

## **Appendix A**

### **A.5.3 On-line Options Report**

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Galway County Council  
**N6 Galway City Transport Project**  
On-line Options Report

GCOB-4.04-008

Issue 1 | 28 August 2015

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

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

Job number 233985

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## Glossary of Terms

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**On-Line Options:** On-line road options, where the existing transportation networks and corridors are reused and enhanced where appropriate.

**Single Carriageway:** This is a term used to describe the mainline cross-section of a road which has one vehicular lane in each direction of travel. This cross-section can include or exclude hard strips and hard shoulders.

**Proposed Mainline:** This is the term used to describe the primary vehicular carriageway of the on-line options being considered. This can be single carriageway, dual carriageway etc.

**Grade Separated Junction:** This is a junction which provides connectivity between roads at different elevations. Grade separated junctions are often used in areas where road corridors intersect one another. Grade separated junctions can be beneficial where traffic flows on one corridor dominate movements or alternatively where the traffic flows on both corridors are large resulting in operational and performance issues.

**Vulnerable Road Users:** Vulnerable road users include non-motorised road users such as pedestrians, cyclists and equestrians etc.

**Vulnerable Road User Facilities:** These facilities include pedestrian crossings, signalised or un-signalised, cycle-ways etc.

# 1 Introduction

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## 1.1 Context and Purpose of Report

*Phase 2 Route Selection* of the National Roads Authority Project Management Guidelines (NRA PMG) involves the examination of alternative options, including on-line options, the identification of key constraints, the development of feasible options and the systematic assessment of these options leading to the selection of a preferred option.

This report examines and details on-line road based options, where the existing transportation networks and corridors are reused and enhanced where appropriate. The development of the on-line option in this report does not consider complimentary measures such as the development of intelligent transport systems, traffic management etc. The purpose of this report is to identify the level of intervention required in order to accommodate the anticipated traffic volumes using an on-line road based option.

This report presents the optioneering and preliminary options assessment for on-line road options. On-line road options in this report are designed in accordance with the National Roads Authority (NRA) Design Manual for Roads and Bridges (DMRB). Where existing corridors are modified, their multi-purpose function, namely acting as a corridor for vulnerable road users and vehicular traffic is replicated and/or enhanced.

The level of detail required for Phase 2 Route Selection of the NRA PMG would be insufficient to comprehensively assess potential on-line road options in an urban environment. Therefore, options have been detailed to preliminary design level in order to facilitate an appropriate assessment. The preferred on-line option will then be compared against the alternative route options developed during Phase 2 Route Selection.

## 1.2 Existing Transportation Issues

The transportation network of Galway City and its environs has been examined and its issues identified. The results of this analysis are presented in the Route Selection Report.

## 1.3 Scheme Objectives

The objectives of the scheme are set out within the Project Brief. These objectives are detailed under the multi heading criteria outlined by the Department of Transport in their report '*Guidelines on a Common Appraisal Framework for Transport Projects and Programmes (June 2009)*'.

These criteria are examined in detail for each option, including the preferred on-line option within the Route Selection Report.



## 1.4 Scheme Operational Goals and Design Strategies

The scheme operational goals and design strategies are discussed in the Route Selection Report.

## 1.5 Extent of Study Area

On-line options involve the reuse and enhancement of existing transportation networks and corridors where appropriate. For this reason the extent of the study area was largely dictated by the existing networks and corridors. The study area was not fixed or immovable and was expanded or contracted as required.

The study area examined during on-line optioneering is presented in **Appendix A**.

## 2 Constraints Study

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A constraints study was undertaken in order to identify all constraints within the scheme study area of the N6 Galway City Transport Project, in order to inform the development of options for the transport solution for Galway.

The objective of the constraints study was to identify the international, national and local issues that must be taken into account when planning and designing the scheme so that the phases which follow (options development and selection and environmental impact studies) can be properly informed.

The constraints are divided into Natural Constraints, Artificial Constraints and External Parameters. Natural Constraints are those which are naturally occurring landscapes and features, Artificial Constraints are those which form part of the built environment and External Parameters include design standards, policies, procedural and legal issues.

These constraints are detailed within **Chapter 4** of the Route Selection Report and where required within this report.

## 3 On-line Options Design Basis

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### 3.1 Purpose of Design Basis

This section sets out the Design Basis which is the basic design criteria to be followed when considering on-line options and includes guidance on each of the following:

- Urban Design;
- Planning;
- Material Assets;
- Engineering;
- Environmental Design;
- Constructability;
- Operational Performance;
- Cost and Economic Benefits; and
- Safety.

The task of uniting the principles of urban design and planning with the requirements of this Design Basis and local, national and European policy and standards cannot be underestimated.

Specialist urban designers were therefore, engaged in order to steer the selection and development of options.

In addition to the engagement of urban designers, the planning departments of Galway County and Galway City Council were engaged in the development of on-line options and input into the development of this Design Basis.

### 3.2 Urban Design Principles

#### 3.2.1 Displacement

It is essential that the proposed transportation solution meets the requirements of the Project Brief and this Design Basis. Where on-line options are considered it is highly probable that existing road/link space will be utilised as part of the ultimate solution. Therefore, due consideration is required as to how the current uses of the existing road infrastructure are reinstated or replaced elsewhere. The existing function and use of the existing infrastructure shall be considered for each on-line option examined.

#### 3.2.2 Link and Place Functions

For many years urban street design has focused on accommodating vehicular access. This approach ignores the function of urban streets and roads as both links and places. Recent design guidance developed in the United Kingdom (*Link and*

*Place: A Guide to Street Planning and Design*) seeks to remedy this approach. This design guidance recommends viewing the urban road network and the urban area itself as a series of links and places. Links are defined as “a movement conduit” whilst place is defined as “a destination in itself”. This design guidance notes that streets and roads in many instances act as both links and places. Links are movement corridors and it should be noted that this includes all modes of transport i.e. vulnerable road users and vehicular traffic etc.

### 3.2.3 Principles of Urban Design

Due to the potentially intrusive nature of on-line options and the fact that the majority of on-line options would likely be within the administrative boundary of Galway City, it is necessary to interrogate the Galway City Development Plan and its associated reference documents in order to guide the design process. Of particular importance is the need to consider the urban design philosophy followed during the preparation of the city development plan. It is noted within the development plan that the following principles were critical in the consideration of urban design:

- Character;
- Legibility;
- Ease of Movement;
- Quality of the Public Realm;
- Continuity and Enclosure; and
- Diversity and Adaptability.

The principles above were examined by planning consultants, Brady Shipman Martin in order to develop a framework which could be applied to the development of on-line options and the current functioning of the city. **Figures 3.1 to 3.4** detail the exercise undertaken by Brady Shipman Martin (BSM) in conjunction with the Arup Urban Landscape and Design group based in London. This exercise examined the character of Galway City, identified the key characteristics of the city and identified the key requirements of any on-line options developed.

Some of the items outlined as part of the above exercise include the following:

- The city has a Green ‘lung’ along the River Corrib and through NUI Galway;
- The city has a Green ‘lung’ along Terryland Park;
- The current N6 is an existing barrier as it currently functions;
- As you travel through the city along the N6, you engage with it in different ways and at different levels; with employment centres at Ballybrit, the River Corrib in the central area, the city core in the central area, the coast and beaches at Salthill and further west Connemara;
- Different users drop in/drop out to different parts of Galway to serve different needs and the N6 is currently the conduit to do this. It is the major east/west connection. It is also the economic connector;
- The N6 is a link that serves various places, but also has the potential to become a place itself at many locations;

- The N6 serves as much as a local road as a national road and therefore, the ultimate on-line solution must cater for both classes of traffic;
- City wide opportunities such as connectivity improvements, developments and proposed environmental enhancement schemes were identified;
- The N6 plays a key north - south and east - west role in transportation movements within the city; and
- Many key institutional land use banks such as University Hospital Galway, Merlin Park Hospital, the National University of Ireland Galway, Galway Shopping Centre, Knocknacarra District Centre are adjacent to or within the on-line study area.



***Figure 3.1: Existing Primary Road Transport Corridors***

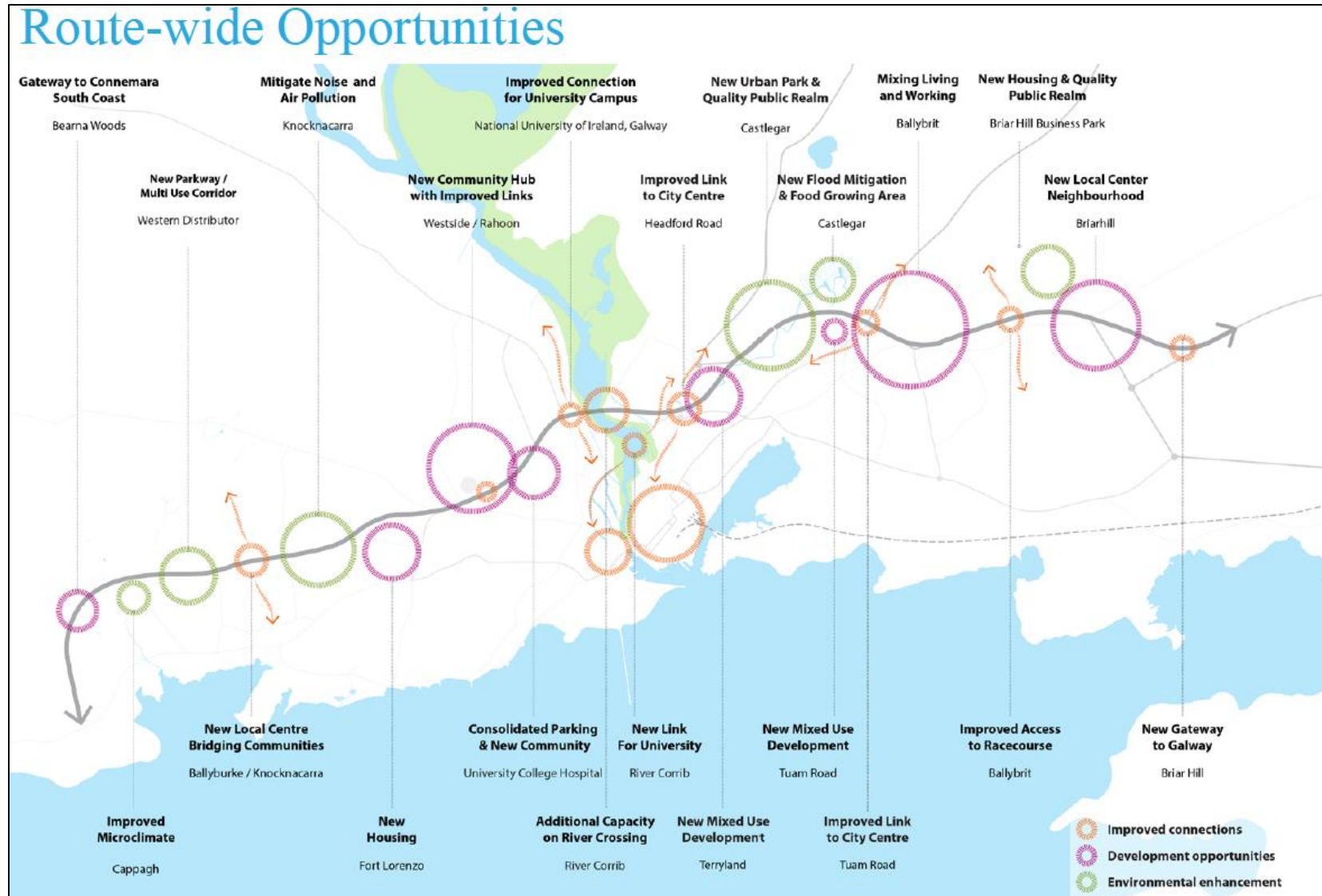
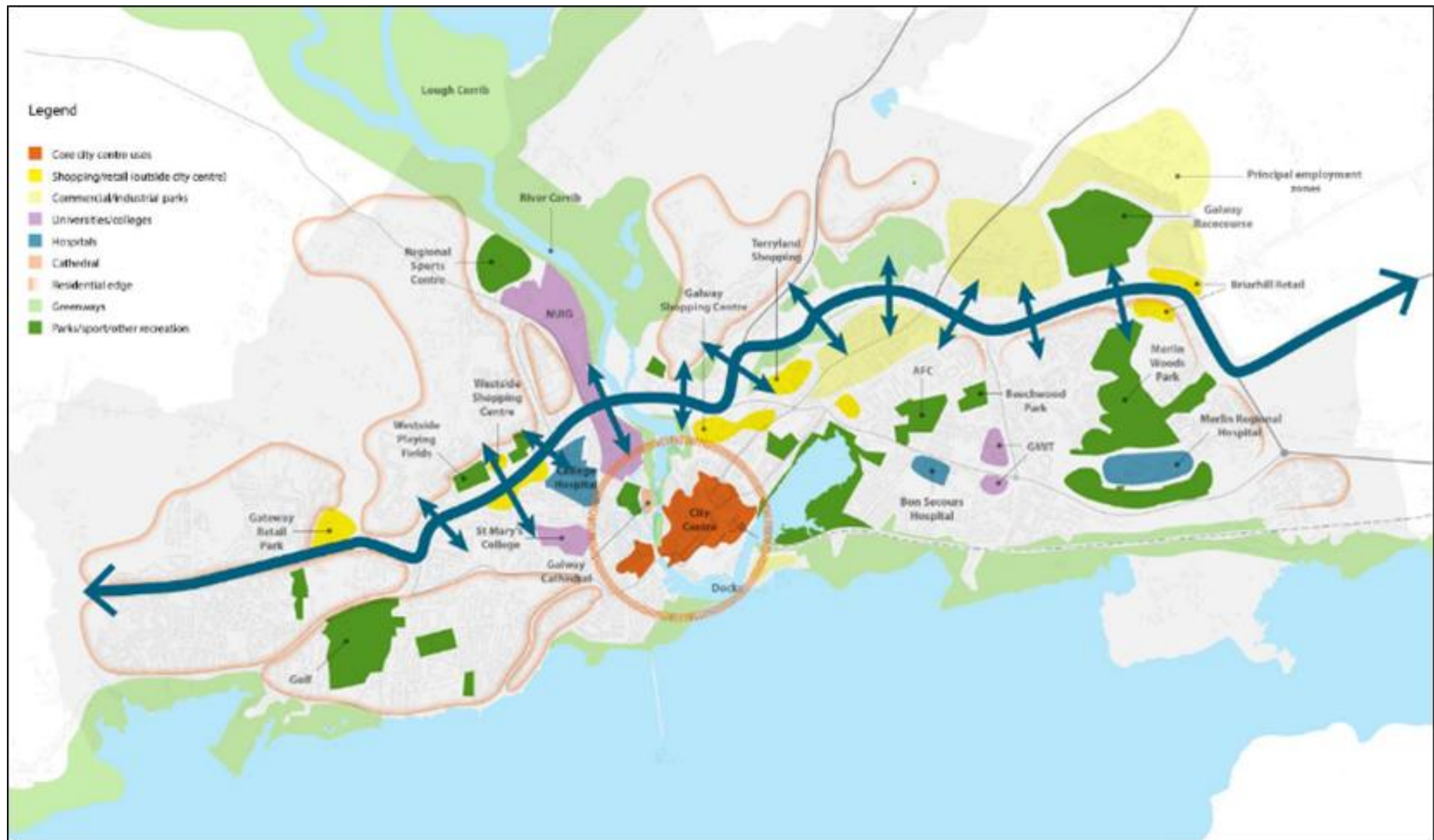


Figure 3.2: Route Wide Opportunities



*Figure 3.3: Connecting the City – East to West*



**Figure 3.4: Connecting the City – North to South**



## 3.3 Planning Criteria

### 3.3.1 Overview

It is necessary to set out the planning criteria to deliver an on-line option. These criteria include the aspirations for Galway City and Galway County from a planning perspective. Cognisance must additionally be given to planned and proposed developments upon which the alternatives considered may impact as well as the design philosophy followed during the preparation of the development plans and relevant local, regional and national planning policy.

### 3.3.2 Overarching Criteria

Planning in County Galway and Galway City is guided by local, regional and national planning guidelines, policies and plans. The Galway City Development Plan (2011-2017) sets out the aspirations for Galway City within its lifetime and the near future. As noted in the foreword to the plan, it aims to “*set out a coordinated and integrated spatial framework for the continued development of this attractive and vibrant City in a sustainable and inclusive manner*”. The Galway County Council Development Plan (2015-2021) sets out the aspirations for Galway County within its lifetime and the near future. As noted in the background to the plan, it “*sets out an overall strategy for the proper planning and sustainable development of the functional area of Galway County Council*”.

The development plans include aims to integrate land use and transportation in order to ease movement to and within the city and county and to provide for access to a range of transport modes for all sections of the community. The N6 Galway City Transport Project has the potential to contribute to achieving these aims.

Alternatives being examined are required to provide transportation benefits and shall be examined for compatibility with the strategic priorities, policies and objectives in the development plans thereof. These strategic priorities, policies and objectives are set out within the respective development plans and are discussed within the Route Selection Report.

Alternatives being examined will have the potential to significantly impact communities, key city institutions, parklands and commercial premises. The provision of road infrastructure or upgrades of existing infrastructure cannot be to the detriment of communities, key city institutions, parklands and commercial premises.

The alternatives considered shall take into consideration and demonstrate that there is a capacity to accommodate public transport provision and facilities for vulnerable road users. The provision of road infrastructure or upgrades of existing infrastructure cannot be to the detriment of public transport services or facilities for vulnerable road users.

Alternatives being examined will have the potential to significantly impact the existing urban setting. Mitigation including design measures could address some of these impacts and shall therefore, be considered during the examination of alternatives.

On-line construction would likely cause significant disruption to the local economies for the construction period and potentially thereafter. Options which result in significant and potentially permanent disruption of the local economies shall be deemed unsuitable and eliminated.

The reliability and resilience of each on-line option considered as part of the N6 Galway City Transport Project when subjected to external and unexpected events shall be examined and evaluated. In particular the reliability and resilience of each option when subjected to accidents and irregular or essential maintenance shall be examined. Where required procedures to enhance the resilience of any proposed option shall be examined and incorporated into the designs.

Alternatives being considered shall support sustainable use and management of areas of natural heritage importance, parks and recreation amenity areas and facilities.

## **3.4 Material Assets**

Material assets include planned and proposed developments, recreationally zoned areas, residentially zoned areas, commercially zoned areas and industrially zoned areas.

A preliminary examination of impacts on material assets is provided within this report. A detailed assessment of impacts for the preferred on-line option will be included within the Route Selection Report. Within the Route Selection Report the on-line option will be compared against the alternative route options developed during Phase 2 Route Selection.

### **3.4.1 Planned and Proposed Developments**

There are numerous proposed infrastructural, residential, commercial, institutional and industrial developments in Galway City. The project stages range from concept/feasibility through to implementation and construction. These developments shall be considered during the optioneering of on-line options. These developments are detailed within the Route Selection Report.

### **3.4.2 Recreationally Zoned Amenities**

Significant areas within the on-line study area are zoned for “*Natural Heritage, Recreation and Amenity*”. Recreationally zoned lands reflect the main parks in Galway City. The banks of the River Corrib and the River Corrib itself are a significant recreational area serving the population of Galway. NUI Galway is a substantial amenity with many of their facilities accessible for public use.

East of the River Corrib the most important amenity areas within or adjacent to the on-line study area include, Terryland Forest Park, Galway Racecourse and numerous local sports facilities.

The aim when developing on-line alternatives shall be to minimise impacts on recreationally zoned amenities.

### **3.4.3 Residentially Zoned Areas**

Residential areas are well distributed throughout Galway City. Galway City has an inner residential hub sprawling towards the suburbs of Knocknacarra, Castlegar and Doughiska. There are many established suburbs within the on-line study area with each of these suburbs having their own unique character.

The aim when developing on-line alternatives shall be to minimise impacts on residentially zoned areas.

### **3.4.4 Commercially Zoned Areas**

The retail industry is a key element in the economic development of Galway City. The city has seen a significant expansion of retail floor space in recent years. District Centres have been developed at Knocknacarra, Ragoon, Doughiska and are proposed at Ardaun. However, the city centre remains the dominant retail area in Galway. Other popular retail facilities include Briarhill Shopping Centre, the Tuam Road commercial estates and Westside Retail Centre. The Headford Road area occupies 30 hectares and has long been a major contributor to the commercial development of Galway City.

The aim when developing on-line alternatives shall be to minimise impacts on commercially zoned areas.

### **3.4.5 Industrially Zoned Areas**

The industrial sector in Galway is fed by a skilled workforce from the third level institutes. The main industries in Galway are medical technology and information and communication technology services. The main business parks and industrial estates within and adjacent to the on-line study area are:

- Industrial Development Authority (IDA) Business Parks at Mervue, Dangan and Parkmore;
- Galway Technology Park;
- Ballybrit Business Park;
- Ballybane Industrial Estate;
- Liosban Business Park; and
- Galway West Business Park.

The aim when developing on-line alternatives shall be to minimise impacts on industrially zoned areas.

## 3.5 Engineering

### 3.5.1 Existing Topography and Land use

The topography and land use of the on-line study area varies as you travel from west to east. The following is a brief overview of this topography:

- Undulating land, interspersed with residential dwellings and numerous local access roads in the area between Bearna and Knocknacarra;
- Suburban residential areas, commercial areas and institutional areas and associated local and regional road networks between Knocknacarra and Newcastle;
- River valley crossing at the River Corrib;
- River valley, suburban residential areas, commercial areas, industrial areas, amenity areas and associated local, regional and national road networks between Terryland and the N17 area;
- Industrial areas, commercial areas and associated regional and national road networks between the N17 and the Ballybrit Business Park entrance;
- Suburban dual carriageway relief road adjacent to residential, industrial, commercial and amenity areas between the Ballybrit Business Park entrance and Briarhill Shopping Centre; and
- Suburban dual carriageway relief road adjacent to commercial and residential areas between Briarhill Shopping Centre and Coolagh Roundabout.

There are numerous proposed infrastructural, residential, commercial, institutional and industrial developments in Galway City as noted in **Section 3.4**. These developments shall be considered during the optioneering of on-line options.

### 3.5.2 Transportation Infrastructure

The predominant travel mode in Galway City and its environs is the private car. As a result the mode share for other forms is low. Nevertheless, Galway City has an extensive infrastructure network catering for alternative modes such as walking, cycling and public transport. These networks are of varying quality with upgrades and proposed additional networks at varying stages of development and delivery.

Transportation infrastructure in Galway City is managed and delivered by Galway City Council in cooperation with the National Transport Authority. Together they have developed a framework plan which aims to deliver a sustainable transport network for Galway City. This plan was formulated following studies such as:

- Galway Metropolitan Smarter Travel Areas Action Plan;
- Galway City and Environs Walking and Cycling Strategy;
- Galway Public Transport Feasibility Study (2010); and
- Galway Strategic Bus Study (2007).

Proposed transportation developments are detailed within the Route Selection Report and the Traffic Modelling Report. These developments shall be considered during the optioneering of on-line options.

### 3.5.3 Level of Service

The Level of Service (LOS) that shall be achieved on the proposed mainline is LOS D. This is the recommended LOS to be obtained for urban and sub-urban road developments as per the Transport Research Board - Highway Capacity Manual (USA). In addition, this correlates with the recommend LOS required by the National Roads Authority for new build schemes as per NRA TD9/12.

Level of Service	Description
A	Free flow with low volumes and high speeds.
B	Reasonably free flow, but speeds beginning to be restricted by traffic conditions.
C	In stable flow zone, but most drivers are restricted in the freedom to select their own speeds.
D	Approaching unstable flow; drivers have little freedom to select their own speeds.
E	Unstable flow; may be short stoppages
F	Unacceptable congestion; stop-and-go; forced flow.

**Table 3.1: Levels of Service**

The provision of the on-line option could generate a requirement to provide a separate link network in parallel with the proposed on-line solution(s). The design of such a parallel network will be in accordance with the Department of Transport Tourism and Sports publication “*Design Manual for Urban Roads and Streets*” (DMURS), *Smarter Travel* (2009), the *National Cycle Manual* (2011) and the NRA DMRB.

### 3.5.4 Design Speed and Alignment

The design speed and related geometric parameters must be consistent with the anticipated vehicle speeds on the road. However, the designer shall also be aware of the road classification, the required capacity and level of service of the proposed or existing road when determining design speed whilst also taking cognisance of the constraints encountered in retrofitting an alignment in an urban environment. It should be noted that it may not always be possible to achieve the desired design speed in on-line retrofit options. Therefore, it is necessary to review the design speed criteria for on-line options on a case by case basis.

Designs speed parameters shall be in accordance with the NRA DMRB and DMURS.

### **3.5.5 On-line Junction Design**

Grade separated and at-grade junction design shall comply with the NRA DMRB.

The design shall ensure that there shall be sufficient capacity in both the Opening Year and the Design Year.

Vehicular accesses shall be provided in the design from National, Regional and Local Roads where required to maintain access and connectivity.

The design shall ensure that there shall be no breaks allowed in the central reserve except those required in the design for access for emergency services or diversionary routing of vehicles.

No direct access shall be permitted to the mainline, either domestic, commercial or agricultural access or the like, except accesses provided for use by emergency services.

All other roads and accesses shall be grade separated from the mainline.

### **3.5.6 Access for Emergency Services**

The design of emergency accesses for use by the emergency services shall comply with the NRA DMRB.

### **3.5.7 Drainage**

The details and location of existing drainage infrastructure shall be obtained from the local authorities in order to identify significant constraints.

The design shall ensure that all existing road and existing land drainage potentially severed by the execution and completion of the works is capable of being incorporated into the design.

The design shall ensure that the requirement for pumped drainage systems is assessed with a view to minimising the requirement for same.

The need for attenuation and storage shall also be assessed and incorporated if required.

### **3.5.8 Utilities**

The details and location of existing and proposed utilities shall be obtained from utility providers and their requirements in terms of diversions and service continuance shall be incorporated into the design.

There are a multitude of utilities within the on-line study area which options may impact to varying degrees. These include:

- Gas Networks Ireland;
- Electricity Supply Board (ESB and ESBI);
- Proposed SSE Ireland high voltage underground electrical cables;

- Local Authority foul, surface and combined sewer services;
- Irish Water foul and combined sewer services and water supply; and
- Telecommunications infrastructure and ducting.

### 3.5.9 Earthworks

The earthworks design shall ensure that all necessary measures shall be taken to mitigate any adverse effects on the surrounding area.

### 3.5.10 Tunnelling

Tunnel design and requirements shall be in accordance with national and international best practice such as UK DMRB BD78/99. Detailed tunnel design will not be undertaken at this phase.

### 3.5.11 Traffic Signalisation

The use of traffic signalisation shall be assessed as part of the design.

Traffic signalised junctions shall be designed in accordance with the NRA DMRB and DMURS.

## 3.6 Environmental Design

The aim when developing on-line alternatives shall be to minimise and avoid impacts on the environmental constraints identified during the constraints study. These constraints are detailed within **Chapter 4** of the Route Selection Report and where required within this report.

An environmental assessment of the preferred on-line option will not be undertaken during its development. A detailed environmental assessment in accordance with National and European law will be undertaken on the preferred on-line option and included within the Route Selection Report. Within the Route Selection Report the on-line option will be compared against the alternative route options developed during Phase 2 Route Selection.

## 3.7 Constructability

The constructability of all on-line options considered as part of the N6 Galway City Transport Project shall be examined. This shall be undertaken at an early stage in the design process in order to avoid unnecessary and irrelevant design. The key items which shall be examined as required are as follows:

- Feasibility of construction;
- Complexity of construction;
- Availability of construction methodologies;
- Anticipated construction methodologies;
- Adaptability of construction methodologies;

- Anticipated timescale of construction;
- Anticipated costs of construction;
- Availability of construction materials;
- Anticipated environmental impact; and
- Anticipated socio economic impact.

## 3.8 Operational Performance

Refer to **Section 1.3** of this report which provides an overview of the Project Objectives and resultant Operational Performance requirements.

### 3.8.1 Reliability and Network Resilience

Due to the intrusive nature of an on-line option, it is likely that the construction and subsequent operation would have a major impact on the road network of Galway City. It is essential that the preferred option is capable of implementation without having an adverse impact on the resilience and operational performance of the road networks. Of particular importance is the response of the preferred option to incidents such as road traffic collisions and adverse weather conditions. The performance of the preferred on-line option shall be examined from this perspective to determine its suitability.

It is essential for network reliability and resilience to consider the overall network requirements. It is not acceptable to utilise the existing link space for strategic vehicular traffic only whilst ignoring the existing multipurpose use of the road infrastructure. As noted providing a parallel distributor network may be a requisite, this is important in terms of resilience as it would improve the overall networks ability to cope with the proposed mainline being closed during maintenance or unusual events.

### 3.8.2 Operational Maintenance

The design of on-line options shall aim to minimise excessively complicated or high cost maintenance and operational procedures.

## 3.9 Cost and Economic Benefits

The cost implications of each option considered shall be examined.

### 3.10 Safety

Options considered as part of the N6 Galway City Transport Project shall be designed with the aim of removing and reducing the existing safety issues and shall not introduce any additional safety issues.

As part of the investigation into the constructability of each on-line option considered as part of the N6 Galway City Transport Project, safety hazards



associated with both its anticipated construction methodology and its anticipated operational performance and procedures shall be considered.

## 4 Preliminary On-Line Optioneering

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### 4.1 Assessment Areas

The on-line study area was divided into three distinct sections for the purpose of alternatives optioneering, namely:

- **Western** : Bearna to Browne Roundabout (N59);
- **Central** : Browne Roundabout (N59) to east of Kirwan Roundabout (N84);
- **Eastern** : Kirwan Roundabout (N84) to the N6 at Coolagh, Briarhill.

### 4.2 Assessment Methodology

The assessment involves examining impacts on:

- Urban Design and Planning;
- Engineering;
- Constructability;
- Operational Performance including Reliability and Maintenance; and
- Road Safety.

The assessment aims to identify and eliminate unsuitable options. It should be noted that not all options considered as part of the on-line optioneering process undergo assessment under each of these headings. Where an option does not pass one of the criteria noted then it is not examined further.

Engineering Criteria shall be used as an initial filter of options considered, this shall discount unfeasible options. Engineering criteria include an assessment from a traffic engineering perspective.

If an option meets the engineering criteria and fails under the other headings noted then it is discounted and not taken forward for further assessment. Options which meet the engineering and subsequent criteria are taken forward for further assessment leading to the selection of a preferred on-line option.

In some instances a solution contrary to Urban Design and Planning may be required in order to provide a feasible road based option from an engineering (particularly traffic engineering), constructability, operational and safety perspective. Where this occurs urban design and planning mitigation shall be incorporated into the relevant designs.

## 4.3 Western Section

Options considered in the western section must travel from the R336 to the River Corrib area utilising and modifying existing road infrastructure where available. The existing Quincentenary Bridge in the central section is the only existing crossing of the River Corrib which could facilitate an on-line upgrade. For this reason, on-line options in the western section must route towards this crossing. A preliminary assessment of the roads connecting the Quincentenary Bridge to the R336 identified the R337, R338 and N6. The consideration of upgrade options on the R337 was discounted due to its sinuous alignment, limited footprint and multiple accesses make it unsuitable for the provision of a high quality on-line upgrade. Further consideration of the surrounding areas highlighted the Knocknacarra area as a significant population centre for western Galway City. It also highlighted that there were plans to develop a bus corridor in the area and that the area has the potential to expand further. Furthermore, the local road network in the area offered the potential to bypass the R337 and connect to the R338, onwards to the N6 and across the Quincentenary Bridge. Optioneering in the western section therefore commenced in the Bearna area by considering connections to the Western Distributor Road area.

### 4.3.1 Bearna to Knocknacarra

#### *Context*

Bearna is a coastal village situated on the western extents of Galway City, approximately 6.5km west of Galway City centre and 11km east of An Spidéal (Spiddal). The village is located at the gateway to Gaeltacht na Gaillimhe, which extends westwards to Carna and which is the single largest Gaeltacht in the country. The area is adjacent to Bearna Woods, Silverstrand and Na Forbacha. Bearna has developed along the R336 Regional Road and has experienced considerable development pressure and rapid growth in recent years.

#### *Existing Road Network*

The R336 is heavily trafficked, particularly at morning and evening peak times as residents commute to Galway City. The area is a popular tourist destination and attracts many visitors annually, particularly in the summer months. Traffic congestion is an issue that needs to be addressed in the village and at junctions along the R336, particularly with the growth and development of the village centre. Pedestrian safety is of particular concern in the area due to the large traffic volumes.

#### *Public Transport Network*

The Bearna area is serviced by both Bus Éireann and private bus operators. There is a need to provide improved bus facilities and to install shelters at the various bus stops.

#### *Walking and Cycling Networks*

There are public footpaths along the busiest route through the village, the R336, along Pier Road, along the recently constructed portion of the new village street and

in new housing developments in the village. Currently there is poor provision for cycling in Bearna.

### ***Road Option Considerations***

There are no existing direct road connections from the R336 to Knocknacarra (Western Distributor Road) in close proximity to Bearna Village or west thereof. Road based options considered as part of on-line optioneering connecting the R336 to Knocknacarra can be summarised as two broad options, those which connect east of Bearna Village (Option A) and those which connect west of Bearna Village (Option B). Both options transverse rural settings interspersed with residential properties. The impact these options have on ecology and the built environment varies significantly.



***Figure 4.1: Bearna Options***

#### ***Option A: Bearna to Cappagh Road***

The level of provision for Option A would be determined from detailed traffic analysis. Based on preliminary information a single carriageway would be adopted. Cycling and pedestrian facilities would be incorporated in this option. Due to the suburban/rural nature of this option and the relatively low anticipated traffic volumes, signalised and at-grade junctions would be preferable to grade separated junctions. Preliminary junction locations would be at the R336 and Cappagh Road tie-ins.

#### ***Assessment -***

An assessment of this option raises no major issues from an engineering, constructability, operational and road safety point of view.

#### ***Option B: Bearna to Cappagh Road***

The level of provision for Option B would be determined from detailed traffic analysis. Based on preliminary information a single carriageway would be adopted.

Vulnerable road user facilities would be incorporated in this option. Due to the suburban/rural nature of this option and the relatively low traffic volumes, signalised and at-grade junctions would be preferable to grade separated junctions. Preliminary junction locations would be at the R336 and Cappagh Road tie-ins.

#### *Assessment -*

An assessment of this option raises no major issues from an engineering, constructability, operational and road safety point of view.

#### ***Conclusions - Bearna Road to Cappagh Road***

Option A and Option B and variations thereof offer similar benefits and therefore, both remain feasible.

Option A will be carried forward for further assessment as part of the on-line optioneering due to its closer proximity to the existing road networks and urban centres. Options similar to Option B shall be further considered during the development of alternative off-line options.

## **4.3.2 Western Distributor Road**

### ***Context***

Knocknacarra is an area to the west of Galway City. This area contains Ballyburke, Galway Golf Club, Ballymoneen, Kingston and Fort Lorenzo. The area is also adjacent to Bearna Woods, Salthill, Rahoon and Keeraun. Knocknacarra constitutes a sizeable proportion of the city with an estimated population of 12,000 and a zoned capacity to reach a population of 18,000.

### ***Existing Road Network***

In general the roads in the Knocknacarra area are of a good standard. The roads north of the Western Distributor Road are of a poorer standard than those to the south.

### ***Public Transport Network***

The Knocknacarra area is serviced by both Bus Éireann and private bus operators. There is a need to provide improved bus facilities and to install shelters at the various bus stops.

### ***Walking and Cycling Network***

The cycling facilities and infrastructure in the area are poor. There is a cycle lane along Bishop O' Donnell Road and the Western Distributor Road but this terminates at the Ballymoneen Road roundabout. There is no cycling provisions in place along any of the other routes. The narrow cross-sections on these routes proves dangerous for cyclists. The narrow widths of these roads also suggest that the inclusion of cycle lanes would be difficult. Pedestrian facilities are present along the main road network in the area. However, the majority of these footpaths are regularly disrupted with on street parking.

## ***Road Option Considerations***

Due to its large population and its anticipated role in accommodating the expansion of the city it was deemed appropriate to consider on-line options which serviced the area. All options considered in the area would reuse the existing corridor where possible and connect to the Ragoon area/R338. When assessing road connections to the Ragoon area two alternatives became evident, reusing the existing road infrastructure via Deane Roundabout and a direct connection between Knocknacarra and Ragoon. This section describes the optioneering in the Knocknacarra area only. The selection of the connection from Knocknacarra to Ragoon is described later in this report but was considered in tandem with the Knocknacarra area.

From assessing the Knocknacarra area it was evident that the options considered for the area would need to be capable of accommodating vulnerable road users and public transport. It was evident that there is an extensive network of variable quality routes for vulnerable road users which needed to be maintained and enhanced. It also became evident that extensive local road infrastructure upgrades may be necessitated in the area, particularly in the northern area of Knocknacarra due to the poor condition of the existing road infrastructure.



***Figure 4.2: Western Distributor Road Area***

### ***Option A: Western Distributor Road***

The first option considered included a mainline (4 lanes) coupled with a parallel network (2 lanes) for local traffic along the line of the existing Western Distributor Road. In order to accommodate access to the parallel road network the proposed mainline would be depressed for the length of the Western Distributor Road, with overbridges providing access to the local network (i.e. north-south connectivity). Access to the proposed mainline in the area would be accommodated only at the western end via an off-line grade separated junction west of Cappagh. Due to the suburban nature of the area vulnerable road user facilities would be provided and accommodated throughout on the parallel road network and its associated junctions. Public transport would be accommodated on the proposed parallel road network.

#### ***Assessment –***

An assessment of this option from an engineering, constructability, operational and road safety point of view raised many issues. Concerns were raised regarding the impact construction would have on the area in both the short and long term and on the suitability of the option from an urban design and planning perspective. This option would have a significant impact on the built environment in the area requiring residential demolitions north and south of the existing Western

Distributor Road over its length. It would also create a significant wide barrier through an urban area which would divide communities north and south of it.

### ***Option B: Western Distributor Road***

Due to the concerns identified during the examination of Option A, a second option was considered which aimed to accommodate the policies set out in the Galway City Development Plan, primarily the proposed Bus Rapid Transit (BRT) Scheme in the Knocknacarra area. This option, as per Option A would include a mainline coupled with a parallel network for local traffic, an off-line grade separated junction west of Cappagh Road and vulnerable road user facilities throughout on the parallel road network and its associated junctions. The option differs in that the vertical alignment along the length of the Western Distributor Road would undulate in order to accommodate a Bus Rapid Transit system using both the proposed mainline and the parallel road network.

#### *Assessment -*

The merits of this option were minimal. Due to the short distances between junctions on the Western Distributor Road, connecting to the parallel road network would not be possible given the geometric constraints. In addition, the accommodation of BRT stations/stops between the proposed mainline and the parallel road network would pose an unnecessary risk to road users, residents and BRT patrons alike. This option would have a significant impact on the built environment in the area requiring residential demolitions north and south of the existing Western Distributor Road over its length. The option is not ideal from an urban design and planning perspective as it create a significant wide barrier through an urban area which would divide communities north and south of it. For these reasons this option was discounted and not taken forward for further assessment.

### ***Option C: Western Distributor Road***

In order to alleviate the concerns identified during the examination of Options A and B, a third configuration was considered. This, as per Option A and Option B would include a mainline coupled with a parallel network for local traffic, a grade separated junction off-line to the west of Cappagh Road and vulnerable road user facilities throughout on the parallel road network. This option would share the same vertical alignment of Option A (fully depressed mainline). The option differs in that the proposed cross-section of the proposed mainline would be reduced to 2 lanes and the cross-section of the parallel road network increased to 4 lanes, thus accommodating the BRT on the parallel road network.

#### *Assessment -*

The merits of this option overall were minimal, it would provide high quality infrastructure for local traffic and BRT but would provide minimal overall benefits considering the impacts it would have on the built environment and community. Over its length this option would require residential demolitions north and south of the existing Western Distributor Road. This initial assessment highlighted that the option lacks operational reliability due to the necessity to close the proposed mainline during incidents such as road traffic collisions, adverse weather conditions and general maintenance due to the single lane in each direction of travel. As per

Options A & B, this option is not ideal from an urban design and planning perspective as it would create a significant wide barrier through an urban area which would divide communities north and south of it. For these reasons this option was discounted and not taken forward for further assessment.

#### ***Option D: Western Distributor Road***

Options which included a mainline coupled with a parallel road network were discounted for the reasons noted above. As a result, options with reduced impact and greater provision had to be investigated.

The first of these considered was an option which incorporated at-grade signalised junctions along the Western Distributor Road, provided dedicated facilities for BRT and provided vulnerable road user facilities throughout.

#### ***Assessment -***

In the area of the Western Distributor Road this option is in accordance with the aspirations identified within the Galway City Development Plan. This option would have minimal impact on the built environment in the area compared to the alternatives noted above. The merits of this option needed to be examined from a traffic engineering perspective in order to assess its performance and applicability.

The traffic analysis indicated that there would be a strong traffic attraction from the surrounding residential areas to the south and north to the proposed mainline. This analysis highlighted that access to the proposed mainline from the surrounding areas needed to be provided.

#### ***Option E: Western Distributor Road***

This option was examined in order to identify potential locations where access to the proposed mainline from the local networks in the Knocknacarra area could be provided. This examination highlighted the area adjacent to Knocknacarra District Centre (Gort Na Bró) as the most suitable due to its location at major intersecting roads and the relative availability of space.

#### ***Assessment -***

This option provides connectivity between the proposed mainline and the local networks in the Knocknacarra area and indicates that the Gort Na Bró area is the most suitable location for the provision of a junction.

#### ***Conclusions – Western Distributor Road***

Options which included a mainline coupled with a parallel road network were discounted for the reasons noted. As a result, options with reduced impact and greater provision were investigated and deemed preferable.

The option carried forward for further assessment as part of the on-line optioneering is Option E. This option would have one vehicular traffic lane and one public transport lane in each direction of travel at-grade along the line of the existing Western Distributor Road, and signalised junctions and vulnerable road user facilities throughout. The assessment of this option highlighted that a high standard of connectivity in the Knocknacarra area would be required and that the area

adjacent to Knocknacarra District Centre (Gort Na Bró) would be the most suitable location for a junction due to its location at major intersecting roads and the relative availability of space. Traffic assessment also indicated that immediately west of and prior to the junction at Gort Na Bró, the number of vehicular lanes in each direction of travel, should be increased to two going eastwards due to the anticipated traffic volumes.

### **4.3.3 Knocknacarra to Ragoon**

#### ***Context***

As noted, when assessing road connections to the Ragoon area/R338 from the Western Distributor Road two alternatives became evident, reusing the existing road infrastructure via Deane Roundabout and a direct connection between Knocknacarra and Ragoon.

Deane Roundabout connects the Knocknacarra area to the R338 and onwards to the N6 national route. It is located between the Ragoon and Knocknacarra areas and is a key junction in the Galway City road network. The junction connects at the eastern end of the Western Distributor Road.

#### ***Existing Road Network***

The Deane Roundabout facilitates through traffic and serves as an access to a number of residential areas.

#### ***Public Transport Network***

The Deane Roundabout serves as a through corridor for public transport travelling to Western Distributor Road, Salthill and further west.

#### ***Walking and Cycling Network***

The Deane Roundabout area serves as a principal route for vulnerable road users wishing to access the amenity facilities in the Salthill area and residential and commercial amenities in the Knocknacarra area. In general, the footways and cycleways in the Deane Roundabout area are of a good standard. In particular, the facilities on the Gort Na Bró and Seamus Quirke Road connections are of a high standard. The roundabout itself is difficult for vulnerable road users to transverse due to the level of traffic and congestion there.

#### ***Road Option Considerations***

Option E represents the preferred option through the Western Distributor Road area. The options considered for the Deane Roundabout area seek to connect to this option by either reusing or enhancing the existing Deane Roundabout area transportation networks or provide a new off-line direct connection.

Road based options considered as part of on-line optioneering connecting the Western Distributor Road area and the Seamus Quirke Road area via Deane Roundabout can be summarised as two broad options. Those which provide a singular connection between the areas and those which provide a dual or split



connection. The singular option incorporates all movements in one corridor whereas the dual connection splits the movements in two prior to Gort Na Bró.

### ***Option A: Deane Roundabout Connection***

The first option considered in the Deane Roundabout area would involve reusing Gort Na Bró as far as Deane Roundabout, the provision of a grade separated junction at Deane Roundabout and onward connection to Seamus Quirke Road. The grade separated junction at Deane Roundabout would provide connectivity from the proposed mainline to the local networks, including residential areas.

Traffic analysis in the Western Distributor Road area indicated that a single vehicular lane in each direction would be insufficient to the east of Bóthar Stiofáin due to the anticipated traffic volumes. Because of this, two vehicular lanes plus one public transport lane in each direction was provided for this option from Bóthar Stiofáin eastwards.



***Figure 4.3: Option A Deane Roundabout Connection***

#### ***Assessment –***

An assessment of this option from an engineering, constructability, operational and road safety point of view raised many issues. Concerns were raised regarding the impact construction would have on the area in both the short and long term. Concerns were also raised regarding the road safety implications and the suitability of the option in the context of the Galway City Development Plan and other local, regional and national policies. In order to accommodate access between the proposed mainline and the local networks a large footprint would be required. This option would have a large impact on the built environment in the area requiring residential demolitions east and west of the existing roundabout and approaching Ragoon/R338. This option is not ideal from an urban design and planning perspective as it creates a significant wide barrier through an urban area. Because of this, this option was discounted and not taken forward for further assessment.

### ***Option B: Deane Roundabout***

Due to the issues identified during the examination of Option A, an option mitigating and minimising these issues needed to be developed.

Option B is a modified version of Option A, it diverges once the scheme has reached Gort Na Bró. Public Transport and vulnerable road users would be diverted northwards on Gort Na Bró along with local vehicular traffic. The remaining vehicular traffic follows Gort Na Bró eastwards towards Deane Roundabout, a grade separated junction is maintained (modified in order to limit impact) at Deane Roundabout as per Option A along with onward connection to Seamus Quirke Road/R338.



**Figure 4.4: Option B Deane Roundabout Connection**

*Assessment –*

An assessment of this option from an engineering, constructability, operational and road safety point of view raised many issues. Concerns were raised regarding the impact construction would have on the area in both the short and long term. Concerns were also raised regarding the road safety implications and the suitability of the option in the context of the Galway City Development Plan and other local, regional and national policies. This option would have a lesser impact on the built environment in the area on the approach to and at Deane Roundabout due to the removal and redirection of the public transport lane. The option however, would have a direct and indirect impact on residential areas over a much larger area and create a significant wide barrier through an urban area. Because of this, this option was discounted and not taken forward for further assessment.

**Option C: Western Distributor Road to Ragoon**

The review of Option E in the Western Distributor Road area identified geometric alternatives on the approach to the Gort Na Bró Road to the south of Knocknacarra District Centre which could minimise impacts on the built environment in the area. The alternatives involve moving the horizontal alignment of the option northwards towards Knocknacarra District Centre, onwards to the amenity lands south of Knocknacarra District Centre and connecting to Ragoon thereafter through a residential area in a buried structure.

#### *Assessment–*

From a land use and planning use perspective, this option would be better than the alternative options in the Deane Roundabout area in the longer term, albeit there is significant acquisition of properties in the short term. This option is better due to the measures included to minimise its scale, overall footprint and impact on the built environment in the long term.

#### ***Option D: Western Distributor Road to Ragoon***

This option is a variation of Option C. This option examined the provision of a deep (Roadheader or Tunnel Boring Machine) tunnel from the Western Distributor Road to Ragoon along the altered horizontal alignment developed in Option A.

#### *Assessment–*

This option would be undesirable from an economic perspective and from a constructability perspective depending on the method proposed. The delivery of a tunnel boring machine tunnel for example would not be feasible economically or practically due to the short length of the tunnel and the need to provide large compounds at each end of the tunnel in order to facilitate construction. Because of this, this option was discounted and not taken forward for further assessment.

#### ***Conclusion***

#### ***Deane Roundabout Connections***

The impacts of Option A and Option B would be similar. They would both have a significant impact on the built environment in the Deane Roundabout area, requiring significant residential property acquisition also, without providing a functional and safe road based option. In order to minimise impacts on the built environment in the Deane Roundabout area, it would be necessary to incorporate substandard geometric parameters inconsistent with the anticipated traffic speeds or volumes which would create safety issues. Additionally, neither option would provide full connectivity in the area due to the number of accesses and difficult topography and therefore would fail to provide adequate connectivity between the proposed mainline and local networks.

For these reasons, these options were discounted and not taken forward for further assessment.

#### ***Western Distributor Road to Ragoon***

The option carried forward for further assessment as part of the on-line optioneering is Option C. This option would connect to the Western Distributor Road at Gort na Bró with a grade separated junction, then proceed east in a cut and cover tunnel with two vehicular traffic lanes in each direction of travel to connect to Seamus Quirke Road.

The inclusion of this high capacity at-grade link would be contrary to the aspirations of the Galway City Development Plan for the area, the inclusion of this option is however necessitated by the lack of an alternative functional road based option capable of safely accommodating the anticipated traffic volumes. A cut and cover/depressed solution would be deemed preferable for this link as it mitigates

the impacts associated with the intrusive nature of the option and reconciles the option with the aspirations for the area within the Galway City Development plan.

#### 4.3.4 Junction Provision: Western Distributor Road

Once the preferred location of the mainline alignment both horizontally and vertically had been determined in the Knocknacarra and Ragoon areas, the provision of connectivity to the network could be examined. It became evident from the examination of options in the Western Distributor Road area that enhanced connectivity to the network would be essential and that existing functionality of the road must be preserved.

The consideration of options was somewhat restricted by the geometric constraints identified during optioneering in the Western Distributor Road to Ragoon areas. That is, the vertical alignment in the Western Distributor Road area had to reduce on the approach to Gort Na Bró. Because of this necessity it was feasible to examine grade separated junctions in the area.

**Figures 4.5 to 4.7** detail the junction layouts considered and tested via traffic modelling during on-line optioneering in the Western Distributor Road area. These junctions were considered combined with Option E: Western Distributor Road and Option C: Knocknacarra to Ragoon.

##### *Options A & B: Junction Provision Western Distributor Road*



**Figure 4.5: Junction Layouts A & B**

Options A and B would result in the closure of Bóthar Stiofáin and the removal of vehicular access to residential areas south of the existing Western Distributor Road.

Option A would provide restrictive access to Knocknacarra District Centre whilst Option B would enhance connectivity to the centre. In enhancing connectivity, Option B would have a large impact on the built environment in the Western Distributor Road area.

*Assessment –*

Both Option A and B would have a significant impact on local traffic movements in the area and the built environment. Both options would restrict rather than enhance connectivity. Options A and B have therefore been discounted and not taken forward for further assessment.

***Option C: Junction Provision Western Distributor Road***

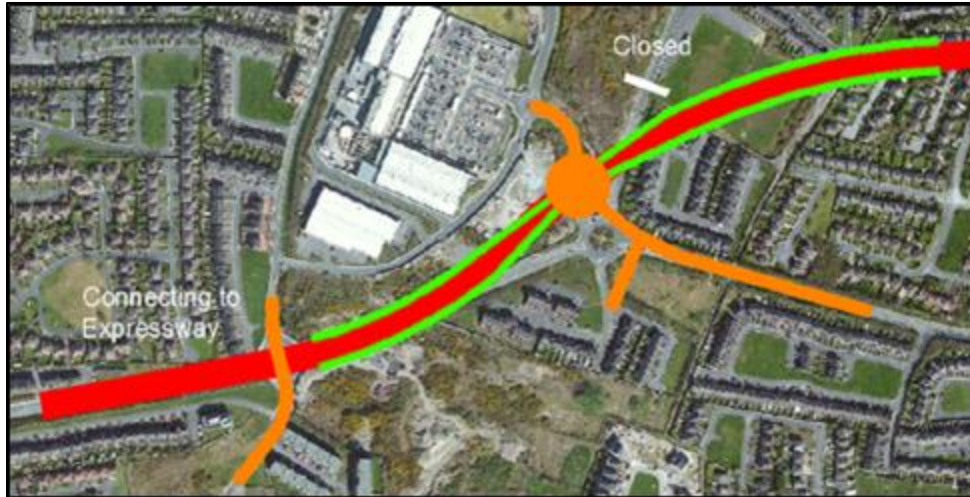


***Figure 4.6: Junction Layouts C***

Due to the concerns identified during the examination of Options A and B, alternative options were considered which aimed to enhance connectivity and minimise impacts on the built environment, particularly impacts to residential amenities. The first of these is Options C. This option would result in the closure of Bóthar Stiofáin and the removal of vehicular access to residential areas south of the existing Western Distributor Road as per Options A and B. However, local connectivity in the Gort Na Bró area would be enhanced from Options A and B via the introduction of a full movement signalised junction. Connectivity between the proposed mainline and local networks would be provided via slip roads.

*Assessment–*

Although local connectivity issues would be improved in the Gort Na Bró area, issues would remain due to the closure of Bóthar Stiofáin and residential accesses south of the Western Distributor Road. Option C has therefore, been discounted and not taken forward for further assessment.



**Figure 4.7: Junction Layout D**

A further alternative to be considered from Options A and B was Option D. This option would follow on from the positive amendments made for Option C. This option would result in the provision of an at-grade signalised junction at Bóthar Stiofáin providing access to residential areas and Bóthar Stiofáin. A full movement grade separated junction would be provided in the area in combination with realigned accesses to Gort Na Bró, Knocknacarra District Centre and other local roads. The footprint of this option was minimised in order to reduce impacts on the built environment in the area.

*Assessment—*

Improved local connectivity combined with the retention of Bóthar Stiofáin and a minimised impact to the built environment lead to Option D being carried forward for further assessment as part of the on-line optioneering.

**Conclusion: Western Distributor Road**

The option carried forward for further assessment as part of the on-line optioneering is Option D. Options A to C would be unsuitable due to their impact on the built environment and the existing road network and its connectivity. These options would restrict local access in the area and restrict access to the proposed mainline.

This preferred junction layout would be out of character in the area, the inclusion of this junction is however necessitated by the need to provide connectivity between the proposed mainline and the local road networks. Option D was determined to be the most preferable due to its reduced impact on the built environment when compared to the alternatives considered and its ability to provide connectivity. This option would have limited visual impact as it would be constructed at ground level, the slip roads associated with this option would be visually screened and minimised by the inclusion of retaining structures.

## 4.3.5 Seamus Quirke Road

### *Context*

Seamus Quirke Road (SQR)/R338 is located in the Ragoon area. Ragoon is an established suburb to the west of Galway City, adjacent to Knocknacarra, Taylor's Hill, Shantalla and Newcastle.

Ragoon, including the area around Seamus Quirke Road is considered an established suburb in the context of the Galway City Development Plan. Plans for the area include the provision of a Bus Rapid Transit, the development of specialist industry and the development of a sports campus.

### *Existing Road Network*

This area includes Browne Roundabout, Seamus Quirke Road and Bishop O'Donnell Road. Seamus Quirke Road and Bishop O'Donnell Road have recently been upgraded and are of a high quality with a vehicular lane and bus lane in each direction of travel, along with upgraded facilities for vulnerable road users throughout. Bishop O'Donnell and Seamus Quirke Road serve as the primary connection from west of Galway City to the national road network and as a result cater for significant traffic volumes.

Roads which provide access to the north-west of Ragoon are Thomas Hynes Road (north-west of Browne Roundabout), Bóthar Le Chéile (east of Westside Playing Pitches), Circular Road (west of the Westside Playing Pitches), Ragoon Road and Western Distributor Road. Thomas Hynes, Bóthar Le Chéile and Circular Road are connected by Siobhan McKenna Road which runs parallel to Seamus Quirke Road.

### *Public Transport Network*

The Ragoon area is serviced by both Bus Éireann and private bus operators. Bus facilities and shelters at the various bus stops have recently been upgraded in the area.

### *Walling and Cycling Networks*

Within the residential areas of Ragoon there is a high quality network of footpaths. Pedestrian facilities are generally of high standard and are only interrupted at junctions and major estate accesses. The facilities on Circular Road are of a lower standard with sections where no footpaths are provided. Cycle lanes are provided on Seamus Quirke Road, Bishop O'Donnell Road and Ragoon Road. Existing road space accommodates cyclists on the remaining roads.

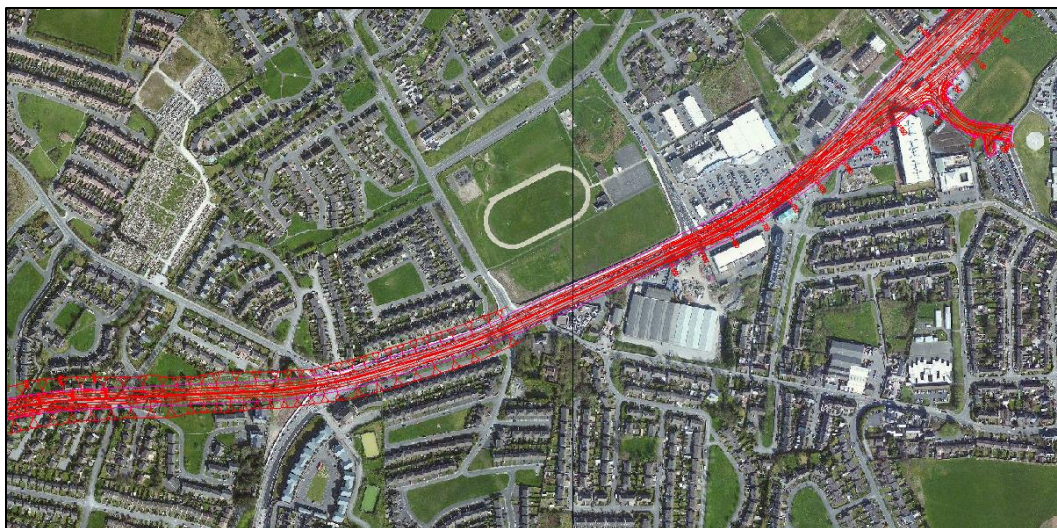
### *Road Option Considerations*

As noted, the Ragoon area includes major road junctions and networks such as Browne Roundabout, Thomas Hynes Road, Seamus Quirke Road and Bishop O'Donnell Road. These are the primary connection points and routes from the west to the east of Galway City and county. Seamus Quirke Road/R338 is the primary direct route to the Quincentenary Bridge from the west of Galway City.

The consideration of options in the area was dependent on the options and layouts at its extremities. On the western end, this area ties to Option A Western Distributor

Road to Ragoon and on the eastern end it will connect to a junction at the intersection of a number of national roads, local roads, and the primary access to University Hospital Galway.

As a result of the selected option at the western end and the likely positioning of a junction at the eastern end a number of options were possible. The cross-section of the proposed mainline was determined to be four lanes following preliminary traffic analysis in the Western Distributor Road area.



**Figure 4.8: Seamus Quirke Road**

#### **Option A: Seamus Quirke Road**

The first option considered would include a mainline coupled with a parallel network with two lanes for local traffic. In order to accommodate access to the parallel road network and restrict access to the proposed mainline, the vertical alignment of the proposed mainline would be depressed over the length of the Seamus Quirke Road. Overbridges would provide access from the local network (i.e. north-south connectivity) to the parallel road. Access to the proposed mainline in the area would be accommodated via a grade separated junction at Browne Roundabout which could be accessed from the parallel road network. Vulnerable road user and public transport facilities and routes would be provided and accommodated by the parallel road network.

#### **Assessment –**

An assessment of this option from an engineering, constructability, operational and safety point of view raised many issues. Concerns were raised regarding the impact construction would have on the area in both the short and long term. Concerns were raised regarding the suitability of the option in the context of the Galway City Development Plan and other local, regional and national policies.

This option would have a significant impact on the area; the option would act as significant barrier for people in the area in the long term due to the large expanses of open pavement created. Due to these impacts, this option was discounted and not taken forward for further assessment.



### ***Option B: Seamus Quirke Road***

Due to the concerns identified during the examination of Option A, a second option was considered which aimed to accommodate the policies set out in the Galway City Development Plan, primarily the proposed Bus Rapid Transit scheme in the area. This option, as per Option A would include a mainline coupled with a parallel network for local traffic, a grade separated junction at Browne Roundabout and vulnerable road user and public transport facilities throughout. The option differs from Option A in that additional lanes are added to the parallel road network to cater for the Bus Rapid Transit.

#### *Assessment -*

The merits of this option were minimal. The increase in width would have an additional impact on the area. Due to these impacts, this option was discounted and not taken forward for further assessment.

### ***Option C: Seamus Quirke Road***

The concerns highlighted during the examination of options A and B required that the approach in the Seamus Quirke Road area be re-examined. The need to maintain community connectivity, reduce segregation, improve or maintain road safety and design in accordance with the urban design principles within the Galway City Development Plan were identified.

The best example of a desirable solution was the existing Seamus Quirke Road. In 2011 the Bishop O'Donnell/Seamus Quirke Road improvement scheme was completed. This improvement provided bus priority, signalisation of junctions and dedicated cycle, pedestrian and vulnerable road user facilities throughout. The challenge was to incorporate an om-line option into the existing environment. The most feasible way in which this could be achieved was locating the proposed mainline in a tunnel beneath the existing Seamus Quirke Road, and recreating the existing environment at surface level. This option would have the ability to cater for the large traffic volumes anticipated and distribute local and national traffic efficiently.

#### *Assessment -*

An assessment of this option from an engineering, constructability, road safety and environmental point of view raised many issues. Concerns were raised regarding the impact construction would have on the area in the short term. This option would have significant impacts during construction, the benefits of this option compared to the alternative at-grade or hybrid surface and depressed options are however significant. This option would maintain and enhance community connectivity, improve road safety and would have the potential to enhance the character of the area through urban design in accordance with the Galway City Development Plan. This option would have significant benefits for vulnerable road users when compared to the alternatives. The provision of the mainline beneath Seamus Quirke Road would remove traffic from the surface level thereby making it much more desirable and safe for vulnerable road users.

### ***Conclusions: Seamus Quirke Road***

The option carried forward for further assessment as part of the on-line optioneering is Option C. This option would have many benefits over the alternatives considered. This option would have the potential to enhance community connectivity, improve road safety and have the potential to enhance the character of the area through urban design in accordance with the Galway City Development Plan. Most importantly this option would seek to minimise overall impact on the area via the construction of a cut and cover tunnel beneath the surface of the existing Seamus Quirke Road with the reconstruction of the existing environment at surface level thereafter.

## **4.4 Central Section**

Options considered in the central section must travel along the existing N6 transportation corridor from its commencement at the N59 Browne Roundabout across the River Corrib and connect to the N6 east of the N84/N6 Junction. Incorporating the N6 corridor into the development of the on-line road option is logical due to its high capacity and current operating function as the de facto bypass of Galway City. Additionally, and as noted previously, the Quincentenary Bridge is the only existing crossing of the River Corrib which could facilitate an on-line upgrade.

### **4.4.1 N59 Browne Roundabout**

#### ***Context***

The existing Browne Roundabout, at the N6/N59 interface, marks the boundary between the Newcastle, Shantalla and Westside areas. The roundabout facilitates the connection between the N59 Galway to Clifden Road, University Hospital Galway, Seamus Quirke Road and the N6 Dublin Road. Due to its strategic function as a key node on the N6 transportation corridor it is a logical location for a junction on the proposed on-line option.

Optioneering to the west of Browne Roundabout indicated that an option comprising a mainline located in a tunnel with the at-grade environment recreated was preferred.

#### ***Existing Road Network***

The Browne Roundabout facilitates through traffic and is the intersecting point of a number of national and local roads.

#### ***Public Transport Network***

The Browne Roundabout serves as a through corridor for public transport travelling to Ragoon, the Western Distributor Road, Salthill and further west.

#### ***Walking and Cycling Network***

The Browne Roundabout area is a principal route for vulnerable road users wishing to access the facilities in the Newcastle and Ragoon areas. In general, the footways and cycleways in the Browne Roundabout area are of a good standard and in

particular, those on the Seamus Quirke Road. The roundabout itself is difficult for vulnerable road users to transverse due to the level of traffic and congestion it caters for and experiences.

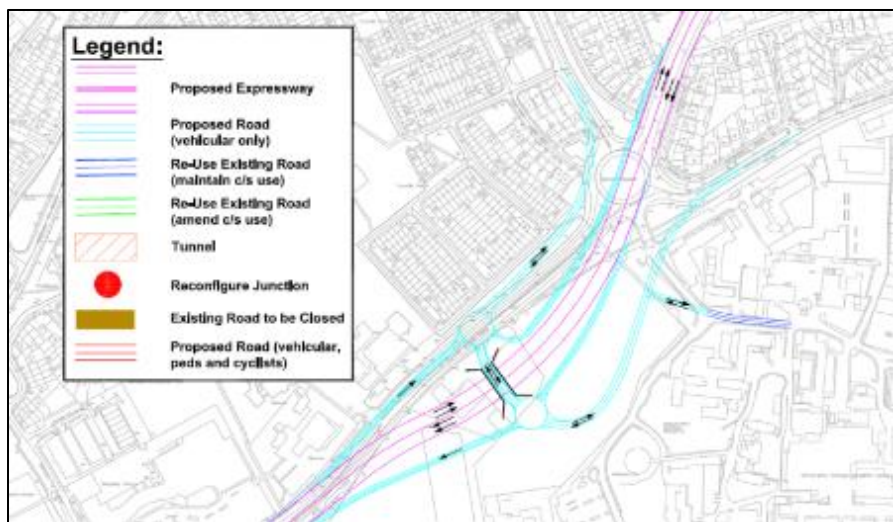
### ***Road Option Considerations***

A number of options can be considered in the Browne Roundabout area. A description of these options is given below.

The provision of a junction in the area is a necessity due to its location at the intersection of a number of national and local roads and its positioning adjacent to University Hospital Galway. The primary criteria for assessing options in this area was their performance from a traffic engineering perspective.

### ***Option A: N59 Browne Junction***

This option would consist of a grade separated dumbbell junction, elevated over the proposed mainline, which would be at-grade through the existing Browne Junction. This option would utilise the existing local road networks both north (e.g. Siobhan McKenna Road) and south (Rahoon Road/Shantalla Road) of the Seamus Quirke Road. Connectivity on the existing road network would be maintained via a new overbridge linking Bóthar Le Chéile to Rahoon Road. Additional pedestrian routes and access roads would be required to access the church and other community facilities at Westside. A new access road through the hospital car park would also be required in order to link the residential developments south of the proposed mainline to the proposed junction.



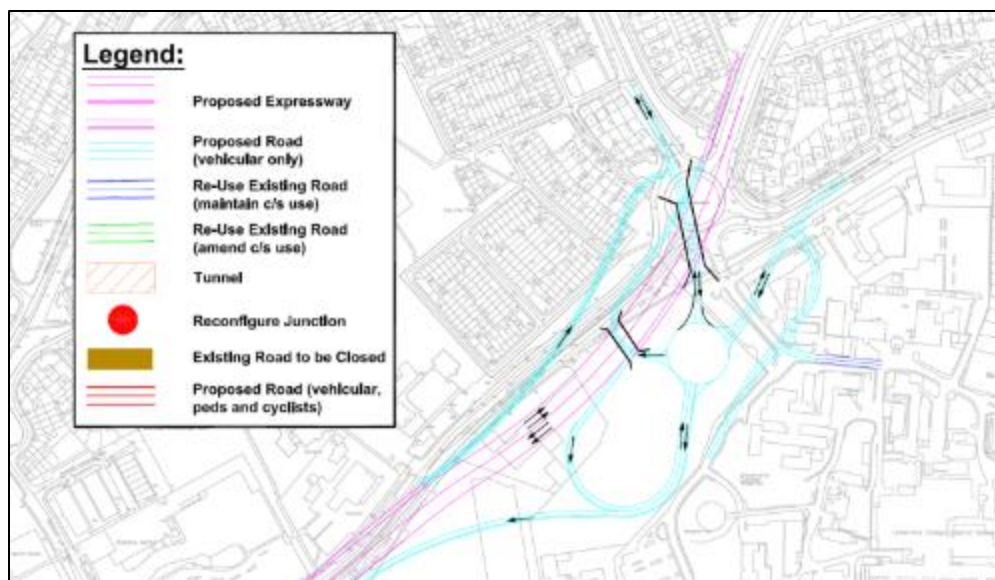
***Figure 4.9: N59 Browne Junction – Option A***

### ***Assessment -***

The dumbbell arrangement would not provide sufficient capacity for the anticipated traffic volumes through the junction. For this reason this option was discounted and not taken forward for further assessment.

### ***Option B: N59 Browne Junction***

This option would consist of a grade separated junction located to the east of the existing Browne Junction and elevated over the proposed mainline, which would be at-grade through the existing Browne Junction. Connectivity between the local networks and the proposed mainline would be provided via a four arm roundabout and local connectivity would be provided as per Option A.



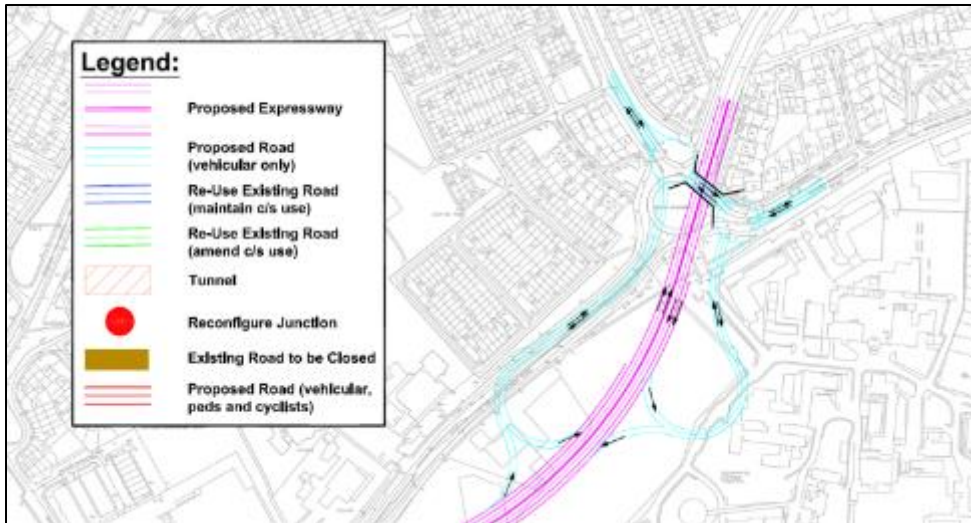
***Figure 4.10: N59 Browne Junction – Option B***

#### ***Assessment -***

The proposed loops would not have sufficient capacity to cater for the anticipated traffic volumes through the junction. Additionally this option would require the demolition of a number of operational hospital buildings. For these reasons this option was discounted and not taken forward for further assessment.

### ***Option C: N59 Browne Junction***

This option would consist of a compact grade separated junction elevated over the proposed mainline, with the proposed mainline at-grade through the existing junction. Local network connectivity would be provided as per Option A. The existing residential areas south of the proposed mainline would need to use alternative routes, as there would be no direct access to the proposed junction. With this option the existing hospital access to the Browne Junction would be removed. Access to the hospital would be via entrances on Newcastle Road and Costello Road.



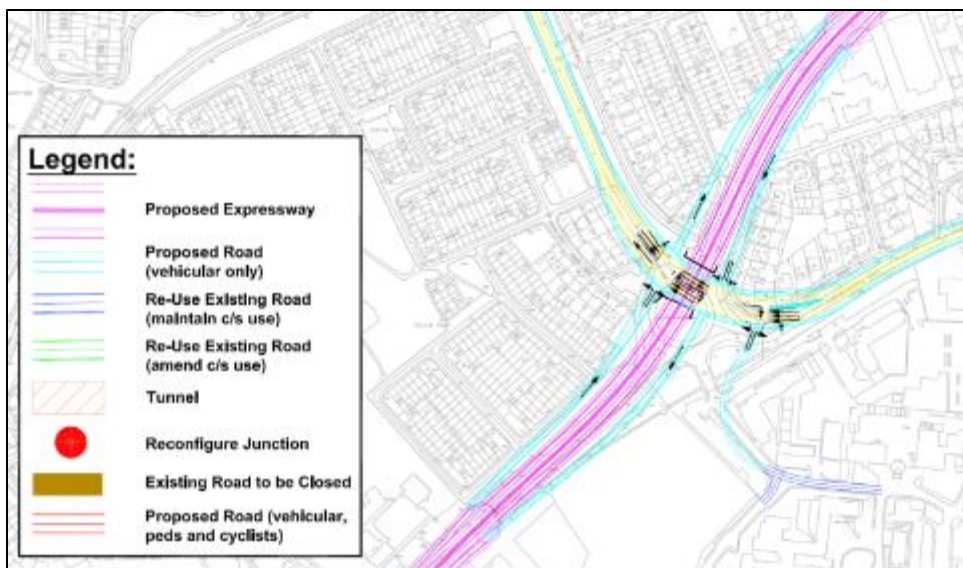
**Figure 4.11: N59 Browne Junction – Option C**

**Assessment -**

The proposed loops would not have sufficient capacity to cater for the anticipated traffic volumes through the junction. Additionally this option would require the demolition of a number of operational hospital buildings and would add significantly to journey times for local residents. For these reasons this option was discounted and not taken forward for further assessment.

**Option D: N59 Browne Junction**

This option would consist of a signalised junction elevated over the proposed mainline, with the proposed mainline at-grade through the existing junction. Local network connectivity would be as per Option A. Additional access roads would be required to access the church and other community facilities in Westside. A new access road through the hospital car park would be required in order to link the residential developments located to the south of the proposed mainline to the proposed junction.



**Figure 4.12: N59 Browne Junction – Option D**

*Assessment -*

The junction layout would be complex due to the proximity of slip roads and local network junctions. This layout would be difficult for drivers to negotiate and could cause operational issues. For these reasons this option was discounted and not taken forward for further assessment.

***Option E: N59 Browne Junction***

Option E would be depressed in a tunnel from the west as per the preferred option in the Seamus Quirke Road area, until it reaches the church at Westside. At this point the proposed mainline would rise back up to grade through Browne Junction. Full connectivity to and from the proposed mainline would be provided via a signalised diamond junction, above the proposed mainline.

The local road network would sit directly on top of the tunnel on the west side, at-grade, until it reached the church. The local networks eastbound and westbound carriageways would then divert either side of the proposed tunnel portal. These carriageways would tie into the merge/diverge slips from the proposed mainline, which would then continue to the proposed signalised diamond junction. A left in/left out access would be provided from the hospital to the newly created local distributor network and a new hospital entrance would be provided onto Seamus Quirke Road. This would facilitate direct access from the hospital to the new junction in order to facilitate all possible movements onto the proposed mainline.



***Figure 4.13: N59 Browne Junction – Option E***

*Assessment -*

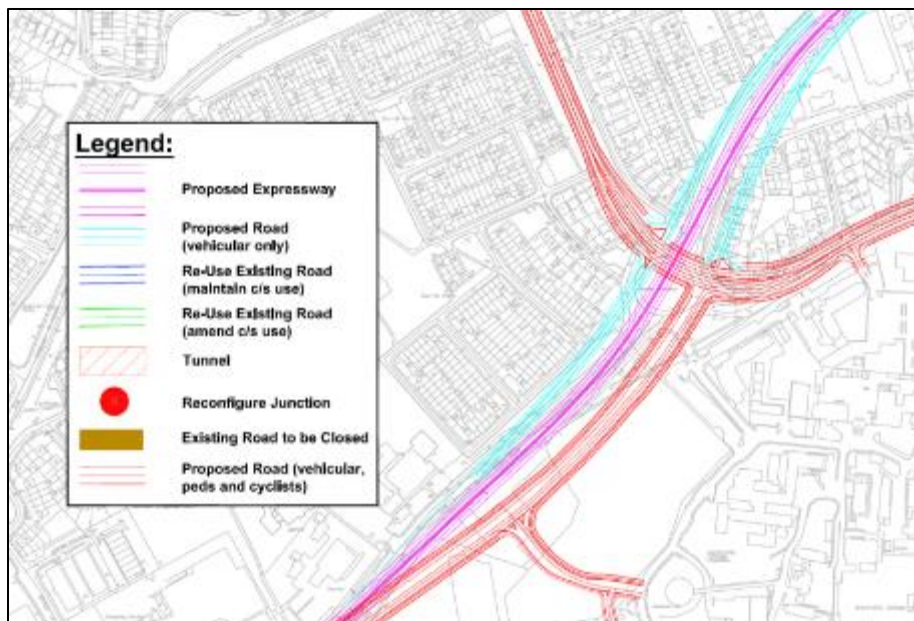
There are a number of safety concerns with this junction layout, on the approach to the junction travelling eastbound from both the proposed mainline and local networks there would be a number of conflicting traffic movements which may result in collisions. This risk would be exacerbated by the different approach speeds from both the proposed mainline and the local network. The provision of a left in/left out junction onto a hybrid uni/bi directional merge is also undesirable and could cause driver confusion and resultant collisions. Additionally at both the

eastbound diverge and westbound merge from the local networks to the proposed mainline and vice versa, vulnerable road users would be manoeuvring in a highly trafficked area competing with large volumes of vehicular traffic. For these reasons this option was discounted and not taken forward for further assessment.

**Option F: N59 Browne Junction**

The concerns highlighted during the examination of options A to E required that the approach in the Browne Roundabout area be re-examined. The need to maintain community connectivity, reduce segregation, improve or maintain road safety and design in accordance with the urban design principles within the Galway City Development Plan were identified.

The horizontal alignment of Option F would be moved eastwards in order to minimise impacts to residential areas west of Browne Junction and the vertical alignment would be depressed beneath the existing Browne Junction in order to minimise visual impacts associated with the provision of the proposed junction. The local Seamus Quirke Road network would sit directly on top of the tunnel on the west side, at-grade, until it reached the church. The local Seamus Quirke Road would then divert to the south of the proposed mainline. Full connectivity to and from the proposed mainline would be provided via a signalised diamond junction at Browne Junction. The westbound merge to the proposed mainline would be removed in this option in order to accommodate the diverted local Seamus Quirke Road and minimise the number of conflicting movements at the proposed junction. The number of movements accommodated by this slip road would be minimal and a number of viable alternative routes would be available to complete the movement. The removal of this slip would have the advantage of reducing the overall footprint of the junction thereby mitigating the planning, visual and landscaping impacts associated with this junction. The left in left out hospital junction would be positioned away from the signalised junction and onto the diverted local network.



**Figure 4.14: N59 Browne Junction – Option F**

### *Assessment -*

This would be the only viable option capable of accommodating connectivity between the local road networks and the proposed mainline in the area. It would have sufficient capacity to cater for the anticipated traffic volumes whilst maintaining and enhancing local connectivity. This option would also be better than the alternative options from a planning, visual and landscaping perspective due to the measures included to minimise its scale and overall footprint.

### ***Conclusions: Browne Roundabout***

Options A to E would be unsuitable due to their impact on the built environment and the existing road network and its connectivity. These options would restrict local access in the area and restrict access to the proposed mainline as well as having a significant impact on the built environment. The option carried forward for further assessment as part of the on-line optioneering is Option F.

This junction would be out of character in the area, the inclusion of this junction is necessitated by the need to provide connectivity between the proposed mainline and the local road networks at this key node on the existing N6 transportation corridor. Option F was determined to be the most preferable due to its reduced impact on the built environment when compared to the alternatives as well as its ability to safely accommodate the anticipated traffic volumes. This option would have limited visual impact as it would be constructed at existing ground level, the slip roads associated with this option would be visually screened and minimised by the inclusion of retaining structures. The parallel network in this area would accommodate vulnerable road users and public transport. Additional provision in terms of pedestrian crossings over the depressed mainline would be required to ensure that this option does not become a major barrier through this very busy area.

## **4.4.2 Newcastle**

### ***Context***

Newcastle Road is situated west of the River Corrib and runs in a north south direction. It extends north from the junction with Thomas Hynes Road at Galway Business Park, across the N6 (adjacent and east of University Hospital Galway (UHG)), and extends south to the junction with Shantalla Road/St Helen's Street. It facilitates access to UHG, NUI Galway and the city centre.

The N59 Thomas Hynes Road is located west of Newcastle Road and extends from the junction of the N59 at Galway Business Park to the Browne Roundabout. It facilitates access to the western suburbs, UHG and the city centre.

### ***Existing Road Network***

The N6 runs through the centre of Newcastle in an east-west direction dividing the area and the NUI Galway campus. The Upper/Lower Newcastle Road divides the Newcastle area east to west. This road is the main access route to the NUI Galway campus.

### ***Public Transport Network***



The Newcastle area is serviced by both Bus Éireann and private bus operators. Bus facilities and shelters at the various bus stops have recently been upgraded in the area.

### ***Walking and Cycling Networks***

Considering the proximity of the Newcastle area to the city centre and its location adjacent to NUI Galway and UHG, pedestrian and cycling networks in particular are limited. Main roads facilitate pedestrians with footpaths on both sides of the road while cycle lanes are infrequent. There is extensive roadside parking in the area which limits the attractiveness and safety of cycling as well as negatively impacting upon the operational performance of the local road networks and primary junctions in the area.

### ***Road Option Considerations***

The design arrangement at the Newcastle Road is dependent on the proposed mainline arrangement east and west of Newcastle Road, in particular the arrangements at Browne and Bodkin Junctions, Browne Junction being located at the western end of this link and Bodkin Junction being located at the eastern end of this link.

It would not be possible to accommodate local traffic including vulnerable road users and mainline traffic on the existing Quincentenary Bridge due to structural and space limitations (due to required road deck layout amendments). For this reason the provision of an additional bridge to accommodate local traffic, vulnerable road users and public transport would be required. As the existing desire line is in the vicinity of the Quincentenary Bridge it would be logical to service the existing desire lines by locating this bridge in the area.

### ***Option A***

This option would not include an additional crossing of the River Corrib, local traffic would be diverted to the proposed Browne Junction and distributed thereafter.

The option closes the existing Newcastle Junction with the N6 with the diversion of local traffic utilising this junction towards the proposed Browne Junction. This option would include widening the existing Thomas Hynes Road to facilitate vehicular traffic using this and Browne Junction instead of Newcastle Road. This option would include an additional lane in both directions of travel and the relocation of the vulnerable road user facilities. A number of signalised junctions would be required as well as restrictions on right turn movements at some locations along Thomas Hynes Road. Left in left out movements would be provided at these locations in conjunction with parallel access roads.



**Figure 4.15: Newcastle – Option A**

*Assessment -*

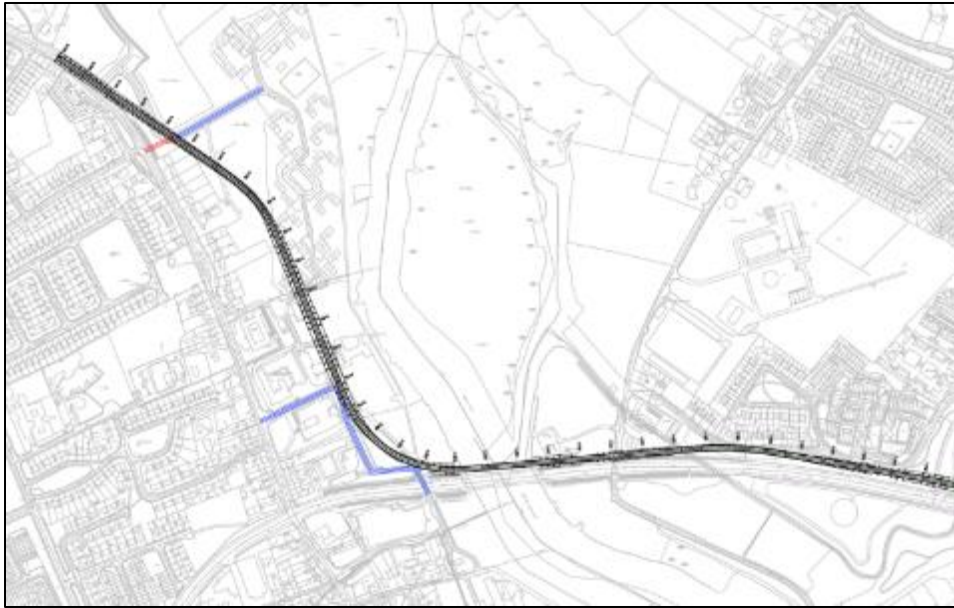
This option would improve north/south connectivity for vehicular traffic on Thomas Hynes Road. However, it would impede east/west connectivity for vehicular traffic and vulnerable road users. This option would funnel all traffic travelling from the N59 through the proposed Browne Junction which would negatively impact its operational capacity and performance. In addition this option would have a large impact on the built environment in the area, particularly adjacent to the entrance to Galway Business Park at Dangan. It would change travel patterns in the whole area with increased pressure on existing estate roads to accommodate east/west traffic.

For these reasons this option was discounted and not taken forward for further assessment.

**Option B**

Option B would include a realignment of Newcastle Road through NUI Galway and across the River Corrib on a new bridge to the north of the existing Quincentenary Bridge and onward connection to the Bodkin Junction.

This option would close the existing Newcastle Road at the Newcastle Road Junction with the N6, the proposed mainline would travel through the area at-grade on the existing N6 transportation corridor.



**Figure 4.16: Newcastle – Option B**

*Assessment -*

This option would cater for local traffic movements between the Newcastle area and the Terryland area. It would not cater for local movements between upper Newcastle and Lower Newcastle. The proposed mainline would travel at-grade through the existing Newcastle Junction which would restrict local vehicular and vulnerable road user movements and create a hostile environment for vulnerable road users in particular.

Vulnerable road user facilities would be provided on at least one side of the option as it travels through NUI Galway, the provision of facilities would be restricted in areas such that demolition of NUI Galway buildings would be avoided. The resultant layout would provide inadequate facilities for vulnerable road users.

This option would impact the protected structure north of the existing Quincentenary Bridge and impact a number of NUI Galway Buildings. The option would segregate the University Student Village from the university.

For these reasons this option was discounted and not taken forward for further assessment.

***Option C***

This option would include the proposed mainline in cutting with Newcastle Road on an overbridge. The proposed mainline would be depressed under Newcastle Road and the Browne Junction. The proposed mainline would return to grade before the existing NUI Galway underpass. A parallel local network would cross the River Corrib to the south of the existing Quincentenary Bridge, and connect the Newcastle area to the Terryland area.

*Assessment –*

This option would maintain local connectivity between the Newcastle and Terryland areas and between Upper Newcastle and Lower Newcastle for both vehicular and vulnerable road users.

This option would have a large impact on the built environment and would require residential demolitions on the eastern side of Newcastle Road north of the existing N6 and commercial demolitions south of the existing N6. It would also require the demolition of the Kingfisher Gym in NUI Galway.

### ***Conclusions: Newcastle***

Providing local connectivity from the Newcastle Road to the proposed mainline would not be possible as it would adversely impact its operational performance. Additionally removing or redirecting local connectivity would not be possible due to the significant movements along existing desire lines from both vehicular traffic and vulnerable road users – the diversion of all of these would be significant and not practical, especially from a vulnerable road users perspective, and would create an unnecessary barrier in an urban environment.

Options which provide an additional local connection north of the existing Quincentenary Bridge would be unacceptable due to their impact on the protected structure north of the existing bridge (Terryland Castle), their inability to provide adequate facilities for vulnerable road users and their impacts on NUI Galway.

The option carried forward for further assessment as part of the on-line optioneering for Newcastle is Option C as it provides a functional and safe road based option. Additionally, the additional bridge crossing is beneficial from an operational and maintenance perspective as it offers a viable alternative route during incidents such as traffic accidents or general maintenance periods.

## **4.4.3 River Corrib Crossing**

### ***Context***

There are four existing crossings of the River Corrib in Galway City. These are the Quincentenary Bridge, the Salmon Weir Bridge, William O'Brien Bridge and Wolfe Tone Bridge. These bridges are critical to the transportation network for Galway City as they provide a connection from west to east. The Quincentenary Bridge is located to the north of the city centre in the vicinity of the NUI Galway. The other three bridges are located in or near the city centre.

### ***Road Option Considerations***

As noted, the existing Quincentenary Bridge is the only existing crossing of the River Corrib which could facilitate an on-line upgrade.

During the examination of options in the Newcastle area the multipurpose function of the existing road networks and the Quincentenary Bridge became evident and for this reason the provision of alternative more attractive and safer routes for vulnerable road users became evident. As the proposal for the Quincentenary upgrade is purely to facilitate vehicular traffic, the existing facilities for vulnerable road users on the Quincentenary Bridge are removed and would require relocation.

The most reasonable way in which this impact could be resolved would be via the construction and provision of an alternative and additional River Corrib crossing.

### ***Option A – Parallel Bridge to the Quincentenary Bridge***

Option A would consist of a new bridge crossing the River Corrib, immediately south of the Quincentenary Bridge. It would pass over the internal NUI Galway road network and connect to the realigned Newcastle Road on the west at a signalised T-junction. The eastern tie-in would tie to a parallel road which connects to the Bodkin Junction (i.e. located at the junction of the Headford Road and the Sean Mulvoy Road). This bridge would cater for local traffic, vulnerable road users and would be sufficiently wide to accommodate public transport in each direction of travel.

#### *Assessment -*

This option would accommodate the displaced local traffic and displaced non-motorised traffic from the Quincentenary Bridge. It would provide for the displaced traffic as close as possible to the existing desire lines in the area. Visually the proposed bridge would be similar to the existing.

This option would be broadly in keeping with the Galway City Development Plan. The option would impact NUI Galway by demolishing the Kingfisher gym. This is an important facility for both NUI Galway and Galway City. An alternative facility would need to be constructed prior to the demolition of the existing facility. Notwithstanding the impact on the Kingfisher gym, this option is taken forward for further assessment as alternative options in the Newcastle area have a greater impact on NUI Galway.

### ***Option B – Vehicular Bridge reusing existing Railway Piers***

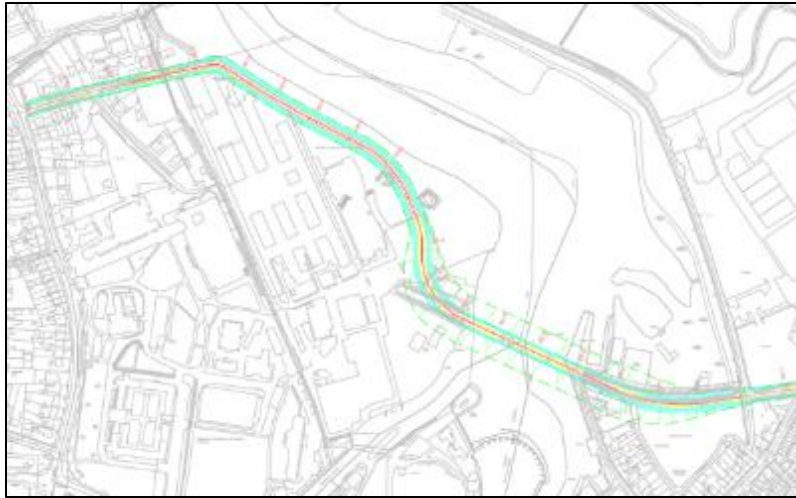
Option B would reuse the existing railway piers at Waterside which previously carried the Galway-Clifden Railway Line. On the western bank of the River Corrib this bridge would connect to a local road and onwards to Distillery Road. On the east side the road would continue on the existing railway embankment and then descend to connect to Dyke Road. This option would cater for local traffic, vulnerable road users, and would be sufficiently wide to accommodate public transport in each direction of travel.

#### *Assessment -*

This option would have the advantage of creating an additional NUI Galway entrance east of the River Corrib. However, it would bring additional traffic into the NUI Galway campus via a substandard geometric arrangement. In addition to the impacts west of the River Corrib, the proposed connection east of the River Corrib would be difficult from a topographical perspective and undesirable from a safety perspective as it would connect to a significantly constrained and heavily congested road network.

The location of this crossing would be remote from the existing desire lines in the vicinity of the Quincentenary Bridge and would require extensive diversions of vehicular traffic and vulnerable road users.

For these reasons this option was discounted and not taken forward for further assessment as part of the on-line option.



**Figure 4.17: River Corrib Crossings – Option B**

#### ***Option C – Parallel Bridge to the Salmon Weir Bridge***

Option C would consist of a parallel bridge to the south of the Salmon Weir Bridge. It would connect to Gaol Road on the west side and St. Vincent's Avenue on the east, with Newtownsmith Road realigned to form a T-junction. A similar layout was examined by Galway City Council in 2011.

The location of this crossing would be remote from the existing desire lines in the vicinity of the Quincentenary Bridge and would require extensive diversions of vehicular traffic and vulnerable road users.

This option was therefore not taken forward for further assessment as part of the on-line option.

#### ***Conclusions: River Corrib Crossings***

Option A will be carried forward for further assessment as part of the on-line optioneering. This option would accommodate the displaced traffic, both motorised and non-motorised, from the Quincentenary Bridge. It would provide for the displaced traffic as close as possible to the existing desire lines in the area. Visually the proposed bridge would be similar to the existing.

The option would impact NUI Galway by demolishing the Kingfisher Gym. Notwithstanding the impact on the Kingfisher Club, this option is taken forward for further assessment as alternative options in the Newcastle area have a greater impact on NUI Galway.

The above options are presented on the structures drawings included in **Appendix A**.

#### 4.4.4 Terryland/Headford Road Area

##### *Context*

The Terryland/Headford Road area encompasses both the signalised Bodkin Junction and Kirwan Roundabout. Both are key nodes in the Galway City transportation network. Both are located on the N6, the primary east/west transportation corridor for Galway City and County.

Following optioneering in the Newcastle and River Corrib areas it was determined that an additional crossing of the River Corrib would be required in conjunction with reusing the Quincentenary Bridge. This additional crossing would facilitate vulnerable road users, public transport and local vehicular traffic.

##### *Existing Road Network*

The roads within the Terryland/Headford Road area form a very busy and often congested network. These roads are a central part of the transport system for the city. The roads are of a good quality with the N6 transportation corridor accommodating four lanes of vehicular traffic.

##### *Public Transport Network*

The Terryland/Headford Road area serves as a through corridor for public transport travelling to Galway City centre and the N84 Headford Road.

##### *Walking and Cycling Network*

The Terryland/Headford Road area is a principal route for vulnerable road users wishing to access the commercial and residential facilities in the area. In general the footways and cycleways in the area are of a good standard. However, the junction and roundabout are difficult for pedestrians, cyclists and vulnerable road users to transverse due to the level of traffic and congestion catered for and experienced. This area is a key example of the road being both a link and a place, and whilst this area should have a very high sense of both, it is dominated by traffic to the detriment of both.

##### *Road Option Considerations*

Due to its location between two strategic nodes of the N6 transportation corridor it was essential that options considered in the area would be capable of accommodating the anticipated large volumes of traffic whilst retaining and enhancing the multi-purpose function of the corridor, namely acting as a corridor for pedestrians, cyclists, vulnerable road users and vehicular traffic.

On-line road options generally involve the reuse and enhancement of existing road corridors where possible. One of the key aims of the on-line optioneering is to determine an option which can operate safely. Early options considered in the Terryland/Headford Road area involved maximising reuse of the existing infrastructure. In taking this approach connecting from the Quincentenary Bridge to the N6 at Headford Road required the incorporation of significantly sub-standard geometric road parameters. Reducing the parameters to such a level would result in the addition of significant safety concerns. When these are considered in conjunction with the anticipated traffic volumes, the multipurpose function of the

existing infrastructure and the collision history of the area the provision of such an upgrade would be unacceptable. For this reason such options were discounted and not taken forward for further assessment. This resulted in the requirement that an off-line option was required in the area, the corridor which presented itself as the most viable was travelling along, adjacent to and above the Terryland River to the rear of Dunnes Stores and other commercial and industrial buildings in the area.

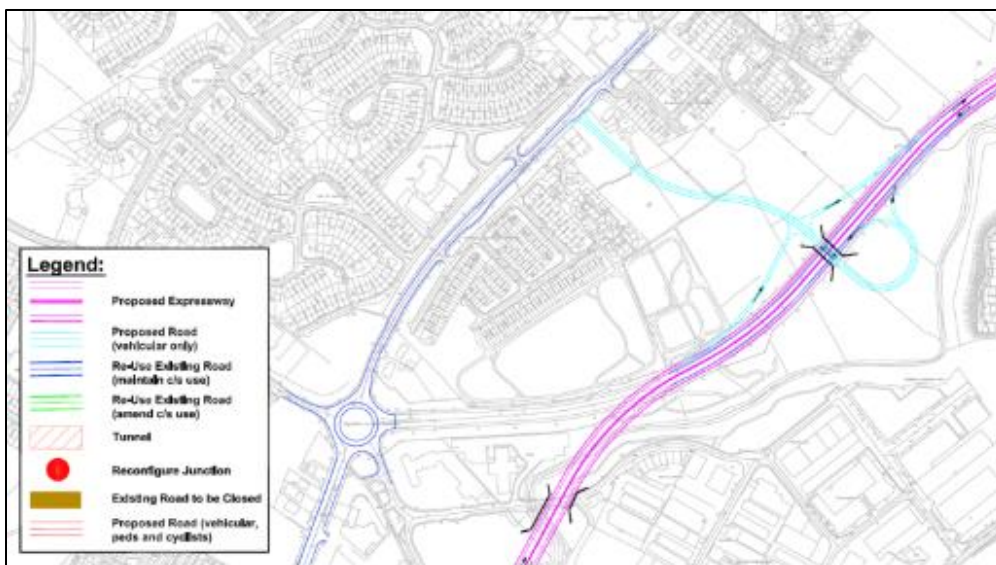
An assessment of this area highlighted that a high standard of connectivity would be required at both the signalised Bodkin Junction and Kirwan Roundabout due to their location at major intersecting roads. From examining the travel patterns immediately east of the River Corrib area, connectivity between the local networks and the proposed mainline would be required. The form of connectivity provided at the Kirwan Junction shall be complimentary to this junction arrangement.

In the context of the Galway City Development Plan 2011-2017 the Terryland and Headford Road area “*lacks a sense of place and identity*”. The natural heritage and amenity associated with Terryland River and Forest Park is underutilised. A short term specific objective of the development plan is to prepare a master plan for Terryland Forest Park. Under section 9.2.4 of the development plan a Local Area Plan (LAP) will be developed for the Headford Road area. The aim of the LAP will be to create a vibrant mixed use commercial and residential area.

The options considered in this area are as follows, these options consider connectivity in the Kirwan Junction area:

### ***Option A***

Option A in the Kirwan Junction area would consist of a signalised T-junction connecting to the south-eastern side of the N84 Headford Road. This connector road would lead to a signalised trumpet-style junction with the proposed mainline. The existing N6 connection to the Kirwan Roundabout would be removed and closed, reducing the existing Kirwan Roundabout to a four-arm roundabout which would improve its capacity and operational performance.



***Figure 4.18: N84 Terryland Junction – Option A***

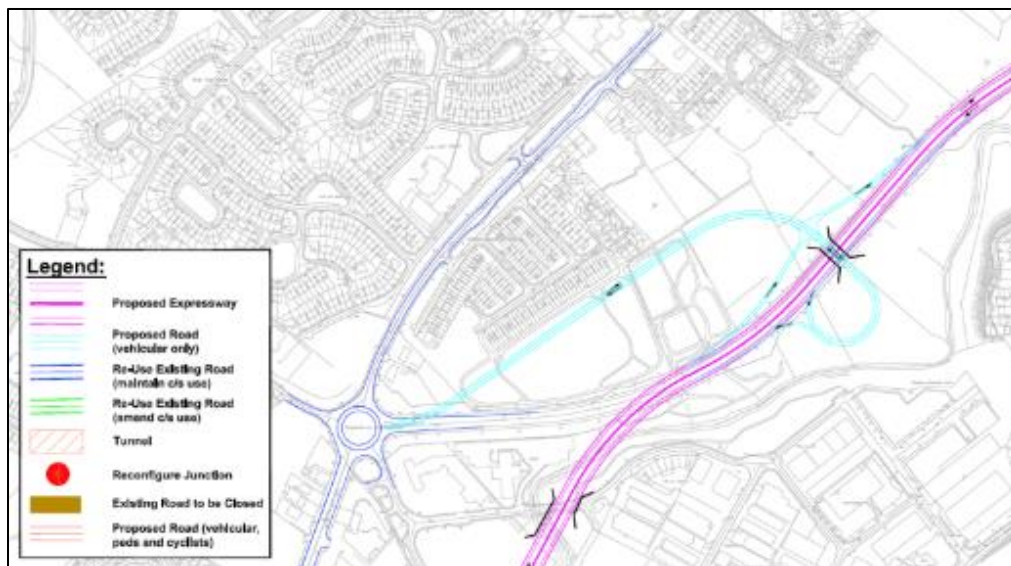


*Assessment -*

From a land use and planning perspective, this option would have a divisive effect on Terryland Forest Park, one of the proposed city parks, and would isolate a significant section of the area currently zoned recreation amenity according to the Galway City Development Plan. For this reason this option was discounted and not taken forward for further assessment.

**Option B**

Option B in the Kirwan Roundabout area is similar to Option A and would cross the proposed mainline at the same location. Option B differs from Option A in that the trumpet would curve to the west rather than the east and would connect to the Kirwan Roundabout and not directly to the N84. The section of the current N6 between Terryland Forest Park and Terryland Retail Park would be removed and incorporated in the forest park.



**Figure 4.19: N84 Terryland Junction – Option B**

*Assessment -*

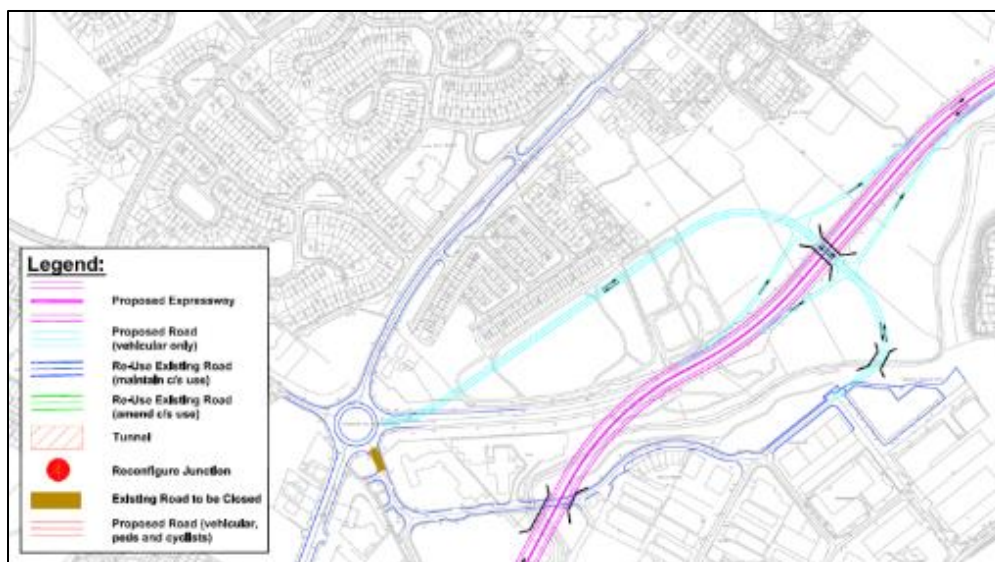
The Kirwan Roundabout would function as it currently does but with reduced traffic volumes utilising the existing N6 arm. Traffic which currently uses the roundabout to travel to the Quincentenary Bridge westwards and vice versa would be transferred to the proposed mainline to the rear of Dunnes Stores. This would reduce congestion at the roundabout.

From a land use and planning perspective, this option would have a similar impact on Terryland Forest Park as Option A. However, it would create a division between the housing estate and the park, and would isolate the area of land between the proposed slip road and the proposed mainline. For these reasons this option was discounted and not taken forward for further assessment.

**Option C**

Option C in the Kirwan Roundabout area would consist of a signalised diamond junction which crosses the proposed mainline and connects to the Kirwan

Roundabout in the same manner as Option B. In this option the link road would continue over the proposed mainline and connect to the internal road network of the Liosban Industrial Estate. The existing connection from Liosban Industrial Estate to the Kirwan Roundabout would be closed, reducing this to a four-arm roundabout. The section of the current N6 between Terryland Forest Park and Terryland Retail Park would again be removed and incorporated in the forest park.



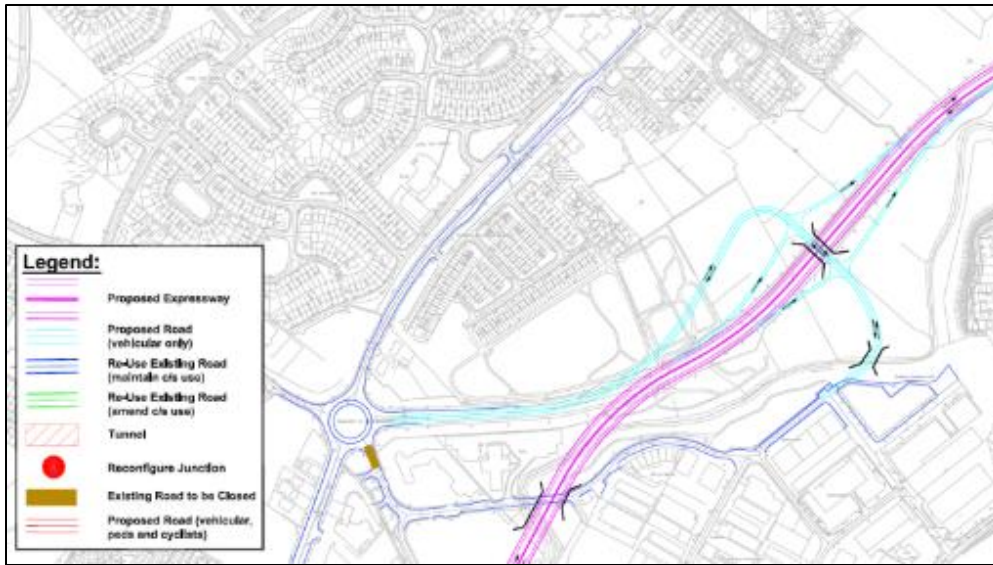
**Figure 4.20: N84 Terryland Junction – Option C**

*Assessment -*

This option would operate in the same manner as Option B on the northern side of the proposed road. On the southern side, the connector road would lead to Liosbán Industrial Estate, this would become a local road connecting the proposed mainline to the estate. This option would close the entrance to the industrial estate/Sandy Road from the Kirwan Roundabout, so all traffic for the businesses in the area would use the proposed junction or the Joyce Roundabout. This would introduce local connectivity issues in the area. For these reasons this option was discounted and not taken forward for further assessment.

**Option D**

Option D would be similar to Option C, with the sole difference being that the north-western access to the Kirwan Roundabout would follow the line of the existing N6 rather than following the boundary of the housing estate.



**Figure 4.21: N84 Terryland Junction – Option D**

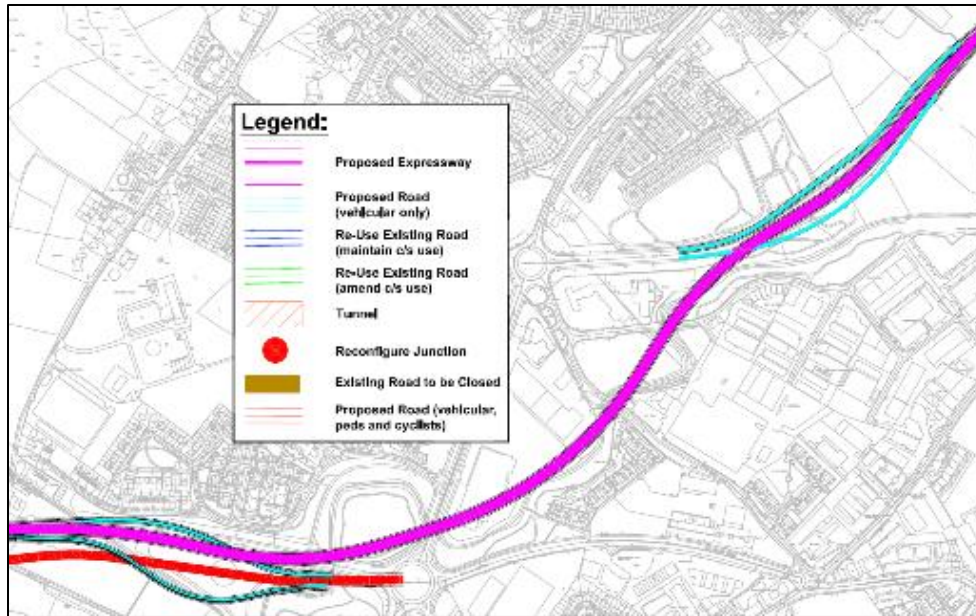
*Assessment -*

This option would include the same connectivity issues as Option C. Therefore this option was discounted and not taken forward for further assessment.

**Option E**

Option E would consist of the proposed mainline on a structure with a staggered free-flow grade separated junction below. The eastbound merge and westbound diverge slip roads would be located in the same location as the previous options, to the east of the Kirwan Roundabout. The Kirwan Roundabout would remain a five-arm roundabout, thereby retaining local connectivity. The operation of the Kirwan Roundabout would be greatly improved due to the removal of by-passable traffic from the local Terryland/Headford Road area.

The westbound merge and eastbound diverge slip roads would be located between the River Corrib and the Bodkin Junction. As per optioneering on the River Corrib area these slip roads would undertake a dual role of providing connectivity between the additional local road network and the proposed mainline. The slip roads would therefore, connect from the proposed mainline to the parallel local road, which would replace the current N6 at the Bodkin Junction. The Bodkin Junction would continue to function as it currently does, with this replacement parallel road, and through traffic would pass overhead on the proposed mainline/viaduct.



**Figure 4.22: N84 Terryland Junction – Option E**

*Assessment -*

This option would provide connectivity at Bodkin and Kirwan Junctions. The option would reduce the traffic using the Terryland/Headford Road networks as by-passable traffic would be accommodated on the proposed mainline/viaduct.

From a land use and planning perspective, the free-flow slip roads included in this option would be kept as close as possible to the proposed mainline to minimise land impacts. As the slip roads are parallel to the existing and proposed mainline, they would not sever land in the same manner as other options.

This option, combined with the proposed mainline through the area would not require any residential demolitions but would require a partial and complete commercial demolition, both located northeast of the Bodkin Junction.

**Conclusions: Terryland Headford Road Area**

Increased safety concerns, caused by significantly sub-standard geometric road parameters, combined with anticipated traffic volumes and the collision history of the area resulted in a fully on-line option being discounted from further assessment for the Terryland/Headford Road area.

Offline options A-D were not taken forward for further assessment due to the impacts that would be imposed by each on the built environment, recreational amenities and local connectivity.

The option taken forward for further assessment in the Terryland/Headford Road area is Option E as it would provide improved connectivity over the alternatives considered and would minimise impacts on the built environment and residential amenities as well as providing a functional road layout. This option would be out of character in the area and negatively impact the potential amenity value of the Terryland River, for this reason the provision of an urban landscaping or amenity routes beneath the viaduct structure as a mitigating factor may be appropriate.

## 4.5 Eastern Section

### 4.5.1 N17 and Ballybrit Junctions

#### *Context*

The area from the N6 at Terryland to the N6 at Coolagh, Briarhill is the most logical corridor for the provision of an on-line option/upgrade due to its high capacity and current operating function as the de facto bypass of Galway City. The N17 and R865 Junctions fall within this corridor and both are key nodes in the Galway City transportation network.

#### *Existing Road Network*

The N17 national route terminates at its junction with the N6 and continues into the city centre as the R336 Tuam Road. Ballybrit Junction is the junction of the N6 with the R865 Ballybane Road and is located to the east of the N17 Junction. Access to Ballybrit Business Park and City East Business Park, is provided by this junction.

Both junctions accommodate significant traffic volumes travelling from all directions. Due to these volumes, the junctions experience congestion throughout the day.

#### *Public Transport Network*

The area serves as a through corridor for public transport travelling to Galway City centre, there are no public transport facilities located within the corridor between the N17 and Ballybrit Junctions.

#### *Walking and Cycling Network*

These junctions have recently been upgraded to incorporate facilities for vulnerable road users, they however remain frustrating for vulnerable road users to negotiate due to delays created by the phased crossing sequence required as a result of the number of conflicting movements facilitated.

#### *Road Option Considerations*

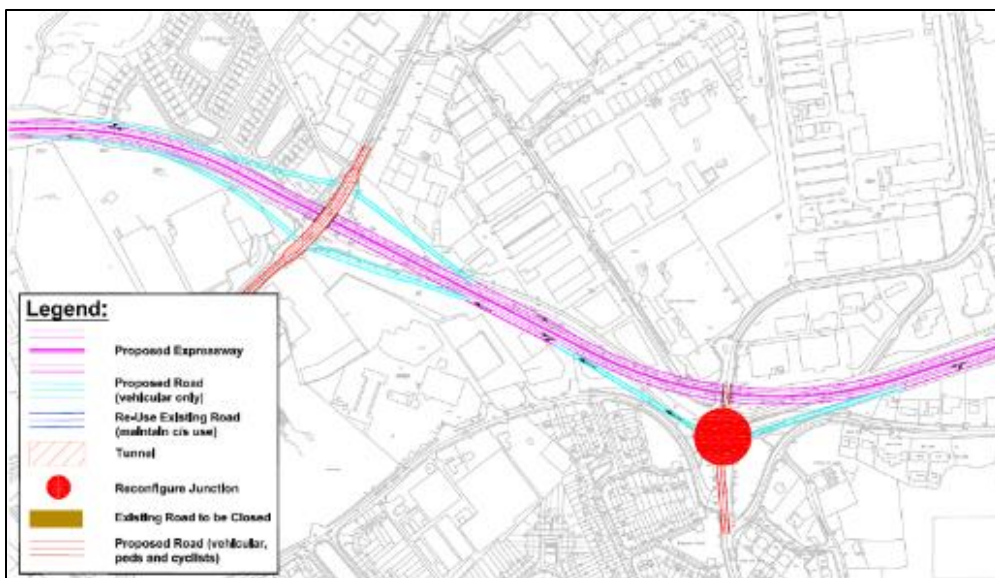
As noted, both junctions cater for significant traffic volumes from all directions. For this reason the incorporation of grade separated junctions in the area would be suitable as a means to separate conflicting traffic movements whilst retaining connectivity. As the junctions are in close proximity to one another it would not be feasible to provide individual junctions at each location and therefore, a combined or shared junction arrangement would be required. In order to facilitate such a junction arrangement it would be necessary from a safety perspective to provide connectivity between the junctions in the form of a separate parallel network rather than via the provision of link roads incorporated into the proposed mainline. Incorporating such link roads would be undesirable from a safety perspective due to the number of conflicting movements present over a short distance and the resultant increased risk of collisions.

Due to the topography of the area only options where the proposed mainline is depressed would be feasible in accommodating grade separated junctions.

### **Option A**

Option A would consist of the proposed mainline depressed and realigned slightly to the north of the existing N6 layout through the area. The local network in the N17 area would be maintained via a signalised diamond junction with six lanes on the overbridge to cater for traffic movements. Connectivity between the proposed mainline and the local networks would be provided via diverge and merge slip roads for both directions of travel on the proposed mainline.

The proposed mainline would also be depressed at Ballybrit Junction. Connection between the proposed mainline and the R865 would be provided using a roundabout, with westbound merge and diverge ramps provided but no eastbound merge or diverge slip roads provided in order to minimise impacts on the built environment north of the proposed mainline.



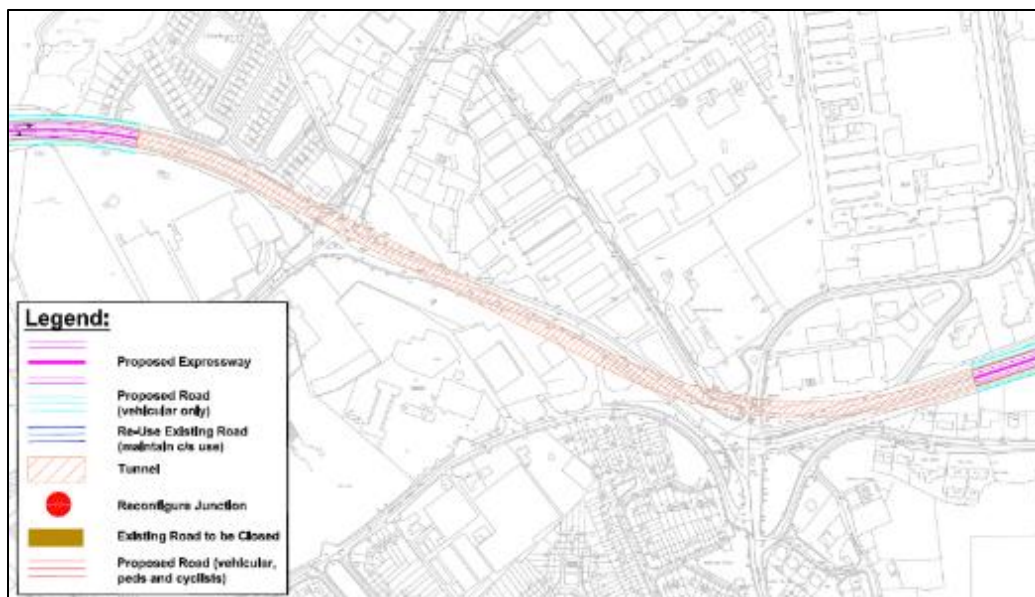
**Figure 4.23: N17 and Ballybrit Junctions – Option A**

#### **Assessment -**

The roundabout would not have the capability to cater for the anticipated traffic volumes on the R865. Additionally there would be safety issues regarding weaving lengths on the proposed mainline between the westbound merge from the R865 and the westbound diverge for the N17. Short weaving lengths are undesirable from a safety perspective due to the number of conflicting movements present over a short distance which results in greater possibility for collisions. For these reasons this option was discounted and not taken forward for further assessment.

### **Option B**

Option B would consist of the proposed mainline in a cut and cover tunnel between the N17 and R865 Junctions with the local network reinstated as per the existing local network layouts on top. The proposed mainline would be realigned through the N17 and Ballybrit Junctions, located slightly north of the existing N6 layout in the area. Slip roads would be provided for connection to the local network from the proposed mainline at the western and eastern portals of the tunnel.



**Figure 4.24: N17 and Ballybrit Junctions – Option B**

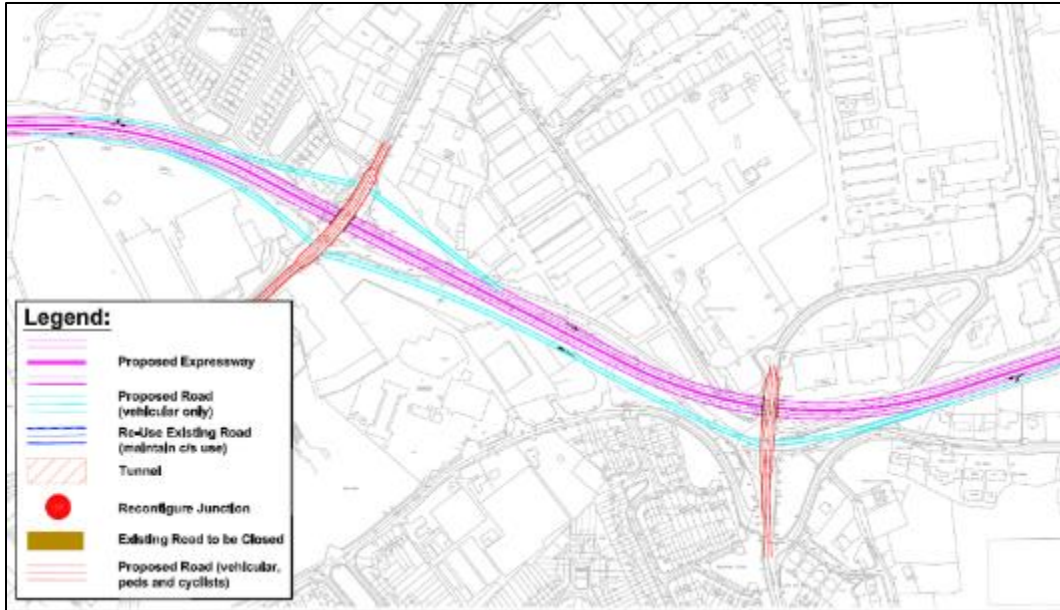
*Assessment -*

This option would have greater cost implications than open cut options without consequent net benefits. For this reason this option was discounted and not taken forward for further assessment.

**Option C**

Due to the local connectivity issues highlighted during the examination of Options A and B it was necessary to reconsider the approach taken in this area. A starting point for this consideration was the approach adopted in the Newcastle area, whereby local vehicular movements would be separated from mainline movements and in the Headford Road/Terryland area where a split junction would be utilised in order to provide adequate connectivity between the proposed mainline and the local networks.

Option C would consist of the proposed mainline depressed and realigned to the north of the existing N6 layout in the area, as per Options A and B. A parallel network would be provided at-grade south of the proposed mainline. Connections to the local network from the proposed mainline would be provided via signalised diamond junctions at both the N17 and R865. The parallel road would also cater for vulnerable road users and public transport. A six lane structure would be required at the N17 Junction over the proposed mainline and a two lane structure would be required at the Ballybrit Junction to cater for traffic movements. Eastbound diverge and merge and westbound merge facilities would be provided at the N17 Junction with westbound diverge slips only at Ballybrit Junction. The local network would provide connectivity between the junctions and facilitate movements omitted from the N17 and R865 Junctions.



**Figure 4.25: N17 and Ballybrit Junctions – Option C**

*Assessment –*

Option C would have the capability to accommodate the anticipated traffic volumes and movements whilst enhancing facilities for vulnerable road users and public transport. Safety issues which were evident in other options considered in this area would be removed by adopting a parallel network and split junction. This option would have limited visual impact as it would be constructed at existing ground level, the slip roads associated with this option would be visually screened and minimised by the inclusion of retaining structures.

This option would have a large impact on the built environment and would require residential demolitions in the N17 area and commercial and industrial demolitions in the area between the N17 and the R865. The impact on both residential and commercial/industrial premises would be minimised by the inclusion of retaining structures and via compact design.

**Conclusions: N17 and Ballybrit**

The option taken forward for further assessment in the N17 and Ballybrit/R865 area is Option C as it would provide improved connectivity over the alternatives considered and would minimise impacts on the built environment and residential/industrial/commercial amenities whilst providing a functional road layout.



## 4.5.2 Ballybrit Junction to Coolagh, Briarhill

### *Context*

The area from the N6 at Terryland to the N6 at Coolagh, Briarhill again is the most logical corridor for the provision of an on-line option/upgrade due to its high capacity and current operating function as the de facto bypass of Galway City. The Ballybrit and Coolagh Junctions fall within this corridor. Both junctions are key nodes in the Galway City transportation network and are of strategic importance as they provide access to the major industrial areas of the city.

### *Existing Road Network*

Both junctions accommodate significant traffic volumes travelling from all directions. Due to these volumes, the junctions experience congestion throughout the day.

### *Public Transport Network*

The area serves as a through corridor for public transport travelling to Galway City centre, there are no public transport facilities located within the corridor between the R865 and Coolagh Junctions.

### *Walking and Cycling Network*

The Ballybrit Junction has recently been upgraded to improve facilities for vulnerable road users. There is also a tunnel beneath the existing N6 which caters for vulnerable road users.

The Coolagh Roundabout is located in a rural area, facilities for vulnerable road users are not provided as there are no public destinations or attractions in the area.

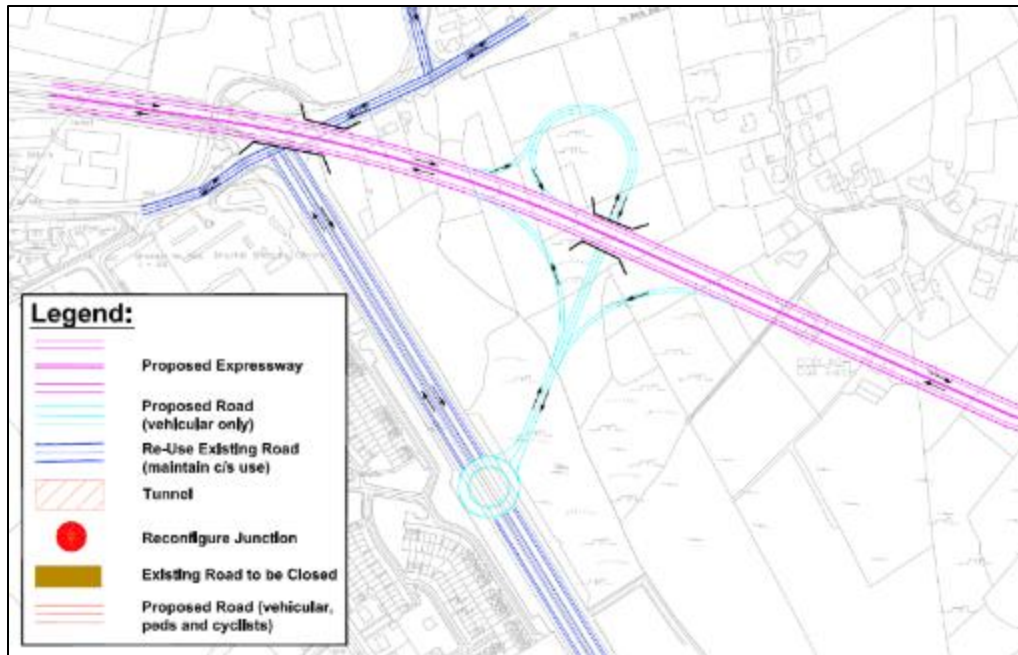
### *Road Option Considerations*

As noted, both junctions cater for significant traffic volumes from all directions. For this reason the incorporation of grade separated junctions in the area would be suitable as a means to separate conflicting traffic movements whilst retaining connectivity.

One of the key aims of the on-line optioneering is to determine an option which can operate safely. Early options considered in the area involved maximising reuse of the existing infrastructure. In taking this approach connecting from the Ballybrit Junction to the N6 at Coolagh would require the incorporation of significantly sub-standard geometric road parameters. Reducing the parameters to such a level would result in the addition of significant safety concerns. When these are considered in conjunction with the anticipated traffic volumes and the multipurpose function of the existing infrastructure the provision of such an upgrade would be unacceptable. For this reason such options were discounted and not taken forward for further assessment. This resulted in the requirement of an off-line option in the area, the corridor which presented itself as the most viable was travelling through the Ballybrit Junction and connecting thereafter to the N6.

### ***Option A***

Option A would consist of the proposed mainline utilising the existing N6 corridor through Briarhill, travelling offline through the Ardaun area and connecting to the existing N6 east of Coolagh Roundabout. Connectivity between the proposed mainline and the local network would be via a trumpet junction in the Ardaun area which would connect to the existing N6 via a link road and proposed roundabout north of the existing Coolagh Roundabout. An underbridge would be provided on the R339 at the Briarhill Junction in order to maintain west-east local connectivity, the existing Coolagh Roundabout would be removed by this option.



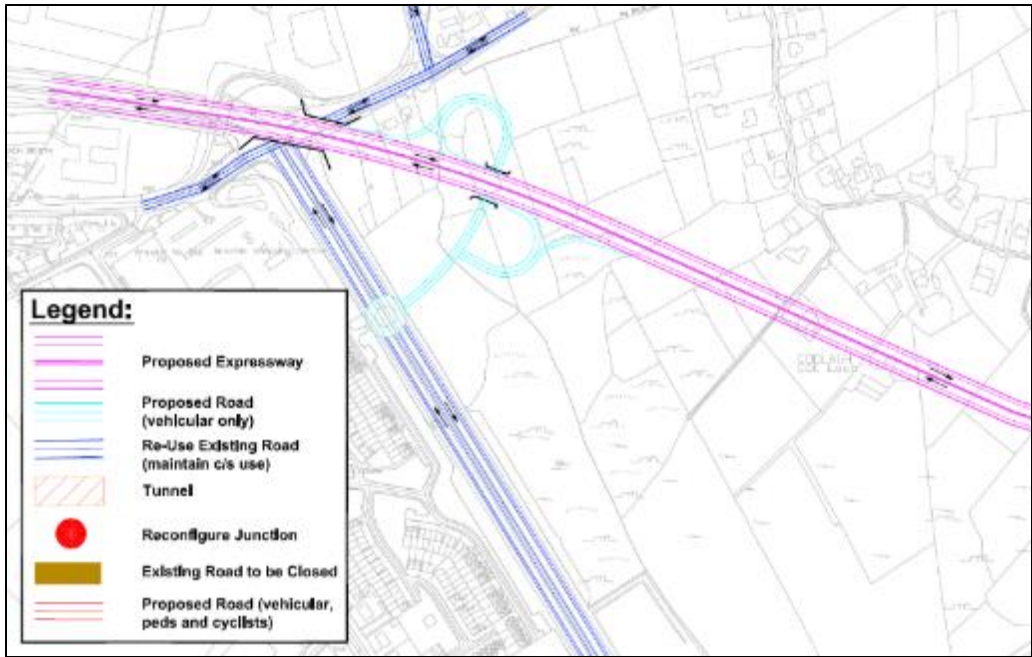
**Figure 4.26: Briarhill Junction and Coolagh Roundabout – Option A**

### ***Assessment -***

This option would not cater for the anticipated traffic volumes on the proposed mainline or the local network. For this reason this option was discounted and not taken forward for further assessment.

### ***Option B***

Option B would consist of the proposed mainline elevated through the Briarhill area with the local network maintained at-grade. Connectivity between the proposed mainline and the local network would be via a compact grade separated junction in the Ardaun area which would connect to the existing N6 via a link road and proposed roundabout north of the existing Coolagh Roundabout. An underbridge would be proposed on the R339 at the Briarhill Junction to maintain west-east connectivity, the existing Coolagh Roundabout would be removed by this option.



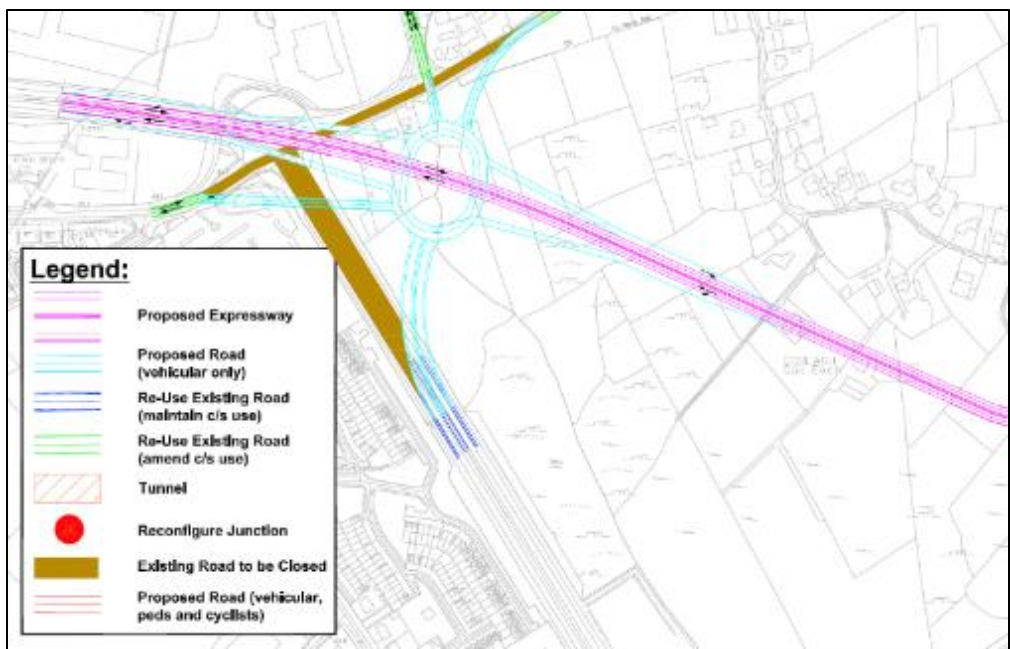
**Figure 4.27: Briarhill Junction and Coolagh Roundabout – Option B**

*Assessment -*

This option would not cater for the anticipated traffic volumes on the proposed mainline or the local network. For this reason this option was discounted and not taken forward for further assessment.

**Option C**

Option C would consist of the proposed mainline at-grade and realigned as per Option A. Connectivity between the proposed mainline and the local networks would be via a raised signalised rotary located east of the existing Briarhill Junction in the Ardaun area. This option would require all local traffic to utilise the rotary.



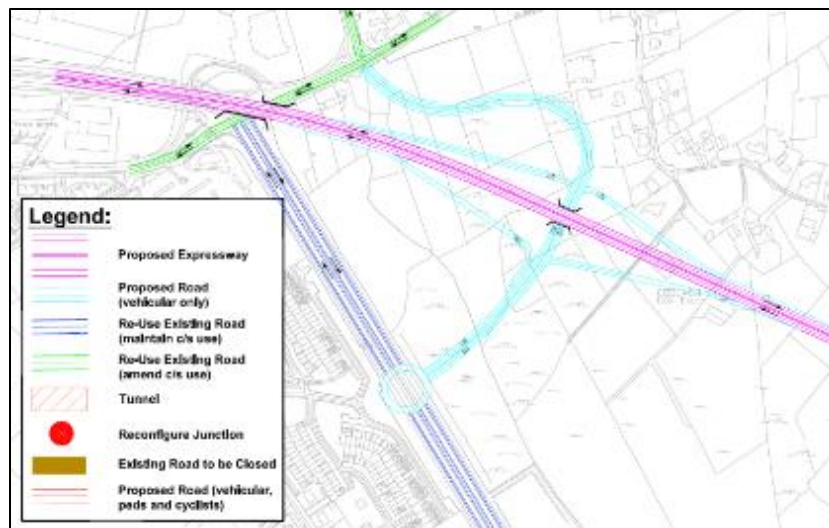
**Figure 4.28: Briarhill Junction and Coolagh Roundabout – Option C**

*Assessment -*

This option would not cater for the anticipated traffic volumes on the proposed mainline or the local network. Additionally it would be visually intrusive to the surrounding environment. For these reasons this option was discounted and not taken forward for further assessment.

***Option D***

Option D would consist of the proposed mainline in cutting and realigned in a similar manner to Option A but located further south through the Ardaun area. Connection between the proposed mainline and the local network would be via a signalised diamond junction located east of the existing Briarhill Junction in the Ardaun area. A new four lane connector road would provide access from the proposed mainline to the existing N6 mainline north of Coolagh Roundabout. This link road would also provide a connection to the R339 at the junction with Parkmore Road. A three lane structure would be required at the proposed junction, incorporating one lane in each direction and a designated right turn lane where required.



**Figure 4.29: Briarhill Junction and Coolagh Roundabout – Option D**

*Assessment -*

From a land use and planning use perspective, this option would be better than Options A - C. It would have sufficient capacity to cater for the anticipated traffic volumes whilst maintaining and enhancing local connectivity. This option would be better than the Options A – C from a planning, visual and landscaping perspective due to efforts spent minimising its scale and overall footprint.

***Conclusions: Briarhill Junction and Coolagh Roundabout***

Options A to C would be unsuitable due to their impact on the existing road network and its connectivity. These options would restrict local access and restrict access to the proposed mainline. The option taken forward for further assessment in the Briarhill Junction area is Option D as it would provide improved connectivity over the alternatives considered and would minimise impacts on the built environment

and residential/industrial/commercial amenities whilst providing a functional road layout.

Whilst Option D junction would be out of character in the area, the inclusion of this junction is necessitated by the need to provide connectivity between the proposed mainline and the local road networks at this key node in the Galway City transportation network.

## 4.6 Outline of Preferred On-Line Option

The On-line Option commences at a signalised junction at the eastern end of Bearna Village. It proceeds north along new road alignments to join the existing Western Distributor Road at a proposed signalised junction at the existing Cappagh Road Roundabout. The On-line Option follows the existing Western Distributor Road to Bóthar Stiofáin and includes the replacement of all the existing roundabout junctions along the Western Distributor Road with signalised junctions. A grade separated junction is provided east of Bóthar Stiofáin in the Gort Na Bró area.

From Knocknacarra it connects via tunnel to the Seamus Quirke Road and is continued beneath Seamus Quirke Road via tunnel towards Browne Roundabout. The existing network would be reinstated in the Seamus Quirke area following tunnel construction. Connectivity between the proposed mainline and the local networks is provided by a grade separated junction in the Browne Junction area.

The option continues eastwards and across the existing Quincentenary Bridge; an additional river bridge is constructed south thereof to accommodate local traffic movements, public transport and vulnerable road users.

Once the option crosses the River Corrib and reaches the Bodkin Junction it travels offline on a viaduct to the rear of the existing commercial facilities and adjacent to, above and along the Terryland River before connecting to the existing N6 east of the Kirwan Roundabout. Connectivity between the proposed mainline and the local road networks is provided via slip lanes at the Bodkin Junction and the Kirwan Junction.

The On-line Option utilises the existing N6 corridor to connect to the N6 on the east side of Galway at Coolagh, Briarhill. It is depressed under the N17 Tuam Road and R865 Ballybrit Junction. Connectivity between the proposed mainline and the local networks is provided by a split grade separated junction connected by a parallel road. This layout results in full connectivity being provided between the proposed mainline and the local road networks. Once the option has passed the R865 Ballybrit Junction it returns to existing ground level and utilises the existing N6 infrastructure travelling towards Briarhill, from where it enters a cutting to traverse the Briarhill area and minimise impacts to the receiving environment. This cutting allows the road network of the Briarhill area to be reinstated following construction. A full diamond grade separated junction is provided to the south east of the existing Briarhill Junction, which is designed to accommodate Parkmore Industrial Park, Ballybrit Business Park and the Briarhill area. This junction connects to the N6 east of Briarhill Shopping centre using a link road and the relocated Coolagh Roundabout. Following this junction, the proposed mainline travels eastwards and

connects to the existing N6 east of the existing Coolagh Roundabout, which is relocated to accommodate the provision of the grade separated junction.

A key plan of the preferred on-line options is presented within **Appendix B**.

## **5 Examination of Preferred On-Line Option**

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### **5.1 Urban Design/Landscape and Visual**

#### **5.1.1 Landscape and Visual**

The preferred on-line option presents many challenges from the point of view of its impacts on landscape/townscape character and the visual environment. These challenges relate to both its construction and thereafter.

The following are the principal aspects of the preferred on-line option that give rise to the significant landscape/townscape and visual impacts during construction:

- Demolition of significant numbers of existing residential properties – particularly in the vicinity of Browne Junction and through Ragoon;
- Direct landtake/removal of existing (retained) residential amenities, including footpaths, gardens, roads, and associated open space – most especially from the River Corrib west along Seamus Quirke Road through Ragoon and on to the Western Distributor Road;
- Direct landtake/removal of existing open space, amenity, parkland, plantings along the road corridor – particularly through Terryland Forest/River Park to the River Corrib;
- The construction of significant under and over ground structures – including an elevated viaduct and section of tunnel – through an existing developed environment; and
- Impacts on protected views on the existing Quincentenary Bridge over the River Corrib, as well as along the N6 east to the Bodkin Junction and north south along the east bank of the River Corrib.

Whilst individual impacting aspects are outlined above it is considered that the collective effect of all of these construction aspects would give rise to locally pervasive and significant negative impacts on the townscape and visual character of the existing urban/developed environment – most particularly from Western Distributor Road to Terryland Forest Park.

The following are the principal aspects of the On-line Option that would give rise to the significant landscape/townscape and visual impacts during operation:

- Provision of an elevated section of viaduct through an existing developed area;
- The provision of a second bridge over the River Corrib in close proximity to the existing bridge – which includes protected views - and through existing developed areas of NUI Galway;
- The provision – at various levels – of a *c.* 80 to 100m wide corridor of multi-lane road development through an existing sensitive community of mixed

residential, community, social, hospital and amenity land uses in the vicinity of Browne Junction; and

- The direct and indirect effect of the loss of a significant number of existing residences from within the communities at Rahoon – albeit with a reinstated landscape corridor over the proposed tunnel.

Again whilst individual impacting aspects are outlined above it is considered that the collective effect of the scale of major infrastructure provided would give rise to unacceptable, overbearing and residual negative impacts on the townscape and visual character of the corridor – most particularly from Terryland Forest Park through to the Western Distributor Road.

## 5.1.2 Urban Design

### 5.1.2.1 Overview

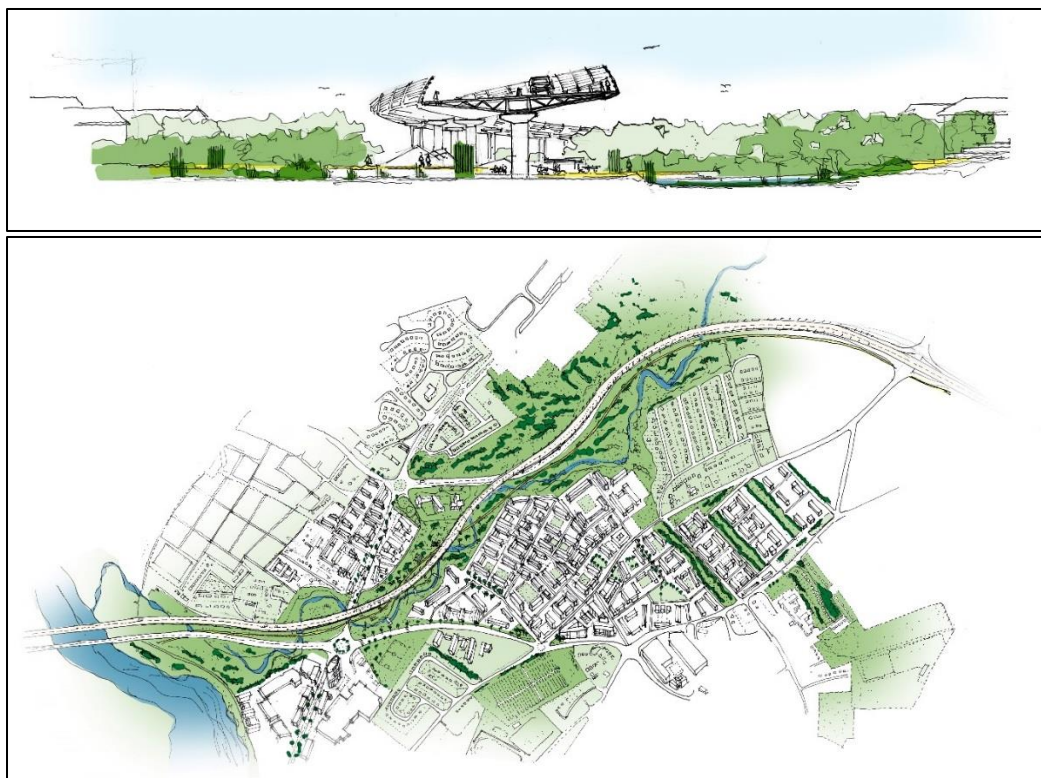
The scale and nature of the infrastructural requirements for the on-line option is of a significant magnitude due to the need to retrofit the route into a sensitive urban environment which demands a more complicated solution than that of a lesser developed area within the city. These requirements can be particularly problematic where infrastructure is proposed in residential, commercial and recreational areas as highlighted in **Section 5.1.1**. In many instances tunnels, viaducts and soft design measures have been incorporated into the design in order to minimise the impacts caused by the intrusive nature of on-line options. In many areas however, it would not be possible to adopt such measures.

Two particular areas of note due to the significant impacts imposed on the built environment, community and commercial areas by the proposed options are Browne Junction and the Terryland area. Both areas were examined in order to identify mitigation measures which could be incorporated in the design which would minimise the impact on the surrounding areas. **Figures 5.1** and **5.2** show the results of this preliminary optioneering.



**Figure 5.1: Browne Junction Area Urban Optioneering**

In the Browne Junction area, expansive areas of pavement would be created which would act as a physical barrier in the area. Mitigating measures proposed would include the provision of a green corridor located away from the proposed junction and the development of a series of interconnected pathways catering for vulnerable road users. This design aims to reduce the impact of the preferred on-line option and the barrier it creates by connecting areas either side of the option using the green corridor.



**Figure 5.2: Terryland Area Urban Optioneering**

In the Terryland area the preferred on-line option would travel along, adjacent to and above the Terryland River Valley. It is an objective of the Galway City Development Plan to develop this area into a recreational amenity for the people of Galway. Mitigating measures would include the development of a linear park beneath the proposed viaduct including the development of a series of interconnecting pathways for vulnerable road users. This park would seek to replace part of the existing multi-purpose function of the N6 transportation corridor by accommodating displaced vulnerable road users. The design seeks to act as an interface between the existing commercial activities at Terryland and the residential, commercial and industrial activities at Liosban Industrial estate.

### 5.1.2.2 Urban Design Assessment

**Aim (Section 7.4 Urban Design, Galway City Development Plan):**

The following principles are critical in the consideration of good urban design:

- **Character:** The promotion of character by reinforcing the local distinctiveness, identity and sense of place. The typology of streets, layout of parks, open spaces,



the natural heritage and the urban morphology contributes to character which evolves over time. New development should enhance this character.

- *Legibility*: The creation of places that are easily recognisable, and while part of the overall city, they have their own identity through recognisable landmarks and/or streets. New development should enhance the legibility of the surrounding place.
- *Ease of movement*: The promotion of accessibility and permeability making places easy to get to and move within. Ease of movement within a city centre may be through pedestrianisation schemes, creation of new streets, and permeability through shops. In the wider area it may be through enhanced public transport, provision of greenways and linkages from residential areas to local services and facilities. New development should ensure maximum permeability and accessibility.
- *Quality of the public realm*: The promotion of streets and public spaces that are attractive and safe and that allow for social interaction. The design of the public realm in any new development requires careful consideration in terms of its layout, function and use of materials such as surfaces and street furniture.
- *Continuity and enclosure*: The promotion of the continuity of street frontages and the enclosure of spaces by clearly defines edges which distinguish public and private areas.
- *Diversity and adaptability*: The creation of places that have variety and choice through a mix of uses which are compatible and viable and which can adapt to changing socio-economic conditions.

The preliminary design has attempted to show how enhancements in design can improve the visual and movement environment. Although there is potential for more improvements it is hard to see how mitigation through design can reconcile the requirements for a high quality transportation solution routed through the built up area of the city and also to satisfy the aspirations in the Galway City Development Plan for “the creation of attractive living environments facilitating communities to grow.”

The accommodation of the on-line option is difficult to reconcile with the basic principles of good urban design – the scale and nature of the route is such that it would not promote a sense of place nor reinforce character. It would offer opportunities for some improvements (refer to **Figures 3.1 to 3.4**) in ease of movement and urban design improvements where the route is submerged and appropriate urban design adopted but of itself would be unlikely to result in a qualitative public realm, or create enclosure or encourage a varied environment of human scale.

## 5.2 Planning

### 5.2.1 Overview

The *Galway City Development Plan 2011-17* includes an aim to integrate land use and transportation in order to ease movement to and within the city and to provide for access to a range of transport modes for all sections of the community. The N6

Galway City Transport Project currently at route selection stage has the potential to contribute to achieving this aim.

The alternatives being examined as part of the N6 Galway City Transport Project, shall each have transportation benefits and are required to be examined in terms of how compatible they are with the strategic priorities, policies and objectives in the *Galway City Development Plan 2011-17*. A preliminary assessment of the on-line option against these policies and objectives is provided within this report. This preliminary assessment takes into consideration that the on-line option accommodates public transport provision along parts of the route and that there has been a preliminary examination of how mitigation including design measures could address some of the potentially significant impacts. This appraisal is general in view of the current stage of the project, looking at the strategic issues only and should not be interpreted as a full review of the proposed on-line option. A full assessment of the on-line option, as well as all options identified during route selection of the N6 Galway City Transport Project will be undertaken and detailed within the Route Selection Report.

The on-line option, includes for re-use of the existing east –west road corridor crossing the city. In the interests of functionality and to examine how potential negative impacts could be impacted a preliminary design has included for sections at-grade, tunnelled, cut sections, an additional river bridge crossing and an element of the route incorporating a viaduct. Included in the on-line option are illustrative suggestions as to how landscaping and design could temper the impact of the option.

This option has been examined in the context of the receiving environment which is predominately one of a built up nature supporting a number of activities including long established neighbourhoods, more evolving neighbourhoods, key city institutions and strategic parklands.

Notwithstanding the potential for improvements in travel time, safety and the likely reduction in traffic congestion this option is seen to have the potential to result in major disruption in the city. This is apparent from the likely demands of the construction which could result in significant disruption on key routes and movement patterns in the city for a prolonged period. This is of particular note as the works would be located in areas of concentrated populations, services and employment.

In addition, the on-line option which penetrates through built areas of the city, including residential areas would likely increase the separation of established communities. This could create an intolerable level of severance for a significant proportion of the city's population.

The scale and nature of the infrastructure required for the on-line option is of significant magnitude; this is because the route would be retrofitted into a sensitive urban environment demanding a more complicated solution than that of a lesser developed area within the city. This design legacy would likely radically impact on the experience and image of the city. Galway City is relatively small in scale, of a low height profile and of a linear pattern. Notwithstanding the efforts in design to partially submerge and tunnel the route and elevate it where it traverses through parklands, the associated infrastructure would likely contribute to a cumulative negative impact on the existing urban landscape of the city.

While acknowledging that the on-line option is at a preliminary design stage, it is likely that this option could run counter to many of the principles of proper and sustainable planning and could also be in conflict with objectives in the Galway City Development Plan 2011-17, in particular those that aim to improve on the sustainability, connectedness and cohesion of the city and especially the established neighbourhoods. The vision for neighbourhoods including those affected by the on-line option, is to endeavour through future re-developments, design guidance and local authority investment to re-balance the existing car dominated environments, increase permeability and linkage, provide for more sustainable modes of transport paralleled by improvement to the adjacent public realms.

The following assesses the preferred on-line option against the policies and objectives of the Galway City Development plan.

## 5.2.2 Galway City Development Plan Assessment

### 5.2.2.1 Section 1

#### **Section 1.3 (Aim):**

*“Provide for a built and natural environment that is of high quality and that contributes to providing a good quality of life for residents and visitors and affords sustainable transportation opportunities.”*

#### *Assessment -*

Notwithstanding the fact that the on-line option could potentially provide a transportation solution to the current traffic congestion on city and environs national/regional routes and also accommodate public transportation, it is considered that this option could have indirect consequences which would frustrate the strategic goals of the development plan which endeavour to improve the cohesion of communities both socially and physically.

The on-line option would likely have a cross-city impact of significant scale on the built up area of the city which currently accommodates a number of uses including established and outer suburb communities and associated services and facilities. The resulting impact could likely contribute to creating a divisive effect on these communities which accommodate a significant proportion of the city's population.

The on-line option would, by virtue of the need to accommodate the route itself, to preserve the accessibility already provided by the existing road network, to re-organise existing junctions and to accommodate public transport modes require infrastructural works of huge magnitude. The design resolution of all these engineering challenges could inhibit mobility within neighbourhoods and also result in a wider impact on the economic, social and potentially the wellbeing of existing established communities.

The scale and re-arrangement of movement patterns are arguably of such a nature that they could induce a barrier to movement. Although the current proposal being at route selection only, has not had the benefit of full design with all mitigation examined it is difficult to see how this barrier affect, both physically and psychologically could be successfully tempered through design. For example, the

current arrangement where critical community facilities are accessed via and across Seamus Quirke Road by residents demonstrates the existing relative ease of access and community linkage to facilities located on both sides of the route option (such as Shantalla N.S., Westside post office, shopping centre, library and hospital). The planning objective in this area is to create greater enclosure of the existing road through building design and to make improvements to the public realm flanking the area.

It is acknowledged that connections from north to south of the on-line option would be accommodated. However the arrangements would likely require more detours with resultant delays and discomfort in crossings for vulnerable road users and local car journeys.

There are occasions where changes in the nature of some roads may have negative localised consequences but can on balance result in a benefit to the overall city community. These may be locations where the impact can be gauged to cause less disruption and where there are not the same levels of concentration of neighbourhoods or community facilities. The on-line option is not of this kind owing to the scale of the project in the context of the population of Galway City and the proportion of the population who could be directly impacted. This route option, notwithstanding that there would be more opportunities for mitigation, owing to the alignment which penetrates through built up, and in some cases multi-generational neighbourhoods may not be in the best interests of the common good. It most likely would result in transport improvements in the city in accordance with one strand of the transportation strategy envisaged by the City Development Plan but the accommodation of such improvements through the monumental infrastructural works required could be detrimental to the overall quality of life experienced in the city both during construction and thereafter.

***Policy 1.5 Transportation Strategy:***

*“Support the implementation of the transportation strategy for Galway City in conjunction with all other transport providers and transport stakeholders in line with national and regional policy in particular Smarter Travel – A Sustainable Transport Future 2009–2020”*

***Assessment -***

The sentiment in the plan is that future transportation solutions will provide for an increase in opportunities for sustainable transportation modes. The on-line option has demonstrated that it has potential to accommodate public transport but only at the western end in Knocknacarra and at parallel roads in central and eastern areas. However, it would be an objective of the plan to integrate better sustainable modes in areas where there is a built up community. Enticing people to increase walking and cycling would be more successful where the dominance of vehicular traffic is being reduced along their immediately accessible route networks rather than where such movements are being retained and expanded. The on-line option would facilitate retention of car movements on the city network albeit with proposals for carrying such traffic in tunnels and over viaducts. Notwithstanding the capacity it might have for increasing safe sustainable modes on elements of the existing network it would still attract significant volumes of traffic

Such environments can, notwithstanding the potential to accommodate walking and cycling safely, be interpreted as hostile environments where the attraction of walking and cycling would be diminished.

### 5.2.2.2 Section 2

#### **Aim**

*“to provide for adequate housing for all sectors of the community in sustainable neighbourhoods that will be attractive places to live within easy access to a range of local services, amenities, community facilities and public transport networks. To ensure that these residential neighbourhoods will have a sense of identity and will foster sustainable living and movement patterns. To improve the quality and to protect the character of Galway’s older neighbourhoods and to regenerate the city centre’s neighbourhoods.”*

#### **Policy 2.2 Neighbourhood Concept**

*“Encourage the development of sustainable residential neighbourhoods, which will provide for high quality, safe, accessible living environments which accommodates local community needs.”*

#### **Section 2.3 Streets and Movement**

*“The tendency to adhere strictly to road standards has led to inflexible residential layouts with roads dominating and open spaces becoming secondary. The layout of residential development needs to create spaces where the car becomes secondary and where the street has an important public realm function beyond the movement of traffic. The Council will encourage new development to be based on a network of spaces rather than a road based layout, a development in which roads play their part but are not dominant.*

*The DEHLG Guidelines for Sustainable Residential Development in Urban Areas (2009) set out a number of design principles to consider in the layout and design of streets in residential areas, these include:*

- *Connectivity and Permeability: provide convenient access to places, particularly to services such as schools and places of work. Routes within the area should be accessible for everyone and as direct as possible.*
- *Sustainability: prioritise the needs of walking, cycling, public transport and the need for car-borne trips to be minimised.*
- *Safety: provide for safe access on streets, paths and cycle routes for users of all ages and degrees of personal mobility.*
- *Legibility: ensure residents and visitors can easily find their way around the area.*
- *Sense of place: ensure streets contribute to the creation of attractive and lively mixed-use places. Streets should not just serve a movement function, their design should include consideration of appropriate opportunities for resting and enjoyment. The use of street names with a connection to the area can also reinforce a sense of place and evocation of the past in new buildings.”*

### *Assessment -*

The on-line option straddles neighbourhoods (both established and outer suburbs as defined in the city plan) e.g. Westside, Knocknacarra, Newcastle. As noted, when reviewed in the context of the location in the urban environment the scale of the project, the magnitude of the infrastructural works required - doubled tiered road arrangement, tunnelling, additional bridging arrangements over roads and river, complex junction arrangement- all are contrary to the aim of achieving sustainable neighbourhoods and establishing a sense of place and ownership.

These arrangements would create additional physical barriers and could have damaging social impacts on neighbourhoods. They could create real and perceived barriers to accessing important services and facilities. These include local schools, parks, health facilities, community centres and shops.

For example the barrier effect of a heavily trafficked dual carriageway along sections of the Western Distributor Road could likely impact on the aspirations for schools (two established to the south and two planned for the north of the road) – where safe routes to school by walking and cycling are now being planned but may have less success in the event of the on-line option going ahead. Although crossings would likely be included in any design for pedestrians/cyclists these are most likely to be of a formal design, perhaps by land bridging such as at Browne Roundabout. They may not however be attractive to all and may not correspond with individual desire lines thereby generating more car trips owing to likely frustration associated with time delays where the most direct walking routes may no longer exist.

Such impacts could likely have consequences to the sense of neighbourhood, could identify and cause disruption to existing social patterns and if so would be in conflict with the cited aims and approaches for residential areas as expressed in the City Development Plan. It is difficult to see how the on-line option could be mitigated to such a degree that the route would contribute to creating a sense of place and legibility that city streets should support.

It is acknowledged that roads such as Seamus Quirke Road and the Western Distributor Road do have the characteristics of barriers. However pursuance of the on-line option could be seen as a retrograde step in that the long term planning for some sections of road along the route are currently to improve connectivity and to increase the attractiveness of such urban roads and streets and to draw in more sustainable street level community interaction and activity. This it is believed could be achieved through re-development of some brownfield sites, development of Greenfield sites and public realm works including for hard and soft landscaping. This is acknowledging that the on-line option suggests that the local road networks at some locations may have lesser volumes of traffic and therefore more potential for sustainable modes. However this is for stretches only and the background of accommodating the on-line option is not conducive for successful change as desired by the Galway City Development plan.

### 5.2.2.3 Section 4

#### **Aim**

*“To provide for a green network in the city that allows for sustainable use and management of natural heritage, recreation amenity areas, parks and open spaces in an integrated manner. The green network will ensure the protection of nature and provide for the enhancement and expansion of passive and active recreational opportunities. It will be accessible to everyone and by sustainable modes of transport, where feasible.”*

#### **Policy 4.2**

*“Support sustainable use and management of areas of natural heritage importance, parks and recreation amenity areas and facilities through an integrated green network policy approach in line with RANS, where it can be demonstrated that there will be no adverse impacts on the integrity of Natura 2000 sites”*

#### **Policy 4.4**

*“Support the actions of the Galway City Heritage Plan and imminent Biodiversity Action Plan relating to the promotion of ecological awareness and biodiversity, the protection of wildlife corridors and the prevention of wildlife habitat fragmentation”*

#### **Policy 4.6**

*“Manage and develop woodlands in the ownership of Galway City Council for natural heritage, recreation and amenity use, including Terryland Forest Park, Merlin Park Woods and Barna Woods/Lough Rusheen City Park”*

#### **Assessment –**

The creation of Terryland Forest Park is a long term objective of the City Development plan to create one of three city parks which will provide for “passive and active recreation, wildlife conservation and education.”

The on-line option has taken cognisance of these designations through designing the expressway route as a viaduct where it traverses these lands and including the development of an urban/linear park thereunder as a mitigation factor against its intrusive nature. However, to introduce a roadway of such a nature through the amenity lands may not satisfy the long term objectives of the land use zoning. Irrespective of the ambition to “float” the road over the park, it would have a significant visual and physical impact on this landscape and form a wide range of views.

The works to necessitate the bridging would of themselves also require huge sensitivity in relation to the existing natural environment. In addition the works may require removal of trees which are the legacy of a number of historical community tree planting initiatives. However, as the design is at a preliminary stage the impact on existing trees may be capable of being reduced or avoided.

The physical presence of the route and the operational impact thereof would be of such a scale as to negate the aspiration of the City Development Plan to develop

this area as the third city park along with Bearna/Lough Rusheen Park and Merlin Park Woods.

#### 5.2.2.4 Section 5

##### ***Policy 5.3 Retail***

“Protect existing district centres, neighbourhood centres and local centres”

*Assessment -*

Reference has already been made to the barrier impact the on-line option could have on existing built up neighbourhoods. In addition, severance would impact on the commercial viability of existing commercial services that have evolved over time built on the patronage of local communities and convenient access.

The retail strategy highlights areas south of the Bodkin Junction, district centres such as Knocknacarra, Rahoon and Doughiska and functioning neighbourhood centres such as Westside where the objectives within the City Development Plan and its retail strategy is to protect and develop further the commercial function of these areas. This is to ensure an adequate provision of services and goods in a convenient manner to accommodate the needs of the population both existing and into the future. However, the scale of accommodating works, arrangement of and suppression of free access crossings along sections of the on-line route at certain locations could frustrate this policy.

#### 5.2.2.5 Section 6

##### ***Policy 6.2 Social Inclusion***

*“Proactively promote all forms of social inclusion, where feasible in land use planning particularly in the built environment and public realm, housing, community facilities, employment opportunities, public transport and accessibility”*

*Assessment -*

The on-line option would likely have a cross-city impact of significant scale on the built up area of the city. It is likely that this could result in restrictions on ease of movement at some locations along the route and in particular for some members of the community.

In particular this can include those who might be more vulnerable to losses in pedestrian mobility – persons with disabilities, the elderly; children due to fear of traffic safety issues. The resultant impact could have, at certain locations such as the Browne Roundabout near the hospital, parts of Western Distributor Road, where volumes will increase or where approach tunnels exist and where these could have a negative impact on the strategic objective to encourage social inclusion. The on-line option would need significant mitigation to minimise these impacts, so that the on-line option presents a transport solution for all sectors of society.



### 5.2.2.6 Section 9

#### Ardaun (9.5)

*“The proposed Ardaun settlement area is located to the east of the city. It is a significant bank of land capable of being extended in the longer term into the county. It is anticipated that this area will accommodate most of the targeted population growth for the gateway as identified by the DECLG in October 2009 and the RPG West Region 2010-2022.”*

#### Assessment -

A section of the on-line option is accommodated in the north-west area of the lands designed to accommodate the settlement area of Ardaun. The design of the route and associated connection could impact on the potential for these lands to accommodate the anticipated targeted population as defined in the city plan core strategy. This may require that additional lands be zoned for the purposes of residential development elsewhere in the city to address this issue. This aspect would have to be examined in more detail with mitigation measures being incorporated into the route design.

## 5.3 Material Assets

As noted in **Section 3.4** of this report, a detailed assessment of material asset impacts for the preferred on-line option will be included within the Route Selection Report.

## 5.4 Engineering

### 5.4.1 Level of Service

The preferred on-line option achieves a Level of Service D.

The provision of the proposed mainline generates the requirement to provide separate parallel networks. The design of these was undertaken in accordance with DMURS, Smarter Travel, the National Cycle Manual and the NRA DMRB. Parallel road networks accommodate local vehicular traffic, vulnerable road users and public transport as necessary. Additionally, parallel roads provide an alternative route during operational incidents and general maintenance periods which require the proposed mainline to be partially or completely closed.

### 5.4.2 Design Speed and Alignment

A design speed of 85kph was adopted for the length of the mainline, excepting the Western Distributor Road where a design speed/speed limit of 50kph was adopted. 85kph is the highest design speed achievable within the confines of the on-line study area.

The design speed and related geometric parameters selected were consistent with the anticipated vehicle speeds on the mainline and local roads.

### 5.4.3 On-line Junction Design

A variety of junction types and layouts are incorporated in the preferred on-line option. Some of these junctions are non-standard as they are being retrofitted into the existing and upgraded road network and environment. The general approach within the NRA DMRB has been followed when developing these junctions. The primary aim when developing junction layouts was the provision of connectivity between the proposed mainline and the local networks. Access to the mainline was limited to primary junctions where possible.

The junctions on the preferred on-line option have been assessed from a traffic engineering perspective via traffic modelling. For the majority of the junctions there is adequate additional capacity, however at a number of locations as noted in **Section 5.4.6** of this report potential capacity issues are evident. These capacity issues shall be resolved during the route selection process via further design and more detailed assessment.

### 5.4.4 Drainage and Utility Impacts

Existing utility records were obtained from the relevant utility service providers. At this stage of the assessment, it would be difficult to consider all utilities that would be impacted by the preferred on-line option.

There are a considerable numbers of low voltage ESB lines, servicing every home and business in the on-line study area, these services were not assessed as part of this assessment, as they are considered minor constraint risks to the project. The ESB services that have been assessed, see bullet list below, are considered to be major utilities for this service provider and pose more significant constraints for the project.

Similarly, there are numerous small diameter foul, combined and surface water sewers and watermains throughout the city that have not been assessed as part of this assessment as they are considered minor constraint risks to the project. The assessment has been carried out based on the larger diameter, more critical services, as detailed in the bulleted list below, as these pose more significant constraints for the project.

As a preliminary assessment, impacts on larger utilities and services were assessed. The following utilities and services were considered for the assessment:

- SSE 110kV lines;
- ESB High Voltage Overhead Lines (HV OH);
- ESB High Voltage Underground Lines (HV UG);
- ESB Medium Voltage Overhead Lines (MV OH);
- ESB Medium/Low Voltage Underground Lines (MV/LV UG);
- Galway City Council, Water mains with pipe diameter greater than 300mm;
- Irish Water, Foul and Combined Sewers pipe diameters greater than 300mm;
- Galway City Council foul and combined sewers with pipe diameters greater than 300mm;

- Galway City Council surface water and trunk sewers with pipe diameters greater than 600mm;
- Gas Networks Ireland underground services;
- Eircom underground services;
- E-Net services; and
- UPC lines.

At the time of writing, there were no available Gas Networks Ireland utility records for the areas west of the Western Distributor Road to the R336 at Bearna. The assessment for the number of interactions with utilities and services for the on-line option is presented below in **Table 5.1**.

Utility Type	No of Impacts
E-Net	0
ESB HV OH	1
ESB HV UG	0
ESB MV OH	2
ESB MV/LV UG	1
Eircom	4
Gas	0
UPC	0
Water - 300mm	0
Water - 450mm	0
Water - 500mm	0
Foul Pipes	0
Surface Drainage	0
Trunk Sewer	0
SSE	0
Total	8

**Table 5.1: On-line Utility Impacts**

The on-line Option traverses the city and consequently has a significant impact on utilities. The cut sections, following the alignment of the existing roads, along the preferred on-line option at Ragoon and Terryland would have major impacts on utilities with large scale diversions required. Some utility services run parallel to the preferred on-line option. Along Seamus Quirke Road, gas, ESB and UPC services run within the footprint and parallel to the existing road. Similarly at the Western Distributor Road, Eircom, ESB and gas services run parallel to the road. Eircom, E-Net, ESB and gas mains all run along the existing N6. There is also a significant number of trunk sewer crossings on the preferred on-line option.

Utility interactions are considered to be a major constraint for the development of the on-line option. Ideally any major utility diversions would be carried out as part of an advance works contract. Known potential conflicts between the preferred on-

line option and the existing/future services have been identified. Potential interface locations with major utilities are shown within the Route Selection Report.

In addition to impacting existing utilities and drainage infrastructure the provision of the preferred on-line option would have long term operational and maintenance requirements via the incorporation of a pumped drainage system at the location of the cut and cover tunnel in the Ragoon area.

## 5.4.5 Structures

### 5.4.5.1 Additional River Corrib Crossing

#### *Option A – Parallel Bridge to Quincentenary Bridge*

This structure would be similar to the existing Quincentenary Bridge. The spans over the river would match the existing bridge with the supports positioned to minimise the impact on river channel flow. The structure would span over the western river bank and over internal NUI Galway roads. This is required in order to keep the area as open as possible to provide for the large movement of pedestrians, internal NUI Galway traffic and the proposed greenway development. The vertical alignment of the bridge maintains headroom for river traffic and the NUI Galway access road as per existing structure.

Details of a preliminary bridge design are presented within **Appendix C**.

#### *Options B – Bridge over Existing Railway Piers*

The Corrib Viaduct carried the Galway to Clifden Railway Line over the River Corrib from the Waterside area to within the grounds of NUI Galway north of the Salmon Weir Bridge.

The substructure that carried the railway line over the river consisted of three no. river piers and two abutments that remain in place. The steel superstructure of the viaduct was dismantled and removed in the 1930s. The piers and abutments are of masonry construction with ashlar stone. The viaduct was made up of three 45m spans with one 6m bascule lifting span. The structural design proposed reuses this existing substructure.

A tied arch steel design is considered in keeping with the previous superstructure of the viaduct. This structure type would reduce the horizontal loads created by the bridge alleviating lateral loads on the substructure. The superstructure could be supported by piles driven within the existing piers and abutments. This would create the effect that the piers are acting structurally when in fact they would only be superficial. The arch would also provide a natural barrier between vehicles and pedestrians crossing the bridge.

The span lengths are dictated by the existing substructure. The rise of the arch is preliminarily sized based on the span lengths. Structural elements such as the bridge deck, arch rib and hanger spacing are sized with dimensions based on preliminary design.

Details of a preliminary bridge design are presented within **Appendix C**.

This option has not been explored in any further detail as part of the N6 Galway City Transport Project as it is removed from the existing crossing desire lines in the vicinity of the Quincentenary Bridge.

### ***Option C – Parallel Bridge to Salmon Weir Bridge***

An additional crossing of the River Corrib was examined by Galway City Council in 2011, this consisted of a parallel bridge to the south of the Salmon Weir Bridge. Two options for a new bridge considered appropriate here follow that proposal:

This option has not been explored in any further detail as part of the N6 Galway City Transport Project as it is removed from the existing crossing desire lines in the vicinity of the Quincentenary Bridge.

### **5.4.5.2 Local NUI Galway Access**

The existing Quincentenary Bridge is in close proximity to NUI Galway on the western river bank. In front of the western bridge abutment, there is a dedicated walkway amenity which is part of a proposal to develop a greenway along the riverbank. The embankment on approach to the western abutment contains an underpass that links the internal NUI Galway road network.

The current underpass has 3.7m headroom and narrow footpaths to cater for pedestrians. It is the main NUI Galway link north and south of the N6. The existing underpass does not fully cater for the needs of the university campus.

Planning permission has previously been granted to NUI Galway for a new underpass adjacent to the existing underpass. This proposed underpass would provide 5.3m headroom and cater for the proposed greenway development. This would also allow the existing underpass to be reused exclusively for pedestrian/cyclists. A similar approach is taken in this option but a larger clear span is provided.

The new underpass is proposed centrally between the existing underpass and the river bridge. The reason for this is to avoid any potential interaction of having two separate structures in close proximity. To cater for the required 5.3m headroom the road level is *c.* 1.5m lower than the existing ground level.

Details of a preliminary bridge design are presented within **Appendix C**.

This option has not been explored in any further detail as part of the N6 Galway City Transport Project as it is removed from the existing crossing desire lines in the vicinity of the Quincentenary Bridge.

### **5.4.5.3 Reuse of Existing Quincentenary Bridge**

The proposed on-line option would cross the River Corrib along the existing N6 reusing the Quincentenary Bridge. This development would involve altering the cross-section of the bridge structure replacing it with the proposed mainline cross-section. A median would be proposed between the carriageways pushing the trafficked lanes closer to each parapet.

The viability of this alteration was assessed using the information available on the existing structure. A report published by the design consultants following completion of the structure covered the planning, design and construction. It indicates that, as a client requirement, the structure had been designed with a provision for five lanes in the future. The proposed road layout would effectively push the trafficked lanes away from the centre link to more centrally over each box section. The live traffic loading would still be within the width of the original five lane design.

Therefore, in principle, the proposed mainline cross-section would have negligible effect on the behaviour of the existing structure. This would need to be verified at further design stages.

#### 5.4.5.4 Terryland Viaduct

As part of the on-line option developed, provision is made for elevating a section of the mainline in the Terryland area of the city. The structure would be approximately 1200m in length and would cross over the meandering Terryland River, the N6 at the Bodkin Junction, Sandy Road and other local accesses. The structure would also require partial demolition and complete demolition of commercial premises in the Terryland area.

The structural depth, substructure cross-sectional area and number of supports is minimised in order to mitigate the impact of the structure from a landscape and visual perspective.

Precast concrete beams would allow spans of up to 45m. Considering the alignment and associated constraints, other options such as post-tensioning were ruled out due to the prohibitive cost and lack of experience with this form of construction in Ireland. The main alternative option is a steel beam/concrete slab arrangement supported on single column supports. This may be perceived better aesthetically than a constant depth superstructure and also allows for greater spans up to 60m.

The structural depth of the steel beam/concrete slab varies from a depth of 3m at the supports reducing to 1.5m at mid-span. Spans were adjusted locally to position the most appropriate support locations.

Details of a preliminary bridge design are presented within **Appendix C**.

#### 5.4.5.5 Standard Structural Arrangements

The on-line option would require the development of a number of grade separated junctions and provision of local access at numerous locations across the city. It is expected that a number of these structures would be accomplished with standard concrete bridge construction.

Two locations were used to represent standard structural arrangements; Ballybrit Overbridge and Terryland Underbridge. These details are presented on drawings within **Appendix C**

Earth retaining structures would be required across the scheme to maintain level differences. It is intended that reinforced earth walls and concrete retaining walls would be used where appropriate.

## 5.4.6 Traffic

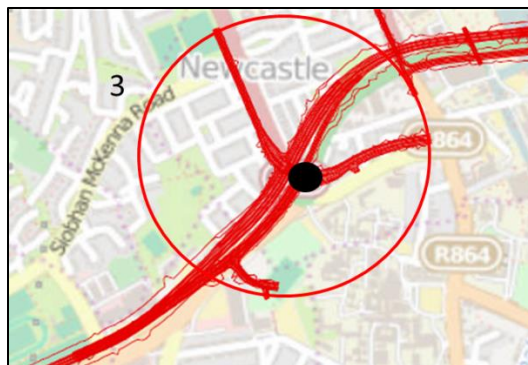
The following is a preliminary assessment of the preferred on-line option from a traffic perspective. During the assessment of alternative options, including the on-line option a Traffic Modelling Report, including full Cost Benefit Analysis will be undertaken. This report will detail the traffic modelling undertaken, traffic surveys undertaken, development of the traffic and demand models, and validation of the traffic and demand models, existing travel patterns and future year model development.

During the optioneering of on-line options traffic modelling was used to determine the optimum layout from a traffic engineering perspective whereby impact on the surrounding areas was minimised. At the time of assessment only the base demand data was available and was therefore used in the assessment.

### 5.4.6.1 Key Traffic Issues of the Preferred On-line Option

This section provides a summary of the links and junctions along the preferred corridor of the preferred on-line option where Volume over Capacity (V/C) ratios exceeded 90% (0.9) of capacity in the 2034 Design Year. Volume over Capacity ratios are useful for highlighting problem junctions and links. Ideally junctions and links should operate at a V/C ratio of less than 85% (0.85) in order to cater for unexpected events or natural growth. Solutions were not progressed during the optioneering stage for the issues noted. These issues may require further infrastructure intervention and or the consideration of complementary measures during further design stages. Such measures could include demand management.

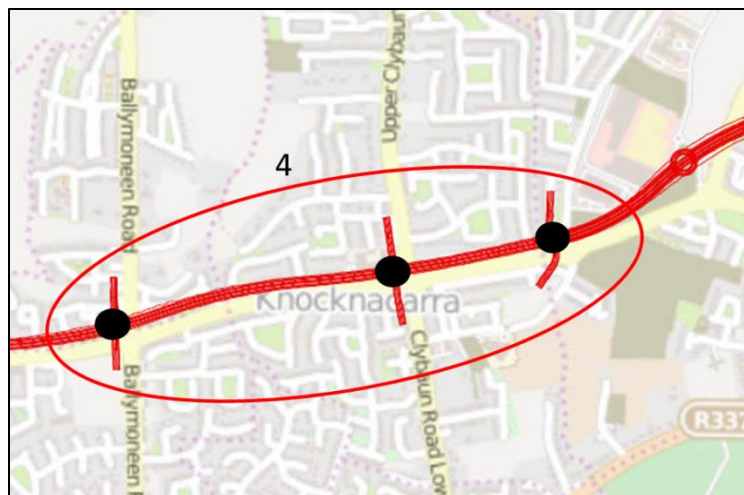
1. The proposed signalised intersection at the location of the existing Browne Roundabout is between 87% and 92% on three of the four arms.



2. The proposed signalised junction between the proposed parallel road and the N6/R865 is over capacity with 90% on the westbound off-slip and 97% on the eastbound Western Distributor Road.



3. The proposed signalised junctions along the Western Distributor Road become increasingly close to and over capacity nearer to the start of the tunnel travelling eastbound.



## 5.4.7 Tunnelling

Tunnels have been incorporated into the design and selection of the preferred on-line option primarily as a mitigating factor to the intrusive nature of on-line options. Construction and associated installation costs are incorporated in the economic assessment. Detailed tunnel requirements such as ventilation, safety management, fire design etc. have not been examined during on-line optioneering.

## 5.4.8 Traffic Signalisation

The use of traffic signalisation has been incorporated into the design of the preferred on-line option. Traffic signalisation has been optimised in order to balance the needs of vehicular traffic flow with the needs of vulnerable road users.

When examining the incorporation of traffic signalisation, details of the existing local network requirements, performance and operation were sought from the



Galway Transportation Unit of Galway City Council. This information was input to the traffic model thereby ensuring an accurate assessment of the performance of proposed traffic signalisation in combination with the local networks operational requirements.

## 5.5 Environmental Design

As noted in **Section 3.6** of this report, a detailed assessment of environmental impacts for the preferred on-line option will be undertaken and included within the Route Selection Report.

Environmental constraints identified during the constraints study were considered when selecting the preferred on-line option.

## 5.6 Constructability

### 5.6.1 Construction Phasing and Traffic Management during Construction

#### 5.6.1.1 General

The constructability of the preferred on-line option and considerations thereof are detailed within this section. **Section 3.7** of this report details the items to be considered when examining the constructability of the preferred on-line option.

The on-line option has the potential to cause major disruptions in the city. This is apparent from the demands of urban construction which could result in significant disruptions and delay on key routes and movement patterns in the city for a prolonged period. This is of particular note for the preferred on-line option as the works would be located in areas of concentrated populations, services and employment.

To minimise disruption, it is envisaged that the on-line option would be constructed on a phased basis, under a number of construction contracts and over a number of years. Potential construction phasing is detailed within **Appendix D**.

#### 5.6.1.2 Overall Construction Phasing

##### *General*

As noted, it is envisaged that the preferred on-line option would be delivered via a number of contracts; the number and scale of contracts is dependent on constraints such as staging requirements, existing network constraints and available funding.

The preferred on-line option lends itself to staged construction in the following manner;

- (a) R336 Bearna Road to Knocknacarra (including Western Distributor Road);
- (b) Knocknacarra to Bodkin Junction;

- (c) Bodkin Junction, N84 Terryland Junction and Terryland Viaduct;
- (d) N17 and R865 Ballybane Road Junctions and Parallel Road; and
- (e) R865 Ballybane Road to existing N6 (including Briarhill Junction).

***R336 Bearna Road to Knocknacarra***

This 5km section can be constructed in two sub-phases;

- a1) 2.7km section from the R336 Bearna Road to Cappagh Road: single carriageway “greenfield” construction; and
- a2) 2.3km section from the Cappagh Road to Knocknacarra: upgrade and widening of the Western Distributor Road including the replacement of all the existing roundabouts with signalised junctions.

A safe transition from single carriageway road cross-section to single carriageway with Bus Rapid Transit and central refuge islands/right-turn lanes is proposed at Cappagh Road via a signalised junction.

***Knocknacarra to Bodkin Junction***

This 3.6km section includes the following key elements, each of which could be constructed as a sub-phase though preferably in tandem;

- b1) Cut & cover tunnel from Knocknacarra along the Seamus Quirke Road to the N59 Junction;
- b2) Seamus Quirke Road to be reconstructed over the cut & cover tunnel;
- b3) N59 Junction;
- b4) Newcastle Road Overbridge;
- b5) Parallel Quincentenary Bridge and NUI Galway Underpass; and
- b6) Bodkin west facing slips to/from the mainline immediately east of the river crossing.

The construction of this section would bring significant benefits to Galway by removing local commuter traffic from the Quincentenary Bridge and transferring it onto the parallel bridge to the south. The construction of the N59 grade separated junction would have benefits for the Newcastle and NUI Galway areas.

***Bodkin Junction, N84 Terryland Junction and Terryland Viaduct***

This 1.3km section includes three key elements which should be constructed in tandem;

- c1) Bodkin west facing slips to/from the mainline immediately east of the river crossing;
- c2) Viaduct, 700m in length, from Bodkin Junction to existing N6, east of the Kirwan Roundabout; and
- c3) N84 east facing slips to/from the mainline immediately east of the existing N84 Junction at the Kirwan Roundabout.

The construction of this section would bring significant benefits to Galway by removing local commuter traffic from the Terryland area and transferring it onto the viaduct and onwards to the Quincentenary Bridge.

### ***N17 and R865 Ballybane Road Junctions and Parallel Road***

This 2km section extends from the N84 Junction to Ballybrit Business Park. This section includes a significant cutting between the N17 and R865. The proposed parallel road to the south of the N6 mainline, connecting the two junctions should be constructed first in order to accommodate diverted traffic and allow the mainline cuttings to be excavated.

The construction of this section would bring significant benefits to the Castlegar and Ballybrit areas of Galway City as well as to City East Business Park access arrangements.

### ***R865 Ballybane Road to existing N6 (including Briarhill Junction)***

This 3km section includes the following key elements which should be constructed in tandem;

- e1) Briarhill diamond grade separated junction southeast of the existing N6/R339 Monivea Road signalised junction;
- e2) Proposed overbridge at the existing N6/R339 signalised junction by depressing the N6 mainline; and
- e3) Improvements to Ballybrit Business Park access to/from N6.

The construction of this section would bring significant benefits to Parkmore Industrial Park, Ballybrit Business Park and the Briarhill area of Galway City.

## **5.6.1.3 Anticipated Construction Durations**

The preliminary construction duration for the sections described above are as follows:

<b>Contract</b>	<b>Approx. Length (km)</b>	<b>Section Location</b>	<b>Contract Duration</b>
A	5	R336 Bearnna Road to Ragoon (including Western Distributor Road)	18 months
B	3.6	Ragoon to Bodkin Junction (including cut & cover tunnel)	3 years
C	1.3	N84 Terryland Junction and Terryland Viaduct	18 months
D	2	N17 and R865 Ballybane Road Junctions and Parallel Road	18 months
E	3	R865 Ballybane Road to existing N6 (including Briarhill Junction)	24 months

***Table 5.2: Anticipated Construction Durations***

An overall construction duration of approximately four to six years would apply to construct the scheme in its entirety. The western section(s) could be constructed

simultaneously with the eastern section(s) in order to accelerate construction and reduce the overall construction duration. However, such an approach may not be feasible for the central sections from the N59 to Terryland.

This construction programme would result in long-term intensive construction works traversing the city via a corridor which is predominately one of a built up nature. The construction works would include significant under and over ground structures; including a viaduct through a parkland area, a tunnel through an established residential area and significant earthworks excavations at a number of existing strategic transportation nodes.

The protracted construction contracts as described above may be detrimental to a number of residential neighbourhoods, service areas, employment centres, city tourism landmarks and strategic parklands and recreational areas.

#### **5.6.1.4 Traffic Management and Construction Phasing**

##### ***General***

An outline design proposal for temporary traffic management at construction stage is presented in **Appendix D**. Traffic management plans/method statements at detailed design stage would be required. Liaison with emergency services and key stakeholders, prior to implementation of traffic management plans would also be a requirement during further design stages.

The construction process would have to be planned to accommodate existing traffic flows and the daily operations adjacent to the scheme. Initial areas requiring traffic management measures have been developed in order to determine the impact that construction would impose upon the existing road network, vulnerable road users, residents, stakeholders and other interested parties.

##### ***R336 Bearna Road to Knocknacarra (including WDR)***

##### ***R336 Bearna Road to Cappagh***

The western sub-section from the R336 Bearna Road to the Cappagh Road is a “greenfield” site. The level of traffic management required for this sub-section would be minor in comparison to that required east of Cappagh Road for the remainder of the on-line option. Within this sub-section, traffic management would be required where the option traverses existing side roads. Three options are available at such locations:

#### **1. Temporary Diversions**

Side roads would require temporary diversions to accommodate construction of on-line bridges and roadworks. The temporary road would be in place with traffic diverted, allowing the bridge and the realignments on the line of the minor road to be constructed. When all bridge works and realignments are complete, single lane working would be necessary while the new section of side road is tied into the existing road.

## **2. Side Road Closures**

Side roads may be required to be closed for a period during construction of the works. Traffic on these roads would be diverted onto other existing roads during the construction period.

## **3. Side Roads Constructed off-line**

Side roads may be constructed offline allowing the use of the existing road to continue until construction of the new section is complete. Single lane working would be necessary to tie the new section into the existing road.

### ***Cappagh Road to Knocknacarra***

The eastern sub-section from Cappagh Road to Knocknacarra would require major traffic management. Traffic management during construction would require detailed consideration to ensure that traffic flow would be maintained throughout the duration of the scheme construction.

It would not be realistic to close the existing Western Distributor Road for any prolonged period due to the levels of existing traffic and the lack of an adequate alternative parallel road network. Traffic management would be required to guarantee the provision of the existing number of lanes at peak traffic hours on the existing road, with provision also for emergency services. Reasonable local access would also be required.

The widening and upgrade of the Western Distributor Road would be carried out on a phased basis with the northern section constructed initially with live traffic and vulnerable road users accommodated primarily to the south. Where possible the existing number of traffic lanes, cycleways and footways would be maintained. This process would then be repeated for the construction of the southern section. Detailed traffic management plans would be required at each of the existing roundabouts where signalised junctions are proposed at the Ballymoneen Road, Clybaun Road and Bóthar Stiofáin.

### ***Knocknacarra to Bodkin Junction (including Cut & Cover tunnel)***

The construction of the section from Knocknacarra (Gort Na Bró) to the Bodkin Junction would require significant traffic management. Detailed consideration would be required in order to ensure that traffic flow would be maintained throughout the construction period particularly on the Western Distributor Road, Seamus Quirke Road, the N59, Newcastle Road, Quincentenary Bridge and Headford Road.

It would not be realistic to close any of the above roads for any prolonged period due to the levels of existing traffic and the lack of adequate alternatives. Traffic management would be required to guarantee the provision of the existing number of lanes at peak traffic hours on the existing roads, with provision also for emergency services and local access.

This section includes the construction of a cut and cover tunnel from Knocknacarra, and along the Seamus Quirke Road towards the vicinity of the proposed N59 grade

separated junction. Due to space restrictions, the tunnel would be constructed using a staged or sequential approach, the Seamus Quirke Road would then be recreated above the tunnel at surface level. Timber hoarding and safety barrier would be required along the boundary of the construction zone in order to protect vehicular traffic and vulnerable road users from construction activities.

The most significant impacts will be experienced between the existing Browne Roundabout and the existing Newcastle Road with additional residential properties being acquired solely for the purpose of maintaining this corridor.

A parallel river bridge would be constructed to and south of the existing Quincentenary Bridge to accommodate local traffic. The existing bridge being utilised for mainline and through traffic. Proposed west facing slips would be constructed at the existing Bodkin Signalised Junction connecting the local traffic network to the mainline of the proposed on-line upgrade.

#### ***N84 Terryland Junction and Terryland Viaduct (Duration 18 months)***

The section from the Bodkin Junction to the existing N6 east of the Kirwan Roundabout would require major traffic management at the western extents of the viaduct at the Bodkin Junction and at the proposed N84 Terryland Junction. No significant traffic management would be required for the construction of the viaduct as this would be constructed offline adjacent to, along and above the Terryland River.

Traffic management during construction would require detailed consideration to ensure that traffic flow would be maintained throughout the construction period particularly on the Quincentenary Bridge, Headford Road, Sean Mulvoy Road, N6, Bodkin Junction and Kirwan Roundabout.

It would not be realistic to close any of the above roads for any prolonged period due to the levels of existing traffic and the lack of adequate alternatives. Traffic management would be required to guarantee the provision of the existing number of lanes at peak traffic hours on the existing roads, with provision also for emergency services and local access.

This section includes the construction of a 1.2km long viaduct, east facing slips as part of the N84 Terryland Junction located on the existing N6 east of the Kirwan Roundabout and partial and full demolition of commercial facilities. It may also include the construction of an urban/linear park and amenity area under the proposed viaduct as a mitigation measure to the intrusive nature of the structure.

#### ***N17 and R865 Ballybane Road Junctions and Parallel Road***

The section from the eastern extents of the N84 Junction to the R865 would require major traffic management. Traffic management during construction would require detailed consideration to ensure that traffic flow would be maintained throughout the construction period on the N6, N17 Tuam Road and Monivea Road.

It would not be realistic to close any of the above roads for any prolonged period due to the levels of existing traffic and the lack of adequate alternatives. Traffic management would be required to guarantee the provision of the existing number

of lanes at peak traffic hours on the existing roads, with provision also for emergency services and local access.

This section includes the construction of significant cuttings at the N17 and R865 and a parallel road to the south of the mainline connecting the two junctions. This parallel road would be constructed in the early phases of construction to allow the cuttings to be excavated. Temporary roads and retaining structures may be required at these cutting locations to maintain the current number of traffic lanes during construction periods.

All works would be carried out a phased basis as detailed preliminarily in **Appendix D**. Where possible the existing number of traffic lanes, cycleways and footways would be maintained. Detailed traffic management plans would be required at detailed design stage. Timber hoarding and safety barrier would be used to protect pedestrians and vehicles from the deep excavations and also to minimise air and noise impacts.

### ***R865 Ballybane Road to existing N6 (including Briarhill Junction)***

The section from the R865 Ballybane Road to the existing N6 would require major traffic management. Traffic management during construction would require detailed consideration to ensure that traffic flow would be maintained throughout the duration of the construction on the N6, Monivea Road, Ballybane Road, signalised Ballybrit Junction, Coolagh Roundabout and Parkmore area.

It would not be realistic to close any of the above roads for any prolonged period due to the levels of existing traffic and the lack of an adequate alternatives. Traffic management would be required to guarantee the provision of the existing number of lanes at peak traffic hours on the existing road, with provision also for emergency services. Reasonable local access would also be required.

This section includes the construction of significant cuttings from the existing Ballybrit Junction to the proposed diamond grade separated junction southeast of the existing junction. Temporary roads and retaining structures would be required at this location to maintain the current number of traffic lanes on the existing N6 and to provide access to the construction site.

All works would be carried out a phased basis as preliminarily detailed in **Appendix D**. Where possible the existing number of traffic lanes, cycleways and footways would be maintained. Detailed traffic management plans would be required at detailed design stage. Timber hoarding and safety barrier would be used to protect pedestrians and vehicles from the deep excavations and also to minimise air and noise impacts.

### ***Summary***

Notwithstanding the measures outlined above to manage traffic and construction phasing impacts, significant traffic management would be required for the entire on-line option and most particularly from the Western Distributor Road to City East Business Park. Significant traffic management would be required where the proposed option traverses or runs parallel to existing roads. Traffic management measures would include numerous temporary diversions and road closures. These would be required for a prolonged time period and be required at a number of

critical transportation nodes, many of which are currently over or nearing capacity. These include the proposed signalised junctions on the Western Distributor Road, tunnel at Rahoon and Seamus Quirke Road, N59/Browne Junction, Headford Road, N6/N17 Junction, Ballybane/Ballybrit Junction and Briarhill/Monivea Road Junction.

These road closures and diversions would run through the spine of the city from west to east resulting in unacceptable journey time delays over an extended time period of at least four to six years. The collective effect of the scale of these road closures, diversions and traffic management would, again, give rise to unacceptable, overbearing and residual negative impacts on the transportation network by causing major disruption.

### **5.6.1.5 Construction Traffic**

#### ***General***

When considering the potential construction traffic over such an extended area, a holistic view would be taken to ensure a realistic estimate is reached. The proposed on-line option would be divided into earthworks sections similar to those for the construction phasing. The dividing line between sections would be either a physical barrier such as the River Corrib or a change in setting from on-line to greenfield construction or other logical locations based on earthworks or other engineering criteria. The aim would be to balance the earthworks (cut/fill) within each of these sections.

#### ***Routing of Construction Traffic***

It is worth noting that where there is a surplus of suitable material in one section and a deficit in another, the material must be transported from one section to the other. If this is transported using public roads it would contribute to construction traffic. This would be assumed to be the worst case scenario.

#### ***Earthworks Quantities and Construction Materials Sourcing***

The earthworks operations would be a major activity on site. The earthworks operations would include excavation, stockpiling, processing, deposition, blasting, disposal, import and haulage. The haulage of materials would be to and from the site, and also along the site.

Suitable excavated materials are generally classified as being either rock or non-rock, depending on the method of excavation required for cuttings. Rock generally requires blasting for its removal in large quantities. Excavated materials that are not suitable for re-use in structural embankments are defined as being unsuitable.

The preliminary bulk earthworks quantities can be summarised as follows:

- Excavation of 2.4 million m<sup>3</sup> of material;
- Suitable material is approximately 2 million m<sup>3</sup> (85% of excavated material);
- Requirement for 0.6 million m<sup>3</sup> of suitable fill material for the construction of the option; and



- Surplus of 1.4 million m<sup>3</sup> of material.

Because of the surplus of material, alternative locations for this material would be required.

Some of the excavated material (surplus topsoil and 15% of excavated) would be unsuitable for embankment construction. This may be used for topsoil on the proposed earthwork slopes and for landscaping. The excess would be disposed of.

Note that these estimates are preliminary in nature.

### ***Temporary Road Closures and Diversions***

Temporary road closures and diversions may be required for a period during construction of the works. Traffic on these roads would be diverted onto other existing roads or temporary roads during the construction period. Temporary roads may be required at structure locations to allow the bridge/retaining structure and the realignments on the line of the minor road to be constructed. Preliminary options are shown on the construction phasing and traffic management drawings included in **Appendix D**.

### ***Potential Plant & Machinery Crossings***

A significant number of plant crossings on the existing route would be required to allow the movement of plant, equipment and construction vehicles through the works. These crossing points would operate for the majority of the anticipated construction period.

### ***Access to the Site***

As with any major construction project, the haulage of materials to and from the site would create a temporary impact for both road users and residents in the areas impacted. To minimise these impacts it is important that only roads suitable for use by construction vehicles would be permitted for hauling materials to the site. It is proposed that the number of access points to the site for the mainline works would be kept to a minimum in order to reduce the impact on road users and residents living along the route.

### ***Construction Site Compounds***

The form in which the proposed option goes to tender, i.e. number of contracts, would determine the number, size and location of construction and storage compounds that would be required. These sites would generally be one hectare in size, would include stores, offices and plant storage, and be distributed at regular intervals along the length of each section of construction. Following completion of construction, these areas would be cleared and re-instated.

### ***Blasting***

Blasting for the purpose of excavation may be required during the construction phase. Noise and vibration abatement measures during blasting would be required. In order to minimise the impact of blasting, a public awareness campaign would also be undertaken before work commenced, explaining what is being done and why.

Drilling and blasting would be carried out by a specialists, who would prepare all relevant method statements and risk assessments. Rock exaction requiring blasting would likely be required at the following locations:

- Ragoon;
- Seamus Quirke Road; and
- N17 to R865 Junction.

The western area currently consists of residential, community, social, amenity and recreation areas including University Hospital Galway. Intense blasting and drilling construction works adjacent to the above areas, and in particular the hospital, would have a significant impact on the area under headings such as air, noise, vibration and dust.

### ***Waste and Recycling***

Typical wastes arising from road construction projects are topsoil, subsoil, peat, trees, hedges and other plant matter, bricks and blocks, concrete, timber, bituminous materials, plastics, metals, dredging materials, asbestos and asbestos cement, scrap parts and fluids generated from equipment maintenance, staff canteen waste and some hazardous wastes such as oils, paints, adhesives and cleaning agents.

The design and implementation of a detailed Construction and Demolition Waste Management Plan in conjunction with an Environmental Operating Plan for the different contracts and overall scheme would provide for the optimum planning, management and handling of wastes generated by the project.

### ***Summary***

The proposed construction traffic routes would be divided into earthworks sections similar to those for the construction phasing. The preferred on-line option, particularly from the Cappagh Road to the N6 at the eastern tie-in would have a significant impact on the existing city transportation network as the works would require significant works for a sustained timeframe at virtually all the key city transportation nodes on the Western Distributor Road, Seamus Quirke Road, Headford Road, N17, Ballybrit and Briarhill.

It would be inconceivable to route construction traffic away from the existing public roads network. In essence this would be assumed to be the worst case scenario for construction traffic.

A significant number of plant and machinery crossings would be required on the existing road network to allow the movement of plant, equipment and construction vehicles through the works. These crossing points would operate for the majority of the anticipated construction period.

The haulage of materials to and from the site would create a temporary impact for both road users and residents living on and adjacent to the existing route. A number of construction site compounds would also be required for the duration of the works. These would be approximately one hectare in size, and would include stores, offices and plant storage, and be distributed at regular intervals along the length of each section of construction.

The combination of construction haulage routes, site access points, plant crossing points and site compounds would contribute to a significant negative impact on the existing road network, air, noise, vibration, light illumination and dust for a significant time period most particularly from the Western Distributor Road to Terryland.

## **5.7 Operational Performance**

The preferred on-line option has been selected as the most appropriate on-line option due to its ability to accommodate the anticipated traffic volumes and to provide the required connectivity with the existing network. In order to facilitate this option the existing primary transportation corridor of Galway City would require significant modification and replacement. This would result in the provision of a singular primary transportation corridor with local network connectivity provided via junctions. In some instances preliminary traffic modelling has indicated that the option, particularly its junctions with the local networks would operate at the fringe of their capacity, these capacity issues have been examined and mitigated where possible during the on-line optioneering. These capacity issues however, highlight that during events such as accidents or weather events, the resultant impact on the local road network could cause congestion and gridlock. This would be primarily due to the reliance of the city on the singular transportation corridor and the amendments of the local networks in order to accommodate and compliment this corridor. This results in a lack of alternative routes and options for vehicular traffic. This operational flaw of the preferred on-line option is a significant safety concern which could only be mitigated through careful and controlled operational management procedures and processes.

The provision of parallel roads was required in a number of areas, this is beneficial from an operational perspective as they provide viable alternative routes during incidents such as traffic accidents or general maintenance periods. It should be noted that such routes would provide a lesser level of service than the proposed mainline during such incidents or maintenance periods.

## **5.8 Cost and Economic Benefits**

### **5.8.1 Overview**

As part of the Stage 1 route selection process, an economic assessment is undertaken using Option Cost Estimates (OCEs). No Cost-Benefit Analysis (CBA) will be undertaken at this stage.

The economic assessment is limited to construction and delivery costs and is intended for comparative purposes only. Full cost benefit analysis, including the road safety benefits and dis-benefits will be undertaken for the Route Selection options assessment.

## 5.8.2 Stage 1 Option Comparison Estimate

The overall cost of delivering the on-line option is approximately **€669 million**. This includes an estimate for the cost of acquisition of homes and commercial premises.

Total estimated costs are inclusive of all items including Main Construction Contract, Land and Property, Planning and Design, Archaeology, Advance Works and Other Contracts, Main Contract Supervision and Residual Network works. Costs are inclusive of value added tax but exclusive of inflation, construction/interface risks and programme risk.

## 5.8.3 Cost and Economic Impact

The construction of the on-line option, particularly from the Western Distributor Road to Terryland Forest Park would include significant traffic management issues and construction impacts. The impact on businesses adjacent to the construction zones could potentially be significant in terms of lost business plus loss of existing customers due to the inconveniences caused by construction.

In addition to the loss of existing business, the extensive construction period could act as a disincentive to attracting new business or new tourism opportunities to Galway City. New businesses and tourists may actively avoid Galway City for the construction period. This would have an impact on the overall economic performance of Galway City which could in turn could have long lasting impacts.

As noted, the economic impact of the construction of the on-line option could have detrimental impacts on Galway City, impacts from which it could take years to recover.

## 5.9 Safety

### 5.9.1 Overview

The following is a preliminary assessment of the preferred on-line option from a road safety perspective. During the assessment of alternative options, including the on-line option a Road Safety Impact Assessment will be undertaken and will examine the impact that any potential options would have.

### 5.9.2 Preliminary Assessment

For the preferred on-line option the greatest impact to users and user safety would occur during construction. There are risks associated with construction of the scale and type associated with this option and this is exacerbated by the urban setting. Connectivity for all users would have to be maintained throughout the construction process through, around and within the construction zones in many instances. For this reason it would not be feasible to construct the scheme simultaneously in its entirety and therefore, phased construction as noted in **Section 5.6** of this report would be required. This approach could minimise the risks associated with the construction process by allowing construction zones and associated diversionary

routes and construction management procedures to be carefully managed thereby ensuring the safety of all users.

As noted the preferred on-line option has been selected based on its ability to accommodate the anticipated traffic volumes and provide the necessary connectivity to the local network. In many instances these volumes are significant and interactions between vehicular traffic and vulnerable road users are unavoidable, particularly at junction locations. This increases the risk of collisions between non-motorised users and vehicular traffic due to the number of conflicting movements concentrated at the locations of the proposed junctions. This is a key safety concern of the preferred on-line option whose significance is reinforced by a study undertaken by the Road Safety Authority into different collisions in the cities in the Republic of Ireland, including Galway. This study notes that almost half of all fatalities in the period from 1997 to 2006 in Galway City were pedestrians with the majority of these fatalities occurring at junctions.

As congestion increases, adherence to the rules of the road decreases, this results in dangerous and undesirable driving practices. These practices are not only a danger to the driver but to all road users and can result in an increased risk of collisions. This is exacerbated by the urban setting of the preferred on-line option with junctions in close proximity to one another and a significant number of conflicting movements.

### 5.9.3 Summary

A key aim of options considered as part of the N6 Galway City Transport Project is the removal and reduction of the existing safety issues and the avoidance of any additional safety issues. Each of the issues noted could be mitigated and managed through the adoption of safe construction methodologies and practices, the adoption of careful and controlled operational management procedures and practices and careful consideration of the interactions between vehicular traffic and vulnerable road users, particularly at junctions.

The latter is a key concern, the provision of upgrades to vehicular routes cannot be to the detriment of vulnerable road user safety. The measures required to safely accommodate vulnerable road users within the on-line option may be substantial and act a deterrent to using alternative modes to the car. During on-line optioneering efforts were made to ensure that vulnerable road users were accommodated and that the provision of the preferred on-line option was not to the detriment of vulnerable road users. In the western and central areas of the preferred on-line option vulnerable road users are facilitated by the incorporation of cut and cover tunnels, an additional river crossing and an offline and elevated viaduct. Each of these allow dedicated facilities for vulnerable road users to be provided. The eastern extent of the scheme is more hostile to vulnerable road users than the other sections due to the extensive infrastructure interventions required.

## 6 Conclusions & Recommendations

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### 6.1 Conclusions

This report presents the optioneering and preliminary options assessment for on-line road options leading to the identification of a preferred on-line option. The preferred option signifies the level of intervention required in order to accommodate the anticipated traffic volumes using an on-line road based option. As noted, the preferred on-line option does not consider complimentary measures such as intelligent transport systems, traffic management etc.

Galway City is relatively small in scale, of a low height profile and of a linear pattern. Notwithstanding the efforts in design to mitigate the impacts of the infrastructure of the on-line option it would likely contribute to a cumulative negative impact on the existing urban landscape of the city with a potential flaw being that it would not comply with proper planning and sustainable development. This is most particularly evident on the section from the Western Distributor Road to Terryland Forest Park. The vision for neighbourhoods including those affected by the on-line option, is to endeavour through future re-developments, design guidance and local authority investment to re-balance the existing car dominated environments, increase permeability and linkage, provide for more sustainable modes of transport paralleled by improvement to the adjacent public realms.

The on-line option contains significant mitigation measures to provide permeability for vulnerable road users, local vehicular traffic and public transport. Whilst the mitigation may connect either side of the infrastructure, the infrastructure itself by its nature and scale could have the potential to remove future opportunities to connect neighbourhoods and communities both from a transportation perspective and planning and design perspective. Whilst the on-line option makes adequate provision for the existing desire lines and car journeys, it does very little to redress the balance and to promote more sustainable transport modes. In fact, it may be argued that it removes the opportunity to redress the car dominated environment.

The construction impacts such as unacceptable journey time delays, extensive road closures and diversions and other overwhelming impacts (such as air, noise, vibration, light illumination and dust impacts) would likely be of such a scale as to render the option unacceptable from a residential, tourism, industrial and commercial perspective and to the city as whole. As per the planning assessment, the impacts are more significant on the section from the Western Distributor Road to Terryland Forest Park due to the narrow construction corridor available and the fact that existing neighbourhoods and commercial activities straddle this corridor.

In order to facilitate the on-line option the existing primary transportation corridor of Galway City would require significant modification and replacement. This would result in the provision of a singular primary transportation corridor with local network connectivity provided via junctions. In some instances preliminary traffic modelling has indicated that the option, particularly its junctions with the local networks would operate at the fringe of their capacity. This highlights that during events such as accidents or weather events, the resultant impact on the local road

network could cause congestion and gridlock. This would be primarily due to the reliance of the city on the singular transportation corridor and the amendments of the local networks in order to accommodate and compliment this corridor. This results in a lack of alternative routes and options for vehicular traffic. This operational flaw of the preferred on-line option is a significant safety concern which could only be mitigated through careful and controlled operational management procedures and processes.

Therefore, the on-line option accommodates the anticipated traffic volumes using an on-line road based option and meets the scheme objectives in terms of reducing congestion, improved journey time, and providing connectivity to the city and the western parts of the county. However, it does have significant impacts on existing residential communities, has significant construction and operational impacts, and has significant planning issues, even with a very high level of mitigation.

## **6.2 Recommendations**

Given that the on-line option is a feasible alternative from an engineering perspective, and given that it is likely to have lesser impacts on the ecological sites which are designated of international importance, the on-line option is worthy of full environmental assessment in order to assess all alternatives in a comparable manner across all the environmental disciplines. These disciplines will include human beings, ecology, landscape and visual, planning, archaeological and cultural heritage and many others.

Therefore, as the preferred on-line option offers a solution to the transportation issues of Galway City and environs, it is necessary to compare the preferred on-line option with all other options developed during route selection. Therefore, the on-line option is taken forward for further assessment.

## Appendix A

### On-Line Study Area





FOR INFORMATION

- Legend:
- Scheme Study Area
  - On-line Study Area

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Job Title  
**N6 Galway City Transport Project**

Scale  
1:25000 @ A1 | 1:50000 @ A3

Date  
August 2015

Issue	Date	By	Chkd	Appd
16	28/08/2015	MG	MH	EMC

Drawing Title  
**Study Area**

Drawing Status  
**For Information**

Job No  
**233985-00**

Drawing No  
**GCOB-I-000-000**

Issue  
**16**

## Appendix B

### Key Plan



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Job Title  
**N6 Galway City Transport Project**

Scale 1:20,000 @ A1 | 1:40,000 @ A3

Date: July 2015

Issue	Date	By	Chkd	Appd
I1	09/07/2015	DM	SB	EMC

Drawing Title  
**On-line Option Scheme Layout Key Plan**

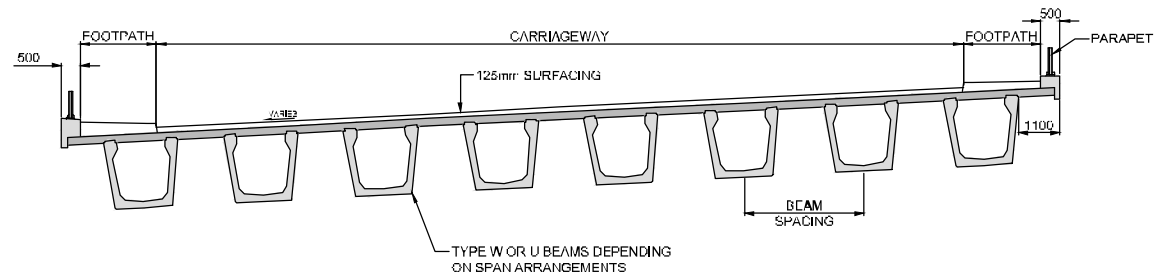
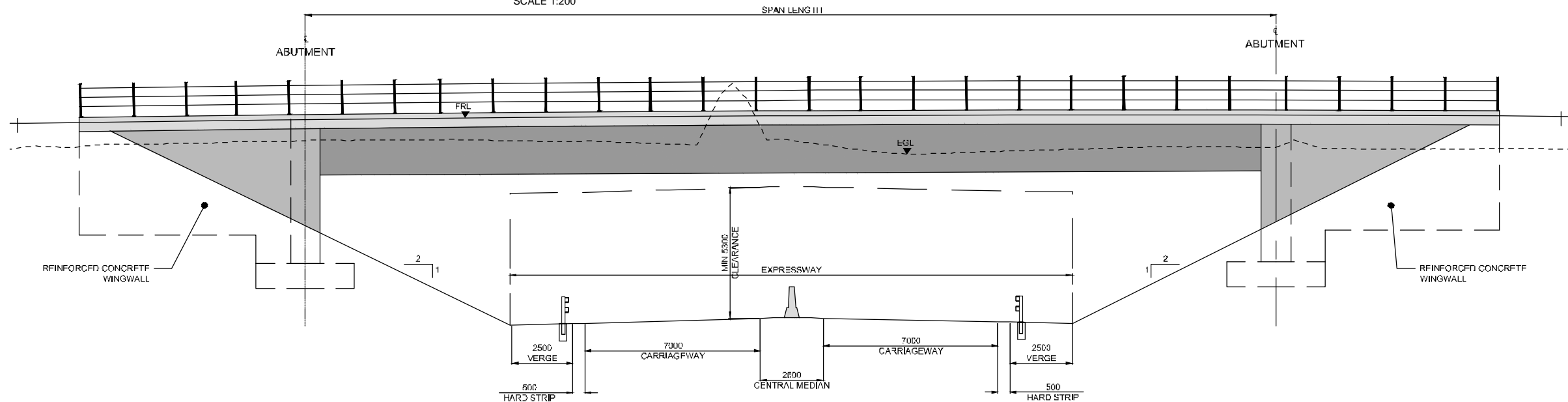
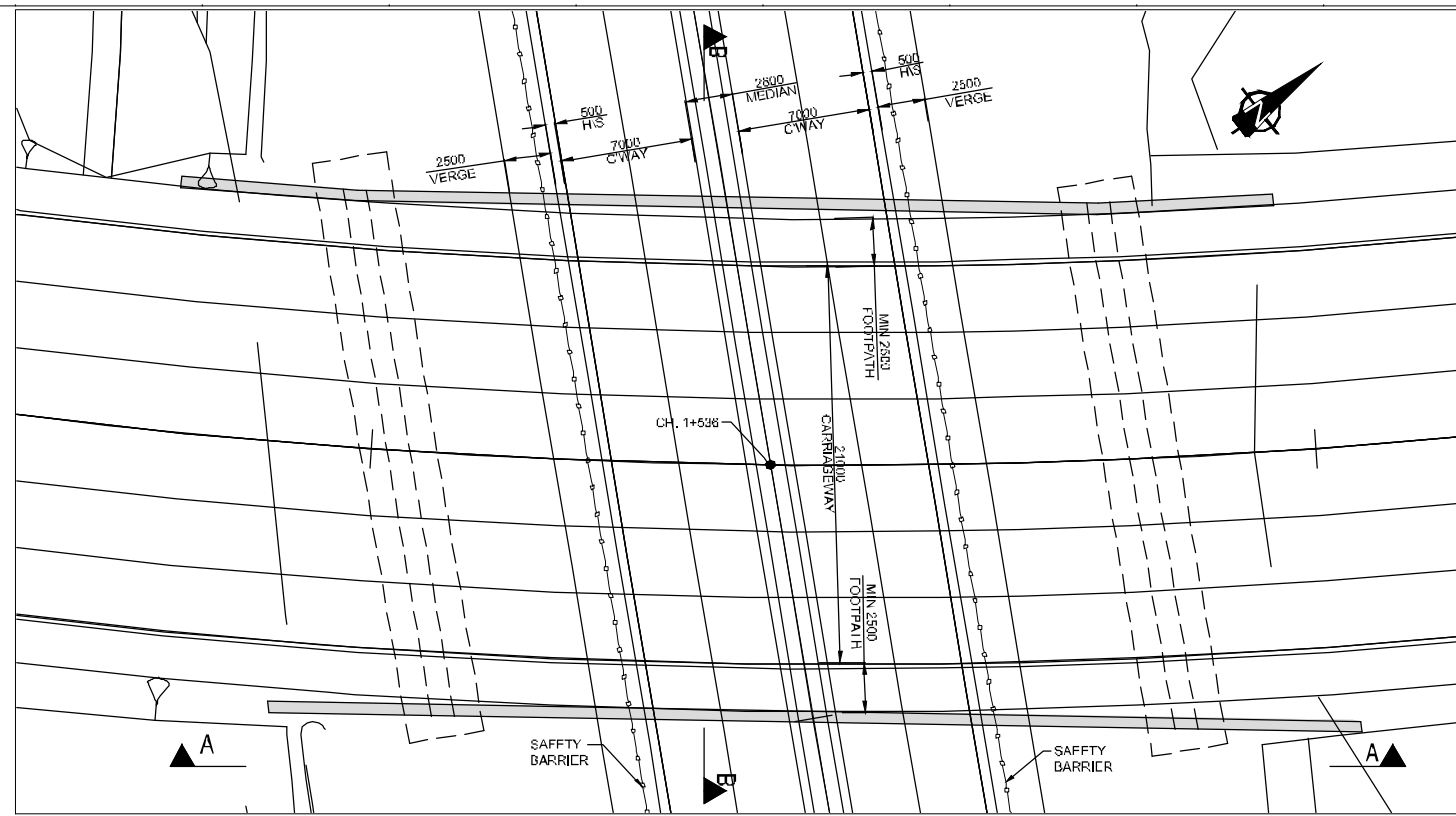
Drawing Status  
**Route Selection**

Job No	Drawing No	Issue
<b>233985-00</b>	<b>GCOB-000-R-200</b>	<b>11</b>

# Appendix C

## Structures

- NOTES:
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  2. LEVELS SHOWN ARE INDICATIVE ONLY.



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Job Title: N6 Galway City Transport Project

Scale: As Shown @ A1  
Date: October 2014

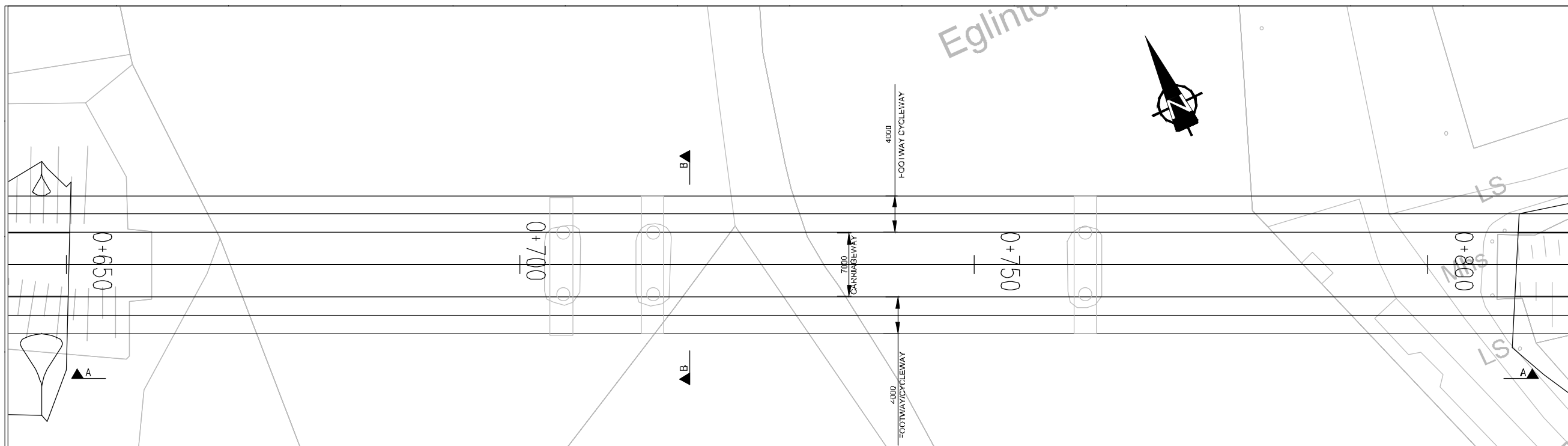
Issue	Date	By	Chkd	Appd
I1	14/10/2014	FB	MS	EMC

Drawing Title: Standard Overbridge Structure Typical Overbridge Structure Ballybrit Overbridge

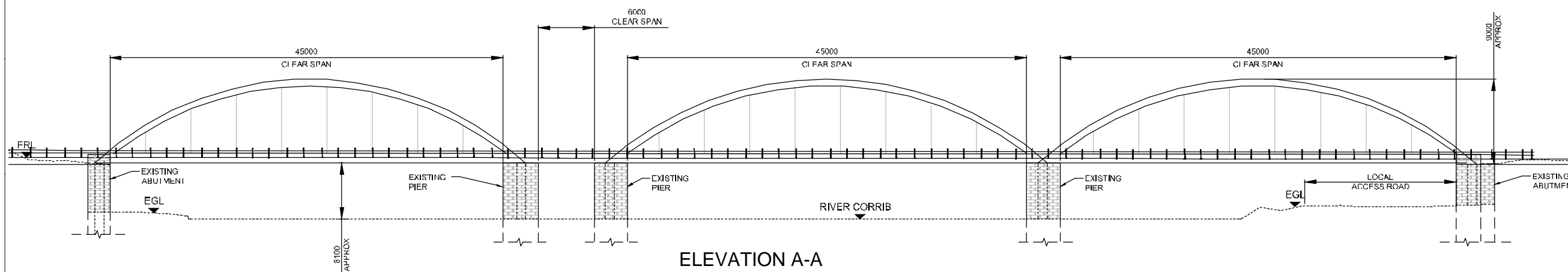
Route Options

Job No: 233985-00  
Drawing No: GC0B-100-R-1700-001  
Issue: I1

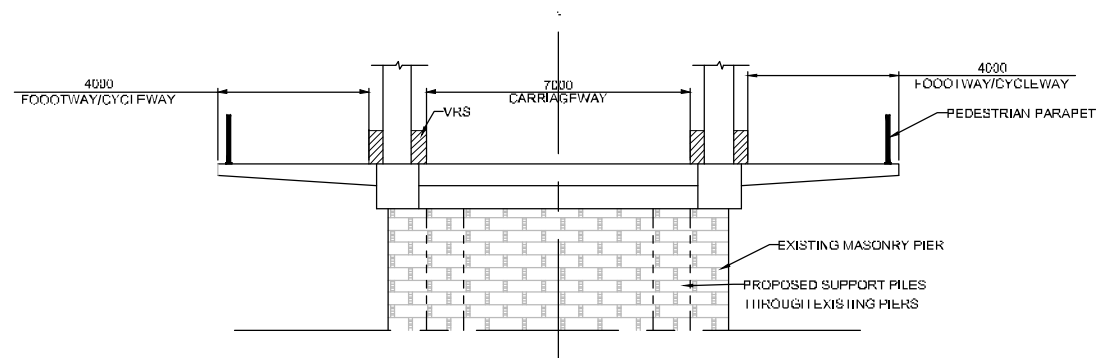
- NOTES:
- ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  - LEVELS SHOWN ARE INDICATIVE ONLY.



PLAN  
SCALE 1:250



ELEVATION A-A  
SCALE 1:250



SECTION B-B  
INDICATIVE CROSS SECTION  
SCALE 1:100

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Job Title  
**N6 Galway City Transport Project**

Scale  
As Shown @ A1

Date  
August 2014

Issue	Date	By	Chkd	Appd
11	28/08/2014	FB	MS	EMC

Drawing Title  
**Local Access River Corrib Bridge Corrib Viaduct Railway Piers**

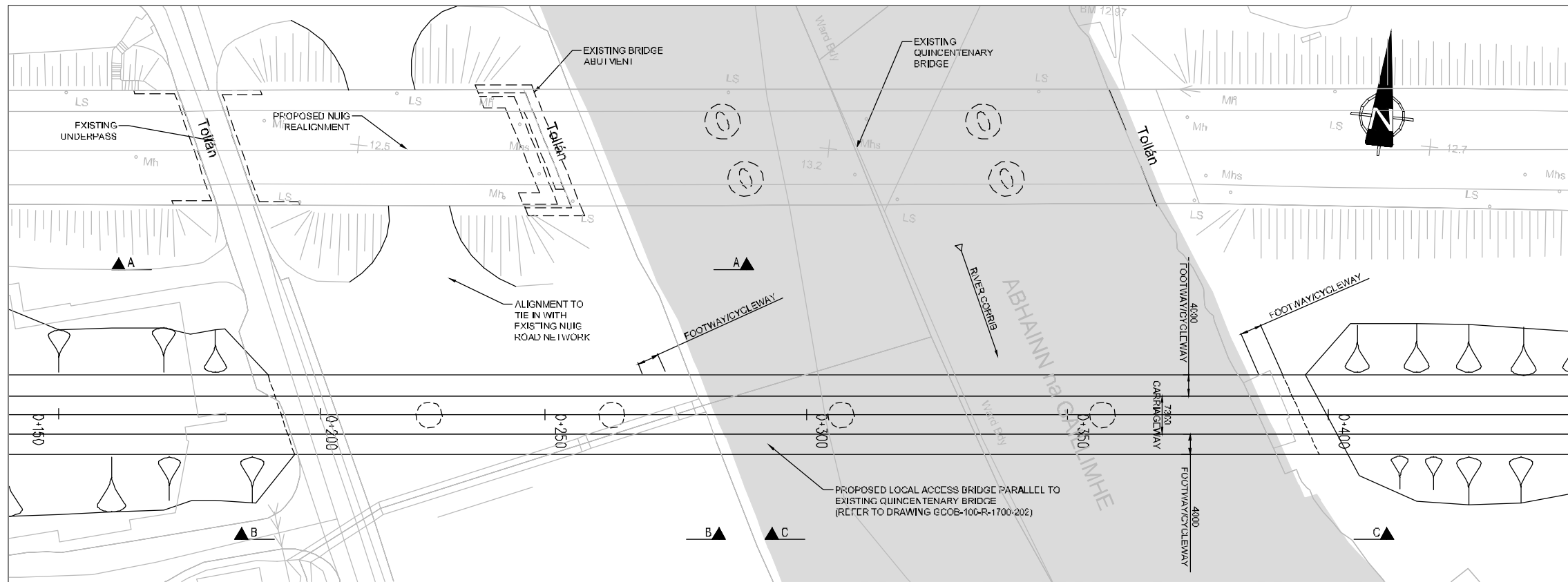
Drawing Status  
**Route Options**

Job No  
**233985-00**

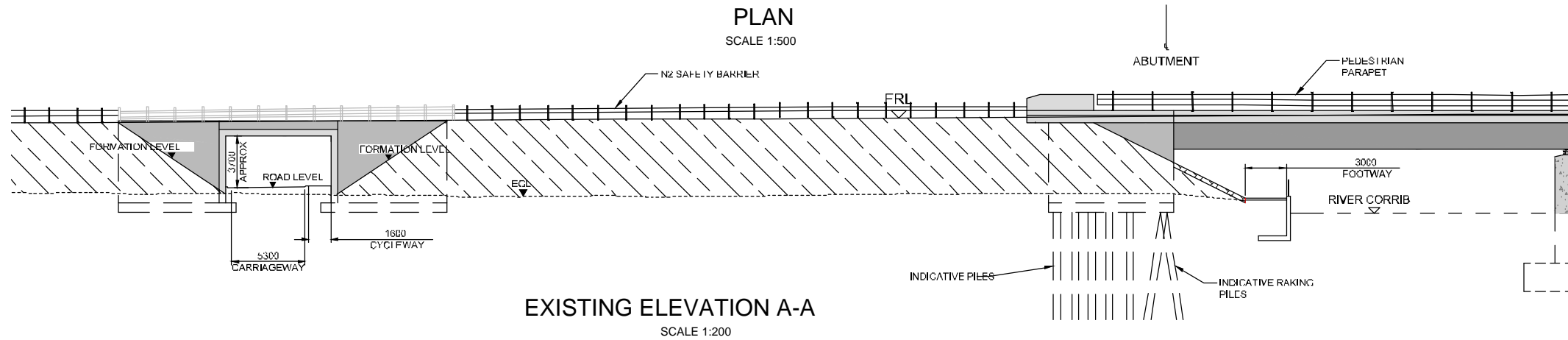
Drawing No  
**GC0B-100-R-1700-101**

Issue  
**11**

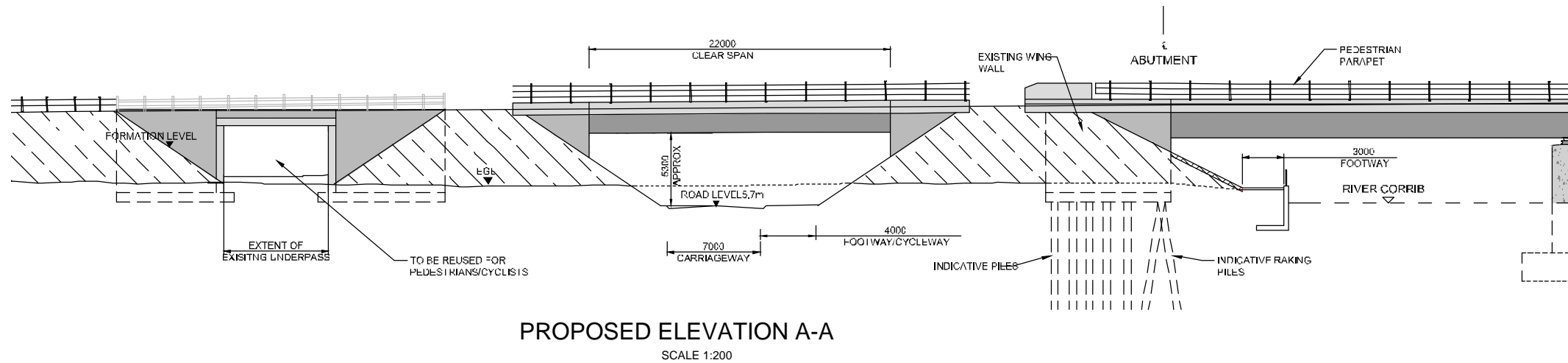
- NOTES:
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  2. LEVELS SHOWN ARE INDICATIVE ONLY.



PLAN  
SCALE 1:500



EXISTING ELEVATION A-A  
SCALE 1:200



PROPOSED ELEVATION A-A  
SCALE 1:200

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Job Title  
**N6 Galway City Transport Project**

Scale  
As Shown @ A1

Date  
August 2014

IT	Date	By	Chkd	Appd
-	30/09/2014	FB	MS	EMC
-	30/09/2014	FB	MS	EMC

Drawing Title  
**Proposed NUIG Underpass  
Quincenary Crossing**

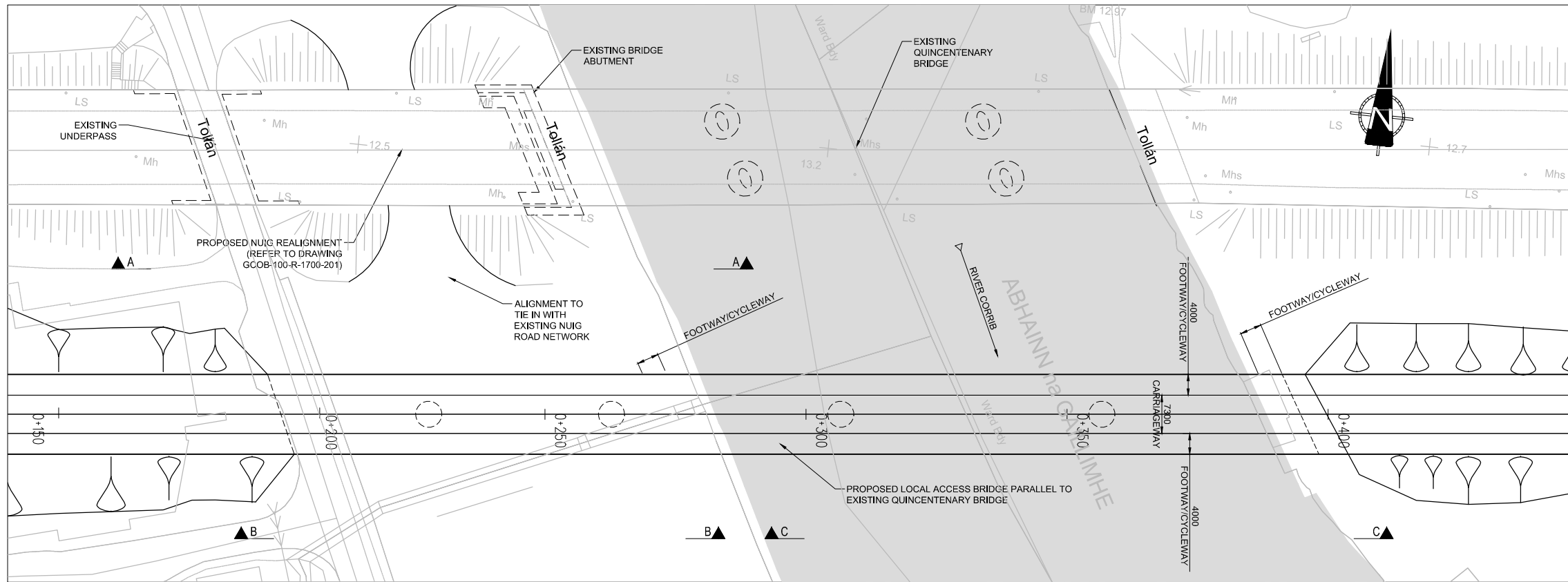
Drawing Status  
**Route Options**

Job No  
**233985-00**

Drawing No  
**GCOB-100-R-1700-201**

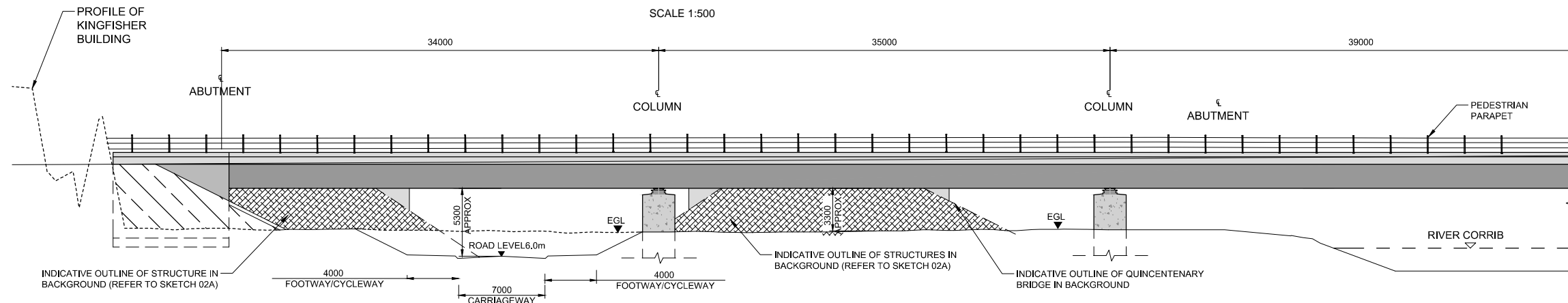
Issue  
**11**

- NOTES:**
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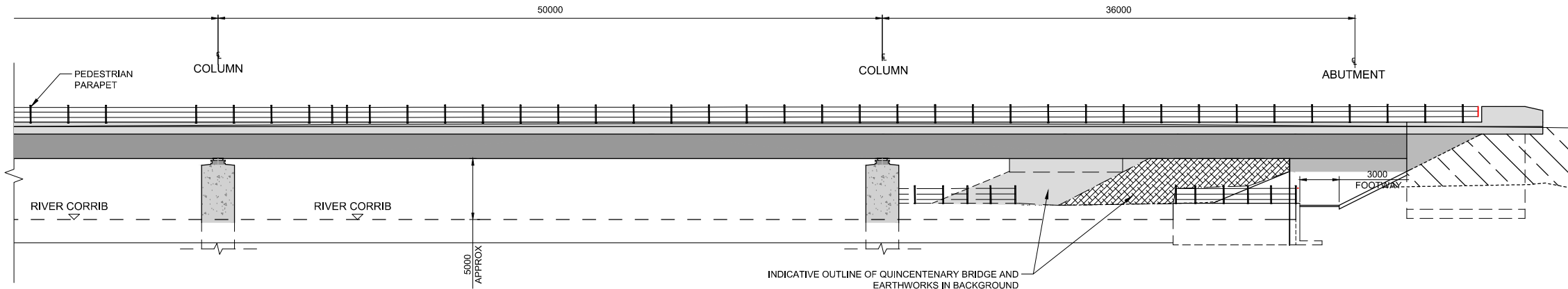
PLAN

SCALE 1:500



PROPOSED ELEVATION B-B

SCALE 1:200



PROPOSED ELEVATION C-C

SCALE 1:200

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Job Title  
**N6 Galway City Transport Project**

Scale  
**As Shown @ A1**

Date:  
**August 2014**

IT	Date	By	Chkd	Appd
-	30/09/2014	FB	MS	EMC
Issue	Date	By	Chkd	Appd

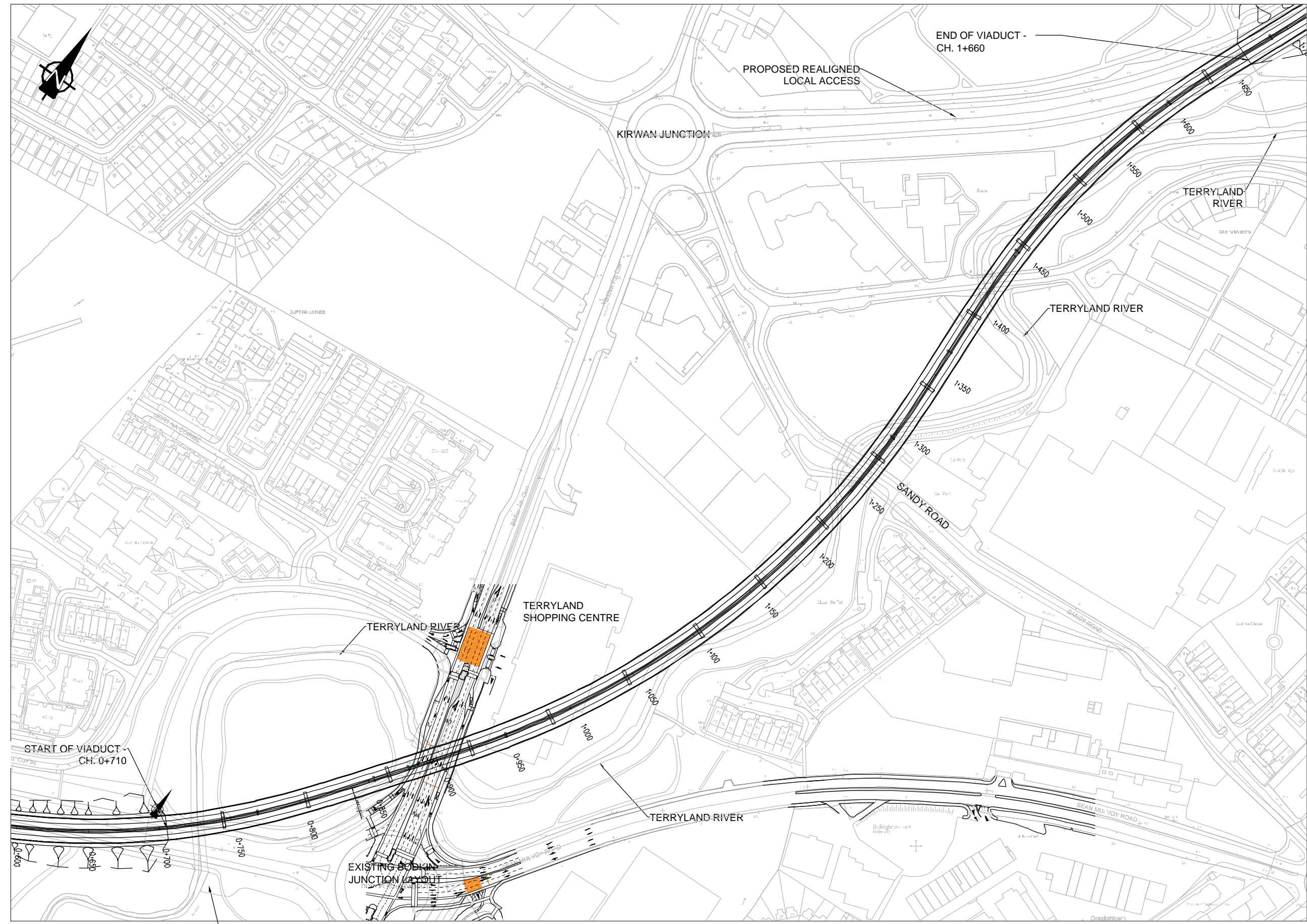
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**ROUTE OPTIONS**

- NOTES:
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PROPOSED REALIGNED LOCAL ACCESS  
**PLAN**  
 SCALE 1:750

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Job Title  
**N6 Galway City Transport Project**

Scale  
 As Shown

Date  
 September 2014

IT	Date	By	Chkd	Appd
-	30/09/2014	FB	MS	EMC
-	05/09/2014	FB	MS	EMC

Drawing Title  
**Viaduct Terryland Area Overall Plan**

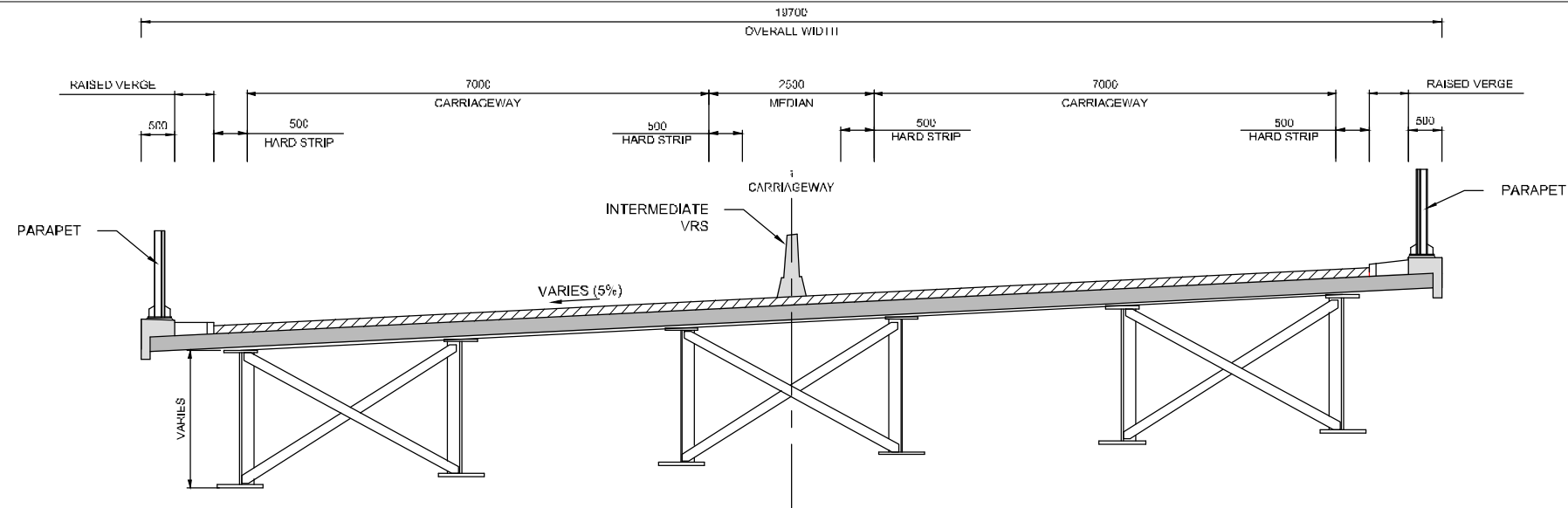
Drawing Status  
**Route Options**

Job No  
**233985-00**

Drawing No  
**GC0B-100-R-1700-300**

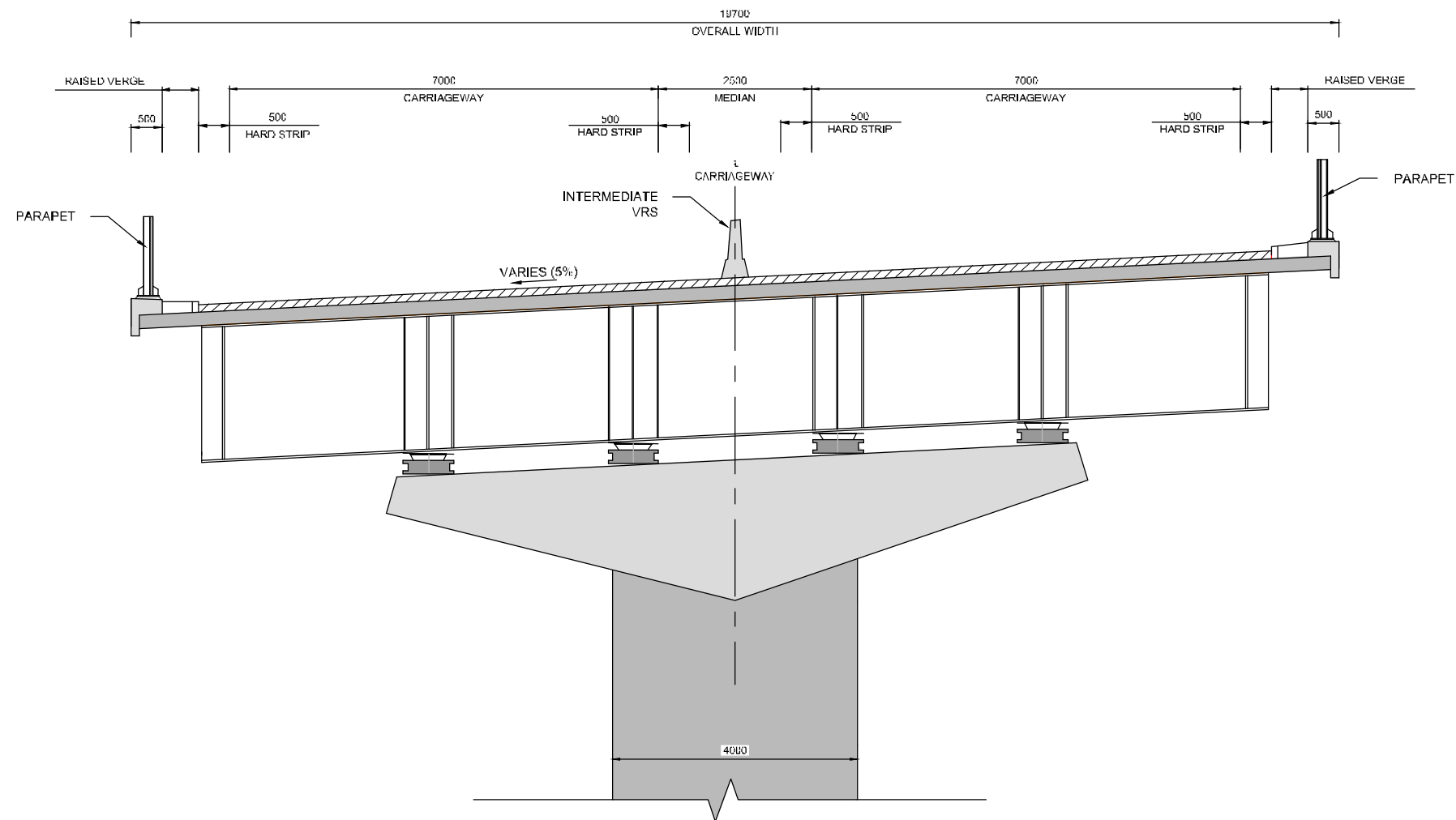
Issue  
**11**

- NOTES:
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INDICATIVE CROSS SECTION AT MIDPSAN

SCALE 1:20



INDICATIVE CROSS SECTION AT SUPPORTS

SCALE 1:20

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Job Title  
**N6 Galway City Transport Project**

Scale  
As Shown

Date  
September 2014

Issue	Date	By	Chkd	Appd
11	30/09/2014	FB	MS	EMC
-	05/09/2014	FB	MS	EMC

Drawing Title  
**Viaduct  
Terryland Area  
Indicative Deck Cross Section**

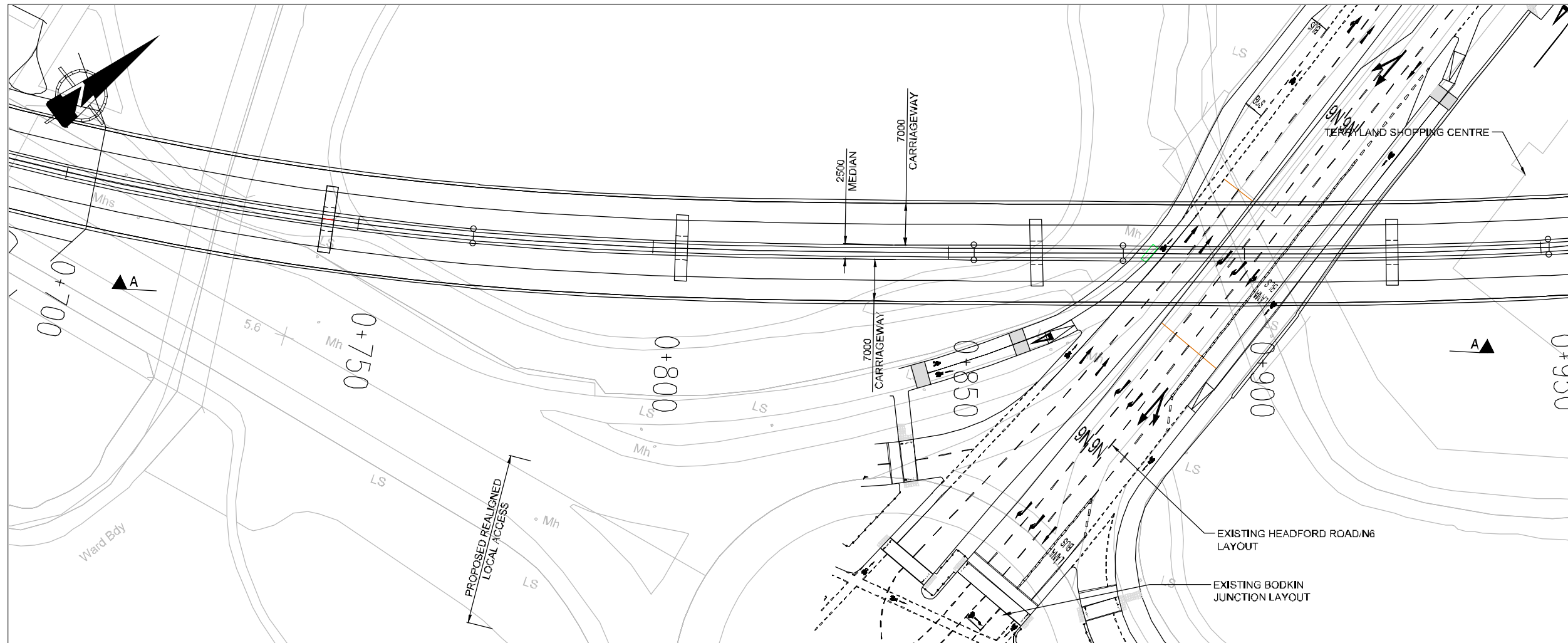
Drawing Status  
**Route Options**

Job No  
**233985-00**

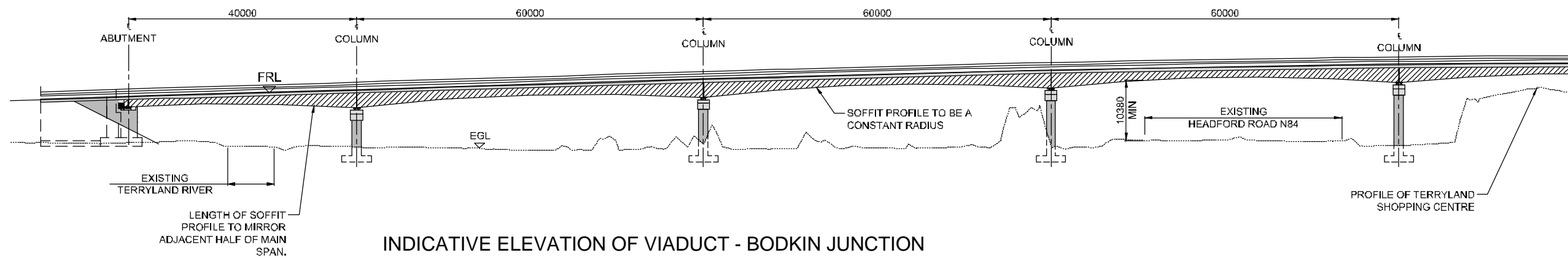
Drawing No  
**GCOB-100-R-1700-301**

Issue  
**11**

- NOTES:
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
  2. LEVELS SHOWN ARE INDICATIVE ONLY.



PLAN OF VIADUCT - BODKIN JUNCTION  
SCALE 1:400



INDICATIVE ELEVATION OF VIADUCT - BODKIN JUNCTION  
SCALE 1:400

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Job Title  
**N6 Galway City Transport Project**

Scale  
As Shown

Date  
September 2014

IT	Date	By	Chkd	Appd
-	30/09/2014	FB	MS	EMC
-	05/09/2014	FB	MS	EMC

Drawing Title  
**Viaduct  
Terryland Area  
Bodkin Junction Plan & Elevation**

Drawing Status  
**Route Options**

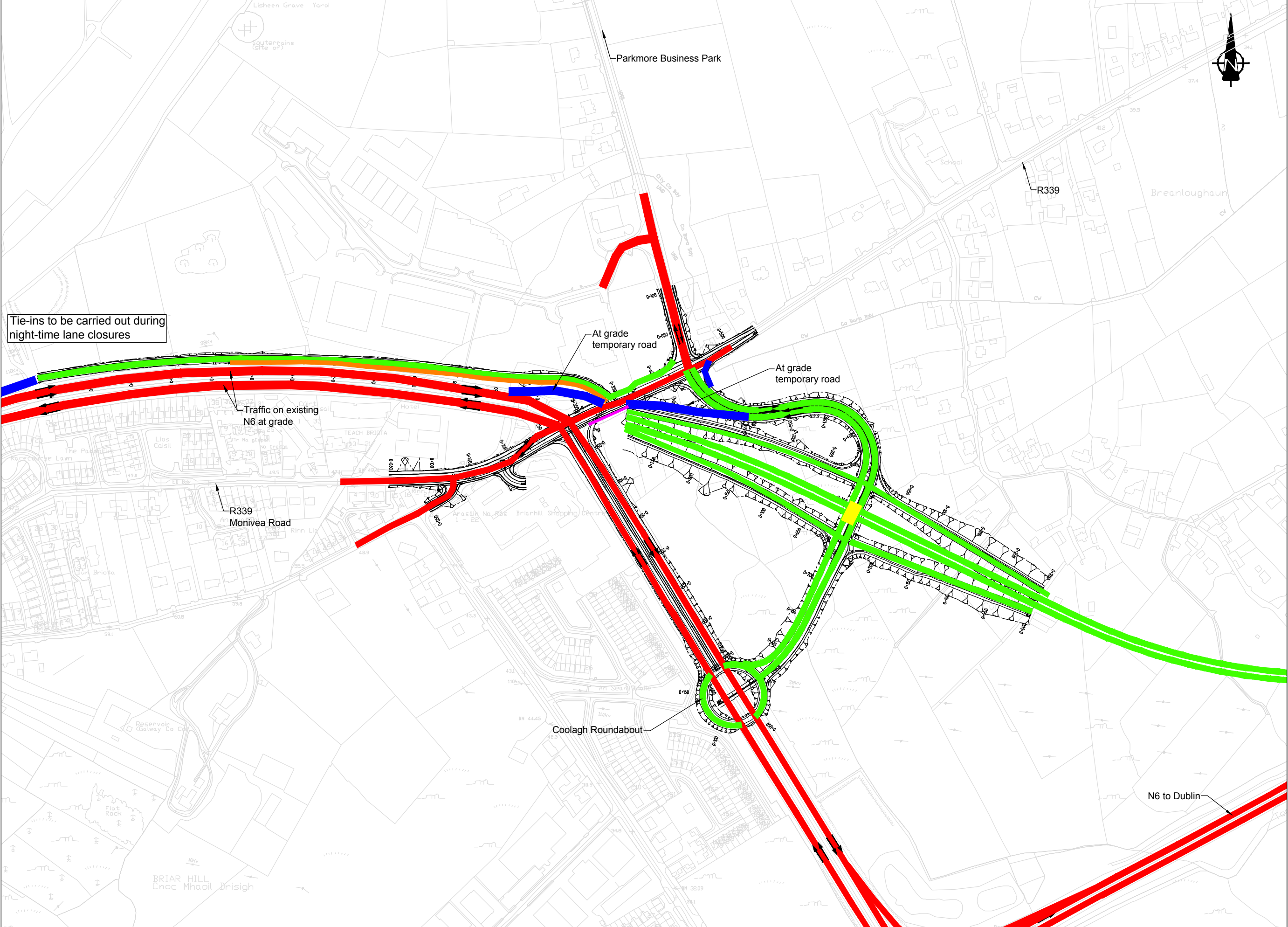
Job No  
**233985-00**

Drawing No  
**GCOB-100-R-1700-302**

Issue  
**11**

## Appendix D

### Traffic Management



**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

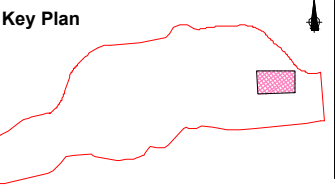
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Job Title  
**N6 Galway City Transport Project**

Scale **N.T.S.**

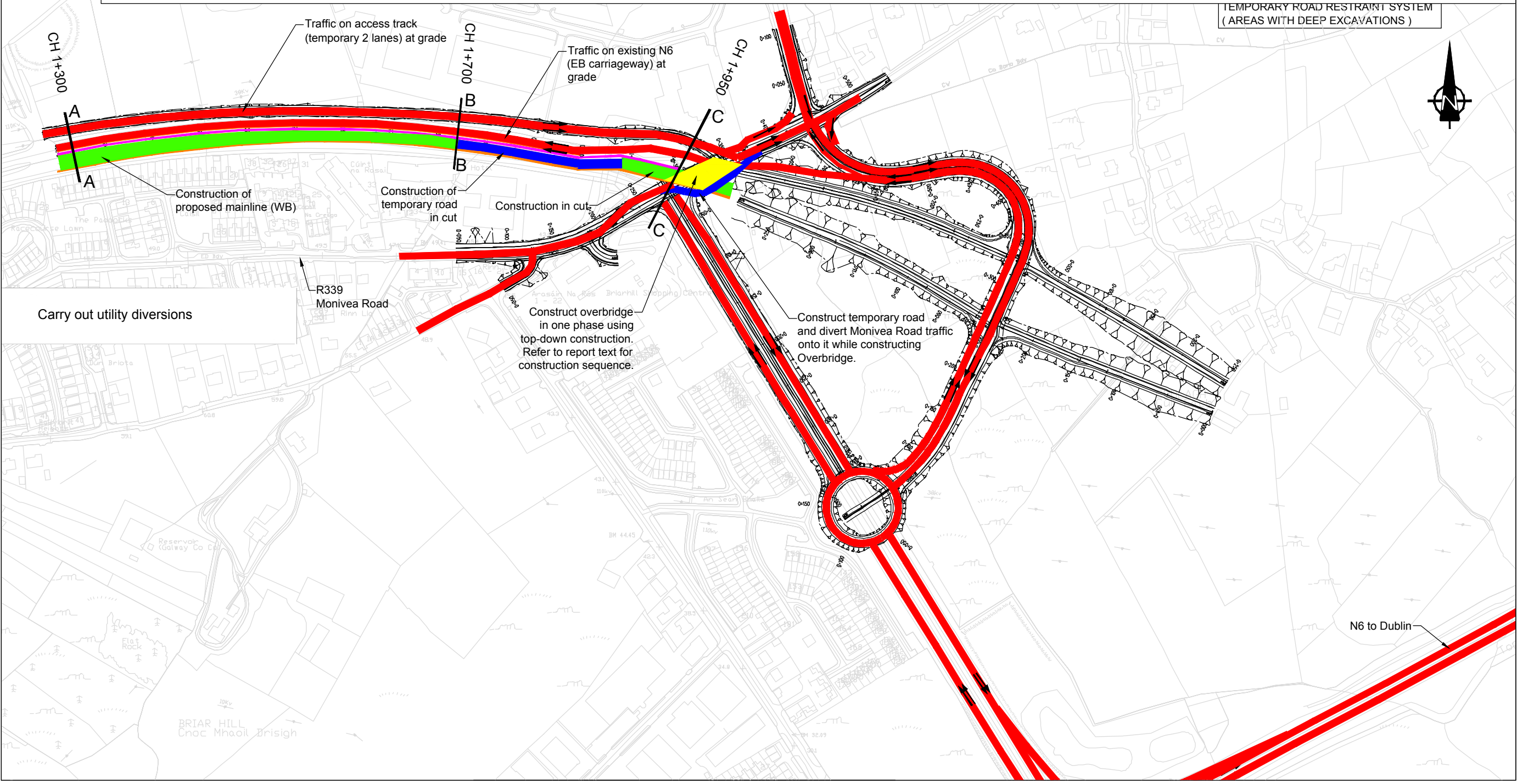
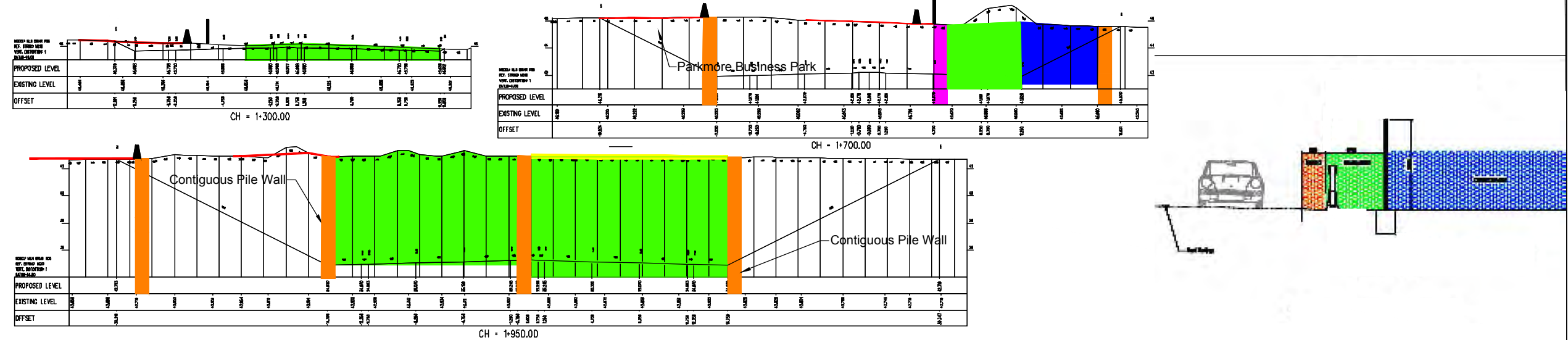
Date: **June 2015**

Issue	Date	By	Chkd	Appd
I1	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing  
Briarhill  
Phase 1**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-01</b>	Issue <b>11</b>
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TEMPORARY ROAD RESTRAINT SYSTEM (AREAS WITH DEEP EXCAVATIONS)

**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- ↑ TRAFFIC FLOW DIRECTION

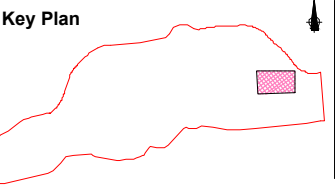
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**N6 Galway City Transport Project**

Scale: N.T.S.

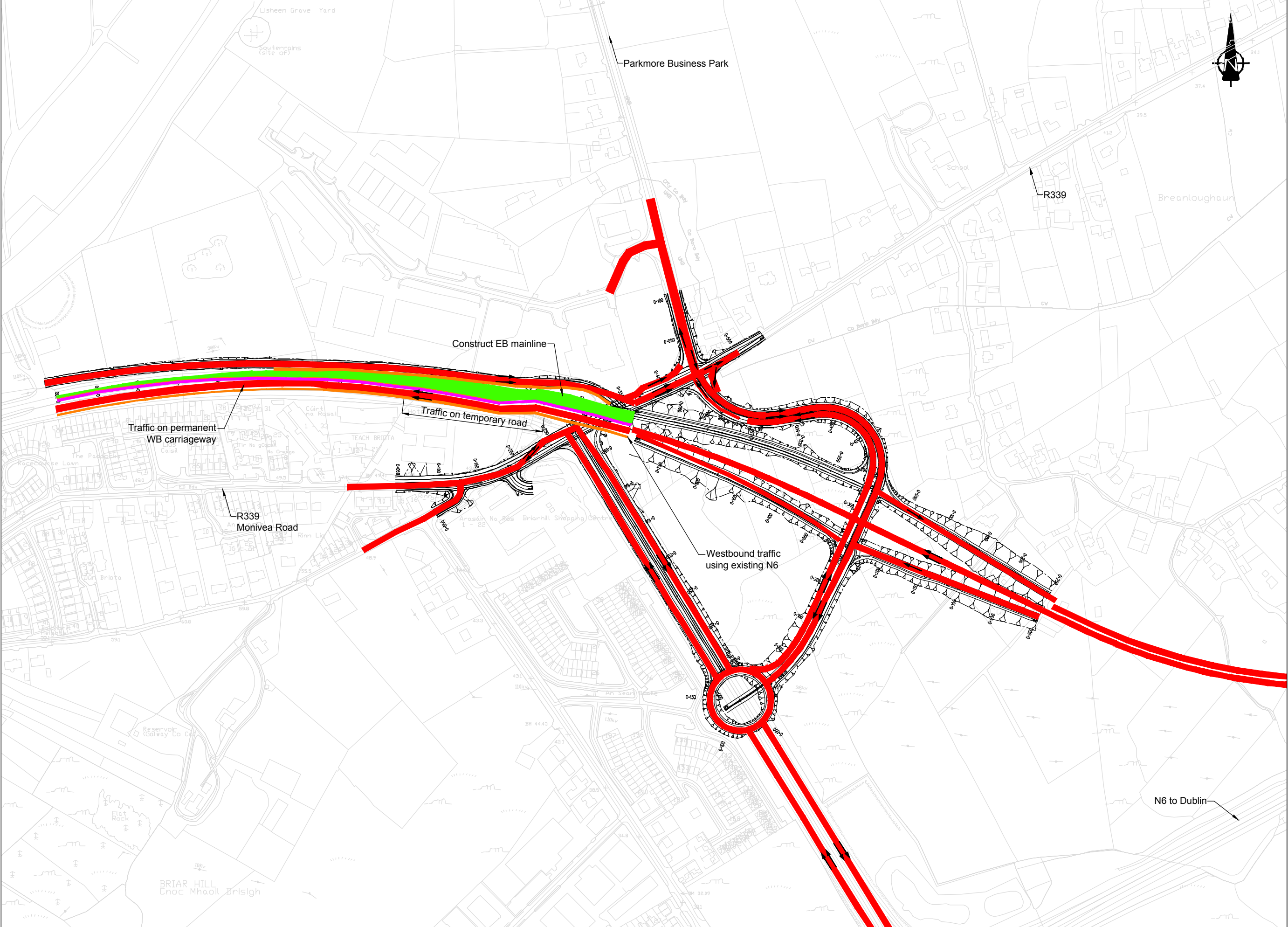
Date: June 2015

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing  
Briarhill  
Phase 2**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-02</b>	Issue <b>11</b>
----------------------------	---------------------------------------	--------------------



**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

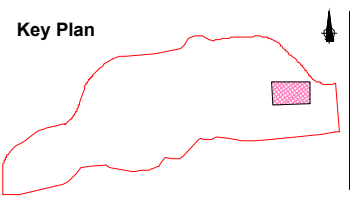
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Scale **N.T.S.**

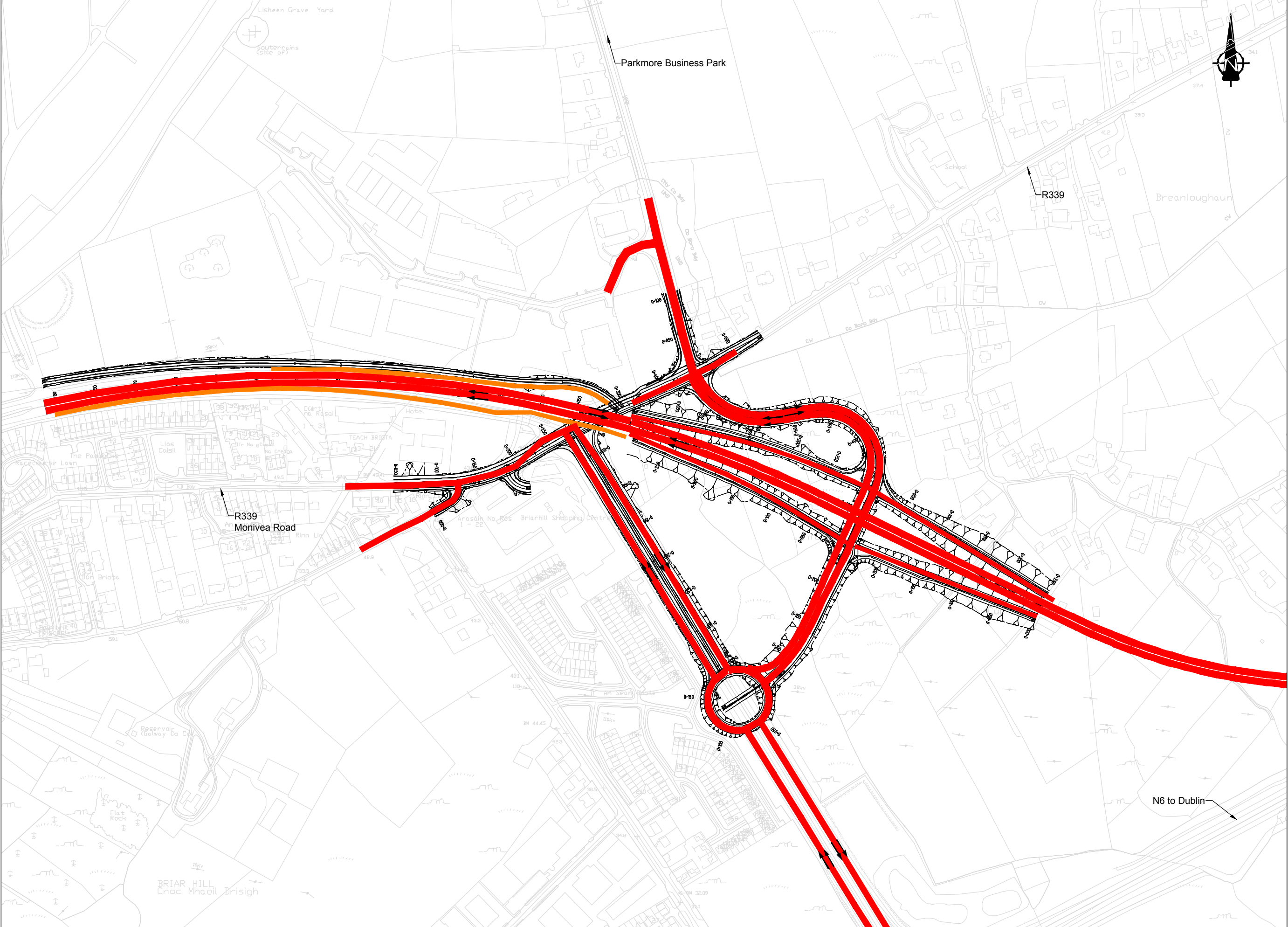
Date: **June 2015**

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing  
Briarhill  
Phase 3**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-03</b>	Issue <b>11</b>
----------------------------	---------------------------------------	--------------------



**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

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Job Title  
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Scale **N.T.S.**

Date: **June 2015**

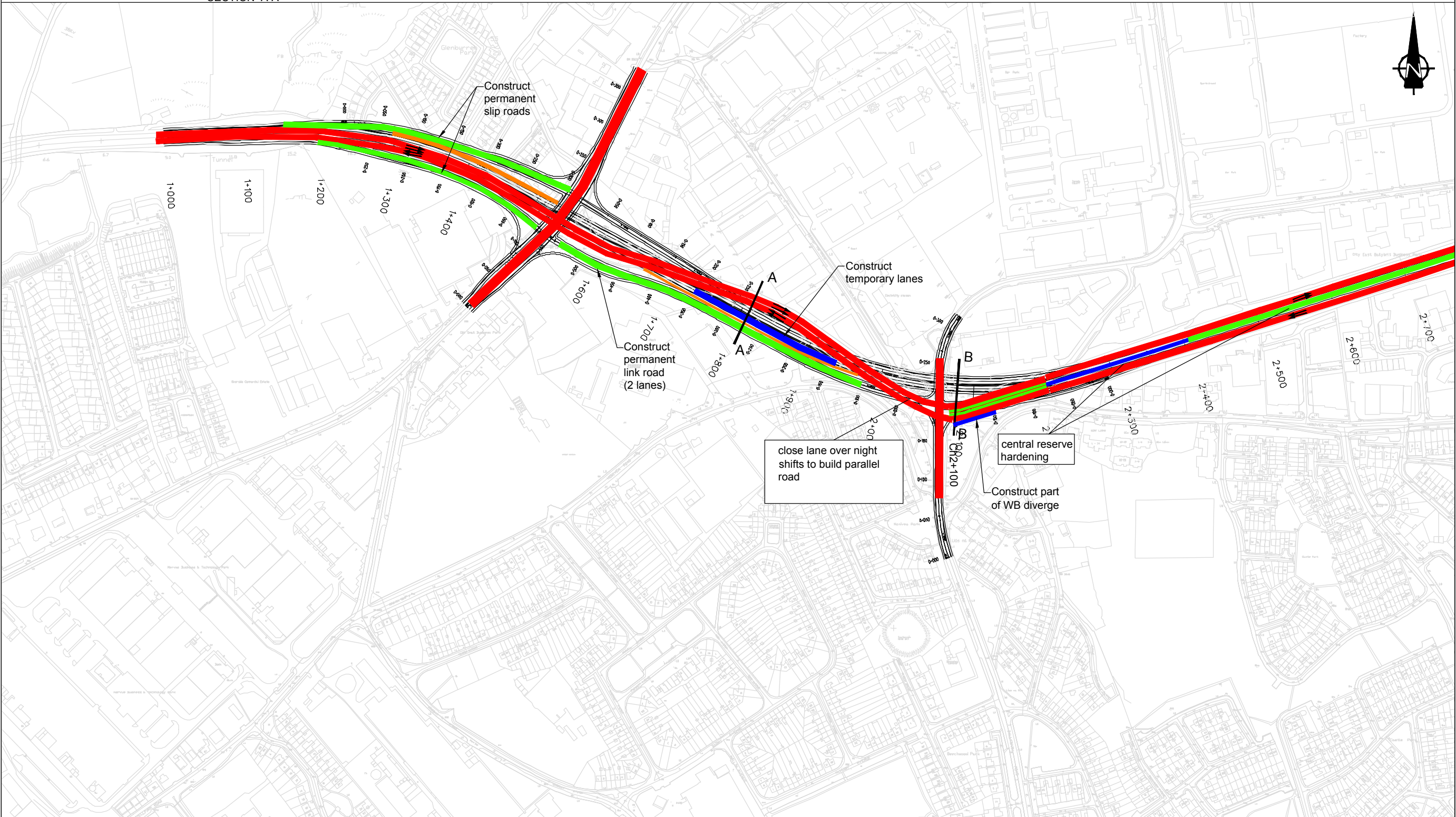
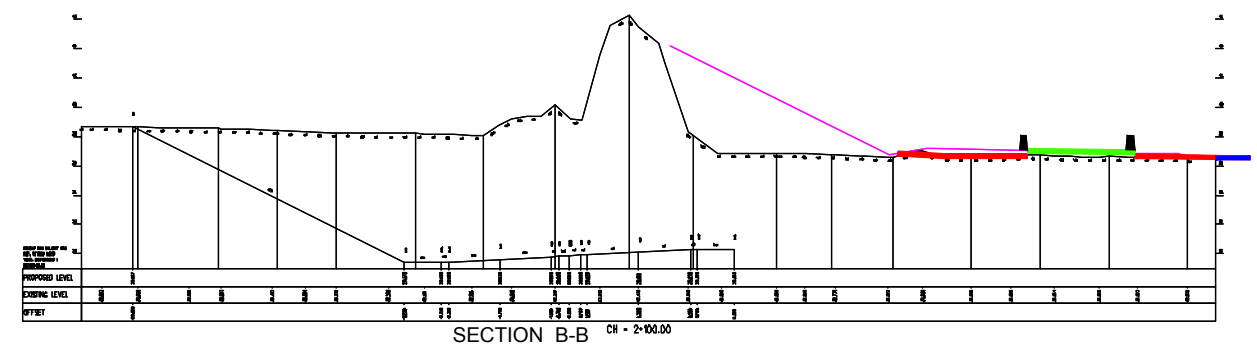
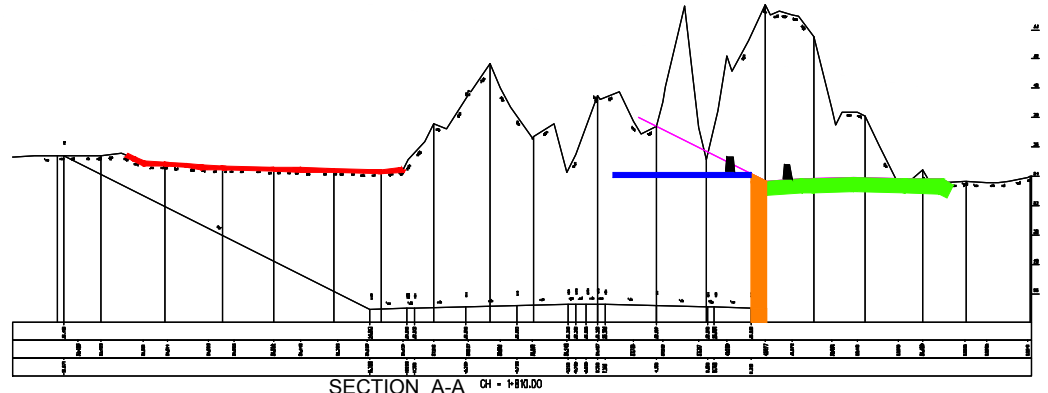
Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing  
Briarhill  
Completed Section**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-04</b>	Issue <b>11</b>
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**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

Son áireamh tá sonraíocht Shuirbhíreacht Ordánais Éireann arna áitíreacht faoi Cheadúnas OSI Uimh. 2010/15CCMA/Comhairle Contae na Gaillimhe. Sártaim ar áiteadun neamhláidraithe cúlcheart Shuirbhíreacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhíreacht Ordánais Éireann, 2010.

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Job Title  
N6 Galway City Transport Project

Scale N.T.S.

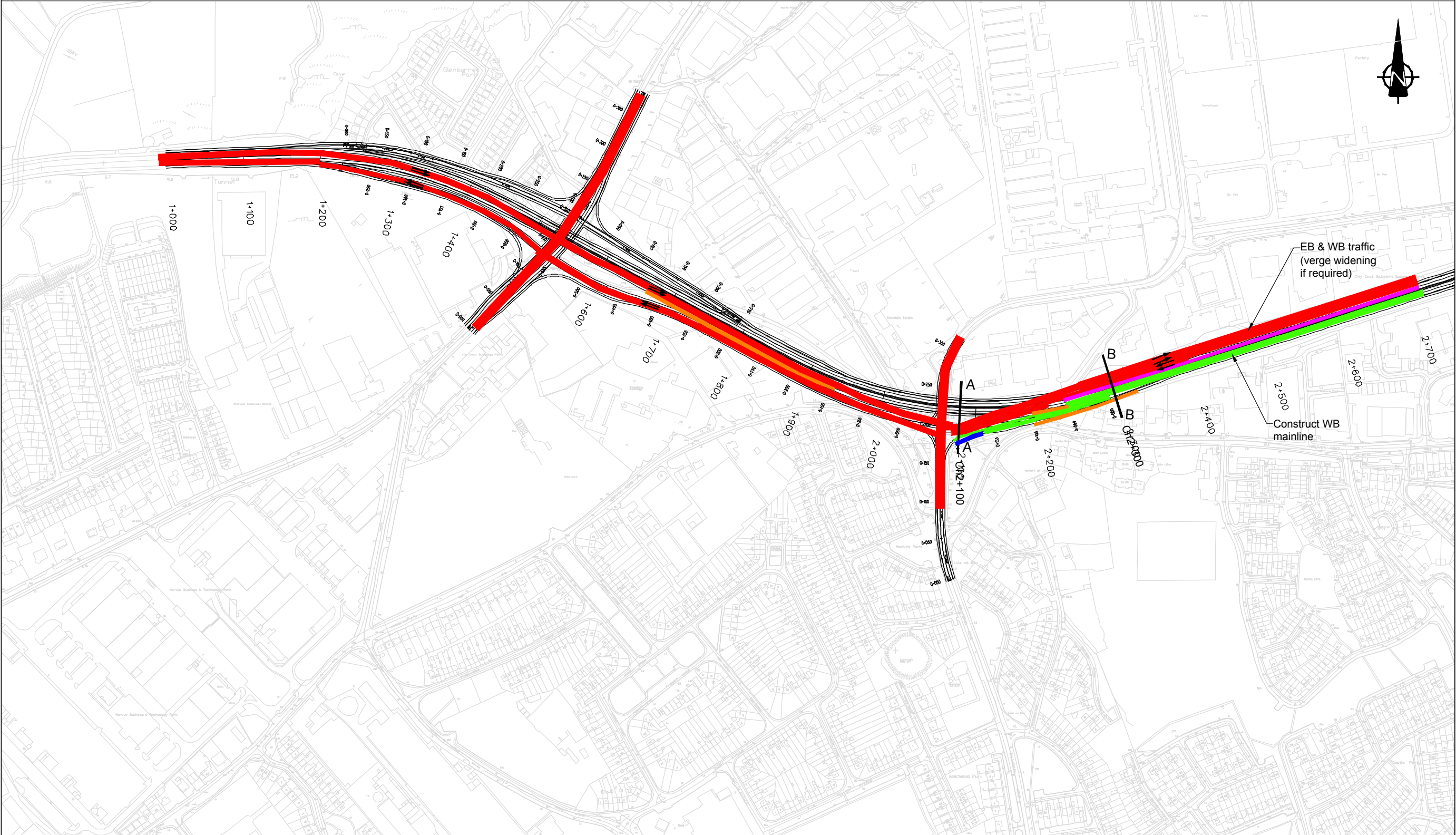
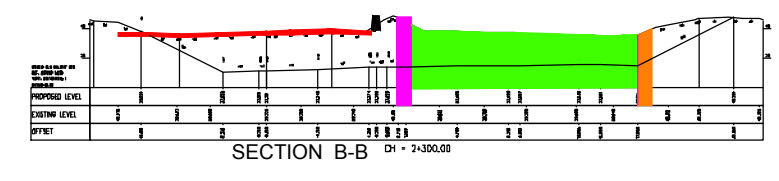
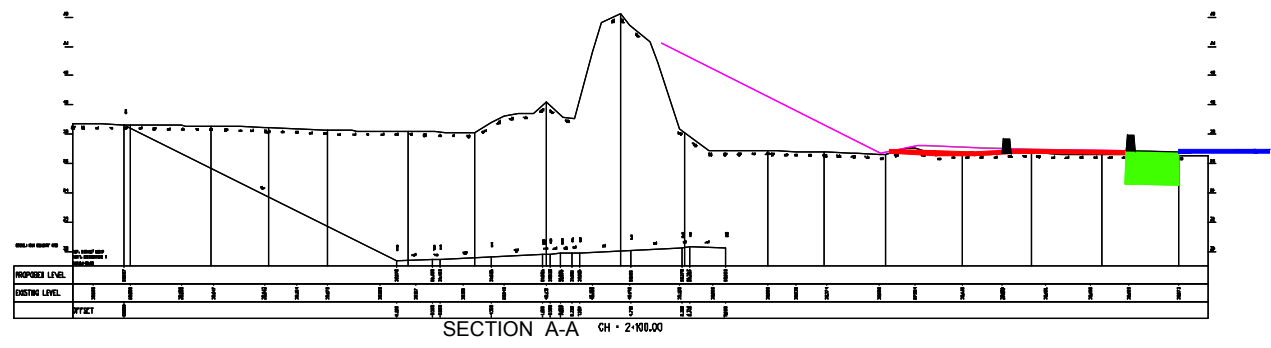
Date: June 2015

Issue	Date	By	Chkd	Appd
I1	26/06/2015	DM	SB	EMC

Drawing Title  
Construction Phasing  
N17 and Ballybrit  
Phase 1

Drawing Status  
Route Selection

Job No 233985-00	Drawing No GCOB-100-R-TM-05	Issue 11
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**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

*Son áireamh tá sonraíocht Shuirbhéireacht Ordánais Éireann arna atáirgeadh faoi Cheadúnas OSí Uimh. 2010/15SCMA/Comhairle Contae na Gaillimhe. Sártaoim aráirgeadh neamhláidraithe cóigeheart Shuirbhéireacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhéireacht Ordánais Éireann, 2010.*

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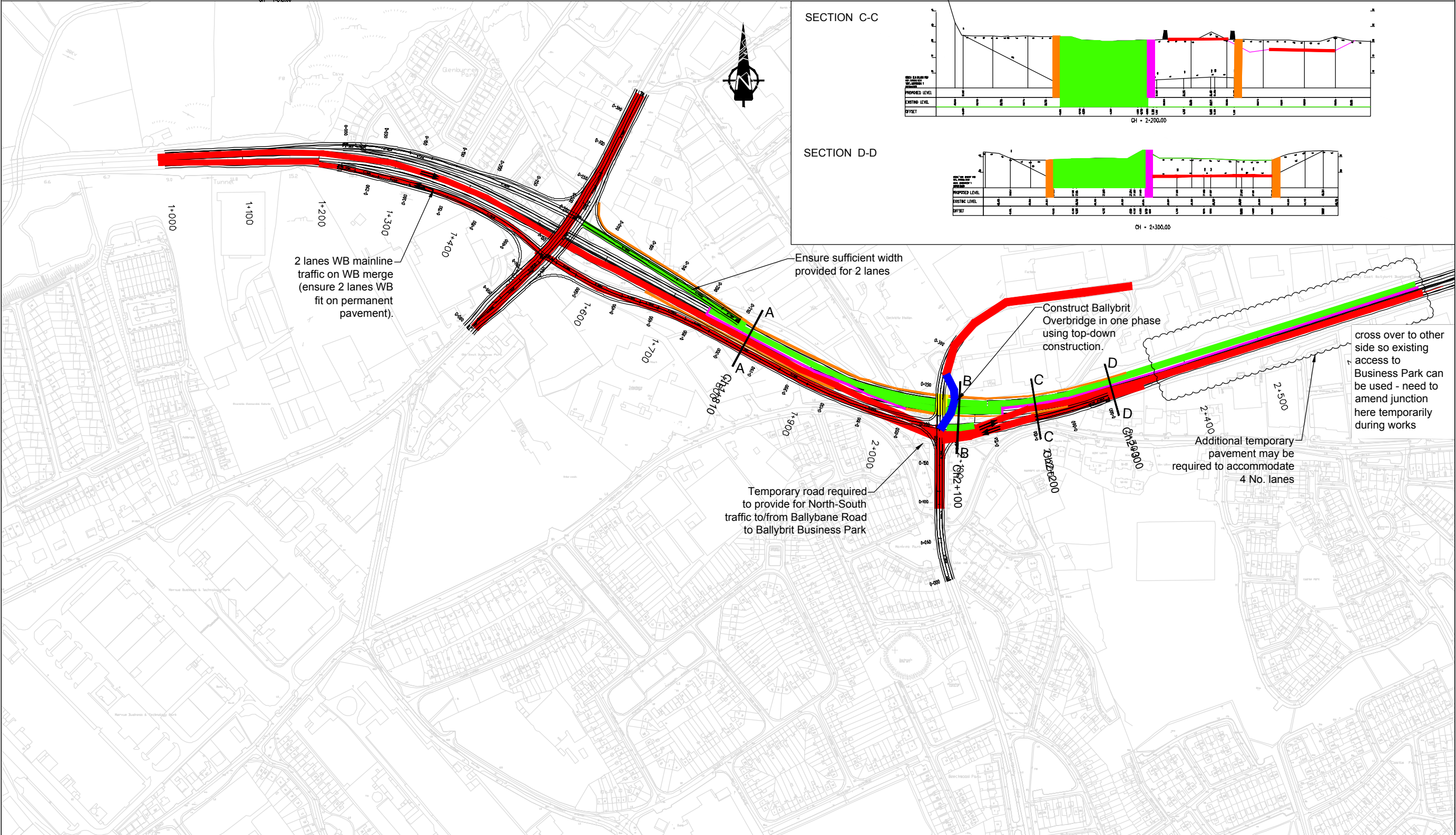
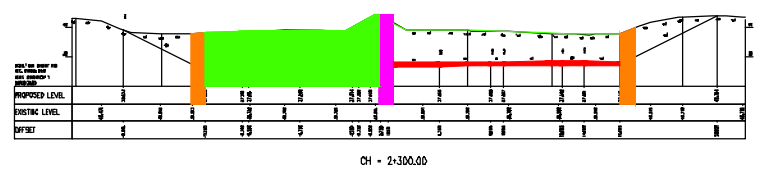
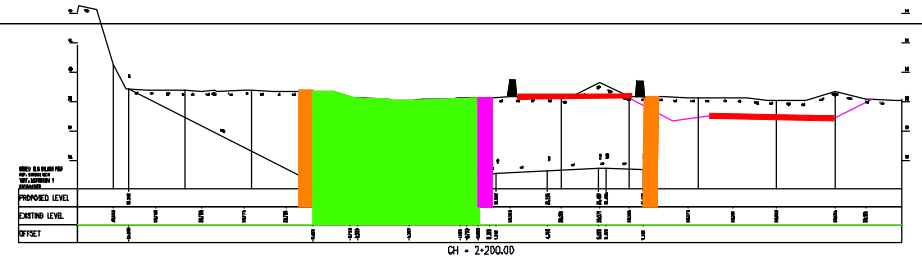
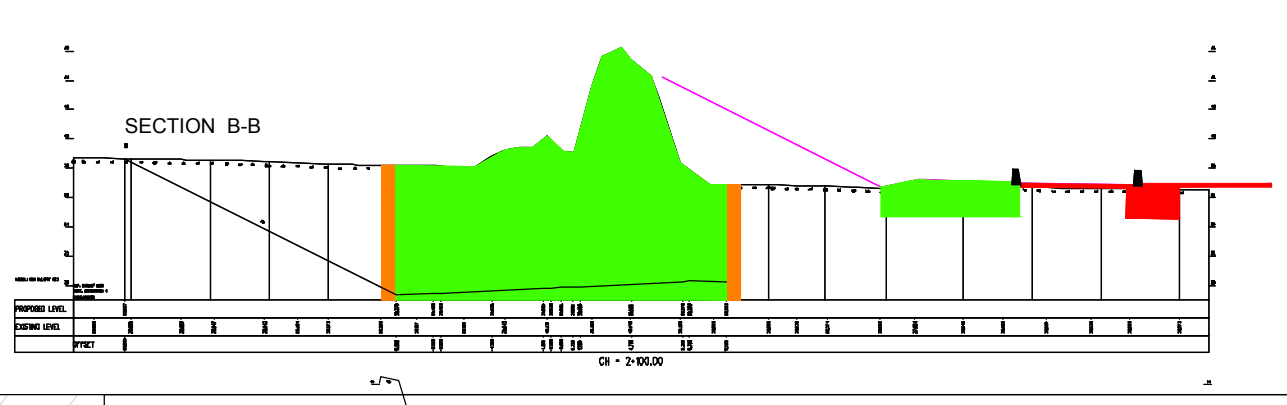
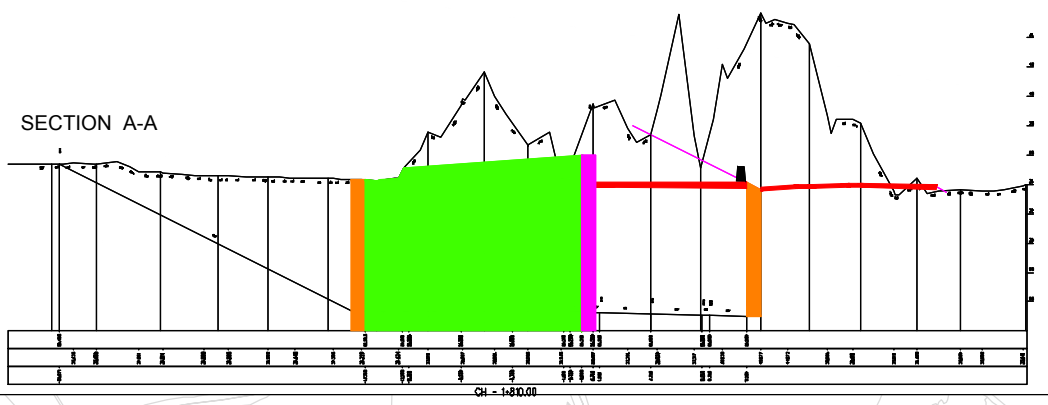
Date: June 2015

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
Construction Phasing  
N17 and Ballybrit  
Phase 2

Drawing Status  
Route Selection

Job No 233985-00	Drawing No GCOB-100-R-TM-06	Issue 11
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**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

San áireamh tá sonraíocht Shuirbhíreacht Ordánais Éireann arna áitíreacht faoi Cheadúnas OSI Uimh. 2010/15CCMA/Comhairle Contae na Gaillimhe. Sártaimh atáirgeadh neamhláidirithe cáilcheart Shuirbhíreacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhíreacht Ordánais Éireann, 2010.

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Job Title  
N6 Galway City Transport Project

Scale N.T.S.

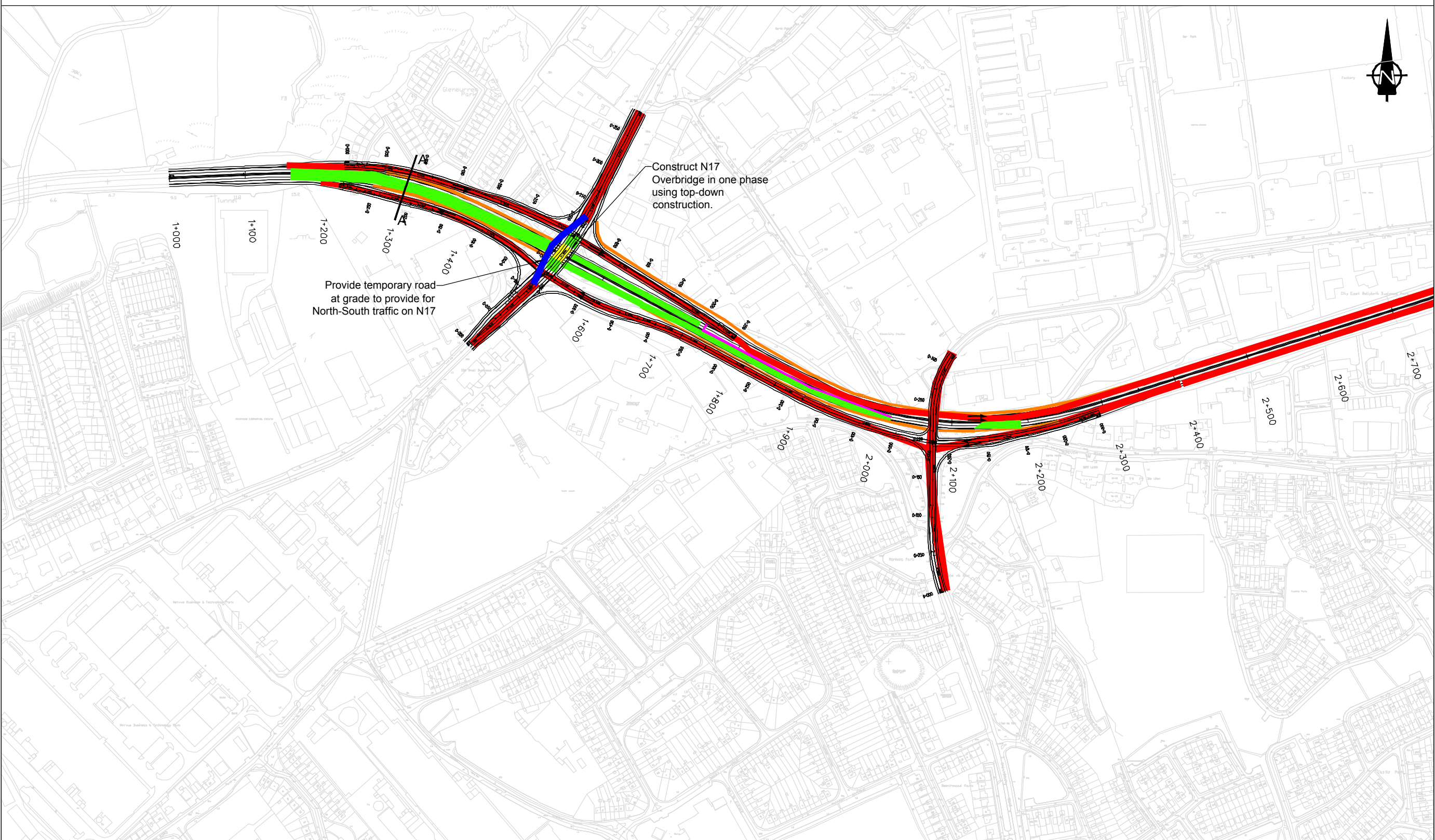
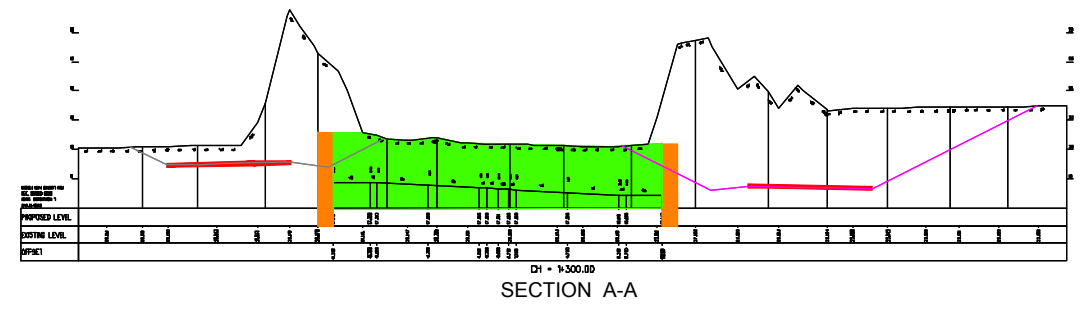
Date: June 2015

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
Construction Phasing  
N17 and Ballybrit  
Phase 3

Drawing Status  
Route Selection

Job No 233985-00	Drawing No GCOB-100-R-TM-07	Issue 11
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Construct N17 Overbridge in one phase using top-down construction.

Provide temporary road at grade to provide for North-South traffic on N17

**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- ↑↓ TRAFFIC FLOW DIRECTION

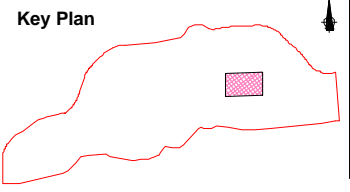
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Scale: N.T.S.

Date: June 2015

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing N17 and Ballybrit Phase 4**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-08</b>	Issue <b>11</b>
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**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

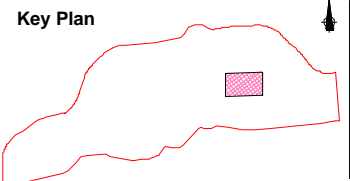
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Job Title  
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Scale **N.T.S.**

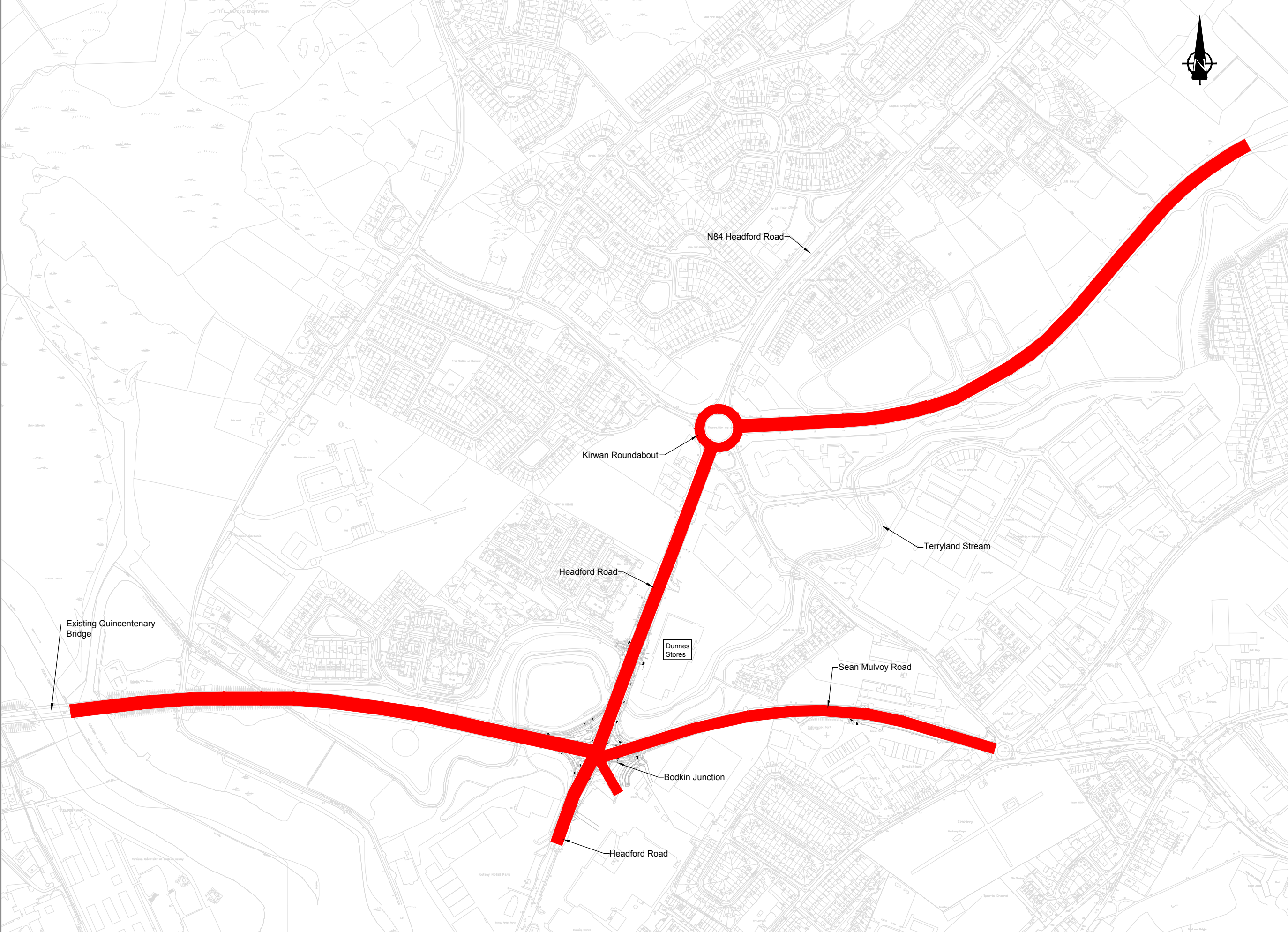
Date: **June 2015**

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing N17 and Ballybrit Complete Scheme**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-09</b>	Issue <b>11</b>
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**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

San áireamh tá sonraíocht Shuirbhíreacht Ordánais Éireann arna atáirgeadh faoi Cheadúnas OSí Uimh. 2010/15CCMA/Comhairle Contae na Gaillimne. Sártaimh atáirgeadh neamhláidirithe cúlcheart Shuirbhíreacht Ordánais Éireann agus Riailtas na hÉireann. © Suirbhíreacht Ordánais Éireann, 2010.

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Scale: N.T.S.

Date: June 2015

Issue	Date	By	Chkd	Appd
I1	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing  
Terryland  
Existing Scenario**

Drawing Status  
**Route Selection**

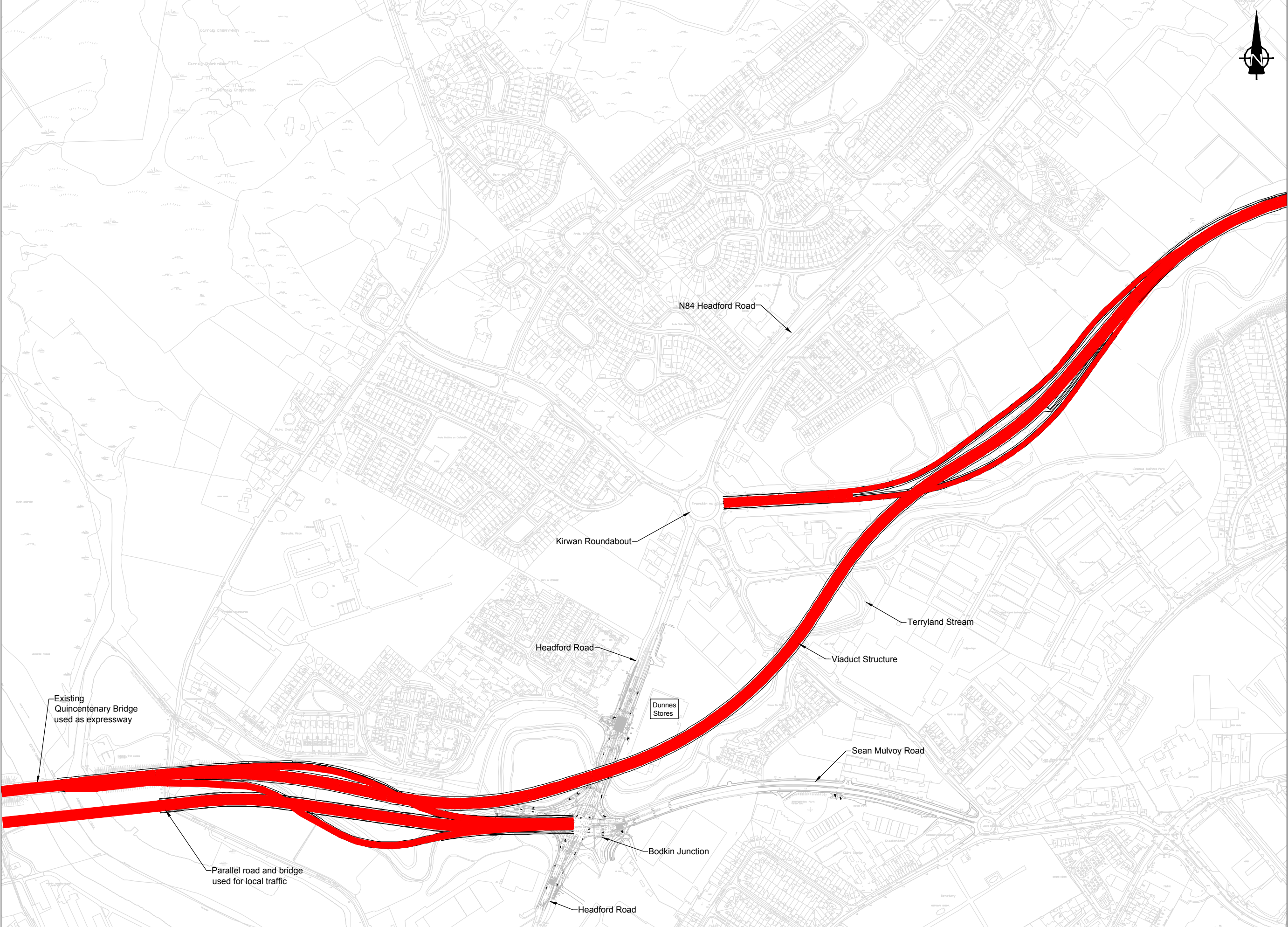
Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-10</b>	Issue <b>11</b>
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**LEGEND:**

- █ TRAFFIC FLOW
- █ CONSTRUCTION IN THIS TM PHASE
- █ INSTALL TEMPORARY ROAD
- █ CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- █ RETAINING WALL
- █ TEMPORARY RETAINING WALL
- TRAFFIC FLOW DIRECTION

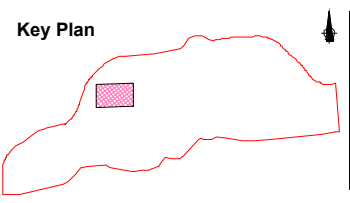
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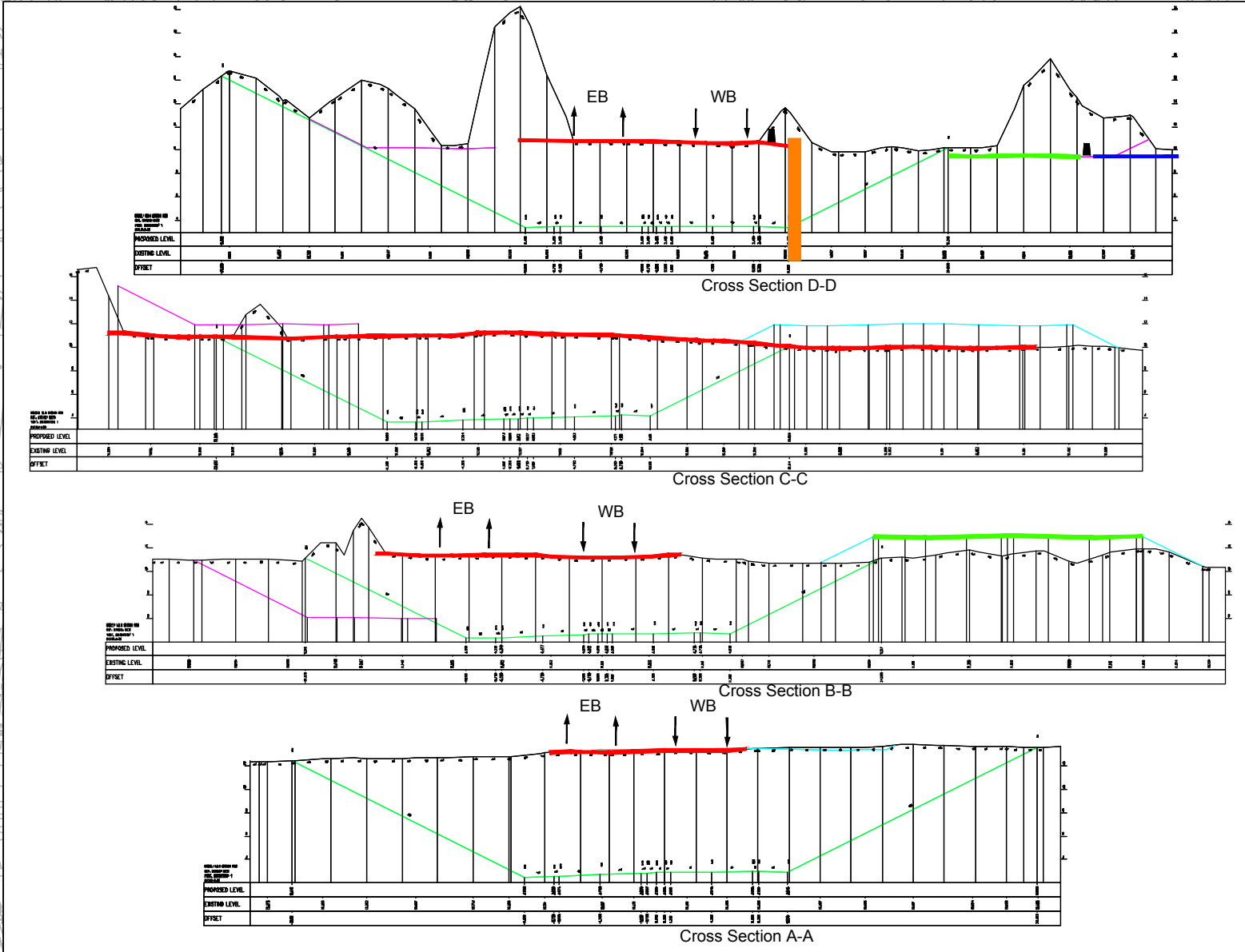
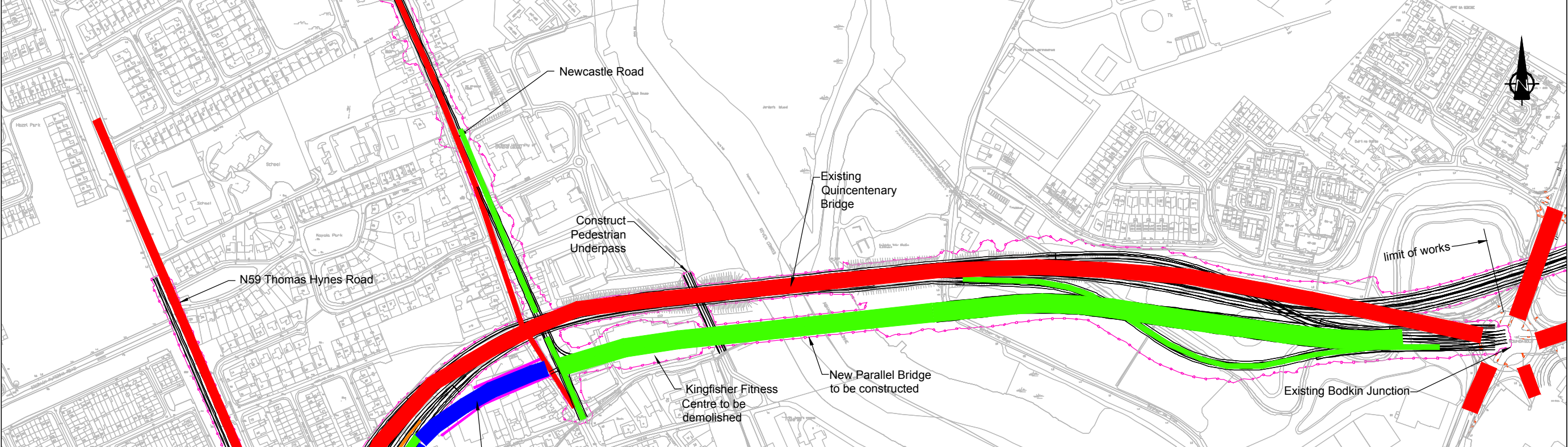
Date: **June 2015**

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing  
Terryland  
Completed Section**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-14</b>	Issue <b>11</b>
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**LEGEND:**

- █ TRAFFIC FLOW
- █ CONSTRUCTION IN THIS TM PHASE
- █ INSTALL TEMPORARY ROAD
- █ CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- █ RETAINING WALL
- █ TEMPORARY RETAINING WALL
- ↑↓ TRAFFIC FLOW DIRECTION

Son áireamh tá sonraíocht Shuirbhéireacht Ordánais Éireann arna atáirgeadh faoi Cheadúnas OSI Uimh. 2010/15CCMA/Comhairle Contae na Gaillimne. Sónaíonn atáirgeadh neamhdánaithe cáilcheart Shuirbhéireacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhéireacht Ordánais Éireann, 2010.

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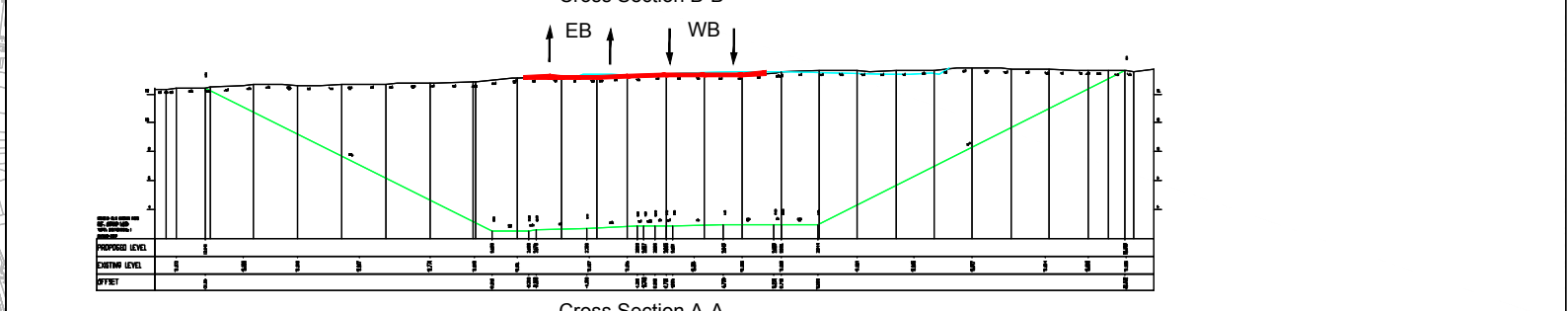
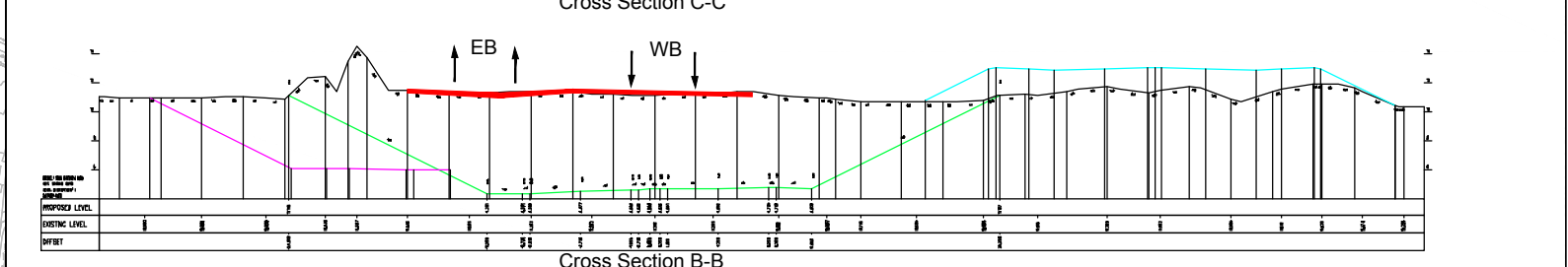
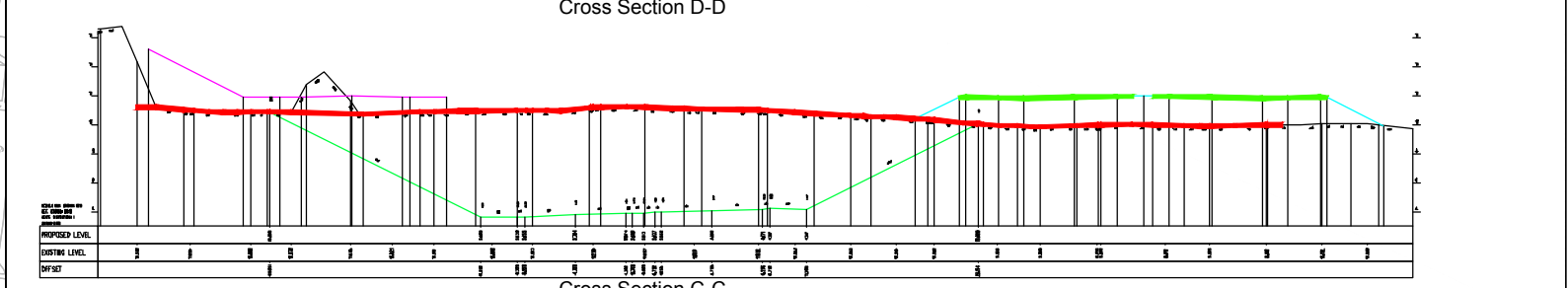
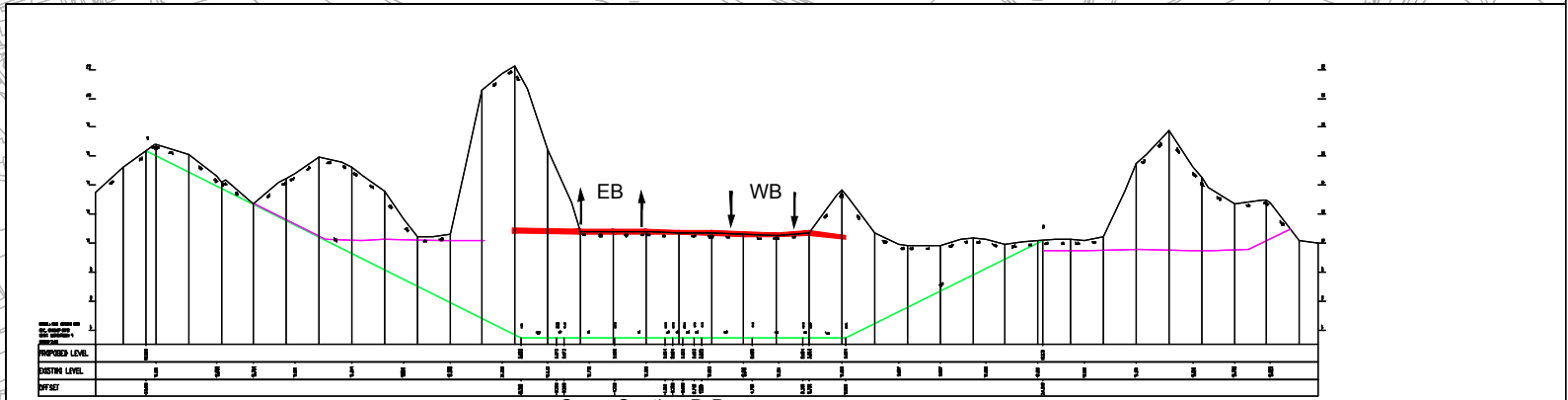
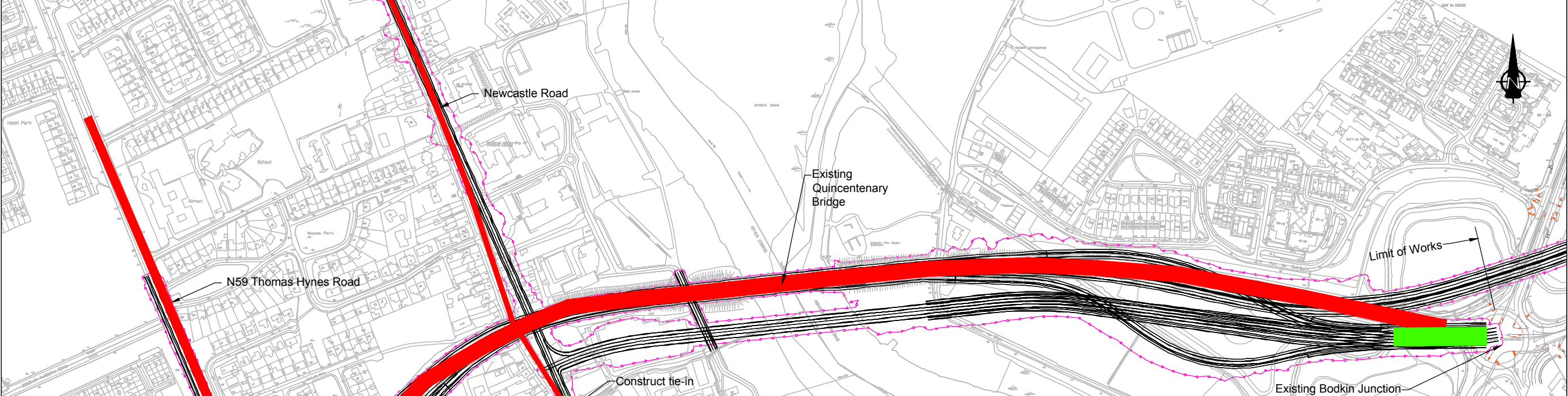
Date: June 2015

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
Construction Phasing  
Brown/Newcastle/Bodkin  
Phase 1

Drawing Status  
**Route Selection**

Job No 233985-00	Drawing No GCOB-100-R-TM-15	Issue 11
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**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- ↑ TRAFFIC FLOW DIRECTION

Son áireamh tá sonraíocht Shuirbhéireacht Ordánais Éireann arna atáirgeadh faoi Cheadúnas OSÍ Uimh. 2010/15CCMA/Comhairle Contae na Galillíne. Sárriamann atáirgeadh neamhdáiríthe cáilcheart Shuirbhéireacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhéireacht Ordánais Éireann, 2010.

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Scale N.T.S.

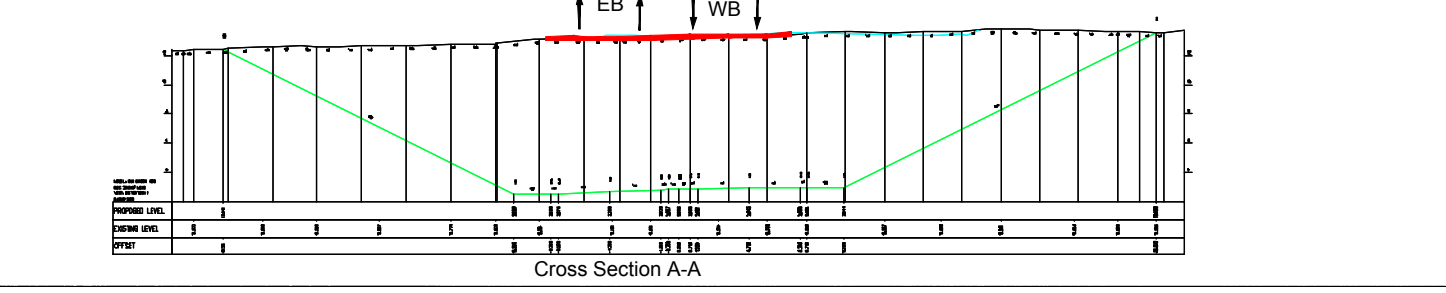
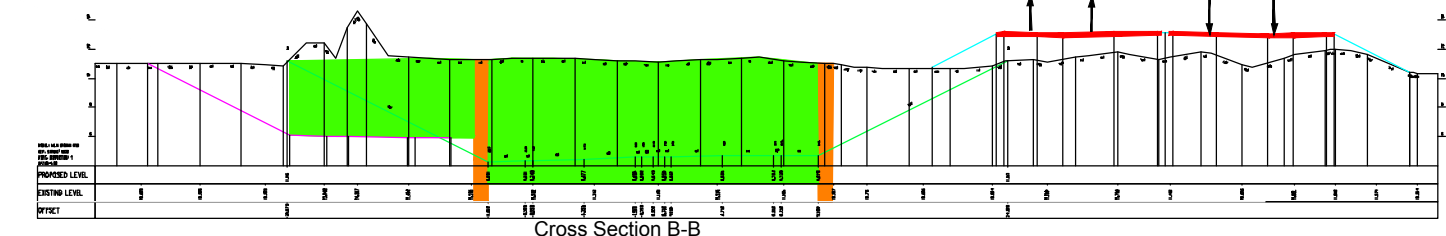
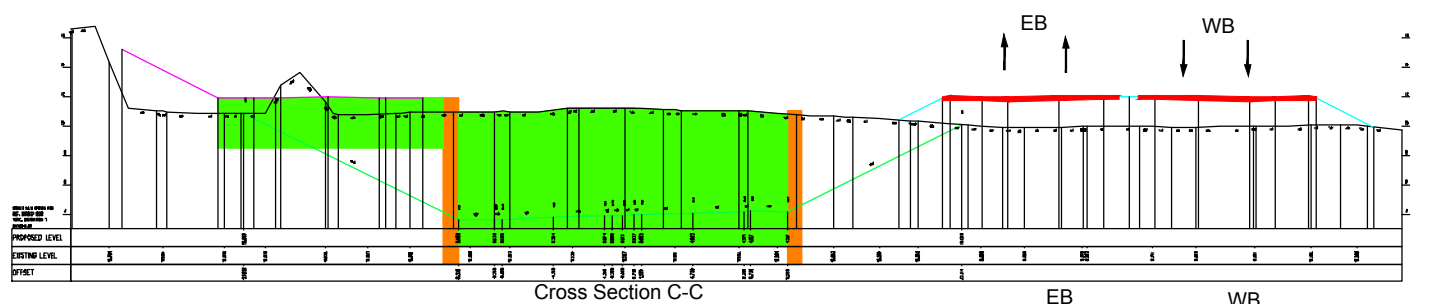
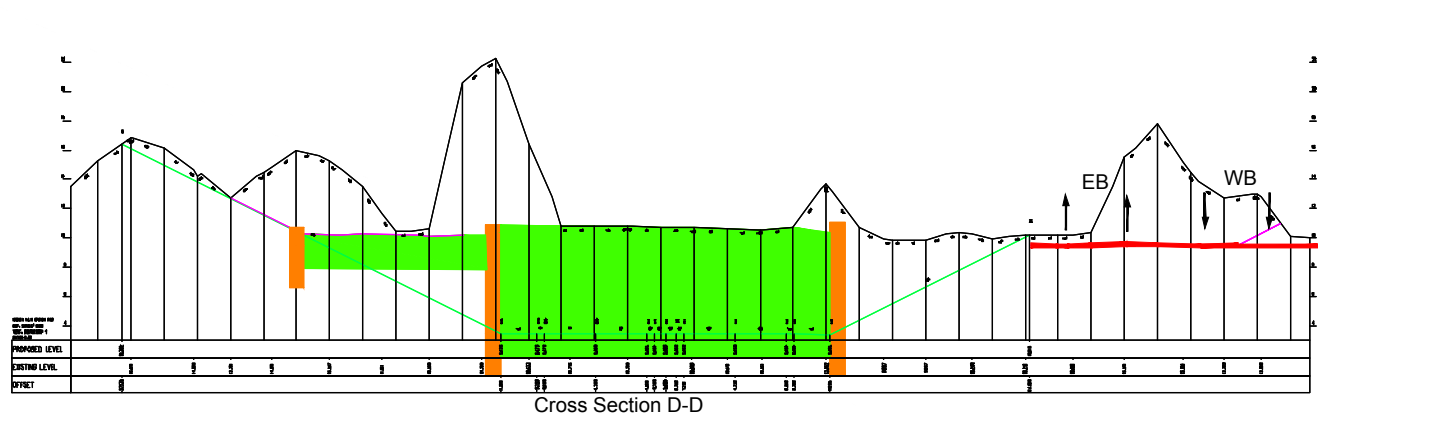
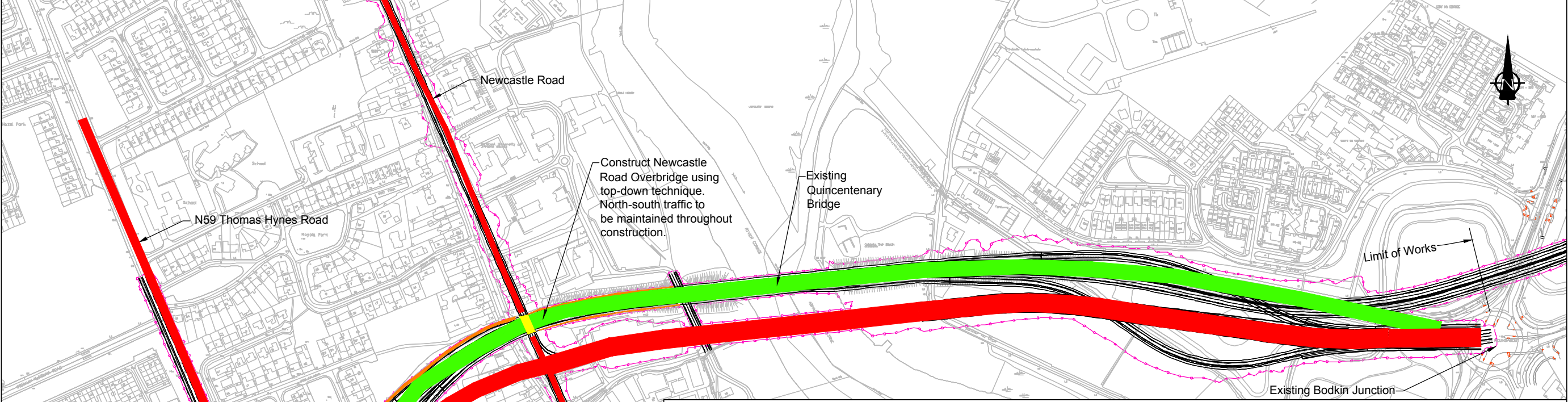
Date: June 2015

Issue	Date	By	Chkd	Appd
I1	26/06/2015	DM	SB	EMC

Drawing Title  
Construction Phasing  
Brown/Newcastle/Bodkin  
Phase 2

Drawing Status  
**Route Selection**

Job No 233985-00	Drawing No GCOB-100-R-TM-16	Issue 11
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**LEGEND:**

- █ TRAFFIC FLOW
- █ CONSTRUCTION IN THIS TM PHASE
- █ INSTALL TEMPORARY ROAD
- █ CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- █ RETAINING WALL
- █ TEMPORARY RETAINING WALL
- ↑ ↓ TRAFFIC FLOW DIRECTION

Son áireamh tá sonraíocht Shuirbhéireacht Ordánais Éireann arna atáirgeadh faoi Cheadúnas OSí Uimh. 2010/15CCMA/Comhairle Contae na Gaillimhe. Sárriamann atáirgeadh neamhdáraithe cáilcheart Shuirbhéireacht Ordánais Éireann agus Riailtas na hÉireann. © Suirbhéireacht Ordánais Éireann, 2010.

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**Nóta Séanta:**  
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Scale N.T.S.

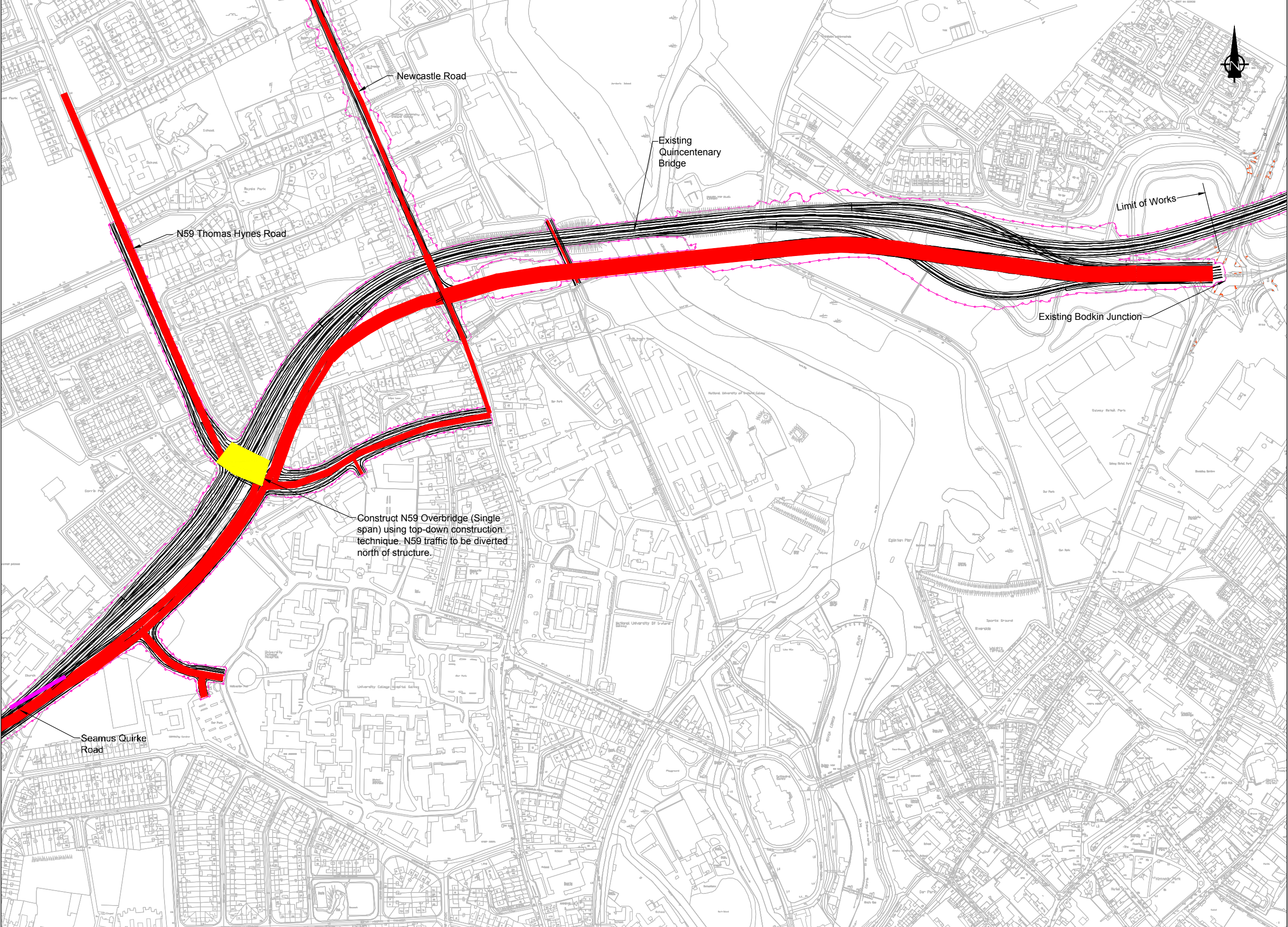
Date: June 2015

Issue	Date	By	Chkd	Appd
I1	26/06/2015	DM	SB	EMC

Drawing Title  
Construction Phasing  
Brown/Newcastle/Bodkin  
Phase 3

Drawing Status  
Route Selection

Job No 233985-00	Drawing No GCOB-100-R-TM-17	Issue 11
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Construct N59 Overbridge (Single span) using top-down construction technique. N59 traffic to be diverted north of structure.

**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- - - TEMPORARY RETAINING WALL
- ↑ ↓ TRAFFIC FLOW DIRECTION

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**N6 Galway City Transport Project**

Scale: N.T.S.

Date: June 2015

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing  
Brown/Newcastle/Bodkin  
Phase 4**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-18</b>	Issue <b>11</b>
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**LEGEND:**

- TRAFFIC FLOW
- CONSTRUCTION IN THIS TM PHASE
- INSTALL TEMPORARY ROAD
- CONSTRUCTION IN THIS TM PHASE (STRUCTURES)
- RETAINING WALL
- TEMPORARY RETAINING WALL
- ↑↓ TRAFFIC FLOW DIRECTION

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Job Title  
**N6 Galway City Transport Project**

Scale **N.T.S.**

Date: **June 2015**

Issue	Date	By	Chkd	Appd
11	26/06/2015	DM	SB	EMC

Drawing Title  
**Construction Phasing  
Brown/Newcastle/Bodkin  
Completed Scheme**

Drawing Status  
**Route Selection**

Job No <b>233985-00</b>	Drawing No <b>GCOB-100-R-TM-19</b>	Issue <b>11</b>
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