provided for planting and earth bunds.

## 2.7 Existing underground and overground services

All the utility providers have been consulted with during the preliminary design process. The existing services in the vicinity of the proposed structures are outlined in Table 6 below.

Table 6 Existing Services

Name of Structure	Existing Services
S01/01 - Forai Maola to Troscaigh Link Overbridge	MV Overhead Single Phase
S03/01 - Barr Aille Overbridge	Overhead Eir Services
S12/02 – Castlegar Wildlife Bridge	None
S13/01 - School Road Overbridge	Underground Eir Services 315 PE Gas, 100mm Watermain Public Foul Sewer LV Overhead Single Phase I
S14/01 – Parkmore Link Road Overbridge	ESB Overhead 38kv ESB Overhead 110kv

Name of Structure	Existing Services
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	ESB Overhead 38kv ESB Overhead 110kv
S16/02 Coolagh Junction Overbridge (EB merge from R446)	ESB Overhead 38kv ESB Overhead 110kv

## 2.8 Geological summary

Table 7 Geotechnical Summary

Name of Structure	Chainage	Average Depth from e.g.l to groundwater level(m)	Average depth from e.g.l to rockhead (m)	Ground Conditions	Preliminary Karst Risk
S01/01 - Forai Maola to Troscaigh Link Overbridge	01+375	0.8	1.0	TOPSOIL / Dark brown PEAT Soft slightly granular SILT Loose to medium dense silty GRAVEL Slightly weathered GRANITE	n/a[1]
S03/01 - Barr Allie Overbridge	03+300	0.5	0.8	Peaty TOPSOIL Slightly weathered GRANITE	n/a[1]
S12/02 – Castlegar Wildlife	12+700	12.7	2.1	Firm to very stiff slightly granular SILT/CLAY Slightly weathered LIMESTONE	High
S13/01 - School Road Overbridge	13+185	7.5	5.1	Firm sandy gravelly CLAY Weathered Rock Slightly weathered LIMESTONE	Medium
S14/01 – Parkmore Link Road Overbridge	14+375	10.0	6.0	Soft sandy SILT Medium dense to dense silty sandy GRAVEL Moderately to slightly weathered LIMESTONE	Medium
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	16+410	2.7	2.9	Firm sandy gravelly CLAY Weathered Rock Slightly weathered LIMESTONE	Low
S16/02 Coolagh Junction Overbridge (EB merge from R446)	16+830	- [2]	1.0	Likely shallow poorly drained Slightly weathered LIMESTONE	Medium

e.g.l. = existing ground level

[1] not applicable as it is an area where the underlying bedrock is granite.

[2] information not available from current ground investigation data

## 2.9 Hydrology and Hydraulic summary

The groundwater levels are listed in the previous section of this document, see Table 7.

## 2.10 Archaeology summary

The archaeology summary is provided in Table 2 above.

## 2.11 Environmental summary

The environmental (ecology) summary is provided in Table 2 above.

## 2.12 Sustainability

Typically concrete is selected as the primary structural material for the underbridges. Concrete has a high durability performance and requires little maintenance during the design life (120yrs), where the product is appropriated specified and executed. Portland cement replacements such as ground granulated blast-furnace slag (GGBS) will be used where appropriate.

Overbridges S01/01, S03/01, S12/01 and S13/01 are of integral construction. This form of construction minimises the inspection and maintenance requirements compared to non-integral forms of construction. Where the structural arrangement is not appropriate for integral construction, such as S14/01, S16/01 and S16/02, bridges with bearings and expansion joints are adopted.

All structures can be readily demolished at the end of the service life of the bridge, and much of the structural materials (concrete, steel etc) can be recycled and reused.

## 3 Structure and aesthetics

### 3.1 Structural Options Considered

At each of the overbridge locations, an assessment of several bridge options have been considered. A brief summary of this assessment is present in Section 3.2 below, along with a description of the recommended structure.

### 3.2 General description of recommended structures

There are six overbridges identified in the preliminary design of the proposed N6.

#### 3.2.1 Structure S01-01 and 03-01

Structures S01-01 and S03-01 carry side roads over the proposed N6. Structure S03-01 is an overbridge carrying the Aille Road (L5384), over the proposed N6. The crossing is in-line with the existing road, i.e. the plan position of the bridge is at the same location as the existing road, and thus a temporary (local) diversion of the local road will be necessary during the construction works. Structure S01-01 will carry the new Forai Maola to Troscaigh Link over the proposed N6 and will not require any local traffic diversions as it is a new section of side road.

At both these locations, the N6 is a single carriageway cross section. For this structure, the following bridge types have been considered in the option assessment stage:

- *Single Span Overbridge*

This structure is single span bridge with vertical walls. The deck comprises of pre-cast concrete beams which can be laid to a skew, with an in-situ reinforced concrete deck slab. This is supported with vertical in-situ reinforced concrete walls, see Figure 1.

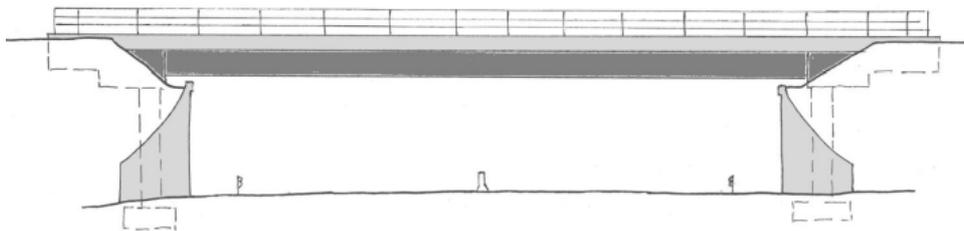


Figure 1: Single span overbridge

- *Two Span Overbridge*

This structure is a 2 span bridge with a central support and side slopes of 1:2. The deck comprises of pre-cast concrete beams which can be laid to a skew, with an in-situ reinforced concrete deck slab, see Figure 2.

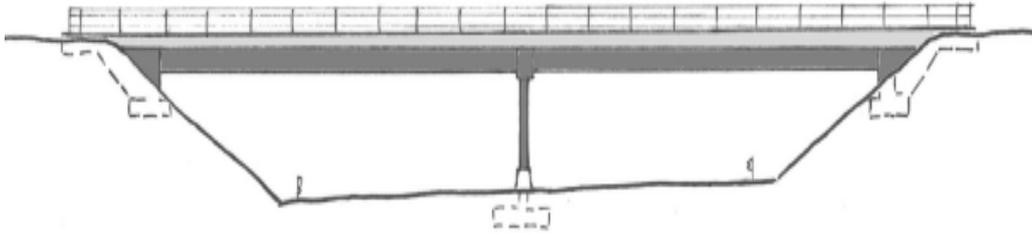


Figure 2: Two span overbridge

- *Three Span Overbridge*

This structure is 3 span bridge with supports either side of the carriageway and side slopes of 1:2. The deck comprises of pre-cast concrete beams which can be laid to a skew, with an in-situ reinforced concrete deck slab, see Figure 3.

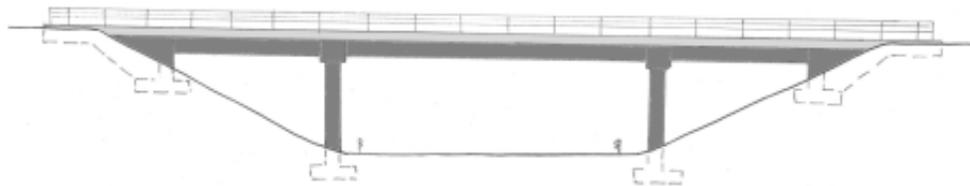


Figure 3: Three span overbridge

The recommended structure is a *three span overbridge*, as this is considered to provide the most appropriate form of construction over a single carriageway mainline and for the rural setting of S01/01 and S03/01.

The single span option does not provide appropriate aesthetics or an open form of construction; the two span overbridge requires a support in the centre of the carriageway which is not appropriate for a single carriageway construction. Alternative forms of a two span bridge, such as asymmetric spans have not been considered at the option development stage.

### 3.2.2 Structure S12-02

Structure S12-02 is an overbridge structure which provides a wildlife crossing over the proposed N6. The structure is provided with earth bunds to encourage and promote mammal crossing, in particular bats.

Three options have been considered, as described below:

- *Twin Arches*

A pair of concrete arches provides a system with a large amount of exposed landscaping on the approach to the structure, as indicated in Figure 4 below. It is a structurally efficient solution.

However, due to the span of the arches and the subsequent rise of the arch, the alignment over the mainline needs to be raised, which is undesirable at this location.

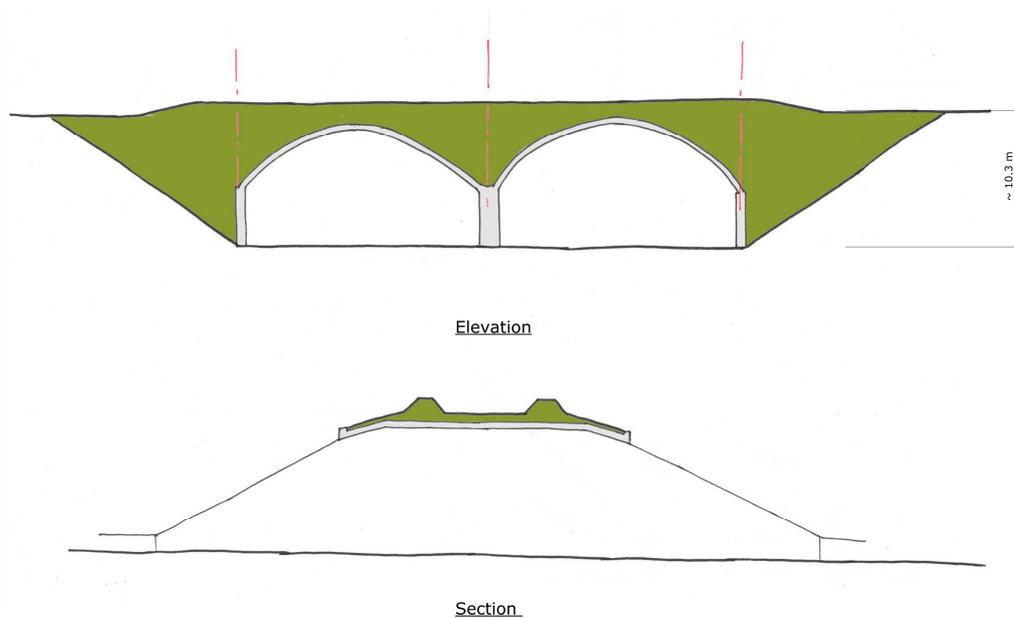


Figure 4: Twin Arches

- *Two Span Overbridge with Inverted Deck*

In an effort to minimise the need to raise the alignment over the mainline and to minimise the extent of visible structure on the approach, an inverted deck could be adopted, as indicated in Figure 5 below. The inverted deck, uses the space within the earth bund to locate the main longitudinal structural elements, and a lower level deck to support the crossing material.

This is not a conventional form of construction for overbridges and thus would only be justified where the aesthetic need demanded such a solution. At this location, such a demand is not considered to be warranted.

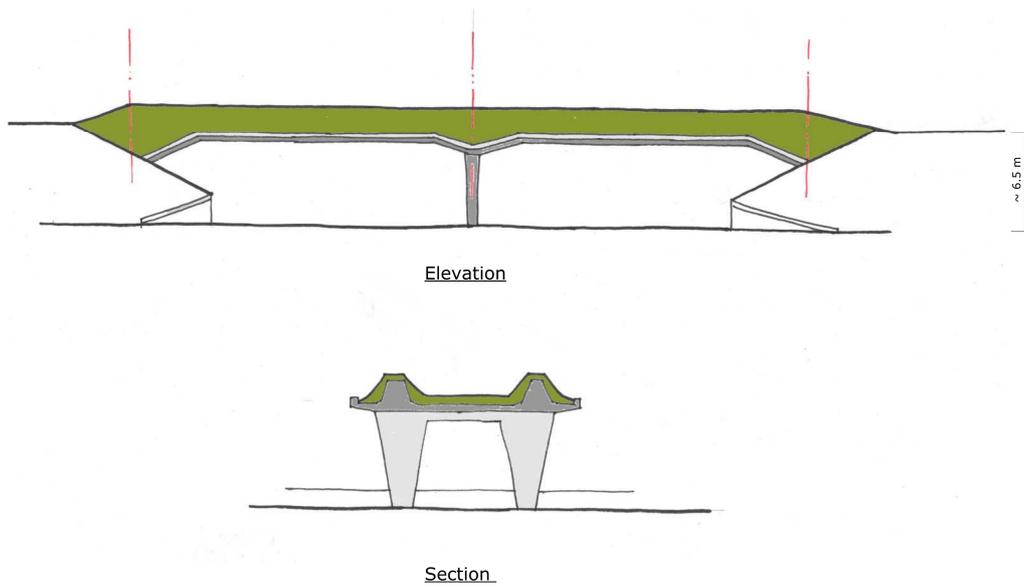


Figure 5: Two Span Overbridge with Inverted Deck Arches

- *Two Span Overbridge with Conventional Deck*

Where a conventional deck, using precast pre-stressed beams and a concrete deck slab is adopted, the level difference between the crossing and the mainline is a compromise between the two options presented above. This option is presented in Figure 6 below. There is an increased amount of structural elements visible on the approaches to the bridge, compared to the other options. However, given the more conventional construction the capital cost will be less than the inverted deck, and from an aesthetic point of view the structure will be comparable to other overbridges on the scheme.

Thus, this option is the recommended form of construction for Structure S12/02.

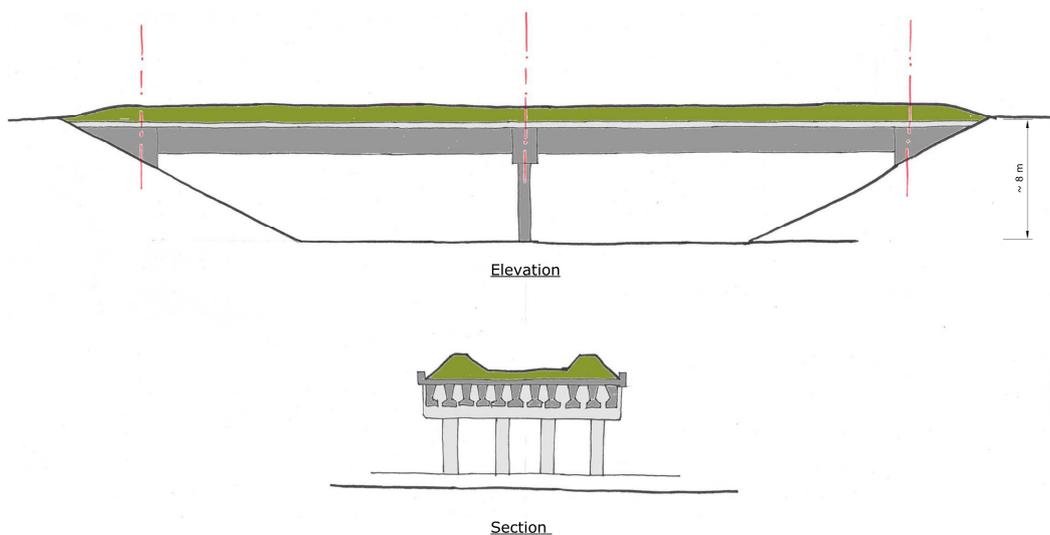


Figure 6: Two Span Overbridge with Conventional Deck

### 3.2.3 Structure S13-01

Structure S13-01 is an overbridge carrying School Road (L-2134-1), over the proposed N6. Similar to S03/01, the crossing is in-line with the existing road, i.e. the plan position of the bridge is at the same location as the existing road, and thus a temporary (local) diversion of the local road will be necessary during the construction works. At this location, the N6 is a dual carriageway cross section, with an additional weaving lane carriageway in both directions.

Due to the local topography and the proposed alignment, the side road is elevated approximately 11m above the N6. The proposed mainline is in a cutting, with rockhead expected to be approximately 5m above N6 road level. At preliminary design stage, a 1 vertical to 1.5 horizontal slope is adopted in the rock cutting with a 2m horizontal bench at the top of the rockhead, and a 1:2 slope in the overburden material.

The following options have been considered for Structure S13-01.

- *Arch bridge*

Given the available clearance and the presence of rock at the bottom of the mainline cutting, and arch-type structure is a potential option. Given the relatively short spans, and the compressive arch action, the structure could be constructed of in-situ reinforced concrete. The typical configuration is given in Figure 7 below.

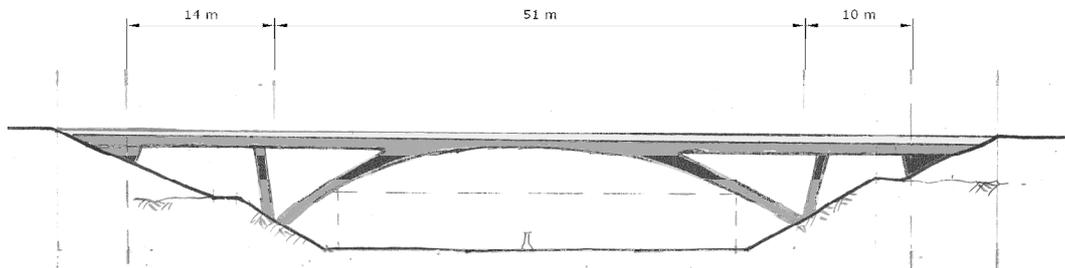


Figure 7: Arch bridge

- *Two Span Overbridge*

This structure is a 2 span bridge with a central support, as indicated in Figure 8 below. The deck is comprised of pre-cast concrete beams and an in-situ reinforced concrete deck slab. At 39m, the spans are relatively long for this form of construction, but considered to be within the feasible range, in terms of design and construction.

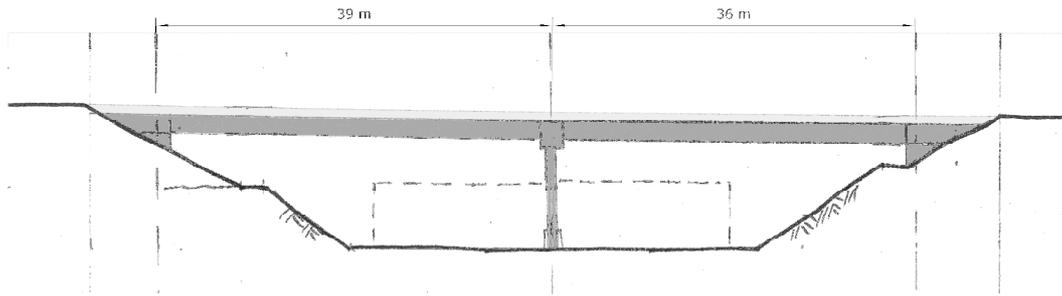


Figure 8: Two span overbridge

- *Three Span Overbridge*

This structure is 3 span bridge with supports either side of the carriageway, as shown in Figure 9 below. The deck is comprised of pre-cast concrete beams with an in-situ reinforced concrete deck slab. Due to the skew crossing and presence of weaving lanes, the central span is approximately 40m. Again, this span length is at the upper limit of precast prestressed bridge beams currently in use. Refer to Figure 6.

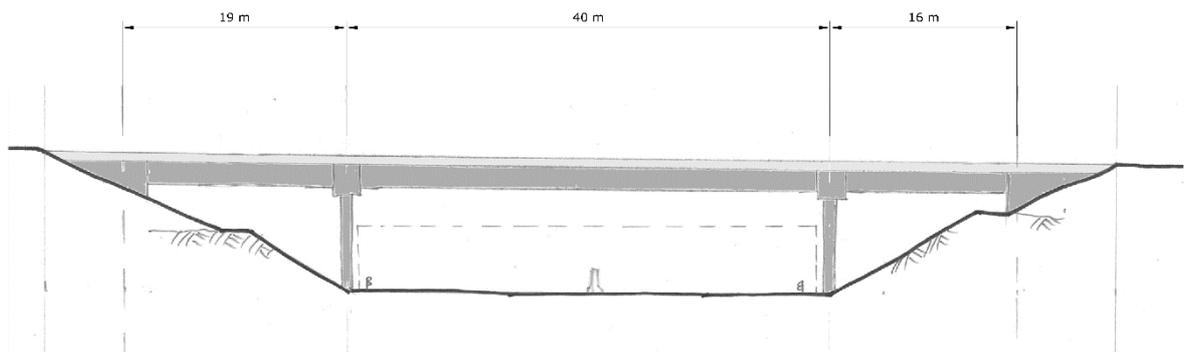


Figure 9: Three span overbridge

The recommended structure is a *two span overbridge*, as this is considered to provide the most appropriate form of construction at this location.

The arch bridge has the potential to provide an attractive and efficient solution, but the geotechnical conditions are more critical and not fully known at this stage of the design.

The three span overbridge is also a feasible alternative. Either of these options could be developed at the next stages of the design as an alternative to the recommended *two span overbridge*.

### 3.2.4 Structure S14-01

Structure S14-01 is an overbridge carrying the proposed Parkmore Link Road over the proposed N6. At this location, the N6 is a dual carriageway cross section, with additional on and off slip lanes.

With embankment side slopes of 1:1.5, due to the ground conditions present, the overall length of the bridge is approximately 90 to 100m.

Two options have been considered. A two span structure with a steel composite deck (Figure 10); and a 3-span structure with a prestressed precast concrete beam superstructure (Figure 11).

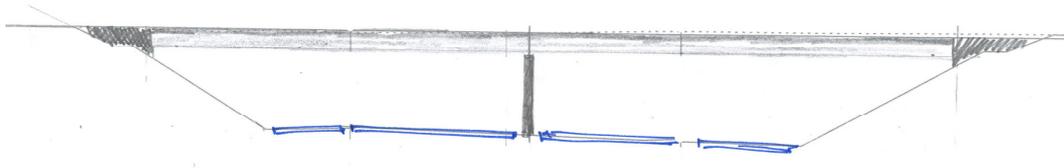


Figure 10: Two span overbridge

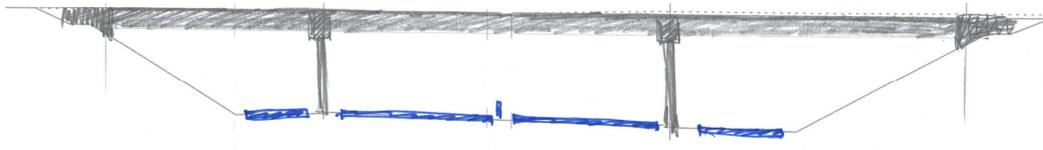


Figure 11: Three span overbridge

The recommended structure is a *three span overbridge*, as this is considered to provide the most appropriate form of construction at this location.

Due to the length, bearings and expansions are proposed at the abutments. A fully integral connection between the deck and the pier is envisaged at the intermediate supports. The general arrangement is indicated on drawing GCOB-1700-D-S14-01-001 in Appendix A.

### 3.2.5 Structure S16-01 and S16-02

Structure S16-01 and S16-02 are overbridge structures at Coolagh Junction, which is the interchange where the proposed N6 Ring Road merges with the existing N6, to the east of Galway City. The overbridges are required to carry merging and diverging lanes over the proposed N6 mainline.

Due to the proximity of the structures to each other, and the similarity in terms of cross section dimensions, length and skew, the options for the two structures are jointly assessed to ensure aesthetic visual consistency. The principle structural

difference between the overbridges is that S16-01 is on a horizontal curvature of approximately 255m, while S16-02 is on a straight highway alignment.

Both overbridges are at a high skew to the N6 mainline. The mainline alignment is on a horizontal curve with a radius of 720m at this location, and consequently widening of the mainline cross section is necessary for forward visibility sightlines.

Several options have been considered as described below. The configurations are presented for S16-01, however the same main principles apply for S16-02, albeit with a straight alignment rather than curved.

- *Four Span Overbridge: Precast prestressed beams*

This is a 4 span bridge, with a skewed deck using prestressed precast bridge beams, as indicated in Figure 12. The beams are integral at the intermediate supports by means of a downstand crosshead, and bearings and expansion joints are provided at the abutments. With spans up to around 36m, the beam lengths are within the normal range of precast bridge beam construction. Straight bridge beams are adopted resulting in a cross section which varies in width and direction over the length of the bridge.

This form of construction can be readily applied to both S16-01 and S16-02; however due to the high skew crossing the pier crosshead and multiple pier supports make the bridges look disproportionately heavy and intrusive in the surroundings.

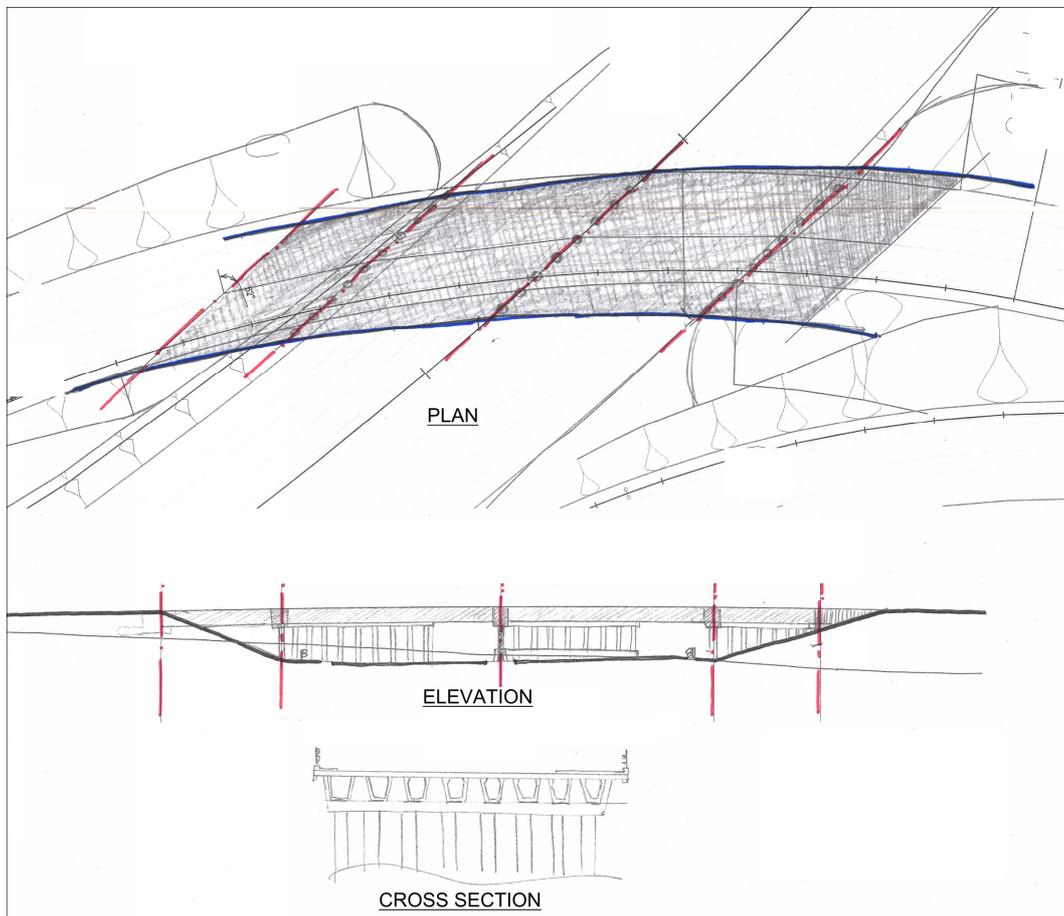


Figure 12 Four span overbridge: Precast prestressed beams

- *Four Span Overbridge: Steel composite*

This is a 4 span bridge, using steel girders composite with an in-situ deck slab. For S16-01 curved beams can be utilised to minimise the bridge deck width. In addition, the ends of the deck can be made square with the side road alignment which will improve the performance and durability of the expansion joints at the ends of the bridge. For S16-02, a skewed bridge configuration is envisaged.

The steel composite deck could be of ladder deck configuration or using pairs of braced I-girders. For the preliminary design, pairs of I-girders are adopted.

The steel composite deck adopted two columns per pier support location. The reduced number of columns and the diaphragm construction within the depth of the girder provides a more open and slender appearance, compared to the prestressed beam option.

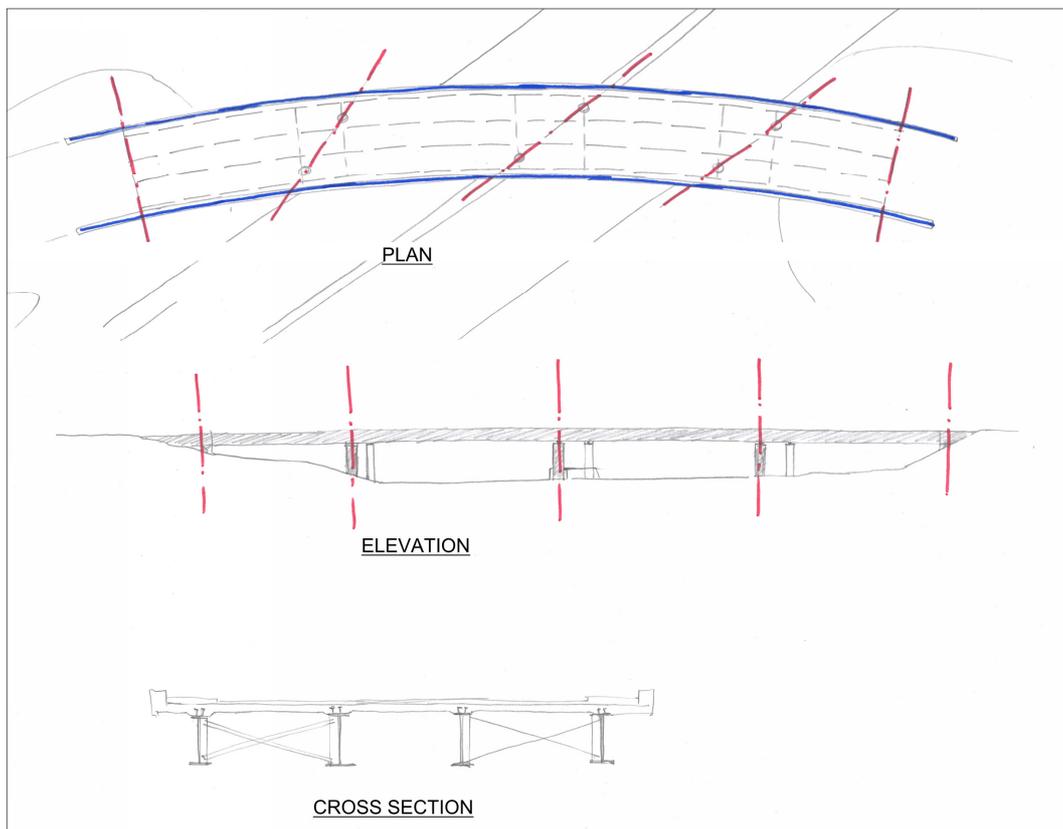


Figure 13 Four span overbridge: Steel composite

- *Four Span Overbridge: In-situ post-tensioned deck*

This is a 4 span bridge with a post-tensioned, cast in-situ, deck slab, as indicated in Figure 14 below. The use of single column supports at each of the intermediate piers, enables the skew arrangement to be avoided. For S16-01 a curved deck is envisaged; whereas at S16-02 a straight bridge deck can be adopted.

Visually, this configuration is considered to be the most aesthetically pleasing of the options, due to the single column support arrangement and the slender continuous deck. However it is likely to be the most expensive to construct.

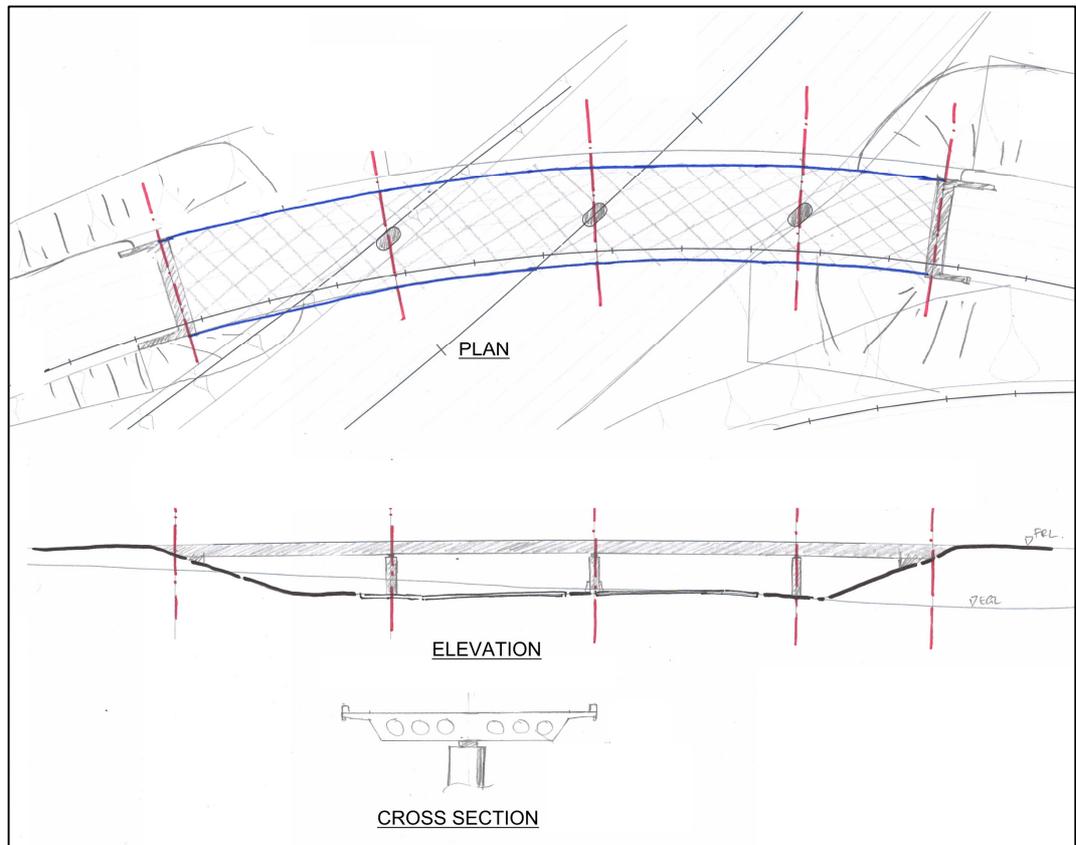


Figure 14 Four span overbridge: In-situ post-tensioned deck

- *Two Span Overbridge: Twin Portal Frame*

As an alternative to an open overbridges construction, a twin portal frame is considered, as indicated in Figure 15 below. Two portal frames with a spans of approximately 20m and a length of approximately 60m are required to provide a square crossing. Full height walls are required over much of the length and long retaining walls are required at opposing corners of the bridge.

To minimise the tunnel effect of this form of construction, “pergolas” can be utilised on the parts of the bridge deck not carrying the side road directly above, and columns can be used instead of walls where no ground retention is required.

Nevertheless, the twin portal frame results in significant visual impact on the road user due to the closed nature of the abutments and the overall length of the structure along the proposed N6.

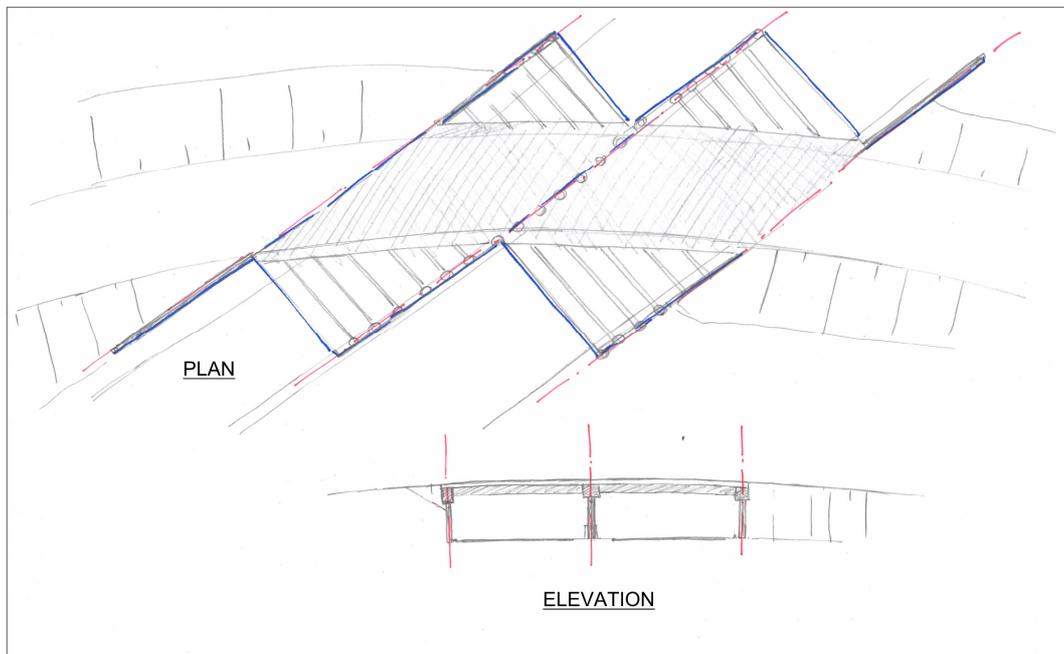


Figure 15 Two span overbridge: Twin Portal Frame

With due consideration of economy and visual impact, the *four span steel composite overbridge* is regarded as the most appropriate option for both S16-01 and S16-02, and is the recommended option further considered in the preliminary design.

### 3.3 Aesthetic considerations

There is variation in structural form and materials within the overbridge structures on the proposed N6. Nevertheless, a consistent approach will be adopted for each overbridge, in terms of finishes and details, to ensure the aesthetic treatment provides “a family of structures”.

### 3.4 Proposals for the recommended structure of family of structures

#### 3.4.1 Proposed category

The proposed category classification is given in Table 8 below.

#### 3.4.2 Span arrangements

Table 8 Span arrangements

Name of Structure	Span arrangement	Span (m)	Skew angle (deg)	Category
S01/01 - Forai Maola to Troscaigh Link Overbridge	3 Span	10.7 + 17.4 + 10.7	0	2
S03/01 - Bar Allie Overbridge	3 Span	12.5 + 19.1 + 12.5	24	2
S12/02 – Castlegar Green Accommodation Overbridge	2 Span	25.2 + 23.9	0	2
S13/01 - School Road Overbridge	2 Span	39.2 + 35.9	28	2
S14/01 – Parkmore Link Road Bridge	3 Span	25.51 + 32.41 +34.16	29	2
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	4 Span	28.0 + 32.7 + 28.5 + 21.6 [1]	0	3
S16/02 Coolagh Junction Overbridge (EB merge from R446)	4 Span	19[2] + 37.5 + 32.3 + 16.0	58	3

[1] Average span length due to curved bridge deck and varying support line orientation.

[2] Average span length given; deck width varies along the length of the bridge.

#### 3.4.3 Approaches including run-on arrangements

The approach embankments will be constructed using a compacted acceptable material with Clause 6N material behind the abutment walls.

### 3.4.4 Substructure

The substructure will comprise of in-situ reinforced concrete bankseat abutments and in-situ reinforced concrete columns, crosshead and diaphragms, where applicable, at intermediate supports.

### 3.4.5 Foundation type

At all the proposed overbridge structures, competent rock is expected at or near the foundations, thus the abutments and central piers will be supported on spread foundations. Where necessary, compacted 6N upfill will be provided between the foundation and the natural ground strata below, to achieve the required bearing capacity.

At some locations there is a medium to high risk of karst features in the ground. Where these occur, appropriate measures will be necessary for the bridge foundations.

### 3.4.6 Superstructure

- *S01/01, S03/01, S12/01, S13/01 and S14/01*

The superstructure comprises precast prestressed concrete beams with an in-situ reinforced concrete deck slab supported on permanent formwork between the beams and on temporary formwork at the overhanging cantilever edges of the deck slab.

- *S16/01 and S16/02*

The superstructure comprises two pairs of steel I girders, and associated steelwork, with an in-situ reinforced concrete deck slab supported on permanent formwork between the beams and on temporary formwork at the overhanging cantilever edges of the deck slab.

### 3.4.7 Articulation arrangements, joints and bearings

At structures S01/01, S03/01, and S12/02 the superstructure will be fully integral with the bankseat abutments and central pier.

The continuous steel composite decks at S16/01 and S16/02 are supported by bearings at the end and intermediate support locations. The concrete superstructure at S13/01 and S14/01 is fully integral at the intermediate support locations and supported on bearings at the abutments. At the abutments, expansion joints are provided.

### 3.4.8 Parapet

With the exception of S12/02, all the overbridges are typically provided with H2-W4 parapets, 1.25m high, with mesh infill. The approach and departure safety barrier and transitions will be H2 containment.

At structure S12/02 pedestrian parapet will be provided at headwalls and wingwalls in accordance with TII DN-STR-03011 (NRA BD 52).

Due to the direct proximity of school facilities adjacent to structure S13/01, the risk of children climbing the bridge parapet, with the possibility of falling has been identified. Measures will be implemented to mitigate this risk, typically by adopting a higher parapet (e.g. 1.8m) and using solid infill cladding. The performance requirements of the anti-climbing measures will be defined in the next stages of the design and procurement process.

### **3.4.9 Inspection and maintenance**

Structures S01/01, S03/01, and S12/02 are of fully integral concrete construction throughout, and have no movement joints or bearings and hence minimal maintenance requirements are expected.

At structures S13/01, S14/01, S16/01 and S16/02 the expansion joints and bearings will have inspection and maintain requirements associated with these elements. The appropriate access and inspection facilities will be provided at these structures.

Structures S16/01 and S16/02 utilise structural steel which will require maintenance during the design lifetime (where weathering steel is not used).

For all overbridge structures, access to the bridge soffit will be from the local road below and will require local diversions and a mobile elevated work platform for access purposes.

Waterproofing systems, joints, parapets etc shall be designed for Working Life Category 2 (replaceable structural parts, up to 50 years design working life).

All other elements of the structure shall be designed for Working Life Category 5 ( $\geq 120$  years design working life).

## 4 Safety

---

### 4.1 Traffic management during construction including land for temporary diversions

Detailed traffic management proposals will be developed at detail design stage by the appointed Contractor in consultation with their Designers and the consent for the diversions and or road closures will be sought from the appropriate local authority.

### 4.2 Safety during construction

The Designer will take account of the General Principles of Prevention, as specified in the Schedule 3 of the Safety, Health and Welfare at Work Act 2005, liaise with the Project Supervisor appointed by the Client for the Design Process and the Project Supervisor appointed for the Construction Stage and carry out all other duties as required by Clause 15 of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013).

The Project Supervisor for the Design Process will comply with all the requirements outlined in Clauses 11, 12, 13 & 14 of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013).

### 4.3 Safety in use

Parapets and safety barriers will be provided across the length of the structure and on the approach to, and departure from, the structure.

Where applicable, pedestrian protection will be provided at the top of headwalls and wingwalls in accordance with TII DN-STR-03011 (NRA BD 52).

At structure S13/01, a risk assessment has been undertaken and there is a need for additional pedestrian containment measures, at this location See also Section 3.4.8.

### 4.4 Lighting

No lighting is proposed at S01/01, S03/01, S12/02 and S13/01.

Lighting is proposed at the overbridges (S16/01 and S16/02) in the vicinity of Coolagh grade separated junction. Lighting is also proposed at S14/01.

## 5 Cost

### 5.1 Budget Estimate in current year, including whole life cost

Table 9 Budget estimate

Name of structure	Structure Cost Excl. VAT (Million Euro)
S01/01- Forai Maola to Troscaigh Link Overbridge	0.6
S03/01 - Barr S01/01 - Forai Maola to Troscaigh Link Overbridge Aille Overbridge	0.7
S12/02 – Castlegar Wildlife Bridge	2.1
S13/01 - School Road Overbridge	1.3
S14/01 – Parkmore Link Road Overbridge	1.9
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	3.3
S16/02 – Coolagh Junction Overbridge (EB merge from R446)	3.2

The cost estimate values given in Table 9 are based on a cost rate per square metre of structure area given in Table 10 below. A range of -10% to +15% is considered to be applicable to the budget cost for this stage of the design.

Table 10 Basis of cost estimate

Structure Type	Rate (Euro/m2)
Prestressed beam deck overbridge	1450
Steel composite deck overbridge	2000

## 6 Design Assessment Criteria

---

### 6.1 Normal Loading

Permanent Actions in accordance with IS EN 1991-1-1:2002 and the associated National Annex.

The structure will be designed for Load Models LM1 and LM2 in accordance with IS EN 1991-2:2003 and the associated National Annex.

All support columns to be designed for full impact loading in accordance with Table NA1 loading of IS EN 1991-1-7

### 6.2 Abnormal Loading

Load Model 3 up to and including SV196 (where applicable) will be considered in accordance with IS EN 1991-2:2003 and the associated National Annex.

### 6.3 Footway live loading

Where applicable, a footway loading shall be in accordance with Clause 5.3.2.1 of IS EN 1991-2:2003. A nominal  $q_{fk} = 5\text{kN/m}^2$  will be adopted.

### 6.4 Provision for exceptional abnormal loads

Not applicable.

### 6.5 Any special loading not covered above

No exceptional abnormal loads are proposed.

### 6.6 Heavy or high load route requirements and arrangements being made to preserve route

Not applicable.

### 6.7 Minimum headroom provided

The minimum headroom clearance for underbridge structures will be 5.3m in accordance with TII DN-GEO-03036 (NRA TD 27).

## **6.8 Authorities consulted and any special conditions required**

Consultation with relevant authorities is on-going. The following groups have been contacted as part of the scheme:

Transport Infrastructure Ireland (TII)

Galway County Council (GcoC)

Galway City Council (GciC)

Land and home owners

## 7 Ground Conditions

### 7.1 Description of the ground conditions and compatibility with proposed foundations

Table 11 Ground conditions

Name of Structure	Foundation Type	Soil / Rock at Formation Level		Safe Bearing Pressure (kN/m <sup>2</sup> )	Formation depth above (+)/ below (-) egl (m)		Typical depth to rockhead from egl (m)
		Pier	Abutment		Pier	Abutment	
S01/01 - Forai Maola to Troscaigh Link Overbridge	Pad	Structural Upfill / Rock	Structural Upfill / Rock	360	-1.7	+3.1	2.1 (Varies)
S03/01 – Barr Aille Overbridge	Pad	Rock	Rock	370	-6.9	-1.2	0.8
S12/02 – Castlegar Wildlife Bridge	Pad	Rock	Rock	385	-7.0	-7.0	2.0
S13/01 – School Road Overbridge	Pad	Rock	Rock	375	-13.9	-5.3	5.0
S14/01 – Parkmore Link Road Overbridge	Pad	Rock	Rock	335	-13.4	Varies - 5.3min	8.0
S16/01 – Coolagh Junction Overbridge (EB diverge to R446)	Pad	Rock	Soil	165[1]	Varies -2.0 min	Varies +4.3 max	2.9
S16/02 – Coolagh Junction Overbridge (EB merge from R446)	Pad	Rock	Soil	165[1]	Varies -2.9 min	Varies +2.7 max	1.0

egl = existing ground level

[1] Minimum safe bearing capacity (at south abutment)

## 8 Drawings and Documents

### 8.1 List of all documents accompanying the submission

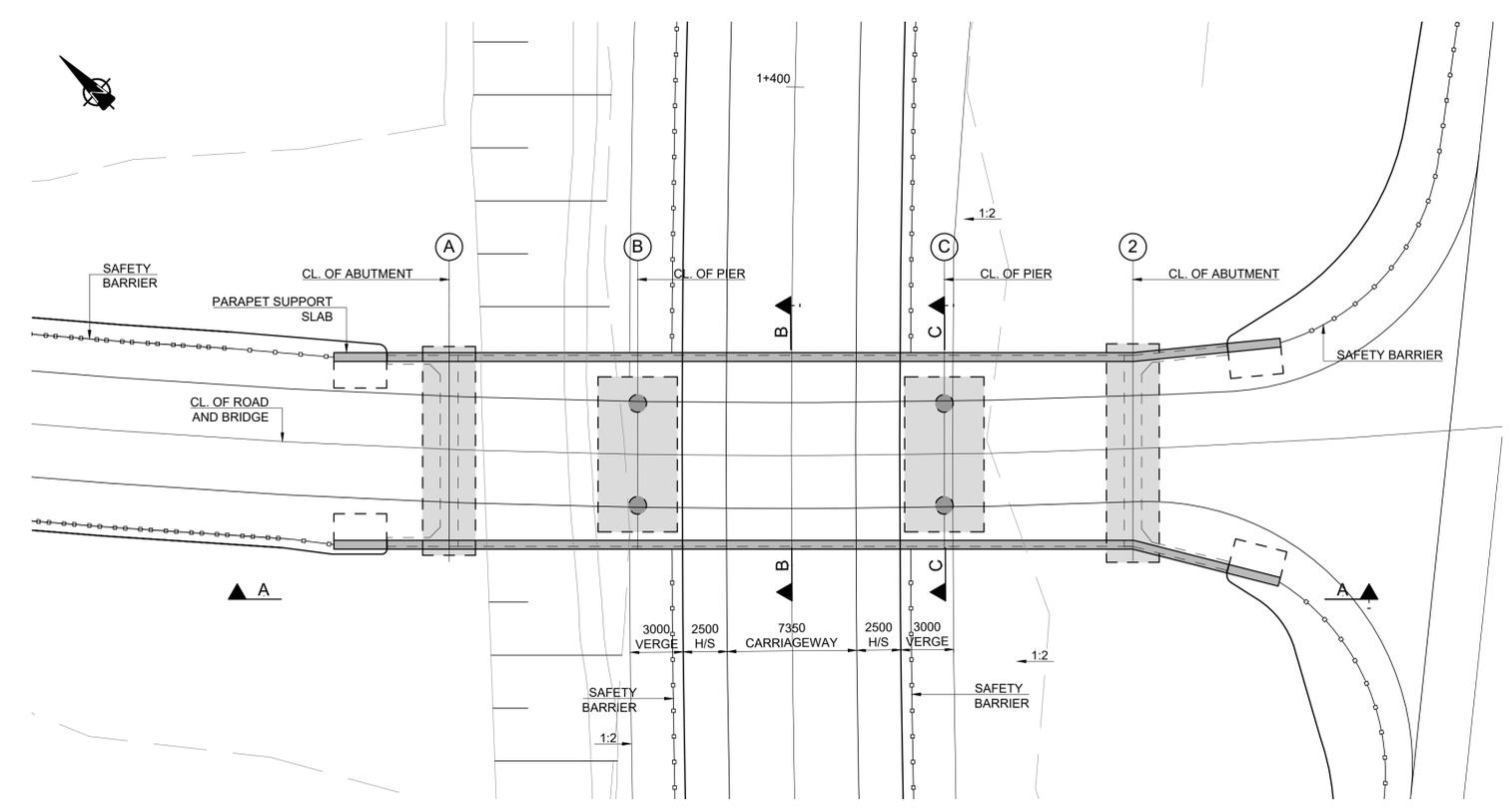
Table 12 Drawings

Name of Structure	Drawing Number
Standard Overbridge – Structure S01/01	GCOB-1700-D-S01-01-001
	GCOB-1700-D-S01-01-002
Standard Overbridge – Structure S03/01	GCOB-1700-D-S03-01-001
	GCOB-1700-D-S03-01-002
Standard Overbridge – Structure S12/02	GCOB-1700-D-S12-02-001
Standard Overbridge – Structure S13/01	GCOB-1700-D-S13-01-001
	GCOB-1700-D-S13-01-002
Standard Overbridge – Structure S14/01	GCOB-1700-D-S14-01-001
	GCOB-1700-D-S14-01-001
Standard Overbridge – Structure S16/01	GCOB-1700-D-S16-01-001
	GCOB-1700-D-S16-01-002
Standard Overbridge – Structure S16/02	GCOB-1700-D-S16-02-001
	GCOB-1700-D-S16-02-002

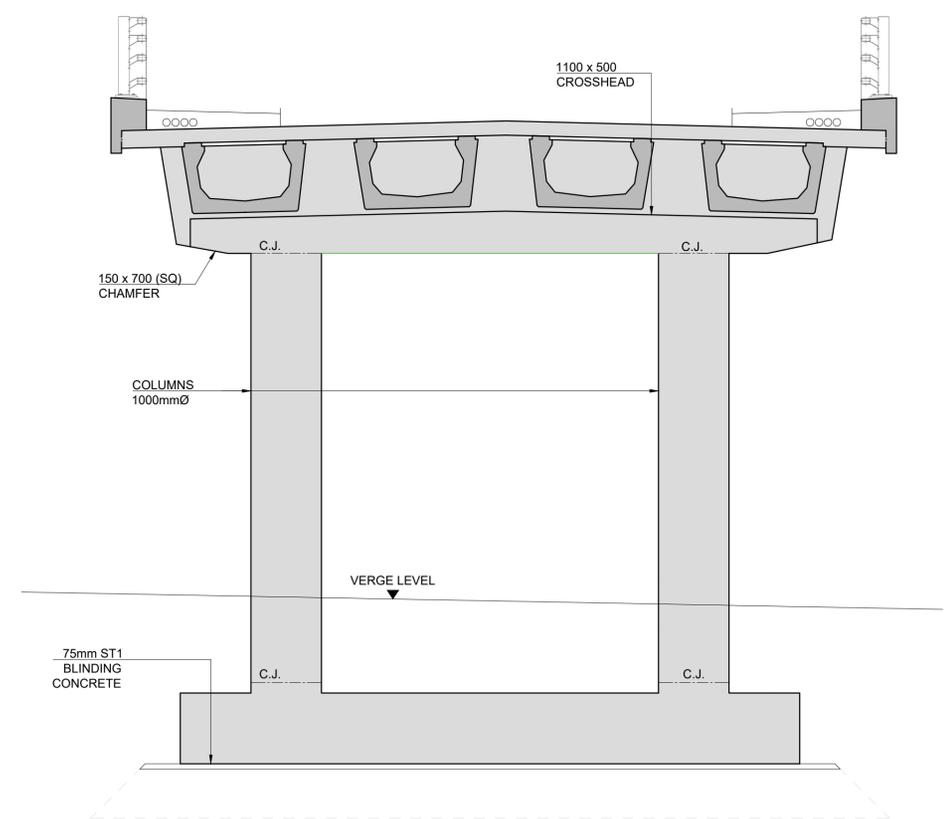
## Appendix A

### Drawings

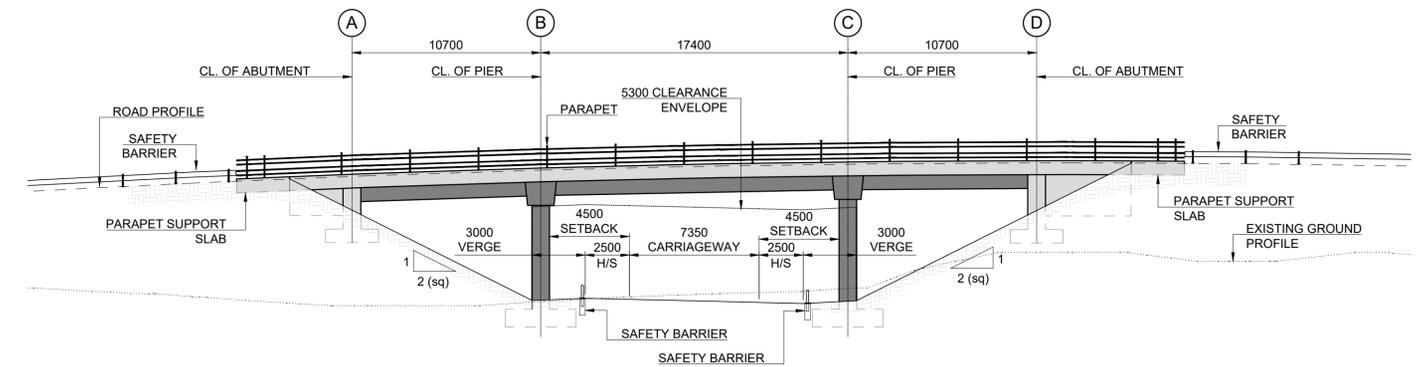
- NOTES:**
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  2. ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE DATUM.



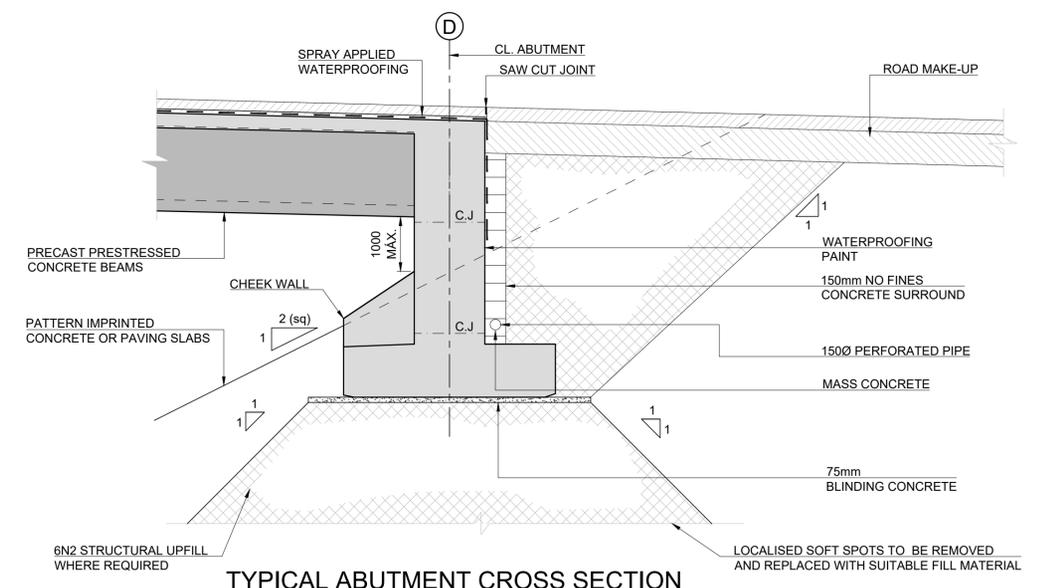
**PLAN ON BRIDGE**  
SCALE 1:200



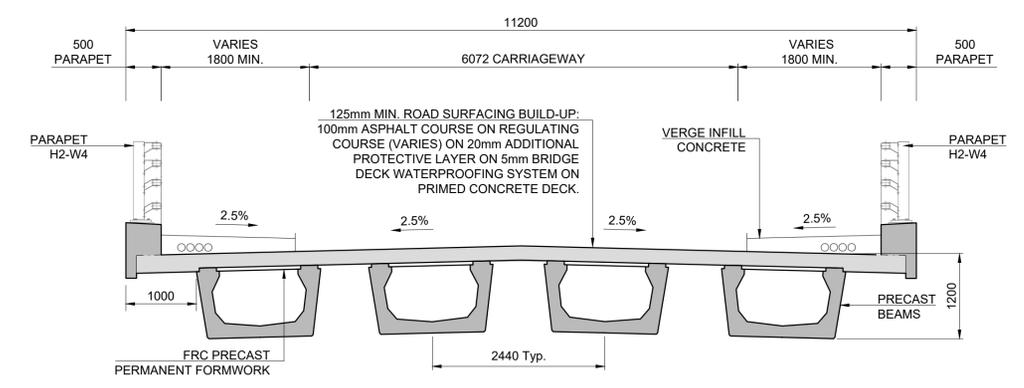
**SECTION C-C**  
SCALE 1:50



**SECTION A-A**  
SCALE 1:200



**TYPICAL ABUTMENT CROSS SECTION**  
SCALE 1:50



**SECTION B-B**  
SCALE 1:50

San áireamh tá sonraíocht Shuirbhéireacht Ordnáis Éireann arna áitirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sárstáin áitirgeadh neamhdáraithe cóipeacht Shuirbhéireacht Ordnáis Éireann agus Bialas na hÉireann. © Suirbhéireacht Ordnáis Éireann, 2010.

© Suirbhéireacht Ordnáis Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
Galway County Council

**Galway City Transport Project**

**An Roinn Iompair**  
Turasoireachta agus Spóirt  
Department Transport, Tourism and Sport

**TIU**  
Bonnagar Iompair Éireann  
Transport Infrastructure Unit

Consultant

**ARUP**

Corporate House  
City East Business Park  
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
www.NGalwayCity.ie  
www.arup.ie

Job Title  
**N6 Galway City Ring Road**

Scale  
**AS SHOWN @ A1**

Date:  
**June 2017**

Issue	Date	By	Chkd	Appd
I1	26/06/2017	MS	PM	EMC

Drawing Title  
**Standard Overbridge Structure S01-01**

Drawing Status

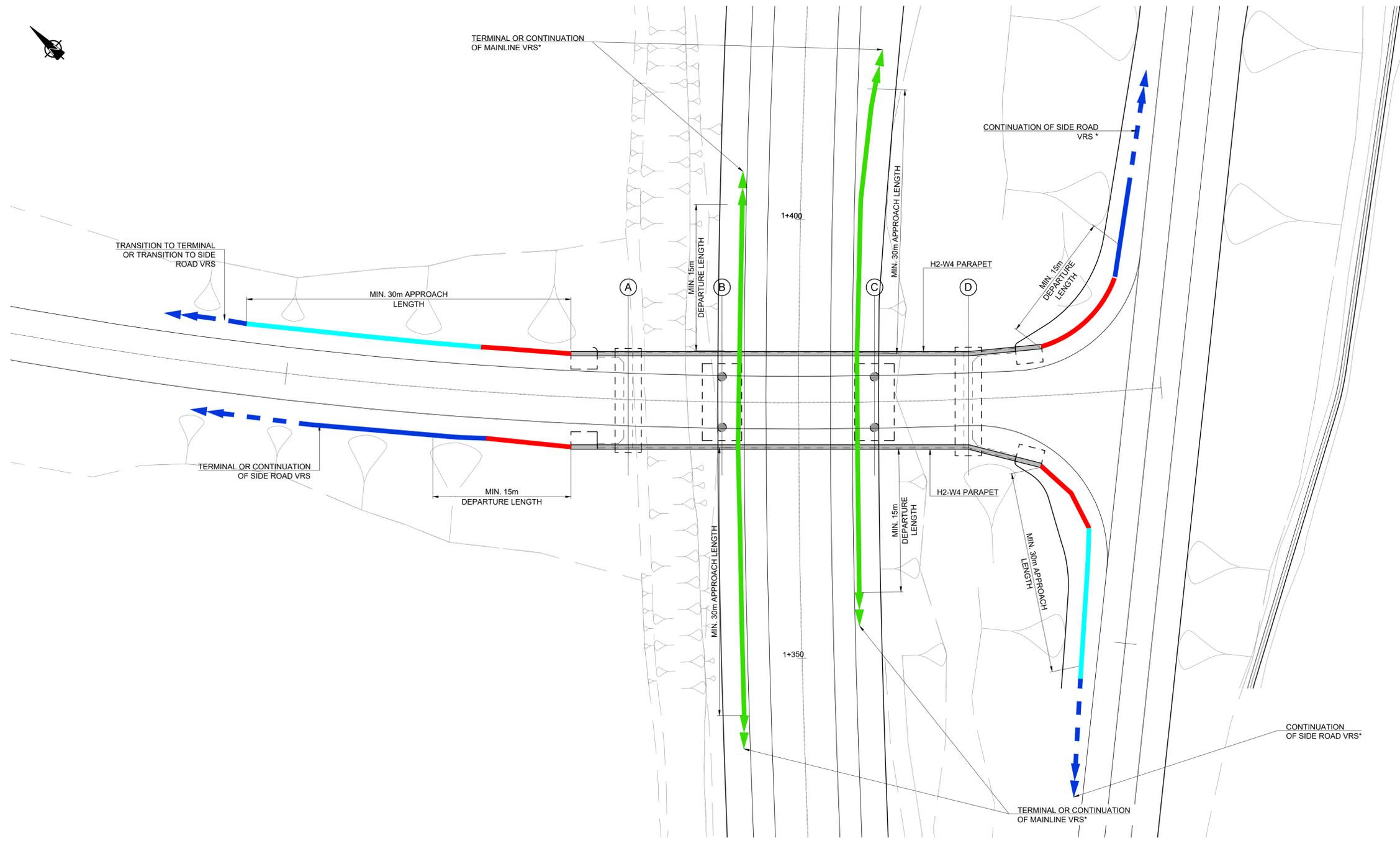
**For Information**

Job No	Drawing No	Issue
<b>233985</b>	<b>GCOB-1700-D-S01-01-001</b>	<b>11</b>

**NOTES:**  
 1. ALL DETAILS SHOWN ARE SUBJECT TO CONFIRMATION DURING THE DETAILED DESIGN AND SERIES 400 CERTIFICATION..

**LEGEND:**

- APPROVED TRANSITION FROM H2 PARAPET TO VRS
- SIDE ROAD VRS
- H2 VRS TO DN-REQ-03034
- MAINLINE BARRIER TO SERIES 400
- H2 - W4 PARAPET TO DN-STR-03011



**PARAPET / SAFETY BARRIER LAYOUT**  
 SCALE 1:250

San áireamh tá sonraíocht Shuirbhíreacht Ordnáis Éireann arna atáirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírúinn atáirgeadh neamhdaraithe cóipeacht Shuirbhíreacht Ordnáis Éireann agus Rialtas na hÉireann. © Suirbhíreacht Ordnáis Éireann, 2010.

© Suirbhíreacht Ordnáis Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
 Galway County Council

**N6**  
 Galway City Transport Project

**An Roinn Iompair**  
 Turasóireacht agus Spóirt

**TIU**  
 Borradh Iompair Éireann

Consultant

**ARUP**

Corporate House  
 City East Business Park  
 Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
 www.N6GalwayCity.ie  
 www.arup.ie

Job Title  
**N6 Galway City Ring Road**

Scale  
**AS SHOWN @ A1**

Date:  
**June 2017**

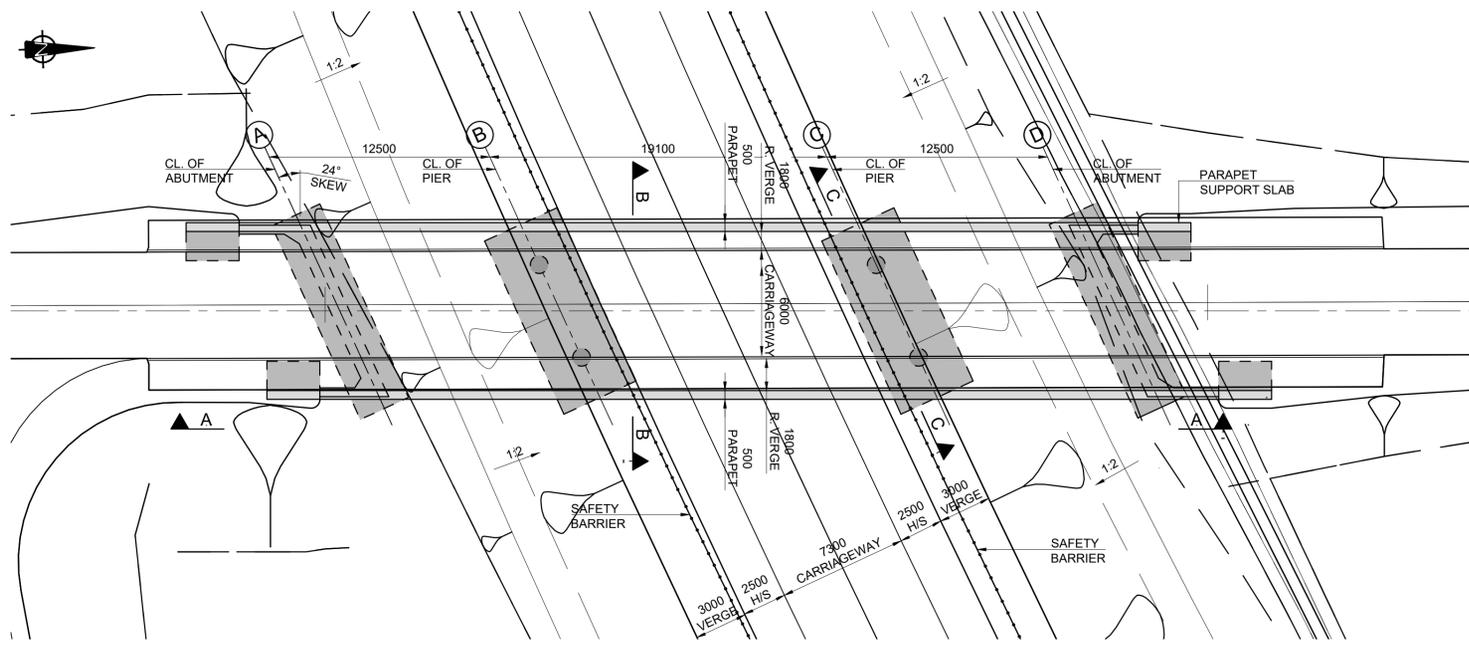
Issue	Date	By	Chkd	Appd
I1	30/06/2017	MS	PM	EMC

Drawing Title  
**Standard Overbridge  
 Structure S01-01  
 Parapet / Safety Barrier Layout**

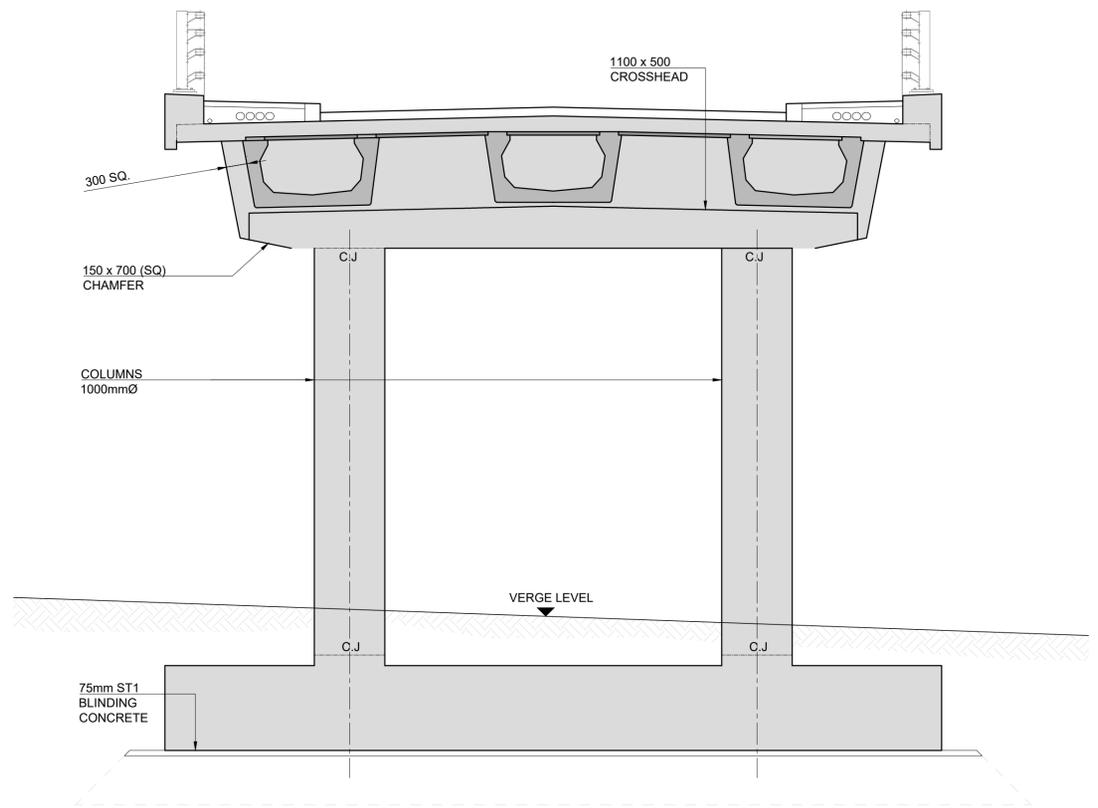
Drawing Status  
**For Information**

Job No	Drawing No	Issue
<b>233985</b>	<b>GCOB-1700-D-S01-01-002</b>	<b>11</b>

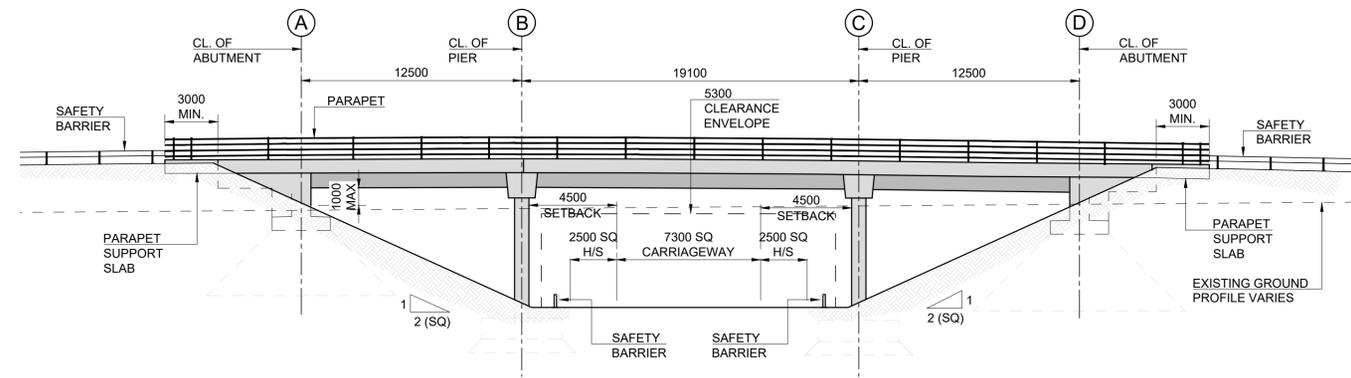
- NOTES:**
- ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  - ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE DATUM.



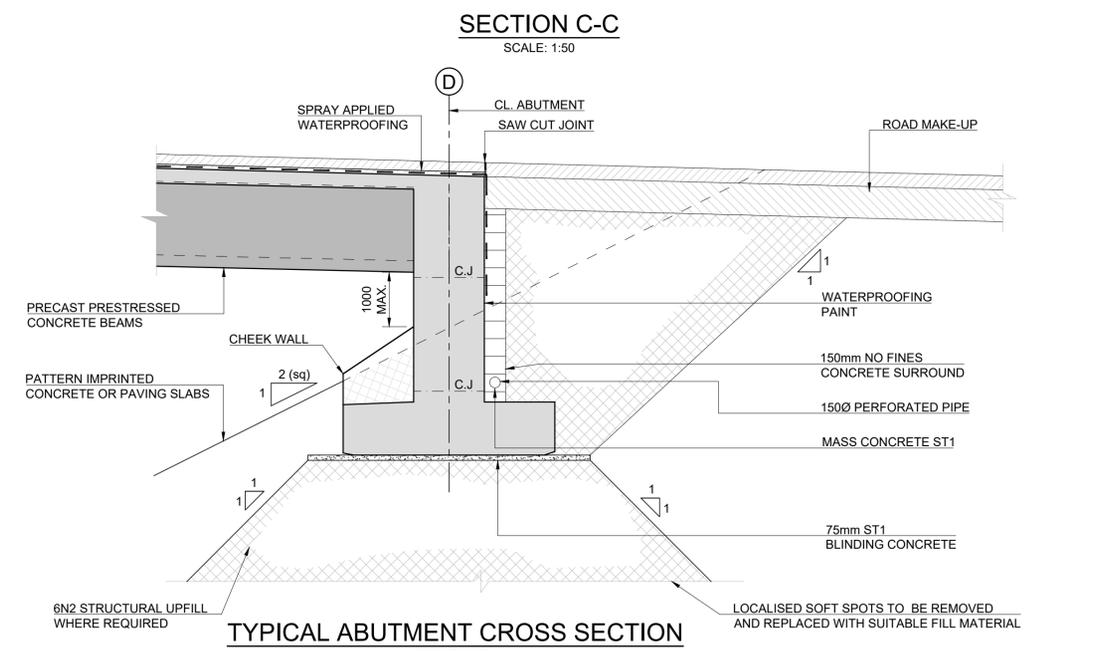
**PLAN ON BRIDGE**  
SCALE: 1:200



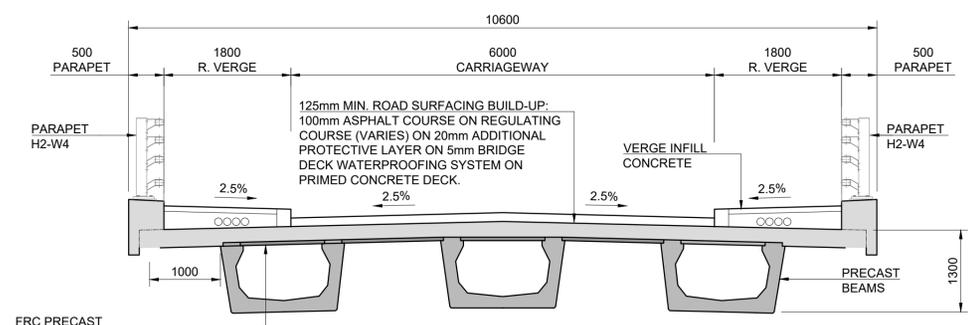
**SECTION C-C**  
SCALE: 1:50



**SECTION A-A**  
SCALE: 1:200



**TYPICAL ABUTMENT CROSS SECTION**  
SCALE: 1:50



**SECTION B-B**  
SCALE: 1:50

San áireamh tá sonraíocht Shuirbhéireacht Ordánais Éireann arna áitirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírúinn áitirgeadh neamhdáraithe cóipeacht Shuirbhéireacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhéireacht Ordánais Éireann, 2010.

© Suirbhéireacht Ordánais Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
Galway County Council

**Gaúway City Transport Project**

**An Roinn Iompair**  
Turasóireacht agus Spóirt  
Department Transport, Tourism and Sport

**TIU**  
Bonnagar Iompair Éireann  
Transport Infrastructure Unit

Consultant

**ARUP**

Corporate House  
City East Business Park  
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
www.NGalwayCity.ie  
www.arup.ie

Job Title

**N6 Galway City Ring Road**

Scale

**AS SHOWN @ A1**

Date:

**October 2016**

Issue	Date	By	Chkd	Appd
I2	30/06/2017	MS	PM	EMC
I1	26/10/2016	PD	PM	EMC

Drawing Title

**Standard Overbridge Structure S03-01**

Drawing Status

**For Information**

Job No

**233985**

Drawing No

**GCOB-1700-D-S03-01-001**

Issue

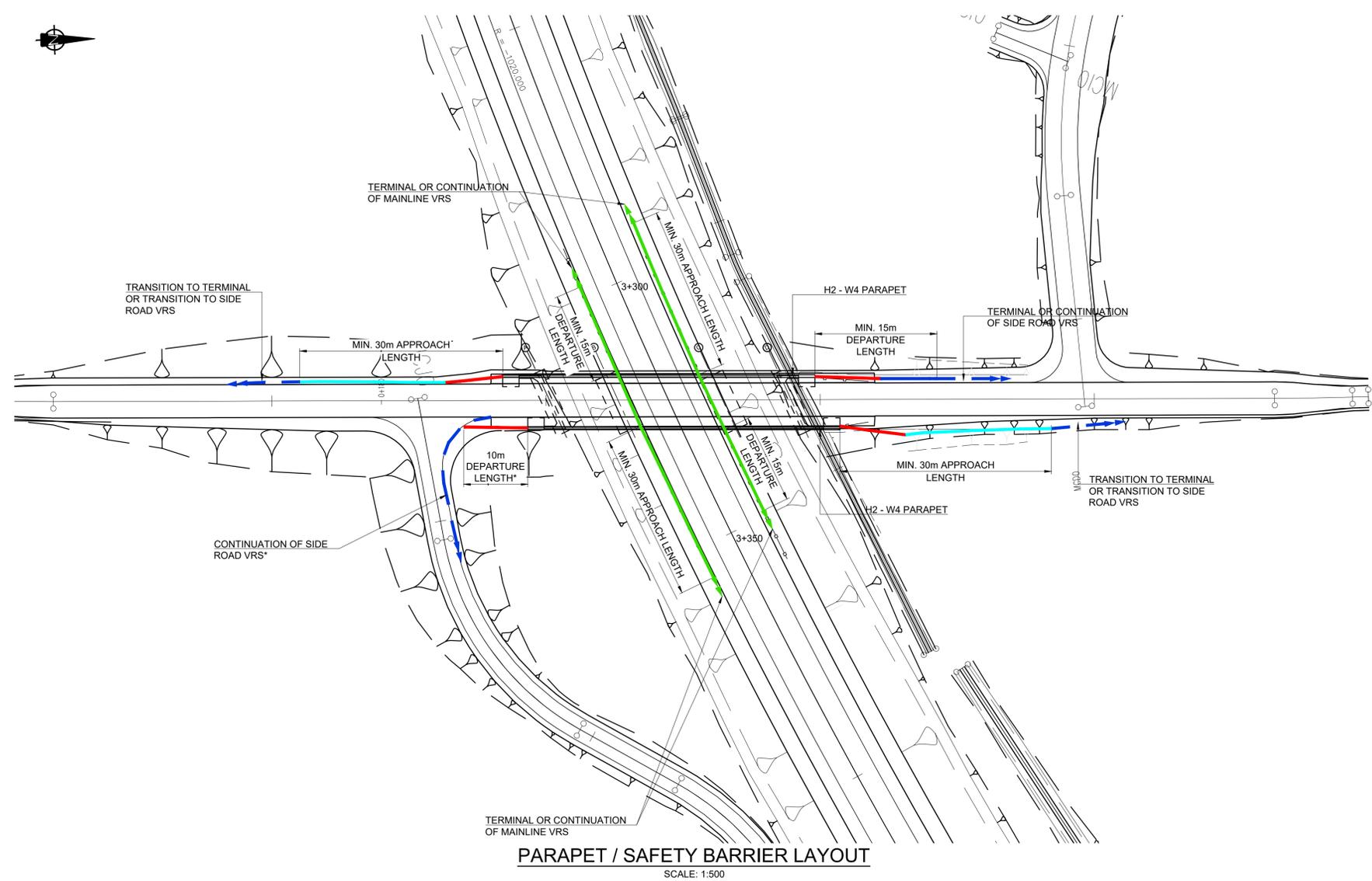
**12**

**NOTES:**  
 1. ALL DETAILS SHOWN ARE SUBJECT TO CONFIRMATION DURING THE DETAILED DESIGN AND SERIES 400 CERTIFICATION.

**LEGEND:**

- APPROVED TRANSITION FROM H2 PARAPET TO VRS
- SIDE ROAD VRS
- H2 VRS TO DN-REQ-03034
- MAINLINE BARRIER TO DN-REQ-03034
- H2-W4 PARAPET TO DN-STR-03011

SIDE ROAD & MAINLINE VRS DETAILS WILL BE CERTIFIED IN 400 SERIES.  
 \* SUBJECT TO APPROVAL OF REALXATION.OR DEPARTURE



San áireamh tá sonraíocht Shuirbhéireacht Ordnáis Éireann arna atáirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sárú ar na sonraíocht neamhdáraithe cóipeacht Shuirbhéireacht Ordnáis Éireann agus Rialtas na hÉireann. © Suirbhéireacht Ordnáis Éireann, 2010.

© Suirbhéireacht Ordnáis Éireann. Gach ceart ar chosaint.  
 Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council.  
 Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

Comhairle Chontae na Gaillimhe  
 Galway County Council

An Roinn Iompair  
 Turasóireachta agus Spóirt

TIIP  
 Borradh Iompair Éireann  
 Transport Infrastructure Ireland

Consultant

Corporate House  
 City East Business Park  
 Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
 www.N6GalwayCity.ie  
 www.arup.ie

Job Title  
**N6 Galway City Transport Project**

Scale  
**AS SHOWN @ A1**

Date  
**January 2017**

Issue	Date	By	Chkd	Appd
I1	30/06/2017	MS	PM	EMC

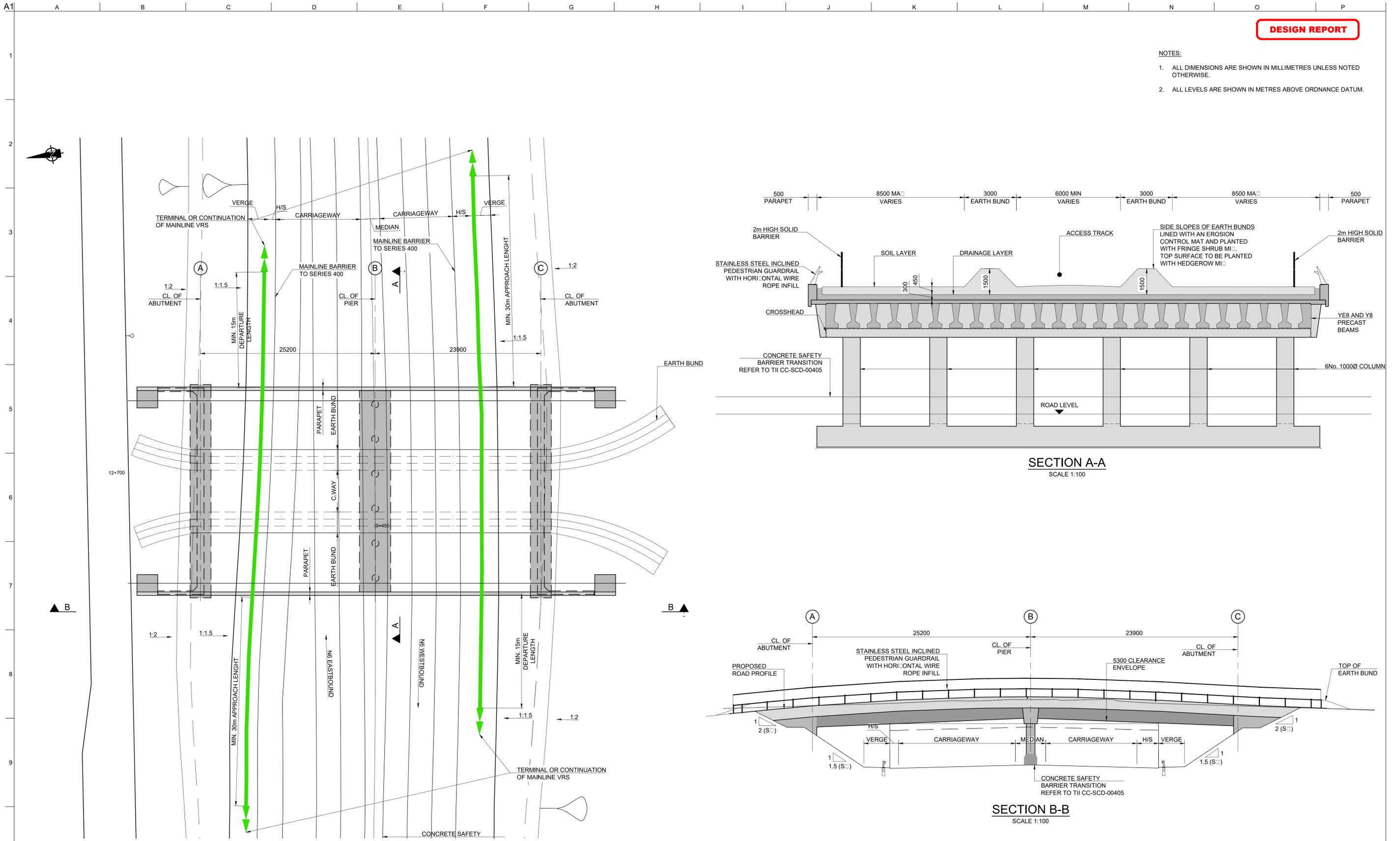
Drawing Title  
**Standard Overbridge Structure S01-01**

Drawing Status

**For Information**

Job No	Drawing No	Issue
<b>233985</b>	<b>GCOB-1700-D-S03-01-002</b>	<b>11</b>

- NOTES:**
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  2. ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE DATUM.



**PLAN**  
SCALE 1:200

**SECTION A-A**  
SCALE 1:100

**SECTION B-B**  
SCALE 1:100

San áiríamh tá sonraíocht Shuirbhíreacht Ordnáns Éireann arna áirígeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírtaíonn áirígeadh neamhdáiríthe císteacht Shuirbhíreacht Ordnáns Éireann agus Rialtas na hÉireann. © Suirbhíreacht Ordnáns Éireann, 2010.

© Suirbhíreacht Ordnáns Éireann. Gach ceart ar chosaint.  
Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council.  
Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved.  
number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
Galway County Council

**N6**  
Galway City Transport Project

**An Roinn Iompair**  
Turasoireacht agus Spóirt  
Department of Transport, Tourism and Sport

**TII**  
Transport Infrastructure Ireland

Consultant

**ARUP**

Corporate House  
City East Business Park  
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
www.N6GalwayCity.ie  
www.arup.ie

Job Title

**N6 Galway City Ring Road**

Scale

**AS SHOWN @ A1**

Date:

**October 2016**

I2	30/06/2017	MS	PM	EMC
I1	10/10/2016	PD	PM	EMC
Issue	Date	By	Chkd	Appd

Drawing Title

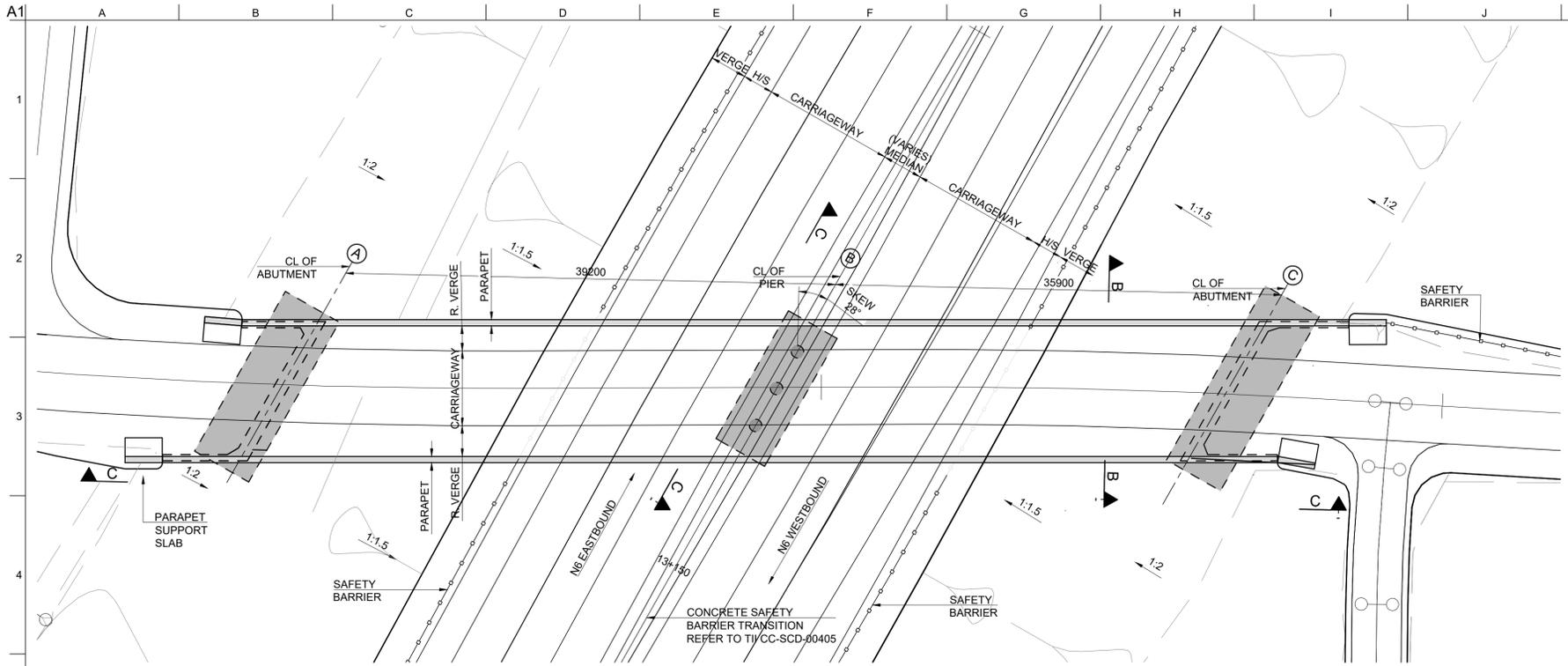
**Standard Overbridge  
Structure S12-02**

Drawing Status

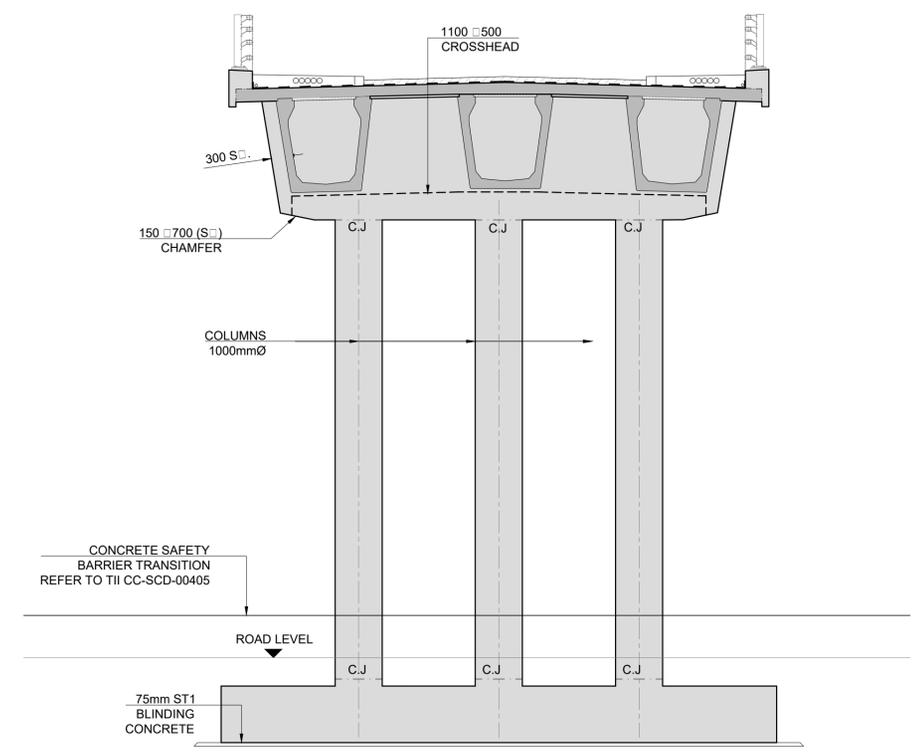
**For Information**

Job No	Drawing No	Issue
<b>233985</b>	<b>GCOB-1700-D-S12-02-001</b>	<b>12</b>

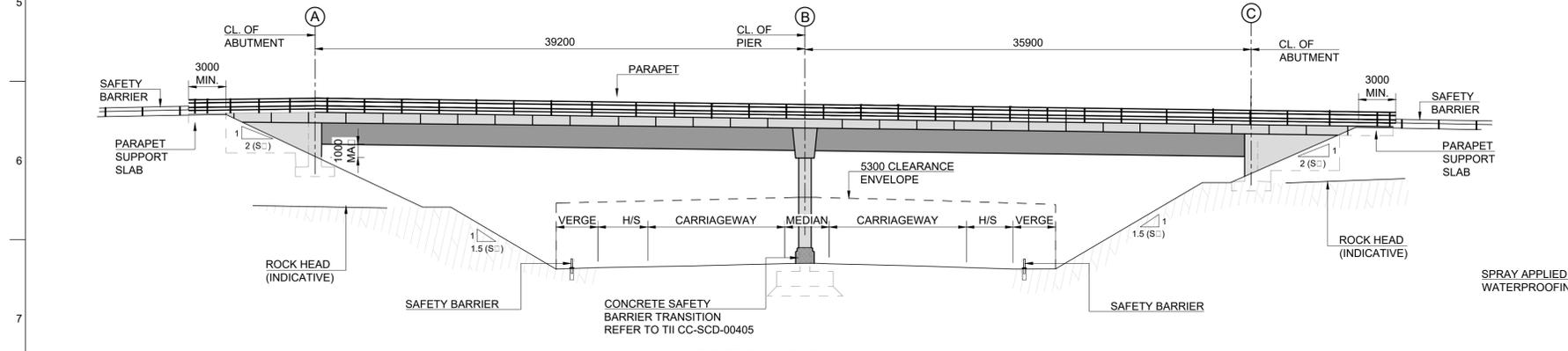
- NOTES:**
- ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  - ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE DATUM.



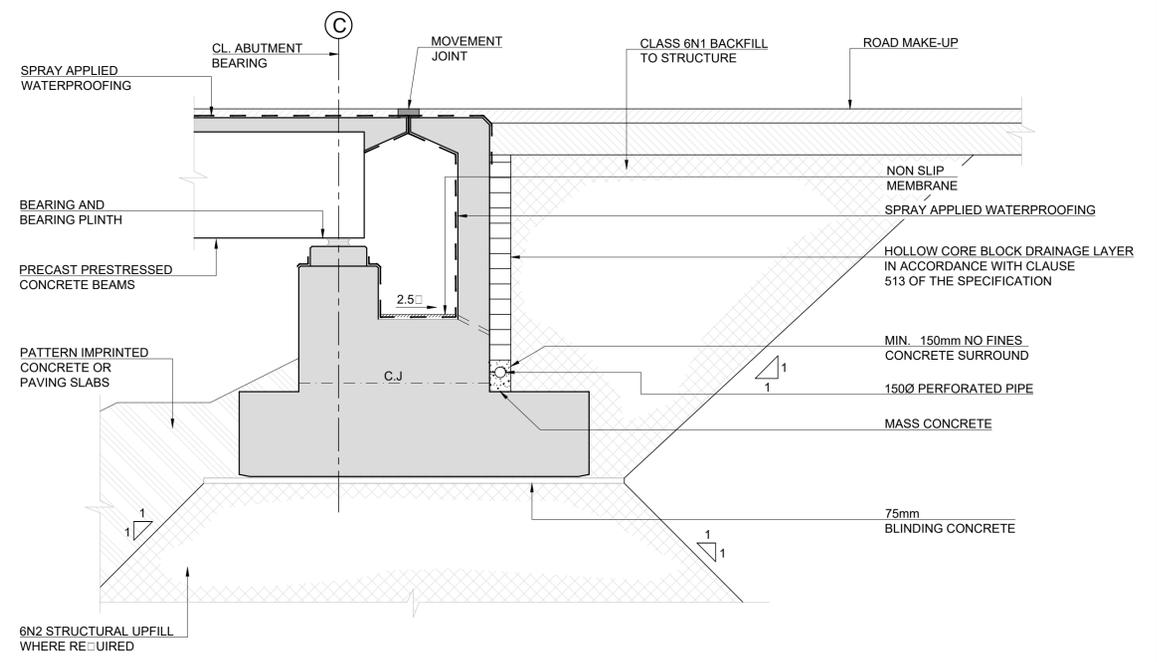
**PLAN ON BRIDGE**  
SCALE: 1:250



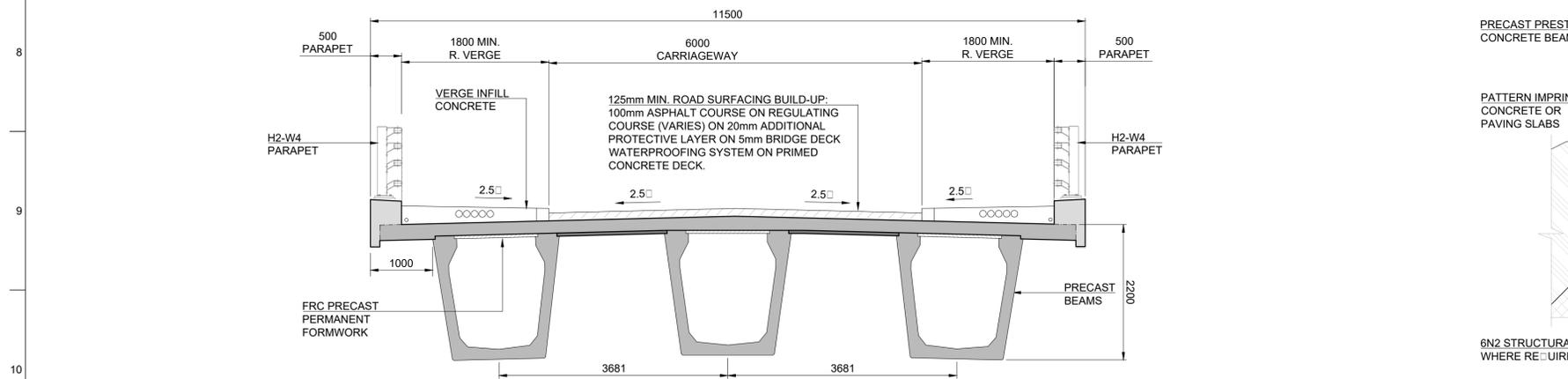
**SECTION C-C**  
SCALE: 1:75



**SECTION C-C**  
SCALE: 1:250



**TYPICAL ABUTMENT CROSS SECTION**  
SCALE: 1:50



**SECTION B-B**  
SCALE: 1:50

San áireamh tá sonraíocht Shuirbhíreachtú Ordnáns Éireann arna áitirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírúitinn áitirgeadh neamhdáraithe cóipeacht Shuirbhíreachtú Ordnáns Éireann agus Rialtas na hÉireann. © Suirbhíreachtú Ordnáns Éireann, 2010.

© Suirbhíreachtú Ordnáns Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.  
Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.  
© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
Galway County Council

**Galway City Transport Project**

**An Roinn Iompair Turasóireachta agus Spóirt**  
Department of Transport, Tourism and Sport

**TII**  
Transport Infrastructure Ireland

Consultant

**ARUP**

Corporate House  
City East Business Park  
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
www.N6GalwayCity.ie  
www.arup.ie

Job Title  
**N6 Galway City Ring Road**

Scale  
**AS SHOWN @ A1**

Date:  
**June 2016**

Issue	Date	By	Chkd	Appd
I2	30/06/2017	MS	PM	EMC
I1	26/10/2016	PD	PM	EMC

Drawing Title  
**Standard Overbridge Structure S13-01**

Drawing Status

**For Information**

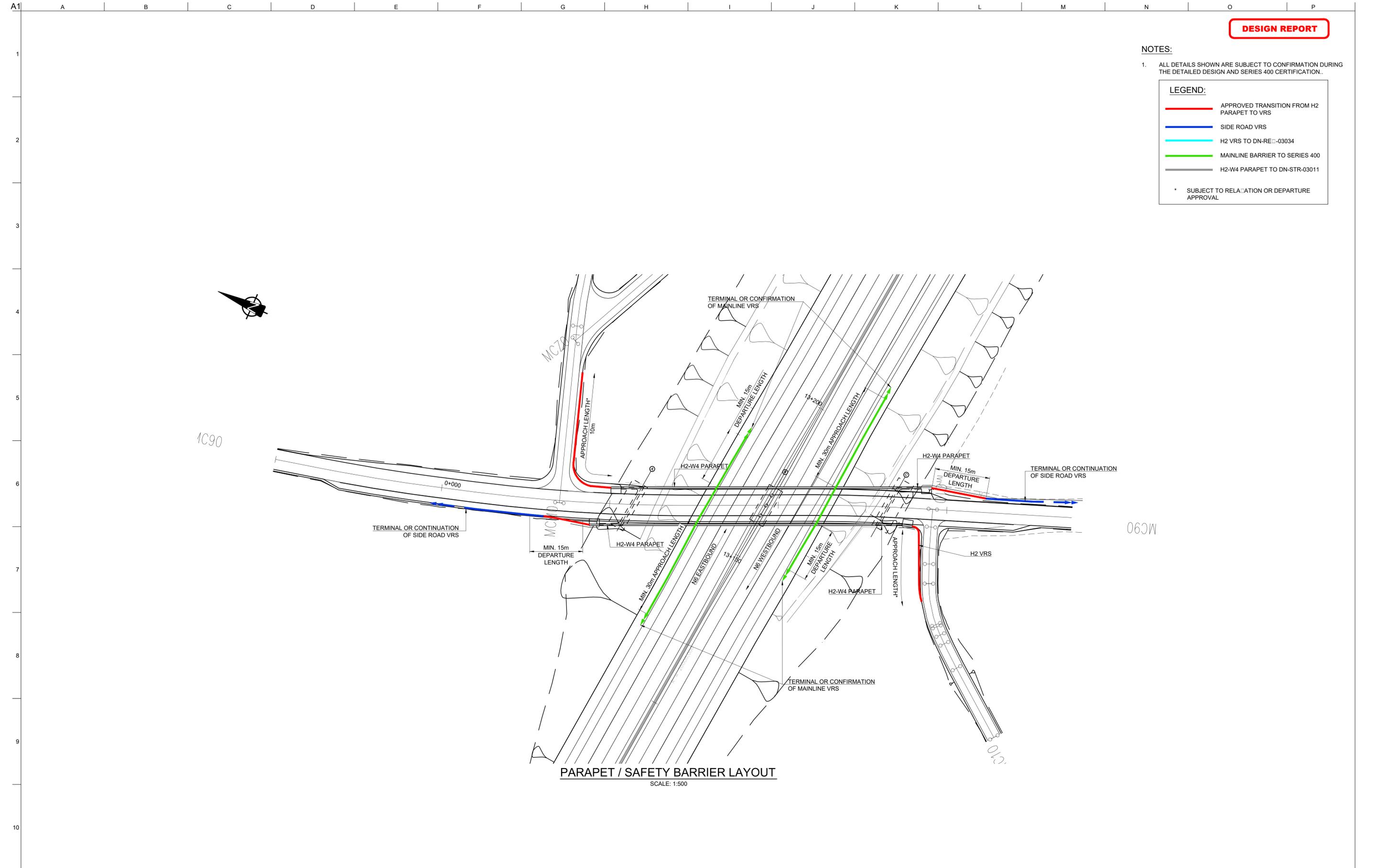
Job No: **233985** Drawing No: **GCOB-1700-D-S13-01-001** Issue: **12**

**NOTES:**  
 1. ALL DETAILS SHOWN ARE SUBJECT TO CONFIRMATION DURING THE DETAILED DESIGN AND SERIES 400 CERTIFICATION.

**LEGEND:**

- APPROVED TRANSITION FROM H2 PARAPET TO VRS
- SIDE ROAD VRS
- H2 VRS TO DN-RE-03034
- MAINLINE BARRIER TO SERIES 400
- H2-W4 PARAPET TO DN-STR-03011

\* SUBJECT TO RELATION OR DEPARTURE APPROVAL



San áireamh tá sonraíocht Shuirbhíreacht Ordnáis Éireann arna atáirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírtaíonn atáirgeadh neamhdáraithe císteheart Shuirbhíreacht Ordnáis Éireann agus Rialtas na hÉireann. © Suirbhíreacht Ordnáis Éireann, 2010.

© Suirbhíreacht Ordnáis Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
Galway County Council

**N6**  
Galway City Transport Project

**An Roinn Iompair**  
Turasoireacht agus Spóirt

**TIU**  
Bonnagar Iompair Éireann

Consultant

**ARUP**

Corporate House  
City East Business Park  
Ballybri, Galway, Ireland.

Tel +353 (0)91 460675  
www.N6GalwayCity.ie  
www.arup.ie

Job Title  
**N6 Galway City Ring Road**

Scale  
**AS SHOWN @ A1**

Date:  
**June 2016**

Issue	Date	By	Chkd	Appd
I1	30/06/2017	PD	PM	EMC

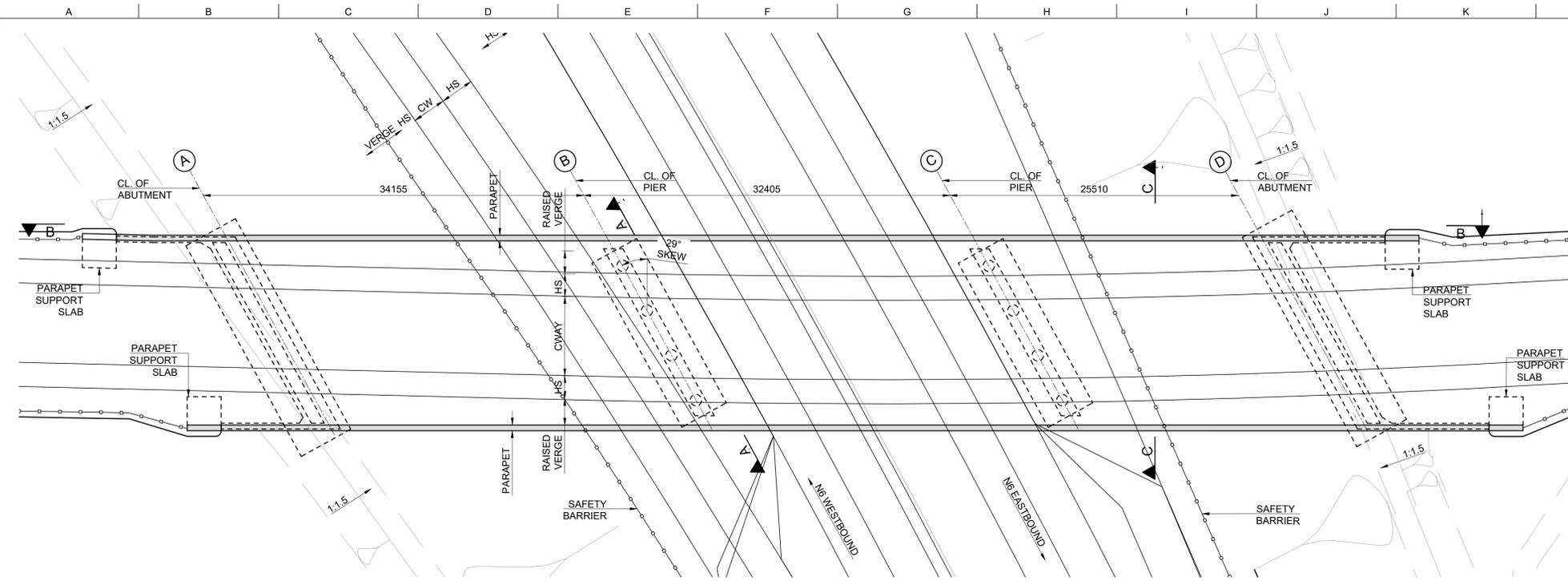
Drawing Title  
**Standard Overbridge  
Structure S13-01  
Parapet / Safety Barrier Layout**

Drawing Status

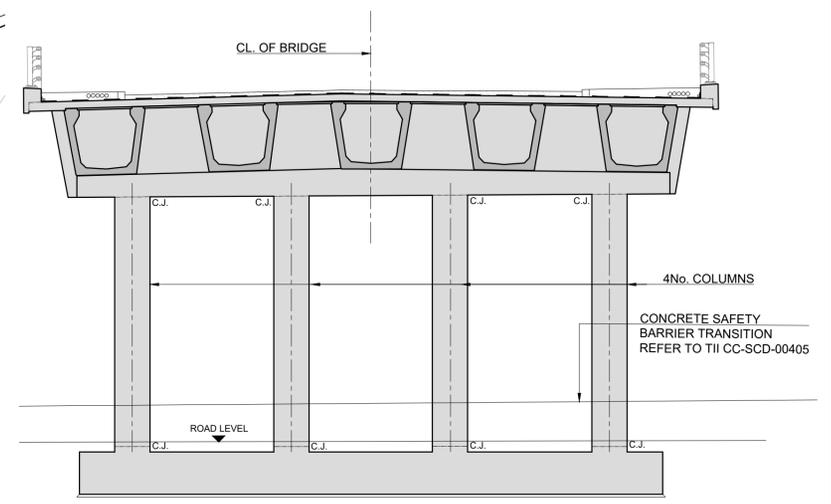
**For Information**

Job No	Drawing No	Issue
<b>233985</b>	<b>GCOB-D-ST-S13-01-002</b>	<b>11</b>

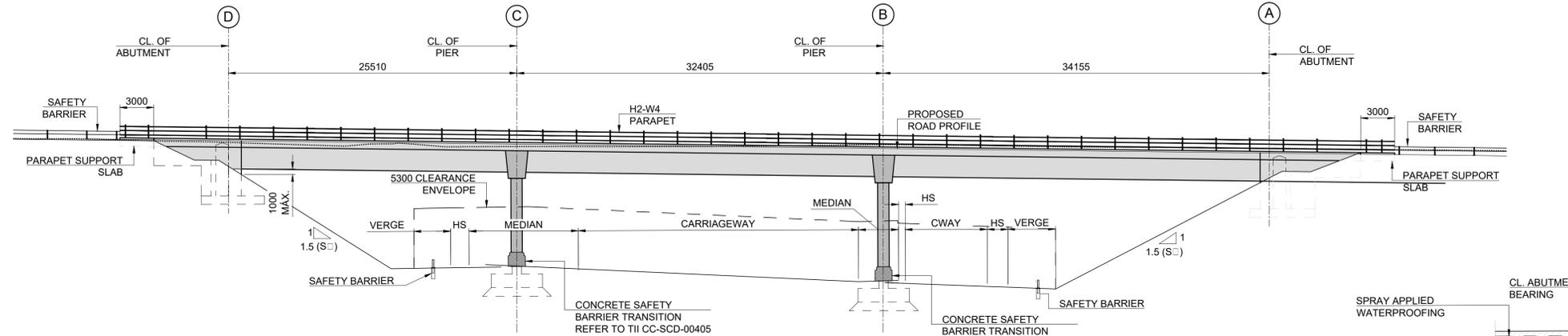
- NOTES:**
- ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  - ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE DATUM.



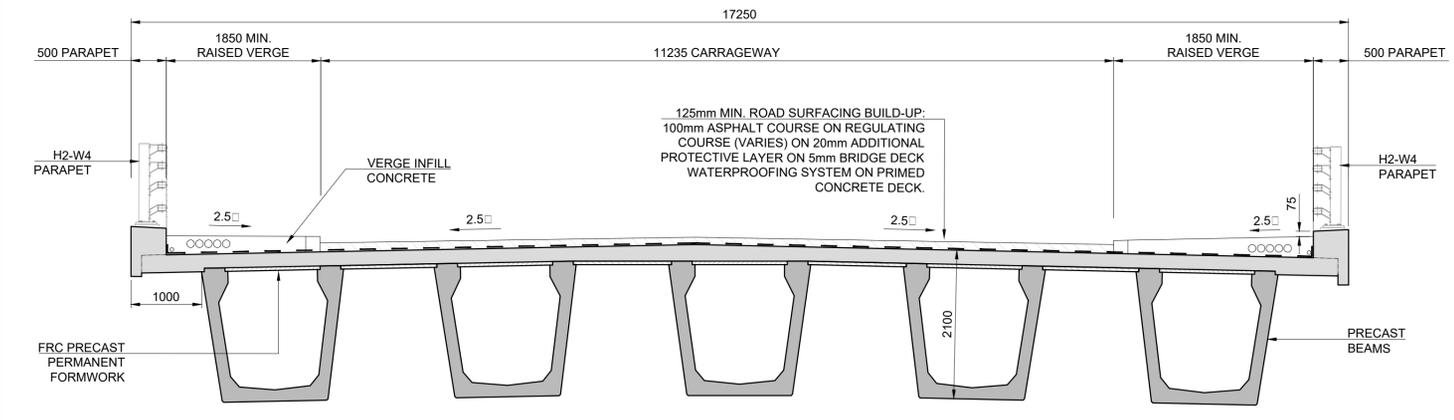
**PLAN ON BRIDGE**  
SCALE: 1:250



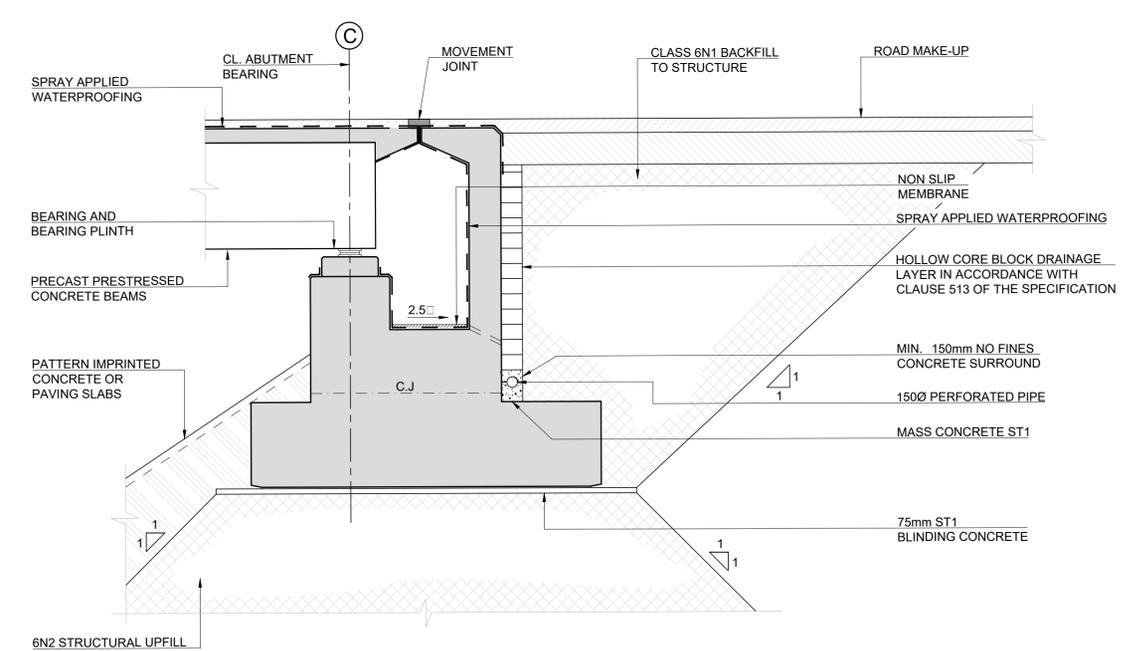
**SECTION C-C**  
SCALE: 1:100



**SECTION B-B**  
SCALE: 1:250



**SECTION A-A**  
SCALE: 1:50



**TYPICAL ABUTMENT CROSS SECTION**  
SCALE: 1:50

San áireamh tá sonraíocht Shuirbhíreachtí Ordánais Éireann arna aistriú go dtí foirm Cheadúnas OSI Umh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírtaíonn aistriúchán neamhdáraithe cóipeacht Shuirbhíreachtí Ordánais Éireann agus Bialtas na hÉireann. © Suirbhíreachtí Ordánais Éireann, 2010.

© Suirbhíreachtí Ordánais Éireann. Gach ceart ar chosaint.  
Umhír cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council.  
Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
Galway County Council

**Galway City Transport Project**

**An Roinn Iompair**  
Turasóireacht agus Spóirt  
Department of Transport, Tourism and Sport

**TII**  
Bonnagar Iompair Éireann  
Transport Infrastructure Ireland

Consultant

**ARUP**

Corporate House  
City East Business Park  
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
www.NGalwayCity.ie  
www.arup.ie

Job Title  
**N6 Galway City Ring Road**

Scale  
**AS SHOWN @ A1**

Date  
**October 2016**

Issue	Date	By	Chkd	Appd
I2	30/06/2017	MS	PM	EMC
I1	10/10/2016	PD	PM	EMC

Drawing Title  
**Standard Overbridge Structure S14-01**

Drawing Status

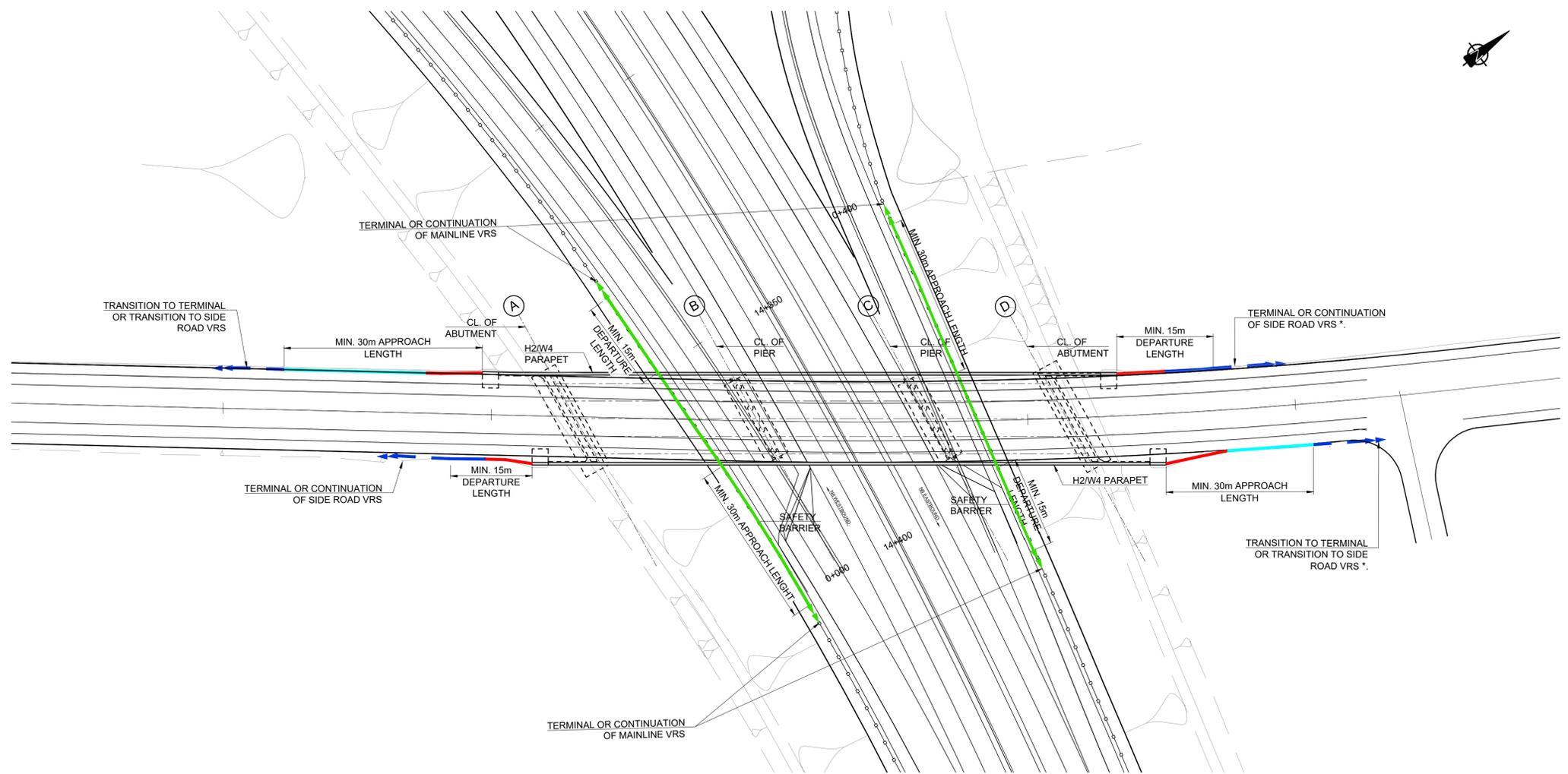
**For Information**

Job No	Drawing No	Issue
<b>233985</b>	<b>GCOB-1700-D-S14-01-001</b>	<b>12</b>

**NOTES:**  
 1. ALL DETAILS SHOWN ARE SUBJECT TO CONFIRMATION DURING THE DETAILED DESIGN AND SERIES 400 CERTIFICATION..

**LEGEND:**

- APPROVED TRANSITION FROM H2 PARAPET TO VRS
- SIDE ROAD VRS
- H2 VRS TO DN-RE-03034
- MAINLINE BARRIER TO SERIES 400
- H2-W4 PARAPET TO DN-STR-03011



**PARAPET / SAFETY BARRIER LAYOUT**  
 SCALE: 1:500

San áireamh tá sonraíocht Shuirbhéireacht Ordnáis Éireann arna atáirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírúinn atáirgeadh neamhdáraithe cóipeacht Shuirbhéireacht Ordnáis Éireann agus Rialtas na hÉireann. © Suirbhéireacht Ordnáis Éireann, 2010.

© Suirbhéireacht Ordnáis Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
 Galway County Council

**An Roinn Iompair**  
 Turasóireachta agus Spóirt

**TIIP**  
 Borradh Iompair Éireann

Consultant

**ARUP**

Corporate House  
 City East Business Park  
 Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
 www.NGalwayCity.ie  
 www.arup.ie

Job Title  
**N6 Galway City Ring Road**

Scale  
**AS SHOWN @ A1**

Date  
**June 2017**

Issue	Date	By	Chkd	Appd
I1	30/06/2017	PD	PM	EMC

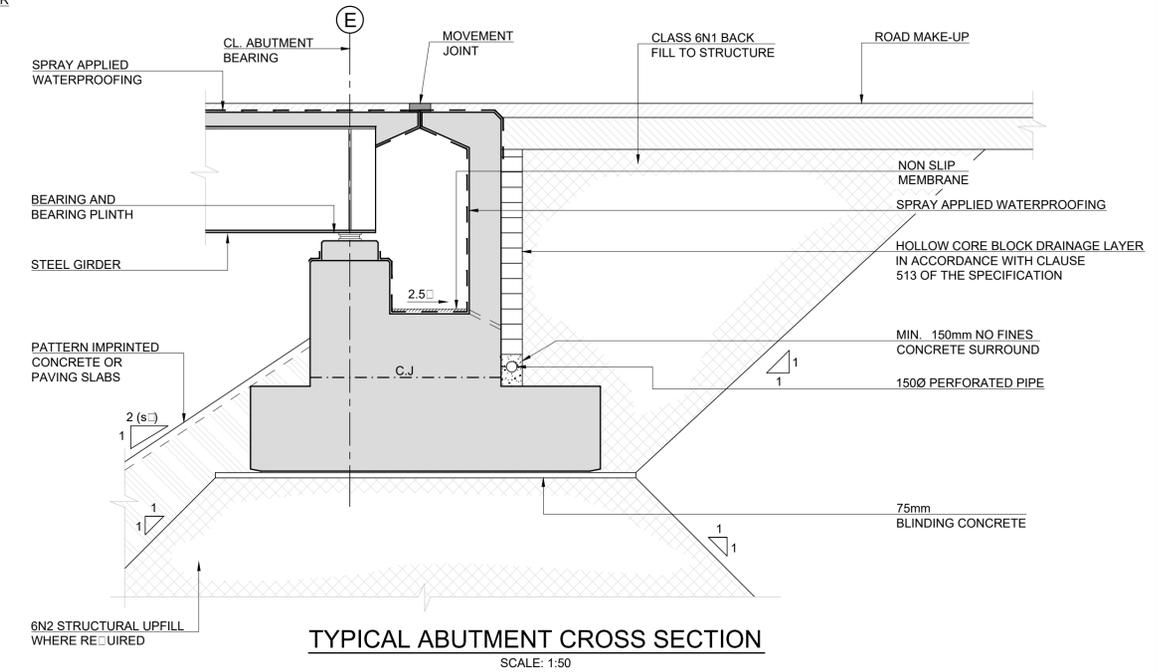
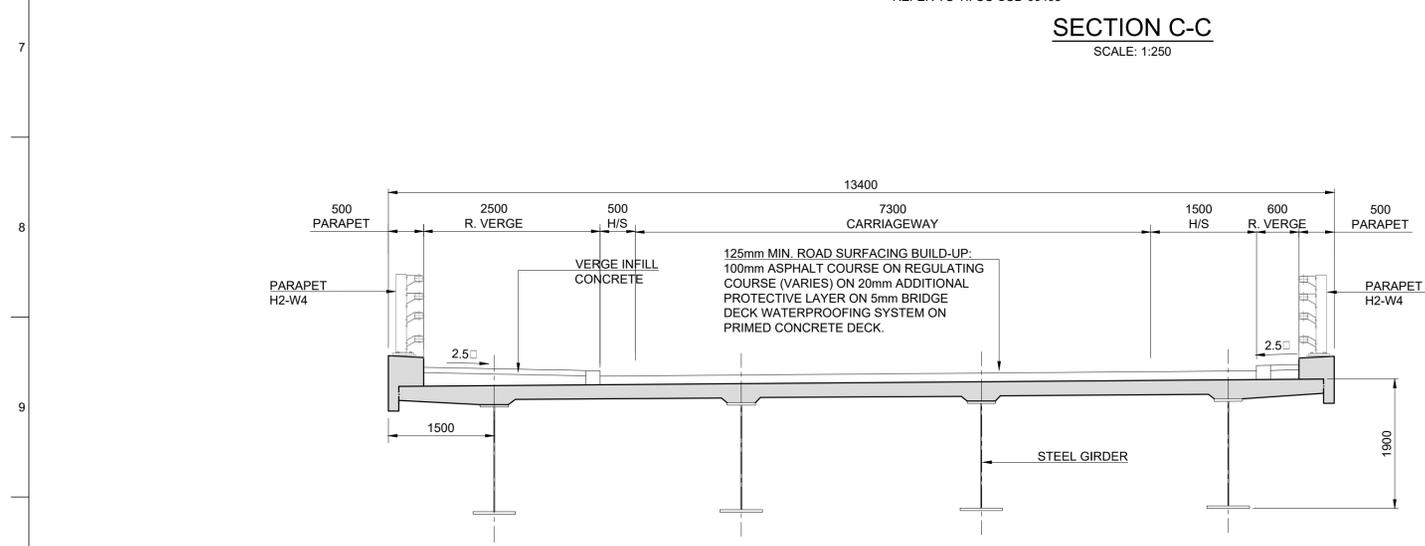
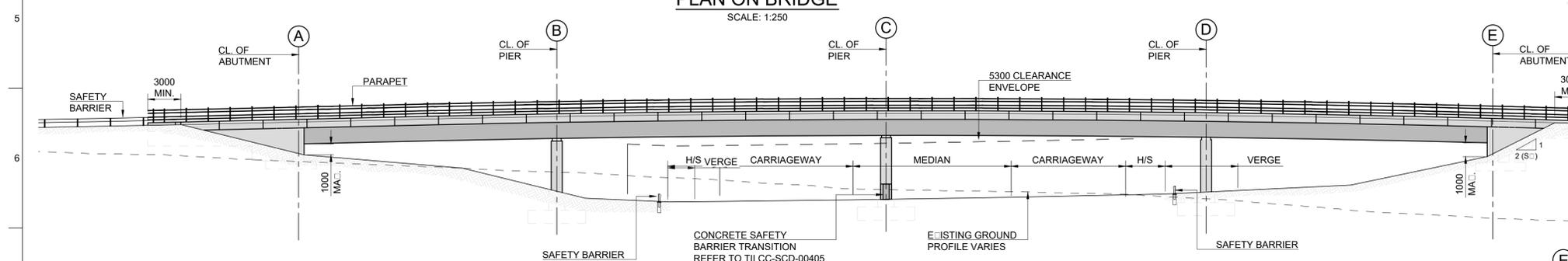
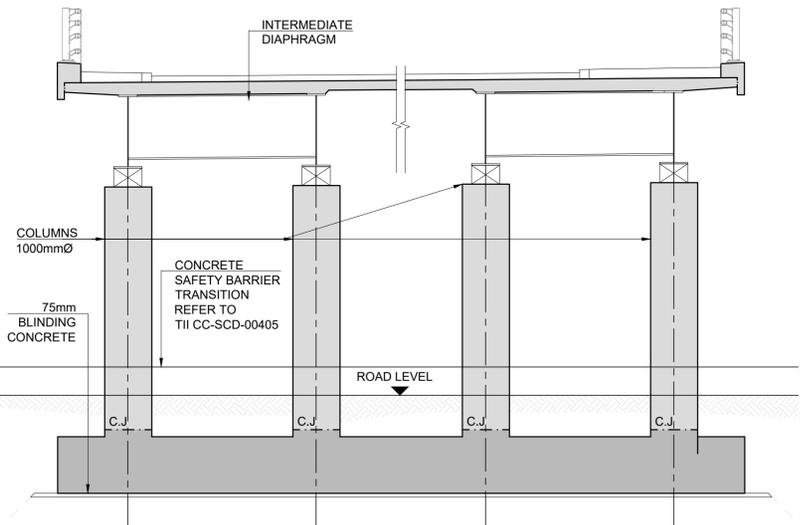
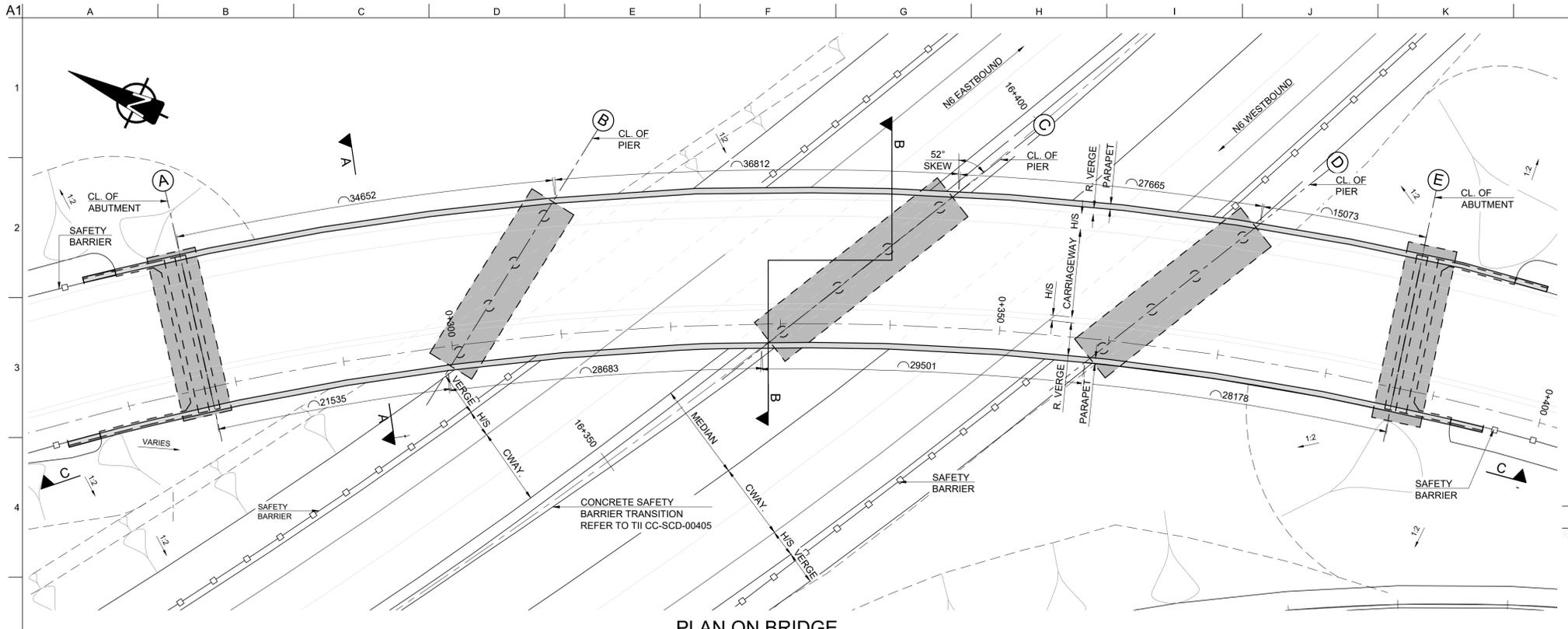
Drawing Title  
**Standard Overbridge Structure S14-01**

Drawing Status

**For Information**

Job No	Drawing No	Issue
<b>233985</b>	<b>GCOB-1700-D-S14-01-002</b>	<b>11</b>

- NOTES:**
- ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  - ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE DATUM.



San áireamh tá sonraíocht Shuirbhíreacht Ordnáis Éireann arna atáirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírtaíonn atáirgeadh neamhdaraithe císpheacht Shuirbhíreacht Ordnáis Éireann agus Rialtas na hÉireann. © Suirbhíreacht Ordnáis Éireann, 2010.

© Suirbhíreacht Ordnáis Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
Galway County Council

**Galway City Transport Project**

**An Roinn Iompair**  
Turasoireacht agus Spóirt  
Department Transport, Tourism and Sport

**TII**  
Bonnagar Iompair Éireann  
Transport Infrastructure Ireland

Consultant

**ARUP**

Corporate House  
City East Business Park  
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
www.N6GalwayCity.ie  
www.arup.ie

Job Title  
**N6 Galway City Ring Road**

Scale  
**AS SHOWN @ A1**

Date:  
**October 2016**

Issue	Date	By	Chkd	Appd
I2	30/06/2017	MS	PM	EMC
I1	26/10/2016	PD	PM	EMC

Drawing Title  
**Standard Overbridge Structure S16-01**

Drawing Status

**For Information**

Job No  
**233985**

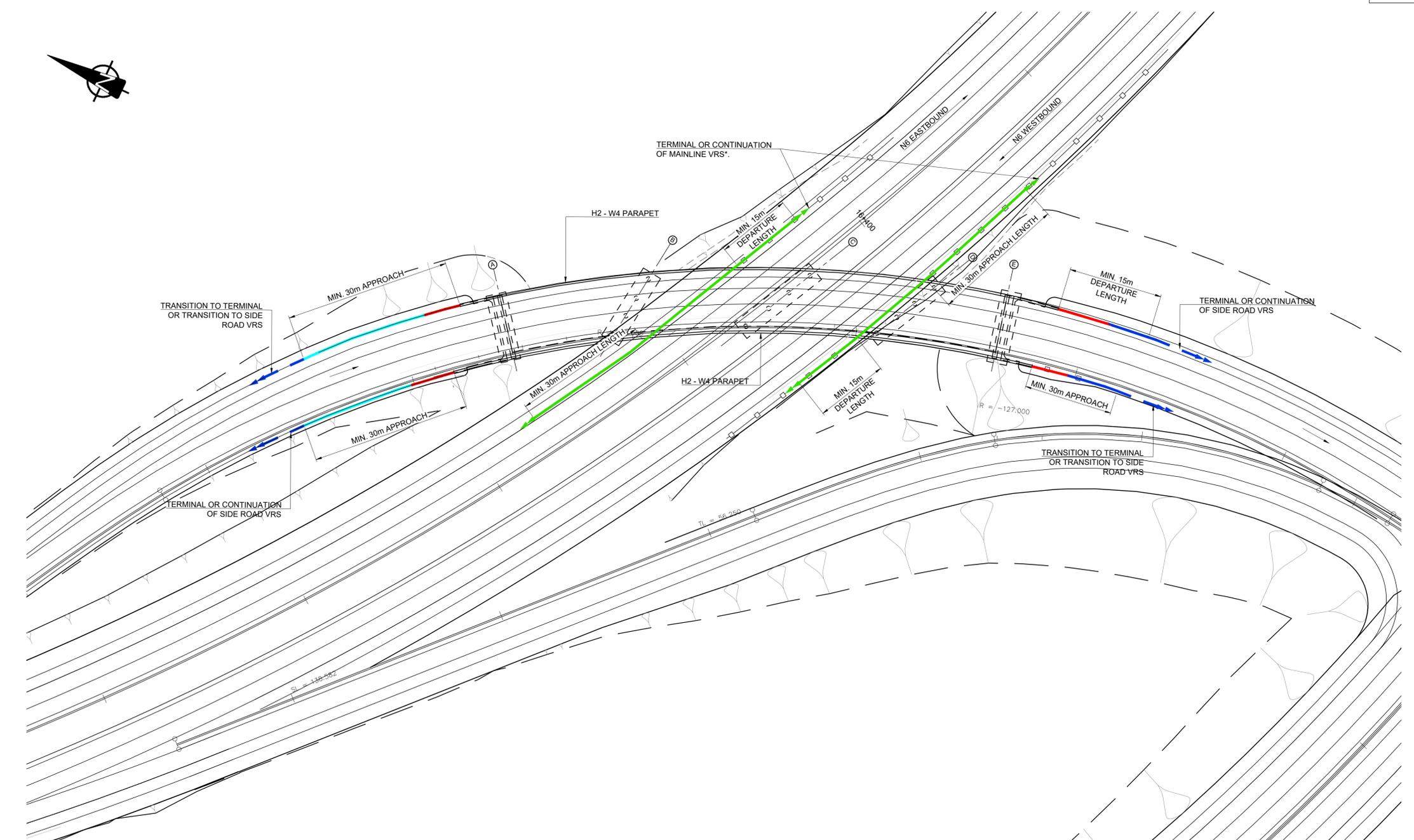
Drawing No  
**GCOB-1700-D-S16-01-001**

Issue  
**12**

**NOTES:**  
 1. ALL DETAILS SHOWN ARE SUBJECT TO CONFIRMATION DURING THE DETAILED DESIGN AND SERIES 400 CERTIFICATION.

**LEGEND:**

- APPROVED TRANSITION FROM H2 PARAPET TO VRS
- SIDE ROAD VRS \*
- H2 VRS
- MAINLINE BARRIER TO SERIES 400
- H2-W4 PARAPET



**PARAPET / SAFETY BARRIER LAYOUT**  
 SCALE: 1:500

**Clients**

Comhairle Chontae na Gaillimhe  
 Galway County Council

N6 Galway City Transport Project

An Roinn Iompair Turasóireachta agus Spóirt  
 Department Transport, Tourism and Sport

TIIV  
 Transport Infrastructure Ireland

**Consultant**

**ARUP**

Corporate House  
 City East Business Park  
 Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
 www.N6GalwayCity.ie  
 www.arup.ie

**Job Title**  
 N6 Galway City Ring Road

**Scale**  
 AS SHOWN @ A1

**Date:**  
 June 2017

Issue	Date	By	Chkd	Appd
I1	30/06/2017	PD	PM	EMC

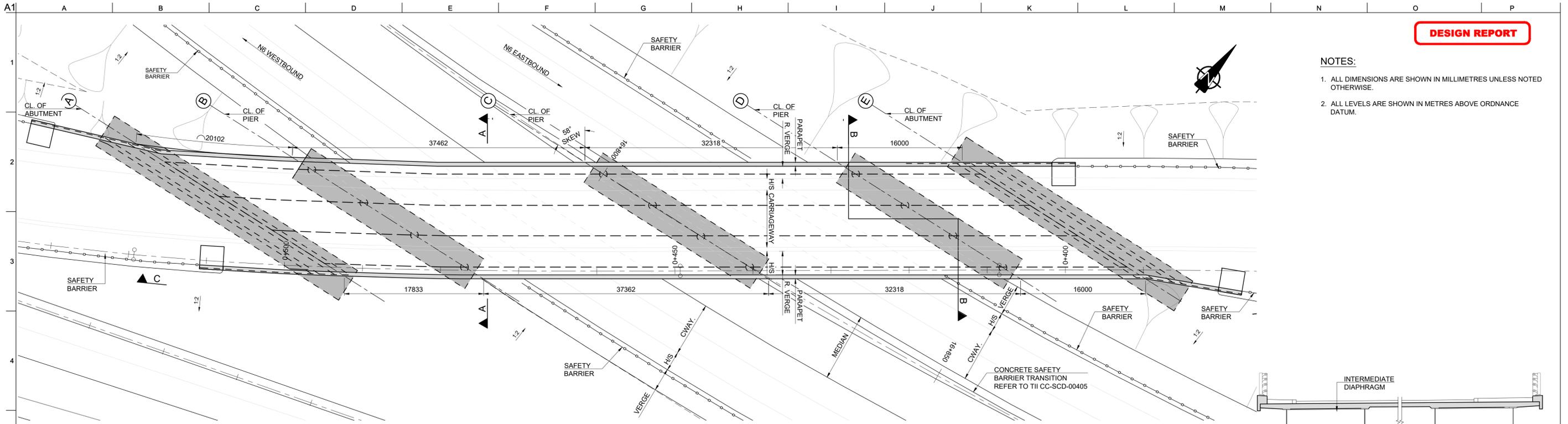
**Drawing Title**  
 Standard Overbridge  
 Structure S16-01  
 Parapet / Safety Barrier Layout

**Drawing Status**

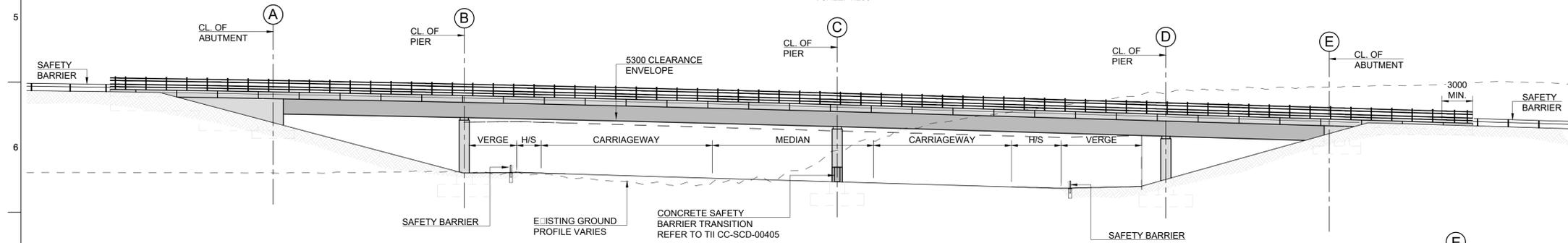
**For Information**

Job No	Drawing No	Issue
233985	GCOB-D-ST-S16-01-002	11

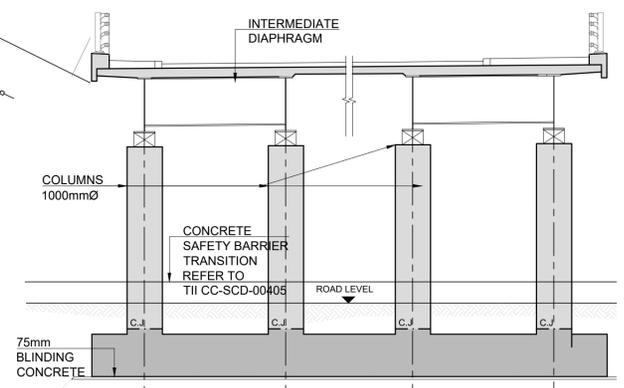
- NOTES:**
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  2. ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE DATUM.



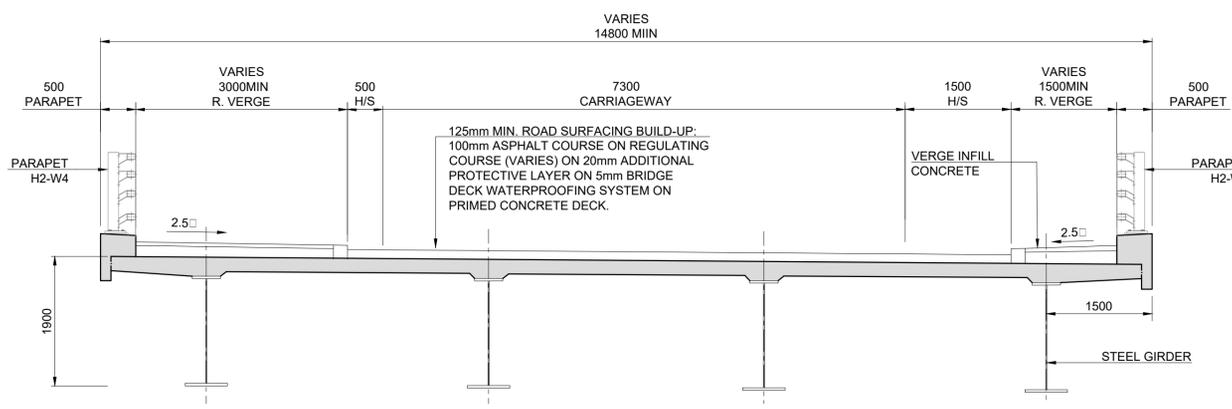
**PLAN ON BRIDGE**  
SCALE: 1:250



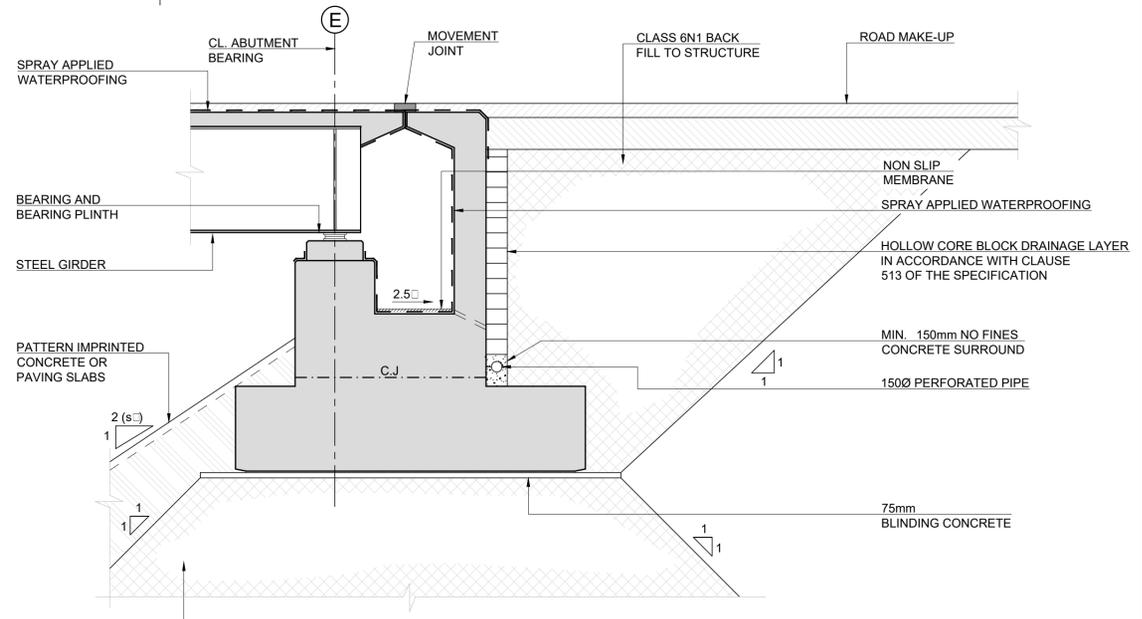
**SECTION C-C**  
SCALE: 1:250



**SECTION B-B**  
SCALE: 1:100



**SECTION A-A**  
SCALE: 1:50



**TYPICAL ABUTMENT CROSS SECTION**  
SCALE: 1:50

San áireamh tá sonraíocht Shuirbhíreacht Ordnáns Éireann arna áirítearadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírtaíonn áirítearadh neamhdáiríthe císpheacht Shuirbhíreacht Ordnáns Éireann agus Riailas na hÉireann. © Suirbhíreacht Ordnáns Éireann, 2010.

© Suirbhíreacht Ordnáns Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

**Clients**

Comhairle Chontae na Gaillimhe  
Galway County Council

Galway City Transport Project

An Roinn Iompair Turasóireachta agus Spóirt  
Department Transport, Tourism and Sport

TII

**Consultant**

**ARUP**

Corporate House  
City East Business Park  
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
www.N6GalwayCity.ie  
www.arup.ie

**Job Title**  
N6 Galway City Ring Road

**Scale**  
AS SHOWN @ A1

**Date:**  
October 2016

Issue	Date	By	Chkd	Appd
I2	26/06/2017	MS	PM	EMC
I1	26/10/2016	PD	PM	EMC

**Drawing Title**  
Standard Overbridge Structure S16-02

**Drawing Status**  
For Information

**Job No**  
233985

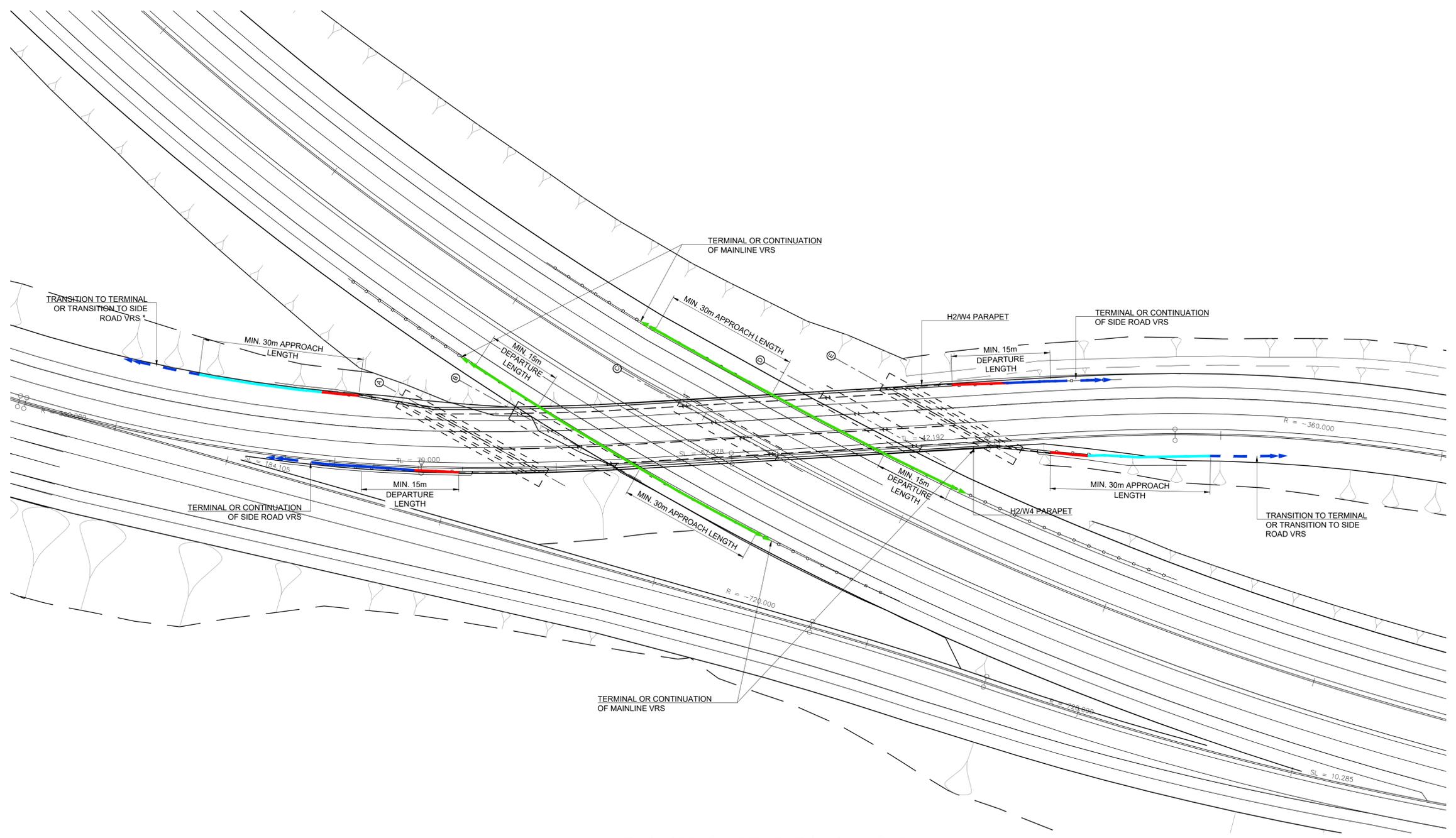
**Drawing No**  
GCOB-1700-D-S16-02-001

**Issue**  
12

**NOTES:**  
 1. ALL DETAILS SHOWN ARE SUBJECT TO CONFIRMATION DURING THE DETAILED DESIGN AND SERIES 400 CERTIFICATION.

**LEGEND:**

- APPROVED TRANSITION FROM H2 PARAPET TO VRS
- SIDE ROAD VRS
- H2 VRS
- MAINLINE BARRIER TO SERIES 400
- H2-W4 PARAPET



**PARAPET / SAFETY BARRIER LAYOUT**  
 SCALE: 1:500

San áireamh tá sonraíocht Shuirbhéireacht Ordnáis Éireann arna atáirgeadh faoi Cheadúnas OSI Uimh. 2010/17CCMA/Comhairle Contae na Gaillimhe. Sírúinn atáirgeadh neamhdaraíthe cóipeacht Shuirbhéireacht Ordnáis Éireann agus Rialtas na hÉireann. © Shuirbhéireacht Ordnáis Éireann, 2010.

© Suirbhéireacht Ordnáis Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/17CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/17CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/17CCMA/Galway County Council.

Clients

**Comhairle Chontae na Gaillimhe**  
 Galway County Council

**An Roinn Iompair**  
 Turasóireachta agus Spóirt

**TII**  
 Transport Infrastructure Ireland

Consultant

**ARUP**

Corporate House  
 City East Business Park  
 Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675  
 www.N6GalwayCity.ie  
 www.arup.ie

Job Title  
**N6 Galway City Ring Road**

Scale  
 AS SHOWN @ A1

Date  
 June 2017

Issue	Date	By	Chkd	Appd
I1	30/06/2017	PD	PM	EMC

Drawing Title  
**Standard Overbridge  
 Structure S16-02  
 Parapet / Safety Barrier Layout**

Drawing Status  
**For Information**

Job No	Drawing No	Issue
<b>233985</b>	<b>GCOB-D-ST-S16-02-002</b>	<b>11</b>

## **Appendix B**

Extract from ground  
investigation data

## B1 Extract from ground investigation data

Reference	Name	Chainage	Ground Investigation
S01/01	Forai Maola to Troscaigh Link Overbridge	01+380	TP3-06, TP3-07, TP3-34
S03/01	Barr Aille Overbridge	03+300	BH3/04R
S12/02	Castlegar Wildlife Overbridge	12+700	BH3/46R, TP3/27
S13/01	School Road Overbridge	13+185	BH3/33R, GP3/12, GP3/18
S14/01	Parkmore Link Road Overbridge	14+375	TP3/22, S14 (P2C1), BH3/47R
S16/01	Coolagh Junction Overbridge (EB diverge to R446)	16+410	BH3/42R, TP3/30
S16/02	Coolagh Junction Overbridge (EB merge from R446)	16+830	



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3				<b>BOREHOLE NO.</b> BH3/04	
<b>CO-ORDINATES</b> 523,645.55 E 724,286.79 N		<b>RIG TYPE</b> Dando 3000		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (m AOD)</b> 36.82		<b>BOREHOLE DIAMETER (mm)</b> 200		<b>DATE COMMENCED</b> 26/01/2016	
		<b>BOREHOLE DEPTH (m)</b> 0.10		<b>DATE COMPLETED</b> 26/01/2016	
<b>CLIENT</b> Galway County Council <b>ENGINEER</b> ARUP			<b>SPT HAMMER REF. NO.</b> <b>ENERGY RATIO (%)</b>		<b>BORED BY</b> WC <b>PROCESSED BY</b> JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL Obstruction - Possible Rockhead End of Borehole at 0.10 m		36.72	0.10						
1										
2										
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
0.1	0.1	1							No water strike

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					

<b>REMARKS</b> Borehole backfilled upon completion. Borehole scheduled for rotary follow-on coring.	<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) UT - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
---	--

IGSL BH LOG 18963.GPJ IGSL\_GDT 16/08/16



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>DRILLHOLE NO</b> BH3/04R
<b>CO-ORDINATES</b> 523,645.55 E 724,286.79 N		<b>SHEET</b> Sheet 1 of 1
<b>GROUND LEVEL (mOD)</b> 36.82	<b>RIG TYPE</b> Knebel	<b>DATE DRILLED</b> 15/02/2016
<b>CLIENT</b> Galway County Council	<b>FLUSH</b> Air/Mist	<b>DATE LOGGED</b> 16/02/2016
<b>ENGINEER</b> ARUP	<b>INCLINATION (deg)</b> -90	<b>DRILLED BY</b> S. Petersen
	<b>CORE DIAMETER (mm)</b> 80	<b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as peaty TOPSOIL.	0.30	36.52		
0.80								SYMMETRIX DRILLING: Driller reports greenish pink rock	0.80	36.02		
1		100	96	84				Very strong, thickly to thinly banded, light pink/red/brown/grey/white/orange mottled, porphyritic, medium to coarse-grained, GRANITE, fresh to locally slightly weathered.				
1.90								Dips are 35° to locally 80°. Discontinuities are widely to medium spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing, slightly iron-oxide stained.				
2		100	100	100								
2.90												
3		100	100	100								
3.70												
4		100	100	93								
4.30												
4.70		100	100	100								
5		100	100	100								
5.60								End of Borehole at 5.60 m	5.60	31.22		
6												
7												
8												
9												

<b>REMARKS</b> Hole cased 0.00-0.80m.					<b>WATER STRIKE DETAILS</b>					
					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					0.30	0.30	N/S	0.30	5	Seepage
<b>INSTALLATION DETAILS</b>					<b>GROUNDWATER DETAILS</b>					
					Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type						
16-02-16	5.00	1.00	5.60	50mm SP						

IGSL RC Fl 10M 18963.GPJ IGSL.GDT 17/08/16



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3				<b>BOREHOLE NO.</b> BH3/33	
<b>CO-ORDINATES</b> 532,101.71 E 728,307.46 N		<b>RIG TYPE</b> Dando 3000		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (m AOD)</b> 35.60		<b>BOREHOLE DIAMETER (mm)</b> 200		<b>DATE COMMENCED</b> 04/02/2016	
		<b>BOREHOLE DEPTH (m)</b> 2.70		<b>DATE COMPLETED</b> 04/02/2016	
<b>CLIENT</b> Galway County Council <b>ENGINEER</b> ARUP			<b>SPT HAMMER REF. NO.</b> <b>ENERGY RATIO (%)</b>		<b>BORED BY</b> WC <b>PROCESSED BY</b> JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	Gravelly TOPSOIL		35.45	0.15						
	Firm light brown /grey slightly sandy gravelly SILT with a medium cobble and boulder content				AA48863	B	0.50			
1	Medium dense light brown silty very sandy GRAVEL		34.60	1.00	AA48864	B	1.00-1.45		N = 16 (2, 3, 4, 4, 5, 3)	
2					AA48865	B	2.00-2.45		N = 36 (3, 3, 7, 8, 10, 11)	
3	End of Borehole at 2.70 m		32.90	2.70						
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.5	2.7	1							No water strike
INSTALLATION DETAILS				GROUNDWATER PROGRESS					
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
<b>REMARKS</b> Pit terminated at 2.70m on obstruction. Borehole BH3/33A re-setup adjacent to hole.					<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) UT - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample				

IGSL BH LOG 18963.GPJ IGSL\_GDT 16/08/16



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3				<b>BOREHOLE NO.</b> BH3/33A	
<b>CO-ORDINATES</b> 532,100.62 E 728,308.29 N		<b>RIG TYPE</b> Dando 3000		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (m AOD)</b> 35.57		<b>BOREHOLE DIAMETER (mm)</b> 200		<b>DATE COMMENCED</b> 04/02/2016	
		<b>BOREHOLE DEPTH (m)</b> 2.50		<b>DATE COMPLETED</b> 04/02/2016	
<b>CLIENT</b> Galway County Council <b>ENGINEER</b> ARUP			<b>SPT HAMMER REF. NO.</b> <b>ENERGY RATIO (%)</b>		<b>BORED BY</b> WC <b>PROCESSED BY</b> JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	Gravelly TOPSOIL		35.37	0.20						
	Firm light brown /grey slightly sandy gravelly SILT with a medium cobble and boulder content									
1	Medium dense light brown silty very sandy GRAVEL		34.57	1.00						
2										
	End of Borehole at 2.50 m		33.07	2.50						
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.4	2.5	0.5							No water strike
INSTALLATION DETAILS				GROUNDWATER PROGRESS					
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments

**REMARKS** Borehole BH3/33A setup adjacent to BH3/33 following shallow obstruction. 2.0hr moving rig out of field with tracked dumper.

**Sample Legend**  
 D - Small Disturbed (tub)  
 B - Bulk Disturbed  
 LB - Large Bulk Disturbed  
 Env - Environmental Sample (Jar + Vial + Tub)

UT - Undisturbed 100mm Diameter Sample  
 P - Undisturbed Piston Sample  
 W - Water Sample

IGSL BH LOG 18963.GPJ IGSL\_GDT 16/08/16



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>DRILLHOLE NO</b> BH3/33R
<b>CO-ORDINATES</b> 532,102.93 E 728,306.15 N		<b>SHEET</b> Sheet 1 of 2
<b>GROUND LEVEL (mOD)</b> 35.63	<b>RIG TYPE</b> Knebel	<b>DATE DRILLED</b> 17/02/2016
<b>CLIENT</b> Galway County Council	<b>FLUSH</b> Air/Mist	<b>DATE LOGGED</b> 18/02/2016
<b>ENGINEER</b> ARUP	<b>INCLINATION (deg)</b> -90	<b>DRILLED BY</b> S. Petersen
	<b>CORE DIAMETER (mm)</b> 80	<b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0					0 250 500			SYMMETRIX DRILLING: No recovery, observed by driller as TOPSOIL.	0.30	35.33		
1								SYMMETRIX DRILLING: No recovery, observed by driller as brown grey silty sandy gravel				
2												
3								SYMMETRIX DRILLING: No recovery, observed by driller as possible weathered rock recovered as brown grey silty sandy gravel with cobbles	2.70	32.93		
4												
5	5.10							SYMMETRIX DRILLING: No recovery, observed by driller as rock	4.40	31.23		
6		100	97	88				Medium strong to very strong, thick to thinly bedded, blueish dark grey, fine grained, LIMESTONE (locally fossiliferous, localized chert and stylolites), slightly to locally moderately weathered.	5.10	30.53		
7								Dips are horizontal to locally vertical. Discontinuities are medium to closely spaced, rough to locally smooth, planar to occasionally undulose. Apertures are tight to wide, locally clay-filled.				
8	8.10	100	94	72								
9												
9.60		100	100	95								

N = 50/235 mm  
(11, 14, 26, 19, 5, 0)

<b>REMARKS</b> Hole cased 0.00-5.10m.					<b>WATER STRIKE DETAILS</b>					
					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
										No water strike recorded
<b>INSTALLATION DETAILS</b>					<b>GROUNDWATER DETAILS</b>					
					Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type						

IGSL PC FI 10M 18963.GPJ IGSL.GDT 17/08/16



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>DRILLHOLE NO</b> BH3/33R
<b>CO-ORDINATES</b> 532,102.93 E 728,306.15 N		<b>SHEET</b> Sheet 2 of 2
<b>GROUND LEVEL (mOD)</b> 35.63	<b>RIG TYPE</b> Knebel	<b>DATE DRILLED</b> 17/02/2016
<b>CLIENT</b> Galway County Council	<b>FLUSH</b> Air/Mist	<b>DATE LOGGED</b> 18/02/2016
<b>ENGINEER</b> ARUP	<b>INCLINATION (deg)</b> -90	<b>DRILLED BY</b> S. Petersen
	<b>CORE DIAMETER (mm)</b> 80	<b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.60	100	100	92				Medium strong to very strong, thick to thin bedded, blueish dark grey, fine grained, LIMESTONE (locally fossiliferous, localized chert and stylolites), slightly to locally moderately weathered.				
11	11.90	100	98	94				Dips are horizontal to locally vertical. Discontinuities are medium to closely spaced, rough to locally smooth, planar to occasionally undulose. Apertures are tight to wide, locally clay-filled. <i>(continued)</i>				
12	13.10	100	100	88								
13	13.10											
14	14.70	100	73	63				13.80-14.08m - Moderately weathered, slight weakening.				
15	16.00	100	88	77				14.88-15.04m - Clay-filled fracture				
16	17.00	100	99	90								
17	17.00							End of Borehole at 17.00 m	17.00	18.63		

<b>REMARKS</b> Hole cased 0.00-5.10m.					<b>WATER STRIKE DETAILS</b>					
					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
										No water strike recorded
<b>INSTALLATION DETAILS</b>					<b>GROUNDWATER DETAILS</b>					
					Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type	18-02-16	11.90	10.60	5.10	Water level measured start last day drilling	

IGSL RC FI 10M 18963.GPJ IGSL\_GDT 17/08/16



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3				<b>BOREHOLE NO.</b> <b>BH3/42</b>	
<b>CO-ORDINATES</b> 534,727.54 E 726,825.97 N		<b>RIG TYPE</b> Dando 3000		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (m AOD)</b> 31.36		<b>BOREHOLE DIAMETER (mm)</b> 200		<b>DATE COMMENCED</b> 22/03/2016	
		<b>BOREHOLE DEPTH (m)</b> 0.30		<b>DATE COMPLETED</b> 22/03/2016	
<b>CLIENT</b> Galway County Council <b>ENGINEER</b> ARUP			<b>SPT HAMMER REF. NO.</b> <b>ENERGY RATIO (%)</b>		<b>BORED BY</b> WC <b>PROCESSED BY</b> JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL: Soft dark brown sandy gravelly CLAY		31.06	0.30						
0	Obstruction - Driller reports Possible Rockhead End of Borehole at 0.30 m									
1										
2										
3										
4										
5										
6										
7										
8										
9										

<b>HARD STRATA BORING/CHISELLING</b>				<b>WATER STRIKE DETAILS</b>					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
0.3	0.3	0.75							No water strike
<b>INSTALLATION DETAILS</b>				<b>GROUNDWATER PROGRESS</b>					
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
<b>REMARKS</b> 1.5hrs getting plant and equipment to borehole location					<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) UT - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample				

IGSL BH LOG 18963.GPJ IGSL\_GDT 16/8/16



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>DRILLHOLE NO</b> BH3/42R
<b>CO-ORDINATES</b> 534,756.39 E 726,839.91 N		<b>SHEET</b> Sheet 1 of 1
<b>GROUND LEVEL (mOD)</b> 32.65	<b>RIG TYPE</b> Knebel	<b>DATE DRILLED</b> 11/03/2016
<b>CLIENT</b> Galway County Council	<b>FLUSH</b> Air/Mist	<b>DATE LOGGED</b> 11/03/2016
<b>ENGINEER</b> ARUP	<b>INCLINATION (deg)</b> -90	<b>DRILLED BY</b> S. Petersen
	<b>CORE DIAMETER (mm)</b> 80	<b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as TOPSOIL.	0.20	32.45		
								SYMMETRIX DRILLING: No recovery, observed by driller as brown clay with cobbles and boulders	1.00	31.65		
1								SYMMETRIX DRILLING: No recovery, observed by driller as possible weathered rock	1.80	30.85		
								SYMMETRIX DRILLING: No recovery, observed by driller as rock with clay bands	2.00	30.65		
2	2.30							SYMMETRIX DRILLING: No recovery, observed by driller as rock	2.30	30.35		
3		100	89	38				Very strong, thick to thinly bedded, blueish dark grey, fine grained, LIMESTONE (locally fossiliferous, localized chert and stylolites), fresh to slightly weathered.				
								Dips are 20° to locally 40°. Discontinuities are widely to medium spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing.				
4	3.90											
5		100	100	100								
	5.45											
6		100	100	100								
7	6.90											
8		100	100	100								
	8.45											
9		100	100	100								
	9.85											

**REMARKS** End of Borehole at 9.85 m

Hole cased 0.00-2.30m.						<b>WATER STRIKE DETAILS</b>					
						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
						2.30	2.30	N/S	2.20	20	Seepage

<b>INSTALLATION DETAILS</b>					<b>GROUNDWATER DETAILS</b>				
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
11-03-16	9.85	5.35	9.85	50mm SP					

IGSL RC Fl 10M 18963.GPJ IGSL\_GDT 17/8/16



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>BOREHOLE NO.</b> <b>BH3/46</b>
<b>CO-ORDINATES</b> 531,751.37 E 728,390.26 N		<b>SHEET</b> Sheet 1 of 1
<b>GROUND LEVEL (m AOD)</b> 29.88	<b>RIG TYPE</b> Hand Dug	<b>DATE COMMENCED</b> 23/03/2016
	<b>BOREHOLE DIAMETER (mm)</b>	<b>DATE COMPLETED</b> 23/03/2016
	<b>BOREHOLE DEPTH (m)</b> 0.60	
<b>CLIENT</b> Galway County Council	<b>SPT HAMMER REF. NO.</b>	<b>BORED BY</b> JD
<b>ENGINEER</b> ARUP	<b>ENERGY RATIO (%)</b>	<b>PROCESSED BY</b> JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL with rootlets and a high cobble and boulder content from 0.20m bgl. Cobbles and boulders are of limestone.		29.28	0.60	AA39980	B	0.00-0.60			
1	Obstruction - Possible Limestone rockhead End of Borehole at 0.60 m									
2										
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
									No water strike

INSTALLATION DETAILS					GROUNDWATER PROGRESS				
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments

<b>REMARKS</b> Hand dug pit at location of BH3/46	<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) UT - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
---	--

IGSL BH LOG 18963.GPJ IGSL\_GDT 16/8/16



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>DRILLHOLE NO</b> <b>BH3/46R</b>
<b>CO-ORDINATES</b> 531,749.54 E 728,391.61 N		<b>SHEET</b> Sheet 1 of 2
<b>GROUND LEVEL (mOD)</b> 29.81	<b>RIG TYPE</b> Casagrande	<b>DATE DRILLED</b> 14/03/2016
<b>CLIENT</b> Galway County Council	<b>FLUSH</b> Air/Mist	<b>DATE LOGGED</b> 15/03/2016
<b>ENGINEER</b> ARUP	<b>INCLINATION (deg)</b> -90	<b>DRILLED BY</b> IGSL
	<b>CORE DIAMETER (mm)</b> 80	<b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as clayey gravel	0.50	29.31		
								SYMMETRIX DRILLING: No recovery, observed by driller as rock				
1	1.20							<p>Very strong, thick to thin bedded, blueish dark grey, fine grained, LIMESTONE (locally fossiliferous, localized chert and stylolites), fresh to slightly weathered.</p> <p>Dips are 20° to locally 40°. Discontinuities are widely to medium spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing.</p>	1.20	28.61		
2		100	91	61								
3												
4	2.70											
5		100	92	56								
6												
7	4.20											
8		100	97	93								
9	5.70											
10		100	99	93								
11	7.20											
12		100	100	92								
13	8.70											
14		100	100	100								

<b>REMARKS</b> Hole cased 0.00-1.20m.					<b>WATER STRIKE DETAILS</b>				
					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)
					No water strike recorded				
<b>INSTALLATION DETAILS</b>					<b>GROUNDWATER DETAILS</b>				
					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					
15-03-16	16.00	11.50	16.40	50mm SP					

IGSL RC Fl 10M 18963.GPJ IGSL.GDT 17/08/16



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

**18963**

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>DRILLHOLE NO</b> <b>BH3/46R</b>
<b>CO-ORDINATES</b> 531,749.54 E 728,391.61 N		<b>SHEET</b> Sheet 2 of 2
<b>GROUND LEVEL (mOD)</b> 29.81	<b>RIG TYPE</b> Casagrande	<b>DATE DRILLED</b> 14/03/2016
<b>CLIENT</b> Galway County Council	<b>FLUSH</b> Air/Mist	<b>DATE LOGGED</b> 15/03/2016
<b>ENGINEER</b> ARUP	<b>INCLINATION (deg)</b> -90	<b>DRILLED BY</b> IGSL
	<b>CORE DIAMETER (mm)</b> 80	<b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.20							Very strong, thick to thin bedded, blueish dark grey, fine grained, LIMESTONE (locally fossiliferous, localized chert and stylolites), fresh to slightly weathered.				
11		100	89	89				Dips are 20° to locally 40°. Discontinuities are widely to medium spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing. <i>(continued)</i>				
	11.70							11.60-11.82m - Clay/gravel-filled fracture				
12		100	95	95								
13	13.20											
14		100	65	41								
	14.70											
15		100	100	100								
16	16.20											
	16.40	100	100	100				End of Borehole at 16.40 m	16.40	13.41		
17												
18												
19												

<b>REMARKS</b> Hole cased 0.00-1.20m.					<b>WATER STRIKE DETAILS</b>					
					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
										No water strike recorded
<b>INSTALLATION DETAILS</b>					<b>GROUNDWATER DETAILS</b>					
					Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type						
15-03-16	16.00	11.50	16.40	50mm SP						

IGSL RC Fl 10M 18963.GPJ IGSL.GDT 17/8/16



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3				<b>BOREHOLE NO.</b> BH3/47	
				<b>SHEET</b> Sheet 1 of 1	
<b>CO-ORDINATES</b> 533,058.02 E 728,289.22 N		<b>RIG TYPE</b> Dando 3000		<b>DATE COMMENCED</b> 22/03/2016	
<b>GROUND LEVEL (m AOD)</b> 37.02		<b>BOREHOLE DIAMETER (mm)</b> 200		<b>DATE COMPLETED</b> 22/03/2016	
<b>CLIENT</b> Galway County Council		<b>SPT HAMMER REF. NO.</b>		<b>BORED BY</b> WC	
<b>ENGINEER</b> ARUP		<b>ENERGY RATIO (%)</b>		<b>PROCESSED BY</b> JL	

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details	
					Ref. Number	Sample Type	Depth (m)	Recovery			
0	Soft dark brown sandy gravelly CLAY		36.72	0.30							
1	Firm light brown slightly sandy slightly gravelly SILT with a medium cobble and boulder content				AA48890	B	0.50		N = 8 (2, 2, 2, 2, 2, 2)		
					AA48891	B	1.00-1.45				
2	Firm to stiff mottled brown slightly sandy slightly gravelly CLAY		35.02	2.00	AA48892	B	2.00-2.45			N = 12 (2, 3, 3, 2, 3, 4)	
3					AA48893	B	3.00-3.45			N = 20 (3, 3, 4, 5, 5, 6)	
4	Obstruction End of Borehole at 4.00 m		33.02	4.00					N = 50/20 mm (25, 50)		

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.9	4	0.75							No water strike

INSTALLATION DETAILS					GROUNDWATER PROGRESS				
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments

<b>REMARKS</b> 1.5hrs getting plant and equipment to borehole location	<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) UT - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
--	--

IGSL BH LOG 18963.GPJ IGSL\_GDT 16/8/16



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>DRILLHOLE NO</b> BH3/47R
<b>CO-ORDINATES</b> 533,062.37 E 728,286.02 N		<b>SHEET</b> Sheet 1 of 2
<b>GROUND LEVEL (mOD)</b> 37.74	<b>RIG TYPE</b> Casagrande	<b>DATE DRILLED</b> 16/03/2016
<b>CLIENT</b> Galway County Council	<b>FLUSH</b> Air/Mist	<b>DATE LOGGED</b> 21/03/2016
<b>ENGINEER</b> ARUP	<b>INCLINATION (deg)</b> -90	<b>DRILLED BY</b> IGSL
	<b>CORE DIAMETER (mm)</b> 80	<b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0					0 250 500			SYMMETRIX DRILLING: No recovery, observed by driller as gravelly clay				
1												
2												
3												
4									4.20	33.54		
4.50								SYMMETRIX DRILLING: No recovery, observed by driller as clayey cobbles	4.50	33.24		
5								SYMMETRIX DRILLING: No recovery, observed by driller as weathered rock				
5.60									5.60	32.14		
6		100	87	87				Very strong, thick to thinly bedded, blueish dark grey, fine grained, LIMESTONE (locally fossiliferous, localized chert and stylolites), fresh to slightly weathered.				
6.60								Dips are 20° to locally 40° & 80°. Discontinuities are widely to medium spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing.				
7		100	75	75								
7.60												
8		100	95	75								
8.60												
9		100	93	83								
9.60												

<b>REMARKS</b> Hole cased 0.00-4.50m.					<b>WATER STRIKE DETAILS</b>		
					Water Strike	Casing Depth	Sealed At
					No water strike recorded		
<b>INSTALLATION DETAILS</b>					<b>GROUNDWATER DETAILS</b>		
					Date	Hole Depth	Casing Depth
21-03-16	12.00	7.00	13.50	50mm SP			

IGSL RC Fl 10M 18963.GPJ IGSL\_GDT 17/8/16



# GEOTECHNICAL CORE LOG RECORD

**REPORT NUMBER**

18963

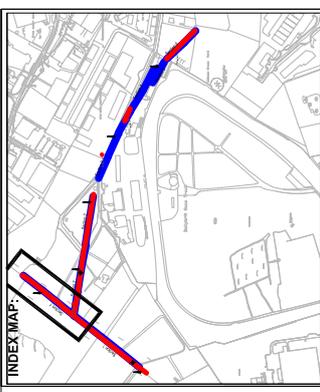
<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>DRILLHOLE NO</b> BH3/47R
<b>CO-ORDINATES</b> 533,062.37 E 728,286.02 N		<b>SHEET</b> Sheet 2 of 2
<b>GROUND LEVEL (mOD)</b> 37.74	<b>RIG TYPE</b> Casagrande	<b>DATE DRILLED</b> 16/03/2016
<b>CLIENT</b> Galway County Council	<b>FLUSH</b> Air/Mist	<b>DATE LOGGED</b> 21/03/2016
<b>ENGINEER</b> ARUP	<b>INCLINATION (deg)</b> -90	<b>DRILLED BY</b> IGSL
	<b>CORE DIAMETER (mm)</b> 80	<b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.60	100	100	100		590		Very strong, thick to thinly bedded, blueish dark grey, fine grained, LIMESTONE (locally fossiliferous, localized chert and stylolites), fresh to slightly weathered.				
11	11.60	100	100	100		770.0000000000001		Dips are 20° to locally 40° & 80°. Discontinuities are widely to medium spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing. <i>(continued)</i>				
12	12.60	100	100	100		860						
13	13.50	100	100	100				End of Borehole at 13.50 m	13.50	24.24		
14												
15												
16												
17												
18												
19												

<b>REMARKS</b> Hole cased 0.00-4.50m.					<b>WATER STRIKE DETAILS</b>				
					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)
					No water strike recorded				
<b>INSTALLATION DETAILS</b>					<b>GROUNDWATER DETAILS</b>				
					Date	Hole Depth	Casing Depth	Depth to Water	Comments
21-03-16	12.00	7.00	13.50	50mm SP					

IGSL RC Fl 10M 18963.GPJ IGSL.GDT 17/03/16



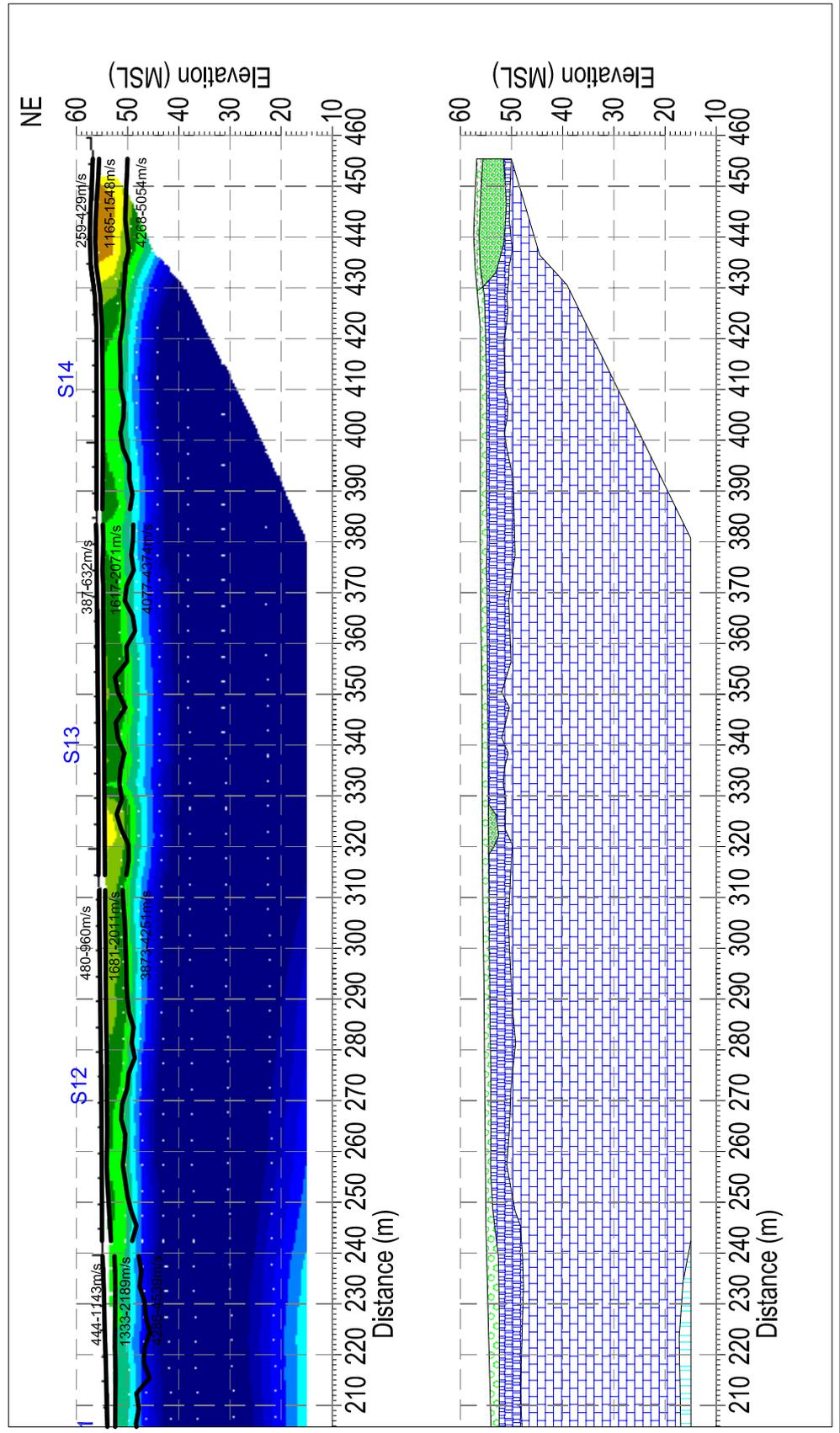
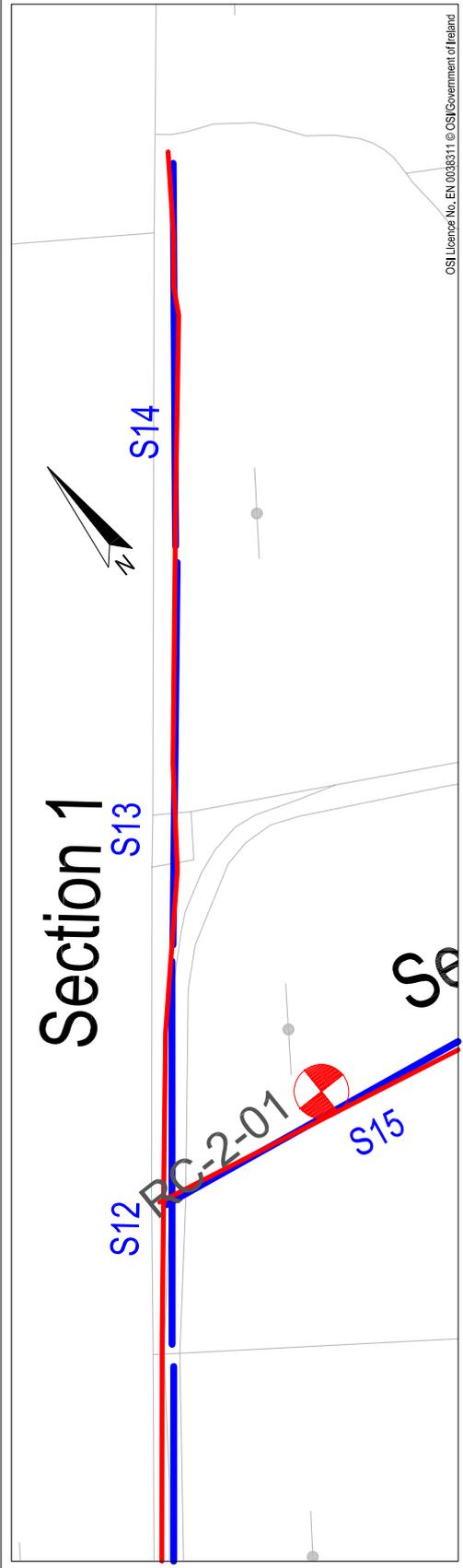


**LEGEND:**

- R1 Electrical Resistivity Tomography
- S1 Seismic refraction profile
- Proposed RC
- Firm-stiff sandy gravelly SILT/CLAY
- Stiff-very stiff sandy gravelly SILT/CLAY
- Very stiff-Hard sandy gravelly SILT/CLAY
- Medium dense-silty clayey SAND/GRAVEL
- Dense-very dense silty clayey SAND/GRAVEL
- Medium dense-silty SAND/GRAVEL
- Moderately weathered LIMESTONE
- Slightly Weathered to fresh LIMESTONE
- possible karstified LIMESTONE

6 Knockmullen Business Park, Regus House, Herald Way  
 Gorey, Co. Wexford, Ireland.  
 T +353 (0)402-21842 F +353 (0)402-21843  
 E info@apexgeoservices.ie www.apexgeoservices.ie

PROJECT: N6 Galway City Transport Project, Phase 2  
 Geophysical Survey  
 DRAWING No.: AGL15188\_03  
 DATE: 09-10-2015  
 CLIENT: ARUP  
 SCALE: 1:1250 @ A4  
 Version: 01 Date: 09-10-15 Drawn By: YOC Checked:





# TRIAL PIT RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>TRIAL PIT NO.</b> <b>TP3/06</b>
<b>LOGGED BY</b> A. Chryst		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b> 521,854.39 E 723,856.76 N		<b>DATE STARTED</b> 12/01/2016
<b>GROUND LEVEL (m)</b> 48.76		<b>DATE COMPLETED</b> 12/01/2016
<b>CLIENT ENGINEER</b> Galway County Council ARUP	<b>EXCAVATION METHOD</b> Hitachi Zaxis 80	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.20	48.56						
	Soft dark brown black fibrous PEAT					AA35350 AA37803	D B	0.50-0.50 0.50-1.10		
1.0	Brown grey slightly clayey/silty sandy fine to coarse angular GRAVEL with many angular cobbles of granite.		1.10	47.66	↓ (Seepage)	AA37804 AA37805	D B	1.10-1.10 1.10-1.50		
	Obstruction - Possible Granite bedrock End of Trial Pit at 1.50m		1.50	47.26						

**Groundwater Conditions**  
Seepage at 1.30m

**Stability**  
Good

**General Remarks**



# TRIAL PIT RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>TRIAL PIT NO.</b> <b>TP3/07</b>
<b>LOGGED BY</b> A. Chryst		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b> 521,718.09 E 723,627.37 N		<b>DATE STARTED</b> 12/01/2016
<b>GROUND LEVEL (m)</b> 46.47		<b>DATE COMPLETED</b> 12/01/2016
<b>CLIENT ENGINEER</b> Galway County Council ARUP	<b>EXCAVATION METHOD</b> Hitachi Zaxis 80	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
	Grey brown silty very gravelly fine to coarse SAND with cobbles of granite.		0.20	46.27		AA37806	D	0.20-0.50		
			0.50	45.97		AA37807	B	0.20-0.50		
	Obstruction- Possible Granite bedrock End of Trial Pit at 0.50m									
1.0										
2.0										
3.0										
4.0										

**Groundwater Conditions**  
Dry

**Stability**  
Good

**General Remarks**  
0.50hr Clearance required in tracking machine to trial pit location. 0.25hr Reinstatement during track out of field



# TRIAL PIT RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>TRIAL PIT NO.</b> <b>TP3/34</b>
<b>LOGGED BY</b> A.Chryst		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b> 521,962.32 E 723,827.95 N		<b>DATE STARTED</b> 20/01/2016
<b>GROUND LEVEL (m)</b> 48.89		<b>DATE COMPLETED</b> 20/01/2016
<b>CLIENT ENGINEER</b> Galway County Council ARUP	<b>EXCAVATION METHOD</b> Hitachi Zaxis 80	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.15	48.74						
	Soft dark brown black PEAT					AA44464	D	0.50		
						AA44465	D	0.50		
						AA44466	B	0.50		
1.0	Soft to firm grey brown slightly sandy slightly gravelly SILT/CLAY with frequent cobbles		0.90	47.99	↓ (Seepage)	AA44467	D	1.00		
						AA44468	B	1.00		
						AA44471	CBR	1.00		
						AA44472	CBR	1.00		
2.0	Grey clayey/silty sandy fine to coarse angular GRAVEL with many cobbles and occasional boulders		1.70	47.19						
	Obstruction - Possible Rockhead End of Trial Pit at 2.10m		2.10	46.79		AA44469	D	2.00		
						AA44470	B	2.00		

**Groundwater Conditions**  
Water seepage at 0.90m

**Stability**  
Good

**General Remarks**  
Carried out near location BH3/01. Additional samples acquired at 1.0m under instruction from ARUP - samples taken for CBR analysis. 0.75hr tracking to and from location.

IGSL TP LOG 18963.GPJ IGSL.GDT 26/6/17



# TRIAL PIT RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>TRIAL PIT NO.</b> <b>TP3/22</b>
<b>LOGGED BY</b> A.Chryst		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b> 533,297.22 E 728,311.06 N		<b>DATE STARTED</b> 19/01/2016
<b>GROUND LEVEL (m)</b> 56.03		<b>DATE COMPLETED</b> 19/01/2016
<b>CLIENT ENGINEER</b> Galway County Council ARUP	<b>EXCAVATION METHOD</b> Hitachi Zaxis 80	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
	Soft brown sandy slightly gravelly SILT		0.15	55.88		AA33946	D	0.15-0.45		
						AA33947	B	0.15-0.45		
	Obstruction - Possible Bedrock End of Trial Pit at 0.45m		0.45	55.58						
1.0										
2.0										
3.0										
4.0										

**Groundwater Conditions**

**Stability**

**General Remarks**  
1hr tracking in total to and from trial pit location inclusive of reinstatement



# TRIAL PIT RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>TRIAL PIT NO.</b> <b>TP3/27</b>
<b>LOGGED BY</b> A.Chryst		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b> 531,637.55 E 728,342.72 N		<b>DATE STARTED</b> 19/01/2016
<b>GROUND LEVEL (m)</b> 30.68		<b>DATE COMPLETED</b> 19/01/2016
<b>CLIENT ENGINEER</b> Galway County Council ARUP	<b>EXCAVATION METHOD</b> Hitachi Zaxis 80	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
	Firm dark brown slightly sandy gravelly SILT/CLAY with rootlets		0.15	30.53						
	Firm grey brown slightly sandy slightly gravelly SILT with occasional cobbles		0.60	30.08		AA44451 AA44452	D B	0.50 0.50		
1.0						AA44453 AA44454	D B	1.00 1.00		
2.0	Very stiff grey and light brown slightly sandy slightly gravelly SILT with occasional cobbles and boulders		1.80	28.88		AA44455 AA44456	D B	2.00 2.00		
2.40	Obstruction - Possible Rockhead End of Trial Pit at 2.40m		2.40	28.28						
3.0										
4.0										

**Groundwater Conditions**  
Dry

**Stability**  
Good

**General Remarks**  
1.15hr tracking to and from location together with padlock removal and reinstatement upon completion

IGSL TP LOG 18963.GPJ IGSL.GDT 16/01/16



# TRIAL PIT RECORD

**REPORT NUMBER**

18963

<b>CONTRACT</b> N6 Galway City Transport Project - Phase 3		<b>TRIAL PIT NO.</b> <b>TP3/30</b>
<b>LOGGED BY</b> A.Chryst		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b> 534,741.61 E 726,867.42 N		<b>DATE STARTED</b> 22/03/2016
<b>GROUND LEVEL (m)</b> 31.74		<b>DATE COMPLETED</b> 22/03/2016
<b>CLIENT ENGINEER</b> Galway County Council ARUP	<b>EXCAVATION METHOD</b> Hitachi 13T	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	<b>TOPSOIL</b> Firm brown slightly sandy gravelly SILT with many angular cobbles and boulders of limestone		0.10	31.64		AA49484	B	0.10-0.50		
	Obstruction - Possible Rockhead End of Trial Pit at 0.50m		0.50	31.24						
1.0										
2.0										
3.0										
4.0										

**Groundwater Conditions**  
Dry

**Stability**  
Good

**General Remarks**  
Pit terminated on possible shallow rockhead