# Route Selection Report

Galway City Transport Project

## Executive Summary

March 2016

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

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Comhairle Cathrach na Gaillimhe
Galway City Council

Comhairle Chontae na Gaillimhe
Galway County Council

ARUP

## List of Volumes

Executive Summary

Volume 1A – Route Selection Report – Part 1

Volume 1B – Route Selection Report – Part 2

Volume 2 – Figures

Volume 3A – Appendices – Part 1

Volume 3B – Appendices – Part 2

Volume 3C – Appendices – Part 3

Volume 3D – Appendices – Part 4

# Contents

# 1 Introduction

## 1.1 Overview

Galway County Council, Galway City Council, Transport Infrastructure Ireland (formerly known as National Roads Authority) and the National Transport Authority are collaborating in developing a solution to the existing transportation issues in Galway City and its environs. The transportation solution will include a smart mobility component, public transport component and a road component. This report presents the findings of the Constraints and Route Selection study for the proposed N6 Galway City Transport Project (GCTP) which is the road component of the transportation solution.


In parallel to the N6 GCTP, the National Transport Authority is engaged with Galway City Council in developing the smart mobility and public transport components of the overall transportation solution (known as the Galway City Integrated Transport Management Programme (ITMP)). Whilst the N6 GCTP will integrate with the ITMP, the route selection process is a stand-alone process and is not reliant on the other components of the ITMP as studies to date have indicated that a road component will form part of the overall transportation solution.

The Route Selection Report presents the findings of the Constraints and Route Selection study for the proposed N6 GCTP. The purpose of this report is to document the process used to select the Emerging Preferred Route Corridor (EPRC) and includes full details on the following:

- Identification of a suitable scheme study area;
- Identification of constraints;
- Development of feasible options;
- Assessment of all feasible options; and
- Selection of a preferred route corridor.

Detailed assessment of the potential impacts of the EPRC will be documented in the Environmental Impact Statement (EIS) as part of the Environmental Impact Assessment process. All of the options in the Route Selection Report were examined using sufficient data to assess their feasibility and to allow an equal comparison of all of the route options developed. The National Roads Authority (NRA) Project Management Guidelines (PMGs) have been used as guidance for the layout and contents of the Route Selection Report.

The NRA 2010 PMGs contain a framework for the phased approach to the development, management and delivery of major national road schemes in Ireland. They are structured so as to ensure consistency in this approach throughout the entire network. The Guidelines are divided into seven phases namely:

- Phase 1 Scheme Concept & Feasibility Studies;
- Phase 2 Route Selection, Phase 3 Design;
- Phase 4 EIA & The Statutory Processes;
- Phase 5 Advance Works & Construction Documents Preparation, Tender & Award;
- Phase 6 Construction & Implementation; and
- Phase 7 Handover, Review & Closeout.

Arup are currently engaged in Phase 2 of the N6 Galway City Transport Project and the Route Selection Report (RSR) documents the findings of Phase 2 Route Selection.

The Route Selection Report (RSR) is split in to three volumes, the main report text is contained within Volume A, the accompanying figures in Volume B and the appendices in Volume C. The main report is further split into two parts namely Part 1 and Part 2. The appendices are also split into two parts.

## Phase 1
April 2014

**Feasibility Study**

**Constraints Study**

**Consideration of all Options**

**Public Consultation No. 1**

Do-Nothing Option

Smarter Travel Option

Public Transport Option

Road Option

Do-Minimum Option

## Phase 2
February 2015

**Project Appraisal of Feasible Options**

**Public Consultation No. 2**

## Phase 3
April 2015

**Selection of Preferred Option**

**Public Display**

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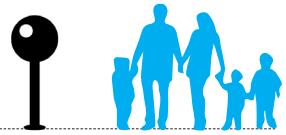

## Phase 3
August 2015

**Publish Route Selection Report**

**Design**

**EIA & The Statutory Process (CPO)**

## Phase 4
Q1 2016

**Application to An Bord Pleanála**

**Oral Hearing**

## Phase 4

**Decision**

## Phase 5

**Detailed Design & Land Acquisition**

## Phase 6

**Construction**

## 1.2 Background

The resolution of the transportation issues in Galway City and its environs has been an objective of both Galway City Council and Galway County Council since 1999. Consultants were appointed in 1999 to undertake feasibility studies, route selection, design and planning for the N6 Galway City Outer Bypass. The resultant scheme including the Compulsory Purchase Order (CPO) and Environmental Impact Statement (EIS) was submitted to An Bord Pleanála (ABP) on 1 December 2006. This scheme consisted of 21.4km of mainline, 9km of link roads, associated intersections and a major bridge crossing of the River Corrib. This scheme is referenced as the N6 Galway City Outer Bypass (2006) or using the acronym of 2006 GCOB throughout this report.

On 28 November 2008, ABP delivered its decision in respect of the N6 Galway City Outer Bypass (2006). ABP granted approval for only part of the scheme, the section from the N59 east to the existing N6, inclusive of both junctions at the N59 and the N6. In their decision, ABP noted their consideration of all data presented and granted partial approval as it considered that the part of the road development being approved would be an appropriate solution to the identified traffic needs of the city and surrounding area. ABP noted that there would be a localised severe impact on the Lough Corrib candidate Special Area of Conservation but that this did not adversely affect the integrity of this candidate Special Area of Conservation.

ABP refused permission for the section of the scheme from the R336 west of Bearna to the N59 (western section). ABP considered that the need for an outer bypass of Galway City connecting the N6 on the east to the R336 coast road as an essential part of the strategic transport network of the Galway area had been established. However, ABP was not satisfied with the section of the proposed road development through Tonabrocky Bog which is:

a. part of the Moycullen Bogs Natural Heritage Area (NHA);

b. an active Blanket bog listed as an priority habitat in Annex I of the EU Habitats Directive; and

c. the site of a population of Slender cotton grass which is a legally protected and vulnerable species.

ABP refused the western section of the scheme on the basis that this part of the road development would not be in accordance with the preservation of the Tonabrocky habitat given the potential for significant adverse effects on the environment and that less damaging alternatives may be available.

An application was made by a third party to the High Court seeking leave to issue judicial review proceedings against the ABP decision which granted approval of the eastern section of the N6 Galway City Outer Bypass (2006). The basis for the request for a review was that ABP erred in its interpretation of Article 6 of the Habitats Directive in arriving at the conclusion that the effect of the road scheme on the Lough Corrib cSAC designated site would not constitute an adverse effect on the integrity of the site.

The High Court undertook a judicial review of the ABP decision. The High Court decision of 9 October 2009 upheld ABP's decision to approve the eastern part of the scheme. On 6 November 2009, the third party was granted leave to appeal to the Supreme Court against the High Court decision of 9 October 2009. The Supreme Court sought the opinion of the Court of Justice of the European Union (CJEU) on an interpretation of the Habitats Directive.

The judgment of the CJEU was delivered on the 11 April 2013. The conclusions which can be drawn from this judgment are as follows:

1. The N6 Galway City Outer Bypass (2006) would have a significant adverse impact on the integrity of the Lough Corrib cSAC due to the removal of 1.5ha of Limestone pavement; and

2. Given that the N6 Galway City Outer Bypass (2006) would have a significant adverse impact on the integrity of the cSAC, the correct planning process should be under Article 6(4) as opposed to Article 6(3).

Following receipt of the CJEU opinion, the Supreme Court quashed the earlier ABP decision. Therefore, the process of developing a transportation solution for Galway City and its environs recommenced at Phase 1, feasibility and concept stage.

Arup was appointed in November 2013 to provide multi-disciplinary engineering consultancy services to include feasibility studies, examination of documents and court rulings relating to the earlier unsuccessful scheme (N6 Galway City Outer Bypass (2006)), route selection, detailed design and final submission of a planning application for a revised scheme.

## 1.3 Identification of Problem

Initial feasibility studies focused on gathering information and data from a wide variety of sources and utilising various mechanisms in order to fully understand the transportation issues in Galway. This work included but was not limited to the following:

- Review of previous scheme;
- Review of current policy documents;
- Review of existing traffic data;
- Review of existing public transport options;
- Examination of existing travel patterns;
- Review of 2011 Census data for Galway and environs; and
- Site visits in Galway.

The feasibility studies identified problems in Galway City and its environs which are interlinked and intertwined and can be summarised as follows:

- Congestion of major routes through the city;
- Journey time unreliability due to uncertain quantum of delay;
- Journey time variability throughout the day;
- Peak hour traffic delays;
- By-passable traffic is in conflict with internal traffic;
- Inadequate transport links to access markets within the city;
- Inadequate transport links, including public transport connections from Galway City onwards to Connemara; and
- Lack of accessibility to the Western Region as a whole.

## 1.4 Scheme Objectives

The overall scheme objective is to provide a holistic transport solution for Galway City and its environs which will benefit both Galway and the western region whilst taking due care of the sensitive environment of the western region.

Overall scheme objectives were established as follows:

- Support the economic performance of Galway City as a gateway to the west, the Gaeltacht areas and Connemara, and the consequent socio-economic benefits of enhanced connectivity of Galway City to national markets, enhanced tourism accessibility, and the national transport system;
- Support the development of Galway City as a Gateway and a driver of development in the West Region in order to deliver balanced regional development to counterbalance the Eastern Region;
- Preserve existing well established communities whilst trying to minimise impacts on the integrity of designated Natura 2000 sites, and not being unduly detrimental to the architectural, cultural or linguistic heritage of the area;
- Segregation of the interface of through traffic from urban traffic in order to realise safer urban streets which in turn allows implementation of sustainable transport policies for shorter commutes and improves the urban environment of Galway City centre; and
- Alleviation of city-wide congestion which will improve journey time reliability and facilitate a more efficient public transport system, providing a multi-modal choice of travel and improving safety levels for all public road users.

## 1.5 Need for the Scheme

### 1.5.1 Overview

The existing N6 is a National Primary route which connects the M6 on the eastern side of Galway City to the N59 and the R338 on the western side of Galway City. Whilst the N6 bypasses Galway City centre, a large portion of the traffic on the N6/R338 is not fully bypassing Galway city environs, rather it is using the N6 to move in an east/west direction across the city, refer **Figure 1** below. In addition to serving the east/west traffic across the city, the N6 links four National routes around Galway City, namely the N59, N84, N17 and N6/M6. It also links a number of regional routes including the R336, which accesses south Connemara.

The geography of Galway City is physically constrained; it is divided by the River Corrib and a sea inlet known as Lough Atalia and it is bounded along the entire southern boundary by Galway Bay and the northern boundary by Lough Corrib, all of which are natural barriers to free movement and development. There are currently four bridges crossing the river, which cumulatively carry approximately 80,000 vehicles per day. Three of the four bridges are in very close proximity to the city centre, thus drawing traffic into the city for the sole purpose of crossing the river.

Galway County and Connemara as far west as Clifden and north as Letterfrack are equally dependent on this narrow funnel for access as access to this area is restricted by the extents of Lough Corrib heading north, the Twelve Bens mountains, the Maamturk mountains and many smaller lakes. **Figure 1** below. highlights that access to this area is via the bridges across the River Corrib in Galway City due to the physical natural constraints.

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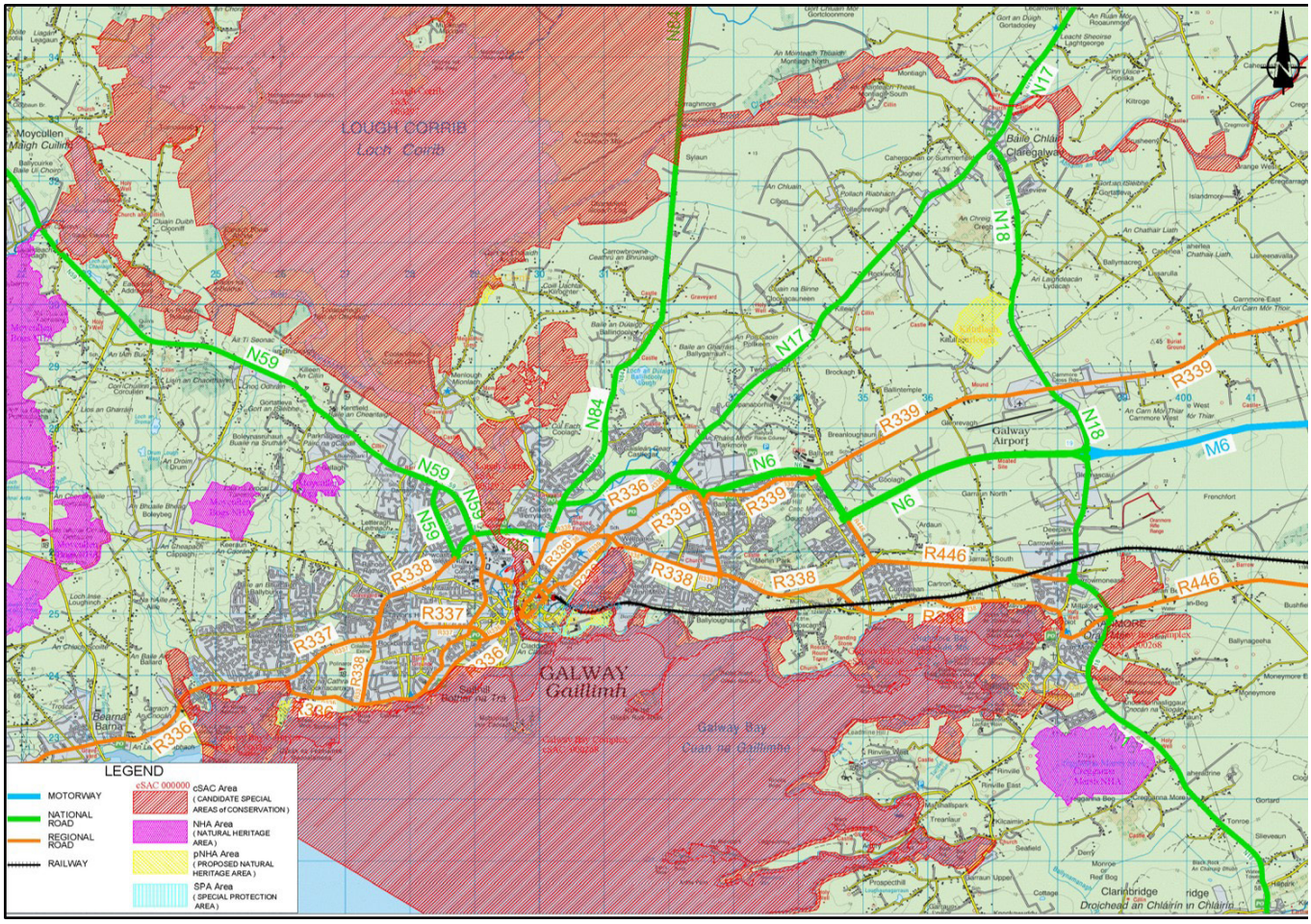



Figure 1 Existing Natural Constraints

### 1.5.2 Supporting Policy

As the N59, N84, N17 and N6 are National roads around Galway City, the responsibility for their performance and maintenance rests with the local authority in conjunction with the National Roads Authority (NRA). The current performance of this road network experiences congestion which in turn leads to journey time unreliability, delay and peak hour traffic delays, all of which filters down into an unsafe environment on the urban street network of Galway City.

The need for a scheme to improve the existing primary road network in this area is underpinned in the strategic priorities of the National Roads Authority and is in line with the European Union transport infrastructure policy. The European transport infrastructure (TEN-T) includes the core transport routes in all EU Member States. The proposed road development from the existing N6 at Coolagh, Biarhill to the junction with the R336 forms part of the TEN-T comprehensive network in Ireland as shown in **Figure 2** below, it is necessary to relieve congestion on this route in order to provide journey time reliability, and to remove peak hour traffic delays thus minimising fuel wastage and emissions as it is recognised that integrated transport networks which are efficient, safe, secure and environmentally friendly are essential to a functioning single market.

The Infrastructure and Capital Investment 2012-2016 – Medium Term Exchequer Framework presents the findings of a Government-wide review of infrastructure and capital investment. The review assesses the existing capacity of Ireland's infrastructure and identifies remaining gaps which must be addressed to aid economic recovery, social cohesion and environmental sustainability and among the main priorities identified are to ensure the National Road Network is maintained and investment continues to enhance Ireland's tourism product. The west of County Galway has a very high quality tourist offering and is dependent on connectivity to the remaining national road network to achieve its potential.

The N6 GCTP is necessary to realise the Government objectives set out in their 2009 policy document "Smarter Travel – A Sustainable Transport Future". With this action plan, the Government aims to change the transport mix in Ireland so that by 2020 car share of total commutes drops from the current 65% to 45% thus facilitating the return of urban spaces to people rather than cars.

Galway City and Galway County Council developed the Galway Metropolitan Smarter Travel Area Action Plan 2010-2015 which is in line with the Smarter Travel national policy and sets out to develop a world-class area for sustainable travel in the area of Galway City and hinterland. The N6 GCTP aligns with these policies and is necessary to resolve the congestion issues which are currently restricting maximum implementation of the Smarter Travel policies by supporting sustainable transport policies for shorter commutes.

Forfás is Ireland's national policy advisory body for enterprise and science. The completion of the ring road for Galway was clearly identified in the Forfás publication of 2012, entitled Overview of Main Infrastructure Issues for Enterprise, as a priority project in order to develop smarter solutions to leverage the significant investments already made and improve our competitiveness. The N6 GCTP is identified as a project at a national level which is necessary to support economic recovery and sustainable growth because of its ability to improve mobility of people and goods into and out of Galway. This is vital to the economic recovery of the Western Region as a whole which is of overriding public interest at a national level as the country moves towards sustainable growth and recovery.

The provision of a bypass for Galway is supported in planning policy at regional level in the "The Regional Planning Guidelines (RPGs) for the West Region 2010 – 2022". The RPGs specifically support the need for a reduction in transport costs by improving the road networks particularly the M6 and potential Galway Outer Bypass as part of the economic development of the region. The RPGs acknowledge that for the West Region to achieve critical mass and growth and ultimately offer an alternative development corridor to the east coast corridor, strong communication links are required to achieve this through well-developed transport links.

The need for the scheme is set out in the Galway County Development Plan 2015 – 2021 as it identifies the need to obtain a solution to congestion, to provide better connection from all parts of the county to the trans-national network, and to improve safety levels on all public roads. It seeks to provide access for all in an integrated manner with an enhanced choice of transport options.

The need for this scheme is underpinned in the Galway City Development Plan 2011-2017, including the most recent variation to the plan, as it seeks to provide congestion relief and a multi-modal choice of travel in order to promote balanced and sustainable economic development that will enable Galway City to fulfil its role as a National Gateway and a Regional Centre.

Therefore, the need for a solution is supported from an international level to national policy level to local policy level in order to address transportation issues for all transport modes which are having an impact on the wider economic and social life of the city, county and region.

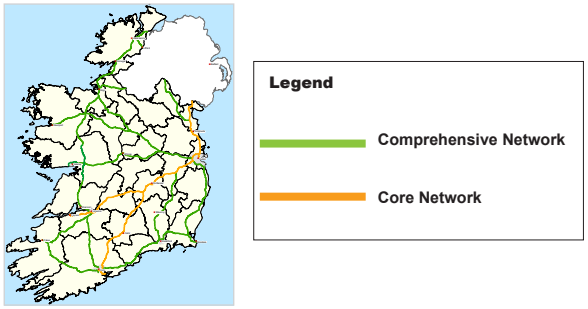



Figure 2 TEN-T network

## 1.6 Constraints Study

A constraints study was completed within the scheme study area shown in **Figure 3** below, which essentially is the area within which it is possible to develop the road component of the transportation solution for Galway.

Constraints of a physical, procedural, legal and environmental nature that may affect the development of possible solution were identified within the scheme study area. The issues that were considered included:

- the existing infrastructure, land use, topography and physical features;
- identification of sites or areas of environmental significance or sensitivity;
- planning, development and socio-economic character; and
- technical constraints.

Key constraints include:

- Built environment of Galway, including well established communities, commercial and educational facilities;
- Natura 2000 designated sites and National Heritage Areas; and
- Sites of significant architectural, archaeological and cultural heritage significance.

## 1.7 Public Consultation No. 1

As part of the Constraints Study, public consultation sessions were held on 14 July 2014 in the Westwood Hotel, Dangan and on 15 July 2014 in the Pillo Hotel, Headford Road. Comments from the public were invited and the results of the consultation were recorded in the Constraints Study.


Figure 3 Scheme Study Area Boundary

# 2 Option Development

Following on from the initial feasibility studies, taking cognisance of the judgment on the 2006 GCOB scheme and the key constraints of the Lough Corrib candidate Special Area of Conservation (cSAC) the options which have been considered are outlined below:

- "Do-Nothing": This option is the Base Year model with growth factors applied to the existing population and traffic data up to the year of opening (2019);
- "Do-Minimum": This option includes road and non-road schemes, including smart mobility measures, which have been committed or are likely to proceed before the year of opening (2019);
- "Do-Something Public Transport": This option was based on measures, options and schemes identified by the existing Galway Public Transport Feasibility Study of 2010 for Galway City Council, including smart mobility measures;
- Lough Corrib Route Options;
- Coastal Route Options;
- Upgrade Existing Road Alternative (On-line): The first road option developed was the on-line upgrade of the existing road infrastructure and utilises the existing N6 and the R338; and
- Build New Road Alternative (Off-line): This option included off-line route options connecting the R336 in the west to the N6 in the east.

## 2.1 Discounted Options

An assessment of the following options discounted them from further consideration as they were deemed not to meet the project objectives:

- 'Do-Nothing';
- 'Do-Minimum';
- 'Do-Something Public Transport';
- Lough Corrib Route Options;
- Coastal Route Options; and
- Tunnel over project extents.

### 2.1.1 'Do-Nothing'

The 'Do-Nothing' option comprised an examination of the existing transportation networks and infrastructure and its ability to meet future transportation demands, in the absence of any upgrade works other than routine maintenance. This option did not provide for any investment in the transportation networks and infrastructure of Galway City and its environs.

Appraisal of the 'Do-Nothing' option demonstrated the following:

- It would not offer a positive economic benefit as it would not serve to reduce the existing congestion;
- It would result in a further decrease in efficiency of the transportation infrastructure over time;
- It would not offer any improvement to safety as it is essentially a continuation of the existing situation whereby many junctions make no provision for vulnerable road users; and
- It would not benefit smart mobility/public transport initiatives as it does not facilitate any improvement on these fronts.

During consultation with Galway City and County Councils on the 'Do-Nothing' option, various projects and plans were identified which are committed and likely to be implemented in the short-term, giving certainty to the fact that the 'Do-Nothing' option is not a real option. The identification of these schemes rendered the 'Do-Nothing' option redundant and it was discounted from further consideration.

### 2.1.2 'Do-Minimum'

The 'Do-Minimum' option followed on from the 'Do-Nothing' option. The investigation of the 'Do-Minimum' option involved an examination of the existing transportation networks and infrastructure and of existing policy and plans for Galway City and its environs. In this scenario, the existing transportation networks and infrastructure combined with likely and committed transportation schemes, including smart mobility measures, were examined to determine their ability to meet future transportation demands.

Appraisal found that the 'Do-Minimum' option operates as follows:

- Would not offer a positive economic benefit as it would not serve to reduce the existing congestion;
- Would result in a further decrease in efficiency of the transportation infrastructure over time as in the 2034 Do-Minimum the total network delay in the morning peak hour rapidly increases by 70% relative to the Base Year, far more than the increase in trips, indicating capacity issues on the network;
- Would not offer a significant improvement to safety as traffic will continue to increase on the existing network without any release of capacity in the highly trafficked urban areas; and
- Would not benefit public transport/smarter travel initiatives as will stifle the possibility of any improvements to the public transport options as capacity will be restricted.

The 'Do-Minimum' option was discounted as a transportation solution/option as it does not meet the project objectives for the reasons noted above.

### 2.1.3 'Do-Something Public Transport'

The 'Do-Something Public Transport' option includes all measures, options and schemes identified by Galway City Council in conjunction with the National Transport Authority as a result of the recommendations of the Galway City Council study entitled Galway Public Transport Feasibility Study of 2010. The 'Do-Something Public Transport' Only Alterative Ooption comprises:

- A Bus Rapid Transit (BRT) operating at a 10 minute frequency from Knocknacarra to the West, through the city centre, to Oranmore in the East;
- All existing city bus services increased to 10 minute frequency;
- Bus priority measures at signalised junctions along the BRT corridor; and
- Re-allocating road space on the Salmon Weir Bridge from general traffic to public transport only.

As part of the Galway Public Transport Feasibility Study of 2010, a number of other public transport options were also examined, including a light rail option. That study determined that a bus based solution was the most appropriate to meet Galway's public transport needs based on the existing and anticipated future transport demands.

It should be noted that the Galway Public Transport Feasibility Study from 2010 assumed that the N6 Galway City Outer Bypass as proposed by the 2006 planning application was in place, thereby making it possible to consider reallocation of road space on the Salmon Weir Bridge. However, the 'Do-Something Public Transport' option as modelled does not include for such additional road infrastructure.

The mode share analysis shows that there is a low public transport mode share of just 5.0% in the 2012 Base Year. This reduces slightly in the 2034 Do-Minimum due to increased car ownership offsetting the increase in congestion.

The 'Do-Something Public Transport' option increases public transport mode share to 5.8% in 2034, which is a 17% increase in public transport trips relative to the Do-Minimum 2034. However due to the overall low public transport mode share, this represents less than a 1% reduction in car trips.

Full implementation of the 'Do-Something Public Transport' option, as envisaged by the current public transport proposals and recommendations of the Galway Public Transport Feasibility Study without the inclusion of the N6 Galway City Outer Bypass (2006), has a negative impact on congestion and only marginally increases the modal share of public transport. It therefore fails to meet the project objectives when implemented in isolation.

The public transport option has been retained as a possible component of an overall solution as opposed to a solution in isolation. It has been carried forward for further testing as part of the ITMP as it could form a component of an overall transportation solution.

### 2.1.4 Lough Corrib Route Options

An option of linking the eastern and western areas of County Galway by crossing Lough Corrib on a viaduct was considered.

The ecological constraints associated with this option make crossing Lough Corrib by viaduct unattractive. Lough Corrib has significant ecological importance and is an area of immense scenic amenity. Any crossing of this lough would involve a significant structure making its incorporation into the landscape extremely difficult.

Traffic analysis shows a strong demand coming from all over the county to the city and back. It also highlights the fact that, the further the proposed route option for a new road component is from the city the less attractive it would potentially be to motorists and the less impact it would have on reducing the existing transportation issues of the city. Any proposal to introduce a viaduct across Lough Corrib would at a minimum be located 4.5km from the existing cross city route – the N6 and R338. There is therefore limited benefit from a traffic perspective to locating a new west to east connection across Lough Corrib.

Crossing Lough Corrib by viaduct would not meet the project objectives for the following reasons:

- It would not reduce journey times on key routes;
- It may not provide a cost effective project;
- It would have a significant impact on designated Natura 2000 sites;
- It would not take due cognisance of the importance of the existing landscape; and
- It may not support the development of critical mass regional population centres as it will not support the development of Galway City as a Gateway.

As alternatives are available which potentially have a lesser impact on the environmental constraints, which would have a higher patronage and provide a greater benefit to the local economy than a crossing of Lough Corrib, further examination of a viaduct crossing on Lough Corrib was discounted.

### 2.1.5 Coastal Route Options

An option of linking the eastern and western areas of County Galway with a route option along the coastline was considered.

The Coastal Route Option requires a significant bridge structure across the mouth of Galway Harbour which is likely to impact on boat traffic and the operation of the harbour and docks area. The bridge would be elevated and visible from all areas surrounding the harbour including the Claddagh, South Park and the Spanish Arch, all of which comprises an area of immense scenic beauty and high amenity. It would impact visually on the landscape of both the city and Galway Bay and requires at least one crossing of the Dublin to Galway railway line.

The ecological constraints associated with this option also make the Coastal Route Option unattractive. Galway Harbour has environmental importance including Galway Bay Complex (cSAC), and Inner Galway Bay Special Protection Area.

This option does not meet one of the scheme objectives to provide a connection to some or all of the national roads leading into the city, namely the N59, N84, N17, and N6/M6 to the east, in order to create an integrated national road network around the city. This could potentially result in no improvement on journey times and journey time reliability which is another project objective.

Alternatives are available which potentially have a lesser impact on the environmental constraints whilst meeting the project objectives and hence, would all be preferable to a coastal route option.

A Coastal Route Option would not meet the project objectives for the following reasons:

- It would not provide journey time reliability on the key routes;
- The crossing of the harbour would have a significant impact on designated Natura 2000 sites; and
- The crossing of the harbour would not take due cognisance of the importance of the existing landscape.

As alternatives are available which potentially have a lesser impact on the environmental constraints, which would have a higher patronage and better meet the project objectives than a coastal option, further examination of this option was discounted.

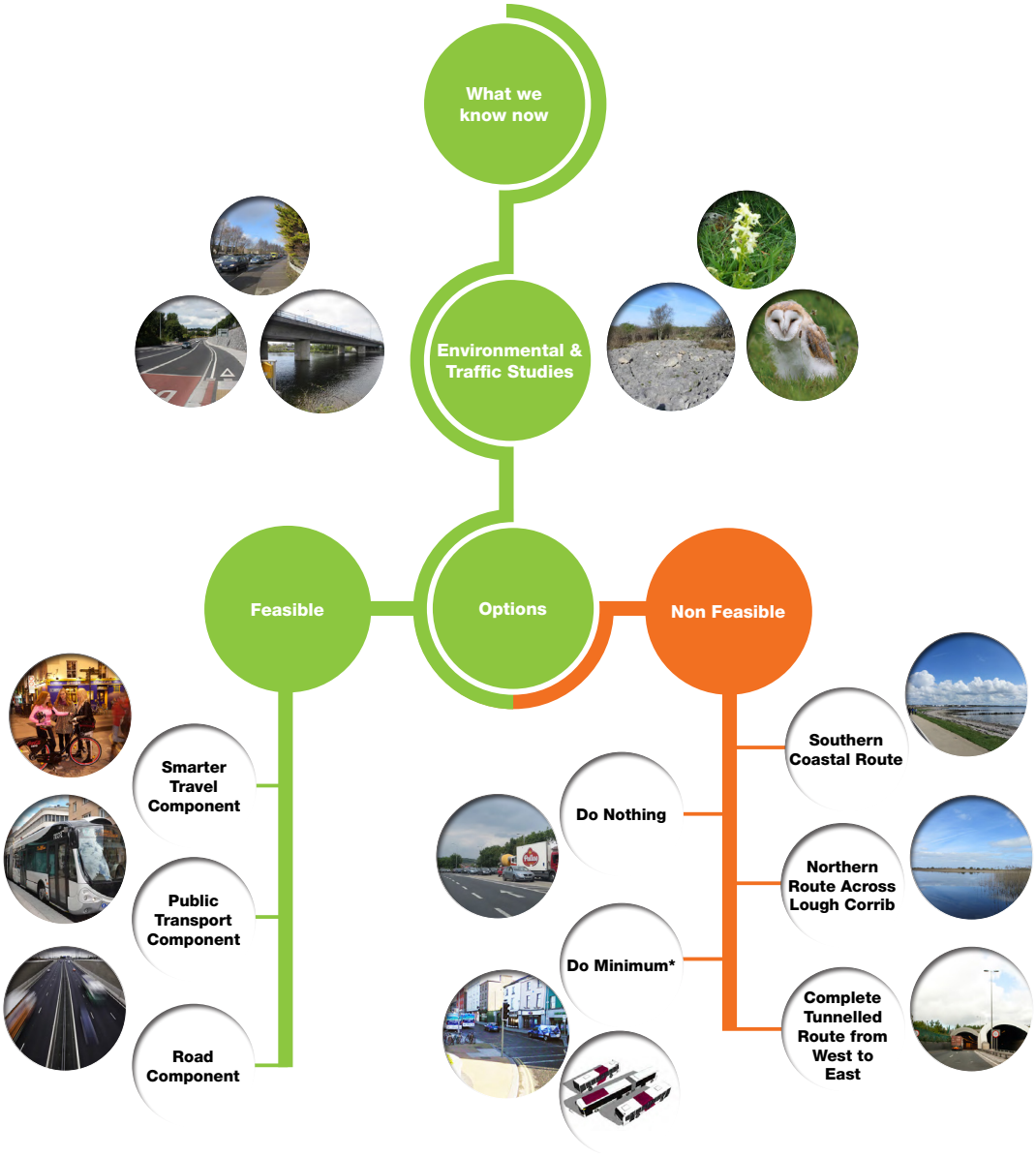



Figure 4 Discounted Options – Public Consultation No. 2

### 2.1.6 Tunnel Over Full Extents

Following on from the above options, an option of linking the eastern and western areas of County Galway with a tunnel from the N6 to the R336 was considered.

This option does not meet the scheme objectives to provide a connection to some or all of the national roads leading into the city, namely the N59, N84, N17, and N6/M6 to the east, in order to create an integrated national road network around the city. This would not show an improvement on journey times and journey time reliability which is another project objective. Equally, traffic demand does not justify the very significant cost of such a tunnel. Therefore, a tunnel from east to west was discounted as it is not deliverable and not justified. However, inclusion of shorter sections of tunnel to avoid significant constraints was considered worthy of further study in the option development process.

As alternatives are available which would have a higher patronage and better meet the project objectives than an east-west tunnel, further examination of this option was discounted.

The discounted options were presented graphically at Public Consultation No. 2 in **Figure 4** above.

## 2.2 Feasible Route Options

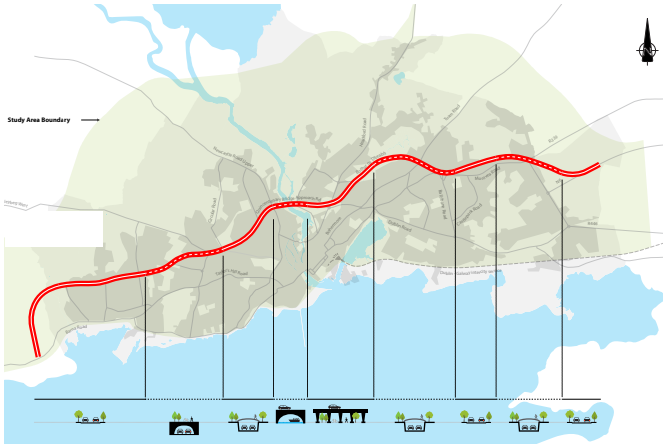
Route Options carried forward for further assessment comprised on-line options which include an upgrade of the existing infrastructure, partial on-line/off-line options and total new construction off-line.

### 2.2.1 On-line Route Option

A full study was undertaken on the upgrading of existing road infrastructure and the development of an on-line route option, where the existing transportation networks and corridors are reused and enhanced where appropriate.

The outcome of this study was a recommendation on which on-line route option to carry forward. This On-line Route 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 Route Option follows the existing Western Distributor Road to Bóthar Stiofáin and includes the replacement of all the existing roundabout junctions along Western Distributor Road with signalised junctions.

At the Rahoon area it connects via a tunnel from Bóthar Stiofáin, through a residential area in Rahoon, to the Seamus Quirke Road and is depressed underneath Seamus Quirke Road and Browne Roundabout via a cut and cover tunnel. It includes connectivity via a roundabout and slip roads at Gort na Bró. It continues east to the existing Quincentenary Bridge along the existing N6. The existing local road network is retained above the proposed mainline over the extents of Seamus Quirke Road. The existing local road network is accommodated by provision of a second bridge crossing over the River Corrib immediately south of the existing bridge. The possibility of an additional River Corrib crossing by reusing the existing railway piers may be proposed as a complimentary measure.




Red1 Route Option

To the east of the River Corrib, the On-line Route Option passes behind the existing shopping centre at Terryland and re-joins the existing N6 to the east of the N84 Junction at the Kirwan Roundabout. A split grade separated junction is provided between the existing N6 and the proposed On-line Route Option in this area, with west facing slips to/from the On-line Route Option immediately east of the river crossing and east facing slips to/from the On-line Route Option immediately east of the existing N84 junction at Kirwan Roundabout.

The On-line Route Option utilises the existing N6 corridor to connect to the M6/ N6 on the east side of Galway at Ardaun. It is depressed under the N17 and Ballybane Roads but has full connectivity to both roads via signalised diamond junctions. A full diamond grade separated junction is provided to the south of the existing Briarhill junction, which is designed to accommodate Parkmore Industrial Park, Ballybrit Business Park and the Briarhill area of the city.

The On-line Route Option is deemed a feasible option and is carried forward as the Red1 Route Option for assessment as part of the route selection process.

### 2.2.2 On-line/Off-line Route Options

Detailed ecological surveys which were carried out between June 2014 and October 2014 informed the Design Team on the process to define option development zones. Option development zones are areas within the scheme study area within which from an ecological perspective the least damaging route options could be developed and where route options would be least likely to have direct or indirect impacts to key ecological receptors. It should be noted that all route options developed within these option development zones still had to be assessed by all other environmental specialists, which could further reduce the zones available for route option development.

Equally the situation may also arise where route options may need to be developed outside of these zones to reduce the impact on other key environmental constraints, such as human beings, archaeology etc. with the necessary ecological mitigation measures included in the design.

**Figure 5** overleaf illustrates the available development zone through the Lough Corrib cSAC at the River Corrib crossing. A number of route options were then developed by the engineering team within the established option development zones commencing from the River Corrib crossing locations in so far as reasonably possible within the confines of engineering standards and all other constraints.

Given the urban environment and the presence of the designated European sites in the scheme study area a horizontal and vertical alignment for each of the route corridor options was designed. The vertical alignment for some of the route options included sections of tunnels to reduce the impact on key constraints identified. A brief description of each of the route options is given below.

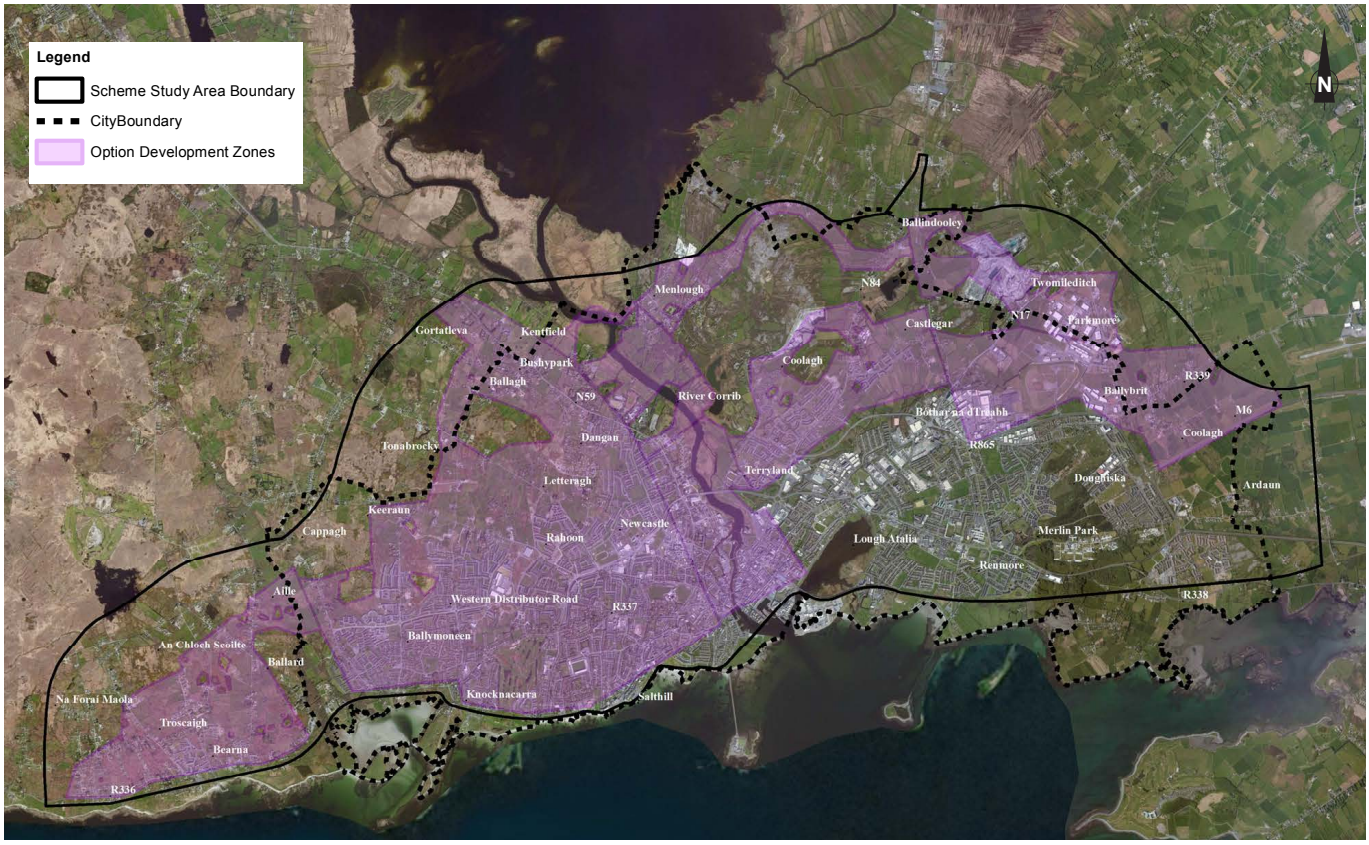
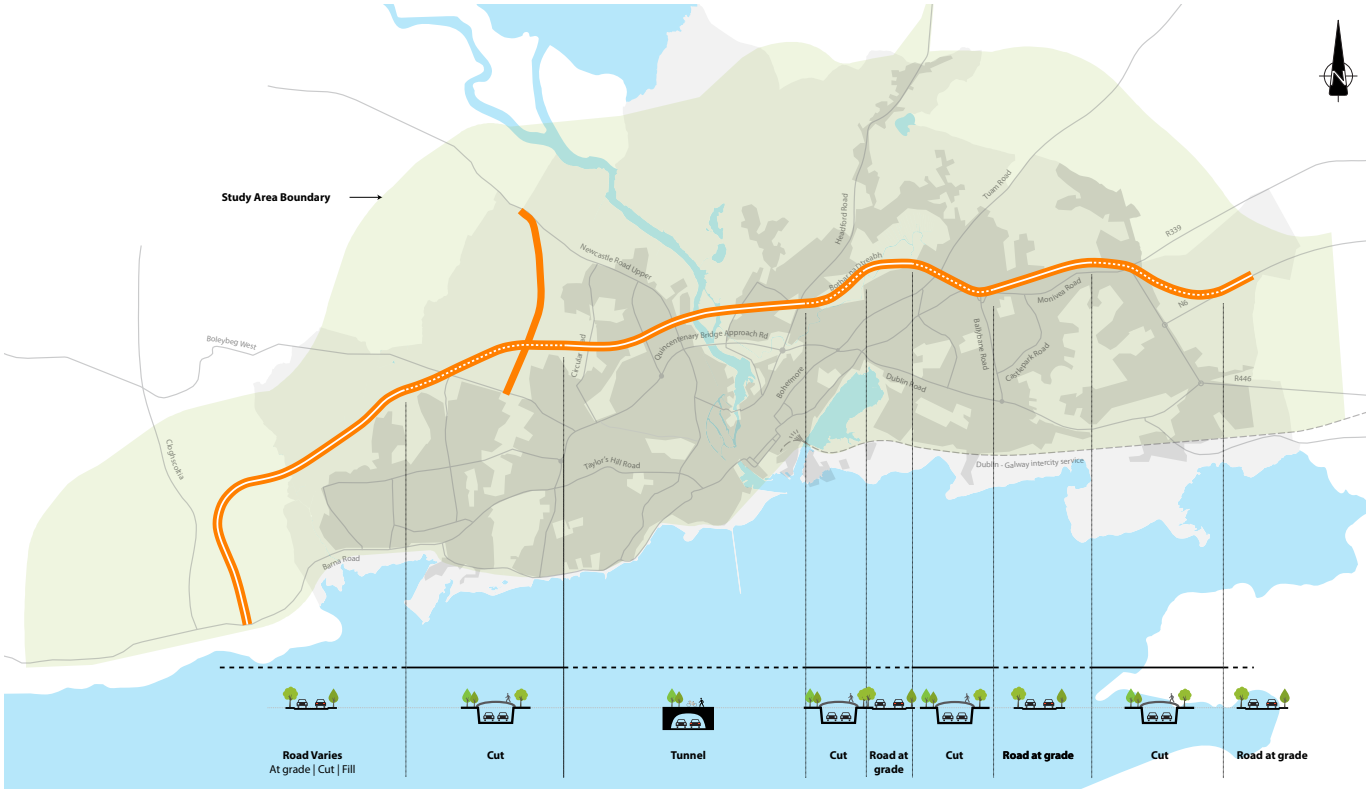



Figure 5 Option Development Zones




Orange1 Route Option

### Orange 1 Route Option

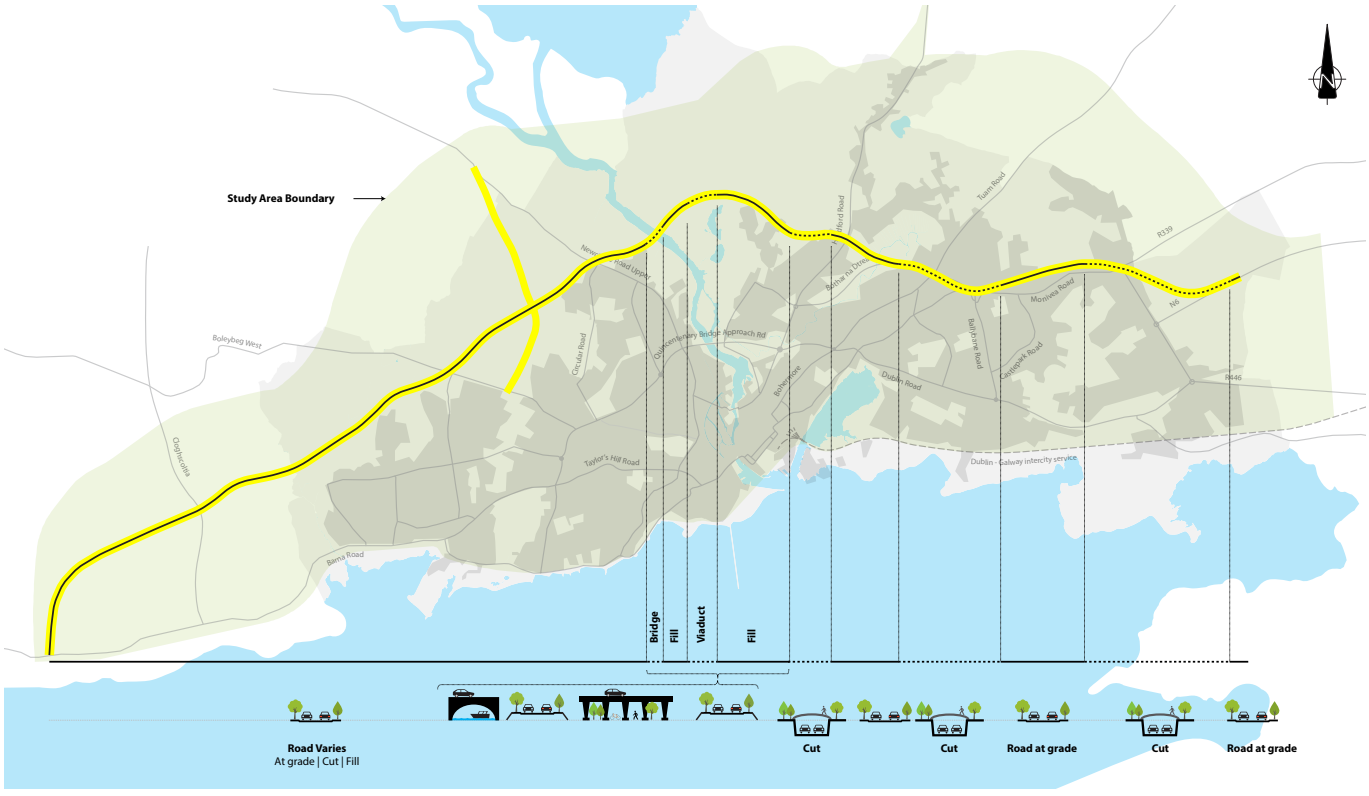
The Orange1 Route Option commences at the same point as the Red1 Route Option to the east of Bearna Village, and follows the path of the Red1 Route Option around Ballard. It diverges from the Red1 Route Option and travels through Ballyburke, towards Letteragh, where it enters a tunnel. It crosses under the River Corrib in the tunnel and emerges in Terryland, to the east of the existing Kirwan Roundabout. The Orange1 Route Option then follows the Red1 Route Option along the existing N6 with all junctions upgraded to grade-separated junctions.

There is a link road associated with the Orange1 Route Option which commences on the N59 at Ballagh and finishes at the northern end of Bóthar Stiofáin, connecting to the mainline of the Orange1 Route Option with a grade-separated junction.

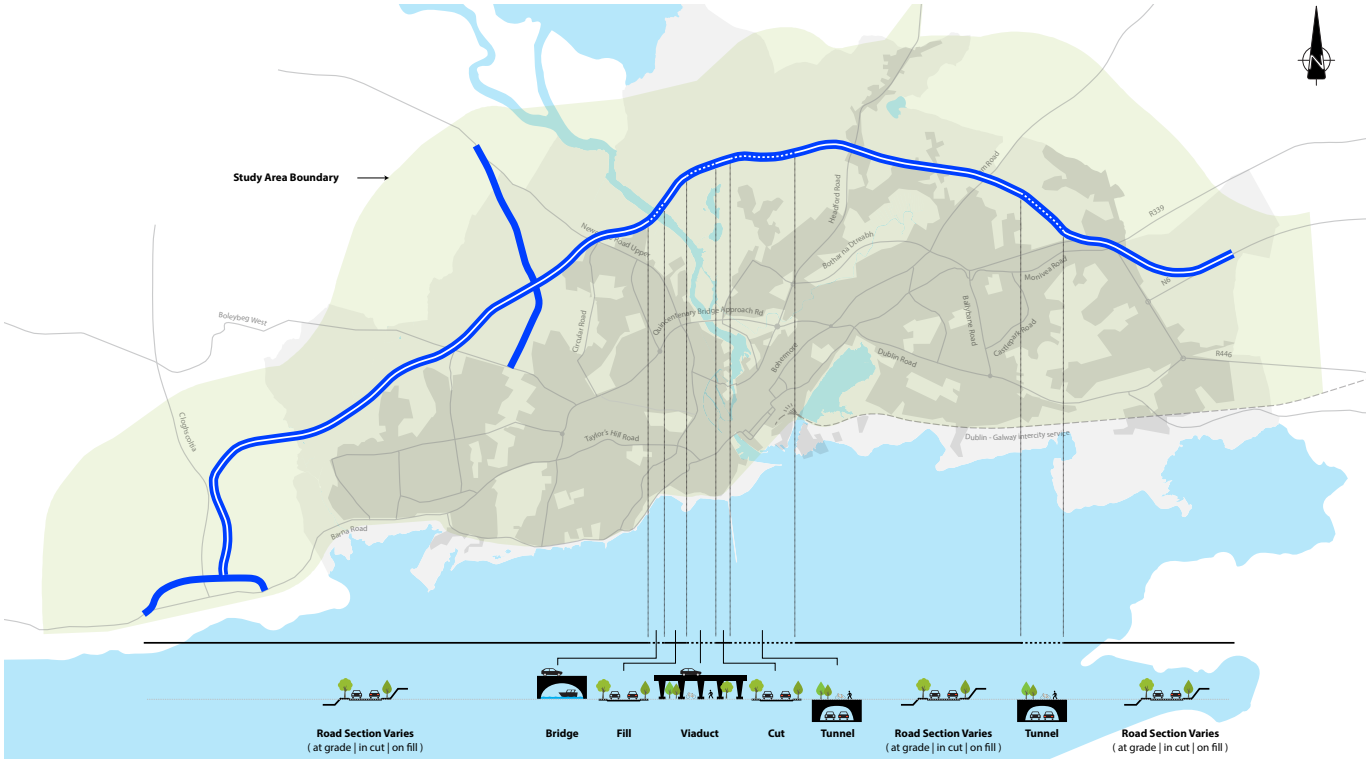
### Yellow 1 Route Option

The Yellow1 Route Option commences at a junction with the R336 to the west of Bearna Village and travels north-east, keeping to the north of Bearna Village and passing through the townlands of An Chloch Scoilte, Na hAille, Ballyburke, Letteragh and Dangan. It crosses the River Corrib to the south of Menlo Castle, then turns south-east and passes through the townlands of Coolagh and Castlegar. It joins the Red1 Route Option to the west of the junction with the N17 and follows the Red1 Route Option eastwards along the existing N6, with all junctions upgraded to grade-separated junctions.

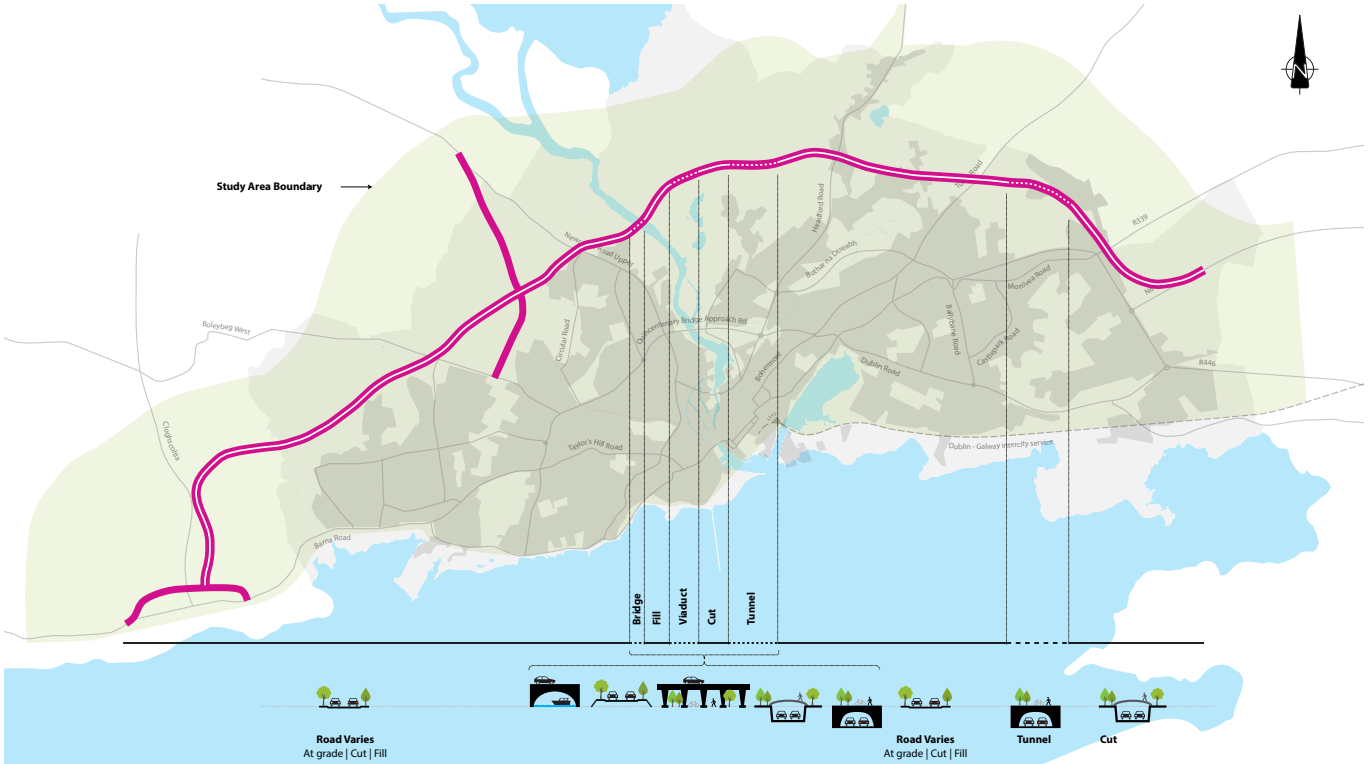
There is a link road associated with the Yellow1 Route Option which commences on the N59 at Gortacleva and finishes at the northern end of Bóthar Stiofáin, connecting to the mainline of the Yellow1 Route Option with a grade-separated junction.




Yellow1 Route Option




Blue1 Route Option




Pink1 Route Option

### Blue1 Route Option

The Blue1 Route Option commences with a junction on the R336 on the western outskirts of Bearna Village and proceeds along an existing relief road parallel to and north of the R336. The remainder of the Bearna Inner Relief Road, to tie back to the existing R336 in the eastern outskirts of Bearna Village, is included as part of the Blue1 Route Option. From the relief road the Blue1 Route Option travels north-east through the townlands of An Chloch Scoilte, Na hAille, Ballyburke, Letteragh and Dangan before crossing the River Corrib to the south of Menlo Castle. It then continues east towards Lackagh Quarry, entering a tunnel to pass beneath the Annex I habitat within the Lough Corrib cSAC and emerging in the quarry, before passing through the townlands of Castlegar and Ballybrit. The Blue1 Route Option enters a second tunnel to pass underneath the racecourse at Galway Racecourse, emerging above ground in the vicinity of Briarhill, and follows the Red1 Route Option to its eastern extremity.

There is a link road associated with the Blue1 Route Option which commences on the N59 at Gortacleva and finishes at the northern end of Bóthar Stiofáin, connecting to the mainline of the Blue1 Route Option with a grade-separated junction.

### Pink1 Route Option

The Pink1 Route Option commences to the west of Bearna at the same point as the Blue1 Route Option, and follows the same path as the Blue1 Route Option as far as Castlegar. It then diverges to the north of the racecourse at Galway Racecourse, and enters a tunnel on the eastern side of the N17. This tunnel passes under the racecourse access road. This route option passes to the south-east of Coolagh Village and connects to the existing N6.

There is a link road associated with the Pink1 Route Option which commences on the N59 at Gortacleva and finishes at the northern end of Bóthar Stiofáin, connecting to the mainline of the Pink1 Route Option with a grade-separated junction.

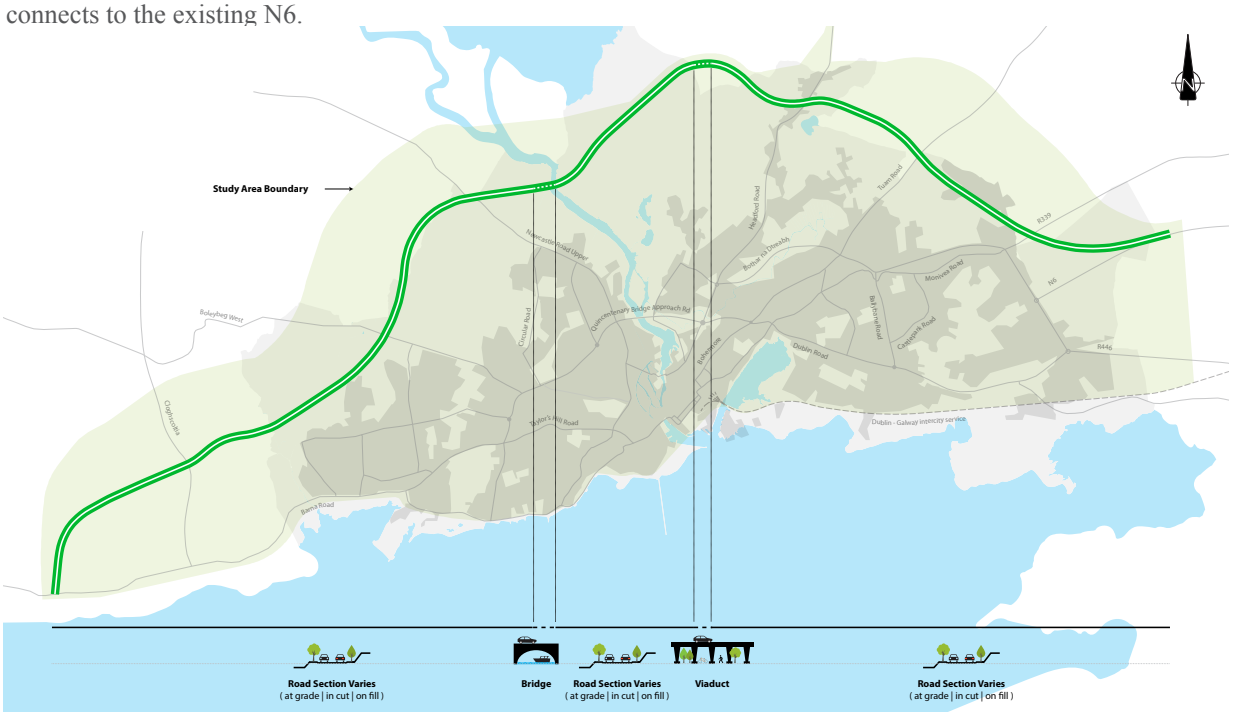
### Green1 Route Option

The Green1 Route Option commences at the same point as the Yellow1 Route Option to the west of Bearna Village and travels north-east, keeping to the north of Bearna Village and passing through the townlands of An Chloch Scoilte, Na hAille, Keeraun, Tonabrocky and Bushypark before crossing the River Corrib to the north of Menlo Castle. The Green1 Route Option proceeds north-east through Menlough to Ballindooley and south-east through Cappanabornia, around the back of Galway Racecourse in a tunnel beneath the racecourse access road, where it briefly overlaps with the Pink1 Route Option. It passes through the northern part of Coolagh Village before terminating on the N6 to the east.

The development of route options is a two-stage process. A number of feasible route options are developed and agreed with the TII. These route options are known as Stage 1 Route Options. An assessment is then completed on these Stage 1 Route Options.

These Stage 1 Route Options were presented to the public at Public Consultation No. 2 (refer Section 2.4)

Following public consultation and further studies, the route options were refined and become Stage 2 Route Options. An assessment and appraisal was completed on the Stage 2 Route Options.




Green1 Route Option

### 2.2.3 N6 Galway City Outer Bypass (2006)

As noted earlier, the eastern section of the N6 Galway City Outer Bypass (2006) from the N6 to the N59 was approved by An Bord Pleanala (ABP) in 2008. At that point in time, the N6 Galway City Outer Bypass (2006) scheme was assessed on the premise that the loss of a relatively small area of Priority Annex I habitat would not adversely affect the integrity of the Lough Corrib cSAC, and the scheme was taken forward on the basis of Article 6(3) of the Habitats Directive.

However, this decision granting approval of the eastern section was appealed to the High Court. The High Court undertook a judicial review of the ABP decision. The High Court confirmed ABP approval but allowed an appeal to the Supreme Court. The Supreme Court sought the opinion of the Court of Justice of the European Union (CJEU) on an interpretation of the Habitats Directive.

The judgment of the CJEU was delivered on the 11 April 2013. The conclusions which can be drawn from this judgment are as follows:

1. The N6 Galway City Outer Bypass (2006) would have a significant adverse impact on the integrity of the Lough Corrib cSAC due to the removal of 1.5ha of Limestone pavement; and
2. Given that the N6 Galway City Outer Bypass (2006) would have a significant adverse impact on the integrity of the cSAC, the correct planning process should be under Article 6(4) as opposed to Article 6(3).

The EU Judgment (i.e. Case C-258/11) established that the loss of a relatively small area of Priority Annex I habitat could adversely affect the integrity of the Lough Corrib cSAC and that where there is the potential to adversely affect Priority Annex I habitat, Article 6(4) applies. If it is determined that Article 6(4) applies, there is a need to identify the least damaging alternatives.

Following receipt of the CJEU opinion, the Supreme Court quashed the earlier ABP decision. Therefore, the process of developing a transportation solution for Galway City and environs recommenced starting again at Phase 1, feasibility and concept stage.

The N6 Galway City Outer Bypass (2006) is presented as the first off-line route option in the N6 Galway City Transport Project route option development process as it was previously progressed through planning and there was also significant knowledge and detail available on this route option (refer **Figure 6**).

Upon completion of the detailed ecological surveys and the definition of the option development zones and detailed traffic studies, it was possible to comparatively assess and rank other off-line options with the N6 Galway City Outer Bypass (2006) Route Option.

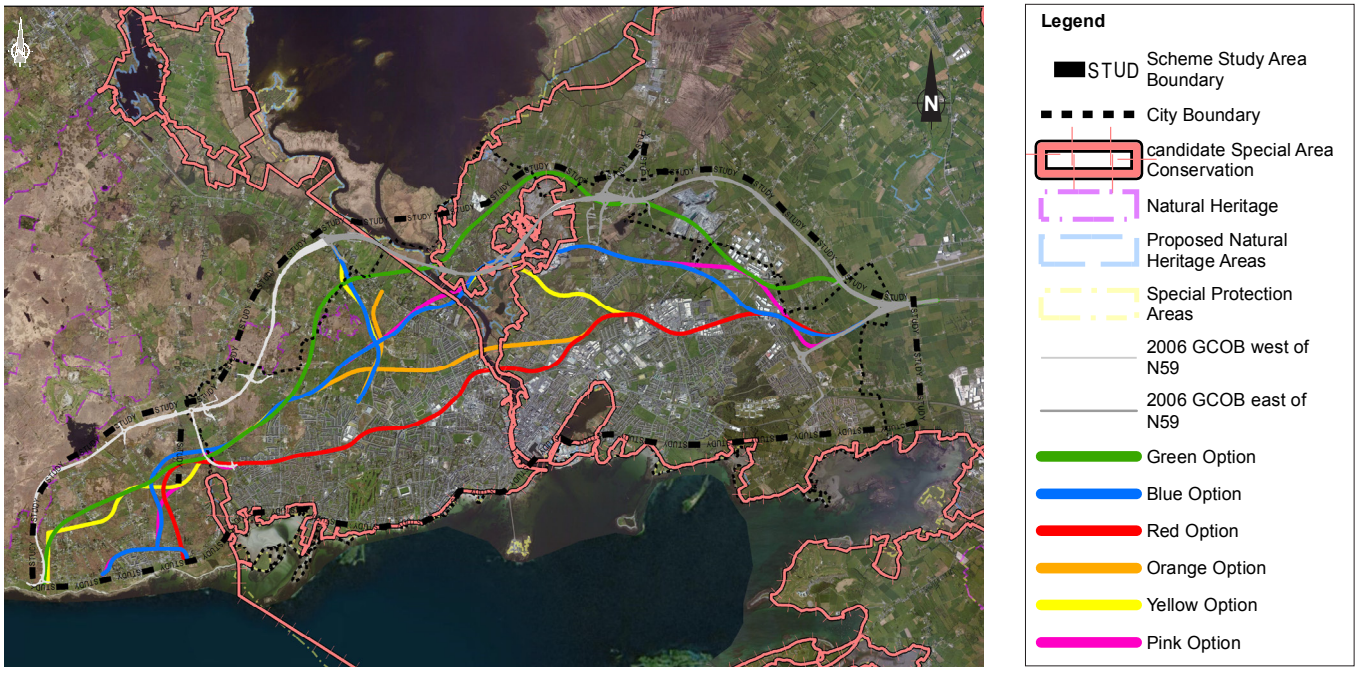



Figure 6 2006 Galway City Outer Bypass with N6 GCTP

Full analysis showed that there are other alternatives which better meet the project objectives in terms of capturing existing travel demand than the N6 Galway City Outer Bypass (2006) Route Option and which have a less damaging impact on the integrity of the Lough Corrib cSAC. When compared with the option development zones, i.e. areas within which from an ecological perspective options could be developed, it also was evident that the N6 Galway City Outer Bypass (2006) Route Option was located outside these zones over the majority of its length.

It should be noted that the boundary of the Lough Corrib cSAC was extended post lodgement of the original N6 Galway City Outer Bypass planning application with ABP, resulting in a greater length of this N6 Galway City Outer Bypass (2006) Route Option crossing through the cSAC and therefore having a greater impact on its integrity than originally anticipated in the N6 Galway City Outer Bypass (2006) Environmental Impact Statement.

Given that there were less damaging alternatives available from the perspective of the integrity of the Lough Corrib cSAC, the N6 Galway City Outer Bypass (2006) Route Option was discounted from further consideration in October 2014.

During route option assessment in November 2014, the N6 Galway City Outer Bypass (2006) Route Option was reviewed again to establish whether it merited inclusion in the first iteration of route options, but again this was discounted as there were less damaging alternatives available. Therefore, the N6 Galway City Outer Bypass (2006) Route Option was not presented at Public Consultation No. 2.

## 2.3 Galway City Integrated Transport Management Programme

As required by national policy, the design team has incorporated the principles of smart mobility into the design process since commencement of the project and smart travel and public transport measures have always been included as measures that are being considered as part of the available alternatives to solve the transportation problem in Galway City and its environs.

The Galway Transportation and Planning Study (GTPS) was formulated over a number of years between 1999 and 2002 jointly by Galway City and County Councils and adopted by both Galway City and County Councils in 2003. The current Galway County Council Development Plan (2015-2021) contains an objective to continue to support the careful management of growth in the commuter zone of Galway City as defined in the GTPS.

As noted above, the 'Do-Something Public Transport Transport' option, as based on the existing plans adopted for Galway, does not provide an adequate solution to reducing congestion levels in the city.

Through consultation with key stakeholders including the TII, NTA, Galway County Council and Galway City Council, the need for a wider integrated transport strategy for Galway has been identified which will identify the level of service requirements for each mode of transport; including walking, cycling, public transport and private vehicle.

It will also include assessment of transport linkages between the city and surrounding settlements, thereby addressing the public transport demand and other modal demand of those living in the county areas in proximity to the city. It will identify a series of supporting infrastructure, operational and policy measures to help optimise travel by sustainable modes in order to meet both the current and future travel needs of Galway.

The strategy will be formulated into an Integrated Transport Management Programme which will set out a phased plan of transportation measures for Galway City and its environs over a 20 to 30 year horizon.

Whilst the N6 GCTP will be integrated into the ITMP, the route selection process is a stand-alone process at this time in order to define the optimum corridor for additional road infrastructure as studies to date have indicated that a road component will form part of the overall transport solution. The ITMP is investigating additional and/or alternative public transport options, given that a location other than the N6 Galway City Outer Bypass (2006) route is proposed for the preferred route corridor. A review of the preferred route option will be undertaken in the context of the recommendations of the wider Galway transport strategy at Phase 3 Design of this project.

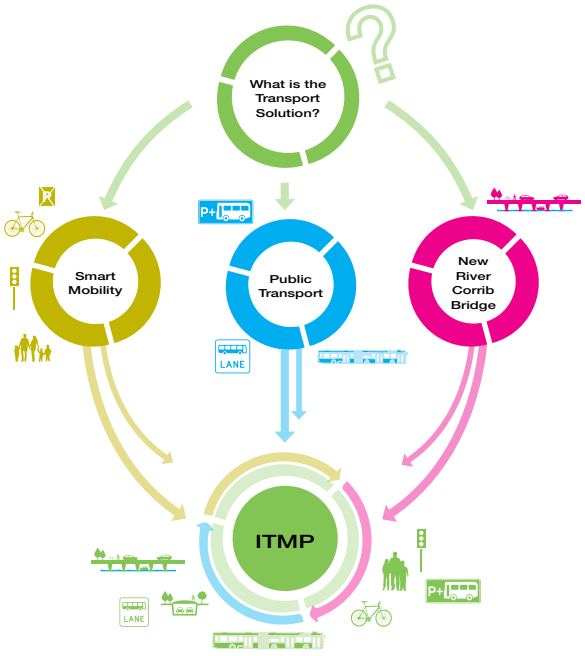



Figure 7 Integrated Transport Management Programme

## 2.4 Public Consultation No. 2

Public Consultation No. 2 took place on 28 and 29 January 2015 and on 3 and 4 February 2015 at the Westwood Hotel, Galway and the Menlo Park Hotel, Galway respectively. The Stage 1 Route Options taken forward to Public Consultation No. 2 are shown on **Figure 8** below. These are denoted with the number 1 after each colour coded name (i.e. Stage 1 Route Options) and this differentiates them from the later version of these routes which included modifications to their alignment following the public consultation, and are denoted with the number 2 (i.e. Stage 2 Route Options).

Following Public Consultation No. 2, the display material was made available for inspection in the project office for four weeks. During this time, multiple consultation meetings were convened with concerned residents and landowners, key stakeholders, residents associations and various other interested parties. This consultation facilitated the dissemination of information and allowed members of the public to make informed submissions on the route selection process. The closing date for submissions on the route options was 6 March 2015. Approximately 1,000 submissions were received via email, post or in person.

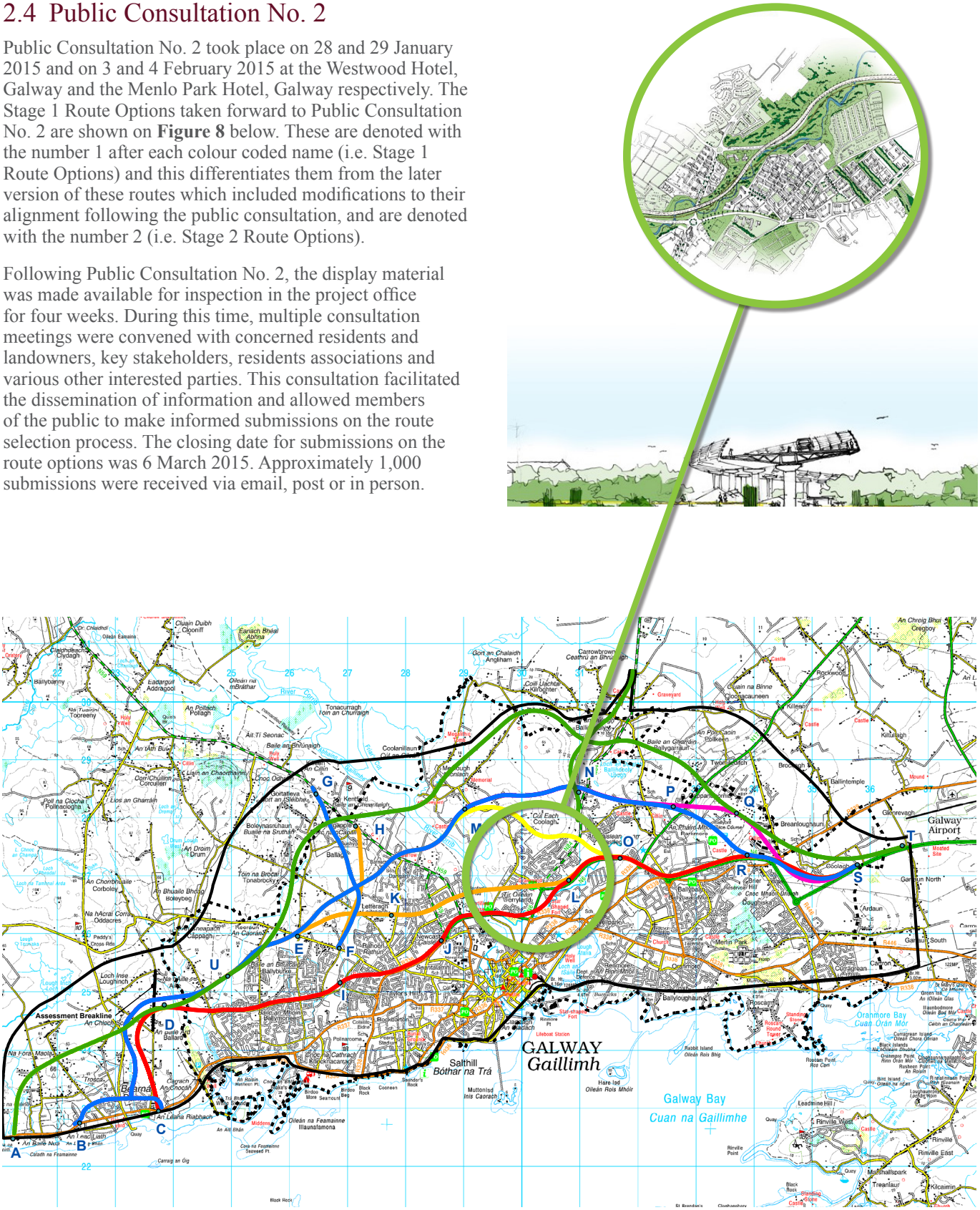



Figure 8 Stage 1 Route options

# 3 Traffic Assessment, Junction Strategy and Cross-section

## 3.1 Introduction of Traffic Model

For the appraisal of the N6 Galway City Transport Project (GCTP) a new multi-modal transport model called the Galway Interim Model (GIM) was developed specifically for the N6 GCTP. The GIM is capable of providing future year forecasts of travel demand, traffic flows and journey times for road and public transport schemes.

Traffic counts, journey time surveys, bus passenger surveys and bus time surveys were undertaken during November 2012. The traffic model was then calibrated to ensure that the model reflected observed data, with validation complete once the final model flows and journey times are representative of observed data. This traffic model contains Base Year traffic data to which growth factors are then applied to obtain future year traffic forecasts for the scheme opening year (2019) and Design Year (2034). These forecast years will be used for assessing and comparing the performance of the various options, either public transport options or route options.

### 3.1.1 Existing Travel Patterns

**Figure 9** below is a schematic diagram to illustrate the travel patterns for private car trips to, from or through Galway City in the 2012 Base Year morning peak hour (extracted from the traffic model). Red arrows show movements that cross the River Corrib and green arrows show movements that do not cross the River Corrib. The arrows include traffic in both directions, inclusive of trips both into and out of the city zones and non-city zones.

In total 35% of total car trips into and around Galway City cross the River Corrib. Of this total number of cross-river trips, approximately 9% are bypass traffic (i.e. 3% of 35%). Some 40% of all trips remain on the same side of the city as where they started within the city.

The strongest movements are from the west side of Galway City to the east side of Galway city which represents 20% of all trips, and from the east of Galway City to the west side of Galway City which represent a further 20%.

This analysis implies that the N6 GCTP must cater for movements from one side of the city to the other in addition to through traffic, rather than a conventional bypass which would mainly cater for wholly by-passable traffic. This analysis also demonstrates the importance of an integrated solution which supports modal shift for shorter commutes.

### 3.1.2 Journey Time Reliability

An analysis of observed journey times on key routes around Galway and its environs was carried out to show the variance in journey times between the peak and off-peak periods. The difference between the peak and off-peak journey times is a measure of the level of congestion during the peak, and increased congestion results in worsening journey time reliability.

This assessment of journey time shows that the travel times on three key routes in the morning peak hour are on average more than double the off-peak travel times.

Journey time unreliability is a significant detractor to incoming businesses seeking to locate in the area, to tourism due to difficulties of scheduling timetables and also to indigenous industries attempting to get goods out to national markets. The N6 GCTP seeks to address this issue by relief of the traffic congestion by removal of traffic both through modal shift, provision of additional road space and separation of bypass traffic.

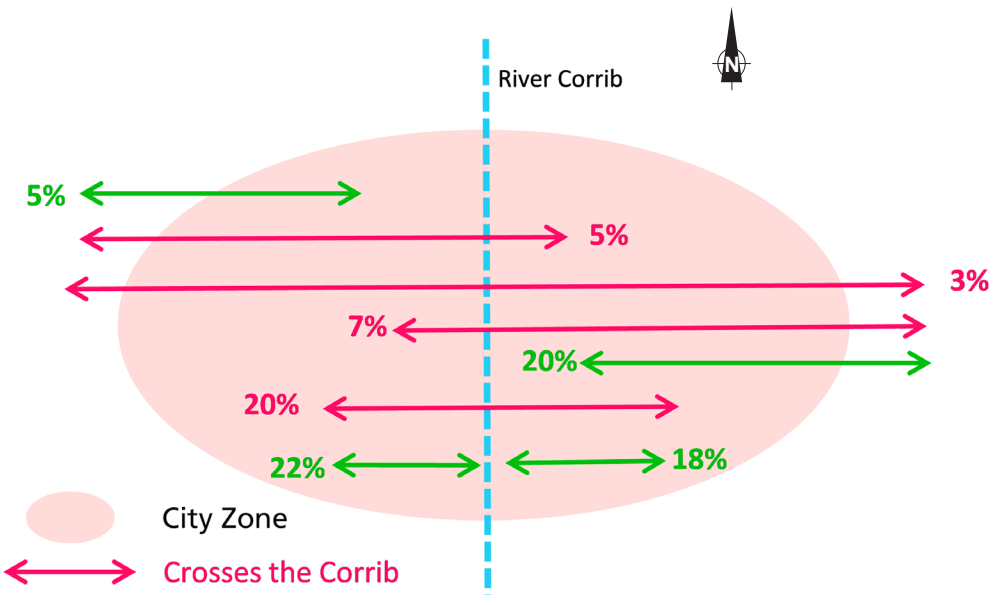



Figure 9 Travel Patterns 2012 Base Year Morning Peak Hour

### 3.1.3 Junction Capacity Assessment

An assessment of the volume to capacity (V/C) ratio was undertaken at signalised junctions and roundabouts, plus other key junctions where main roads intersect within the city. This indicator is useful for highlighting the problem junctions, as the level of delay and congestion at the junctions is related to junction capacity.

This analysis demonstrates that the existing network is restricted by junction capacity with all the junctions on the critical corridors accessing the city, namely the junctions of the N84, N17 and N59 junctions with the N6, currently over capacity at peak hour. These junctions are operating at greater than 100% of their capacity, which in turn leads to the significant delays at these junctions. As these junctions are the main arteries into the city and the main junctions on the circumferential route around the city, this is a significant issue for the Gateway of Galway.

In addition, approximately 40% of all junctions on the key access routes across the scheme study area are operating above 85% capacity. This demonstrates that the network is finely balanced with minimal spare capacity to allow for any unforeseen event or natural growth. This is significant as grid-lock on a city wide scale is evident in the event of an unforeseen occurrence such as an accident, significant weather event, temporary traffic management associated with regular maintenance works on existing road network, seasonal events and particular match day events.

The N6 GCTP is essential to resolve this constant lingering problem of over-capacity of the existing N6 route and existing network which frequently results in grid-lock in the city.

## 3.2 Junction Strategy

Analysis of zonal demand in the traffic model had identified that connectivity and accessibility to Galway County, to key employment centres, to the city and residential zones is essential to achieve multiple project objectives – congestion relief, safer urban streets, journey time reliability and connectivity to the west. Therefore, a solution to the problem is inextricably linked to accessibility to and from the city, and any solution is likely to include junctions which facilitate movement to and from the city.

Analysis of the traffic model has also shown that there is significant movement between the hinterland and the city along the national routes on a daily basis. The junction strategy will seek to meet this travel demand in terms of junction provision along the scheme.

Junctions which provide access to improved road infrastructure generates significant safety benefits to the network via the transfer of high volumes of traffic to the safer roads. Opportunities for further safety benefits present through the provision for vulnerable road users through reallocation of road space on the existing network. Reallocation of existing road space will also facilitate better provision of public transport which improves accessibility to all.

The junction strategy seeks to maximise the transfer to the new road infrastructure in order to maximise opportunities for reallocation of road space on the existing street network to benefit public transport and vulnerable road users. Therefore, it is anticipated that grade separated junctions will be provided at the interfaces with the national road network and at-grade junctions will be provided as required to ensure that connectivity for all modes is provided and to ensure that the optimum use is achieved for all modes from the residual road network.

## 3.3 Cross-section

The need for the N6 Galway City Transport Project (GCTP) to replace the role of the existing N6/R338 road network is supported in terms of policy from national to local level - the specific project need is defined in terms of its potential to solve existing transport issues in Galway City and its environs.

Average Annual Daily Traffic (AADT) volumes are defined as the two-way volume of traffic using a road during the year divided by the number of days in the year. AADT volumes are used as a starting point in the assessment of cross-section provision as they provide an indication of the range of traffic flows over which each carriageway standard is likely to be economically justified, whilst noting that vehicle flow capacities cannot be used in isolation as the ultimate capacity depends on many other factors also. For rural, suburban and urban areas junction capacity is a significant consideration. In each of these cases the cross-section suitability is as dependent, if not more dependent, on junction capacity.

The two cross-section types considered at this initial stage are Type 1 Single Carriageway (S2) and Type 2 Dual Carriageway (D2AP), and these were initially selected as the traffic volumes were estimated to lie in the capacity range of these cross-sections. The cross-section is likely to comprise a dual carriageway at the eastern end which will reduce to a single carriageway at the western end of the scheme.

The cross-sections are indicated in **Figure 10 and 11** below.

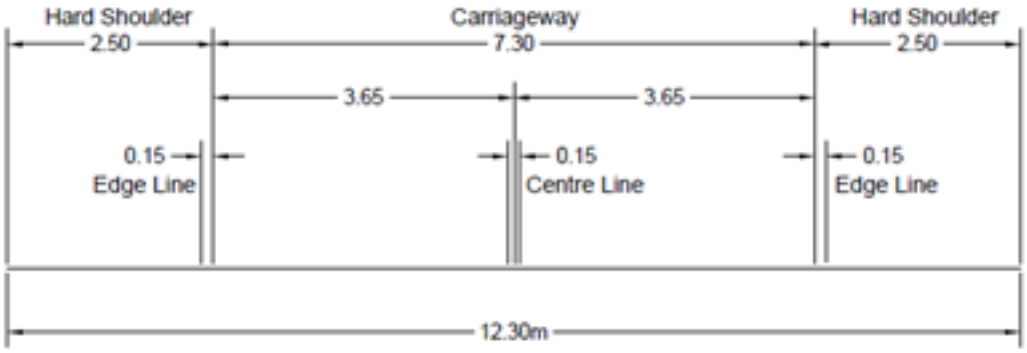



Figure 10 Type 1 Single Carriageway (S2) Cross-section

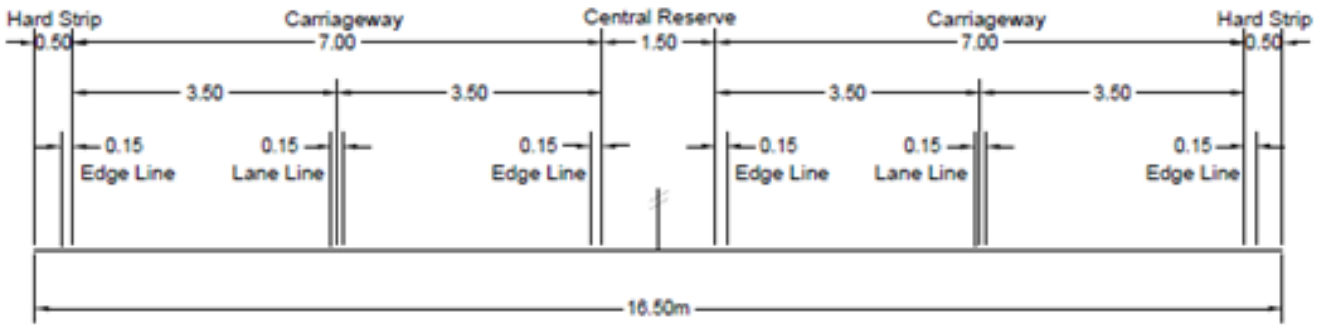



Figure 11 Type 2 Dual Carriageway (D2AP) Cross-section

# 4 Assessment of Feasible Route Options

The information gathered from the studies and surveys along each of the route options, and from Public Consultation No. 2, was collated so that a full comparison could be made and a preferred route corridor identified. The emerging preferred route corridor was then presented to the public.

Some amendments and alterations were developed to improve on previous designs and route options in order to address concerns raised and issues identified. The layout of the Stage 2 Route Options is shown on **Figure 12** below. The key reason for the modifications to the six route options is to reduce impacts to residential properties and communities.

## 4.1 Option Assessment

A project appraisal of the refined route options, namely Stage 2 Route Options, was carried out using the multiple criteria outlined by the Department of Transport in Guidelines on a Common Appraisal Framework for Transport Projects and Programme June 2009. These multiple criteria are Economy, Safety, Environment, Accessibility and Social Inclusion and Integration.

A summary of the overall appraisal of the Stage 2 Route Options using the five criteria is included in the Project Appraisal in Section 4.7 below. For the Stage 2 assessment, the route options are assessed in three sections. Section 1 extends from the R336 to the Galway City boundary and Section 2 extends from the Galway City boundary to the existing N6 in the east of the city. An additional breakline at the N6 tie-in at Coolagh has been incorporated in order to compare the junction layouts at the N6 tie-in for the Stage 2 assessment. This section is referred to as Section 3.

The conclusions from each of these assessments are included in Sections 4.2 to 4.7 below.

## 4.2 Economy Appraisal

For the Economy criterion, Option Comparison Estimates of the refined route options were prepared and a cost benefit analysis was completed for each route option. Factors such as route option length, property acquisitions and significant structures impact on the overall costs, whilst factors such as traffic volumes, junction connectivity and delay contribute significantly to the estimation of the benefits of the scheme, and it is the relationship of the costs of the route option to the benefits of the route options that define the economic appraisal of the route options.

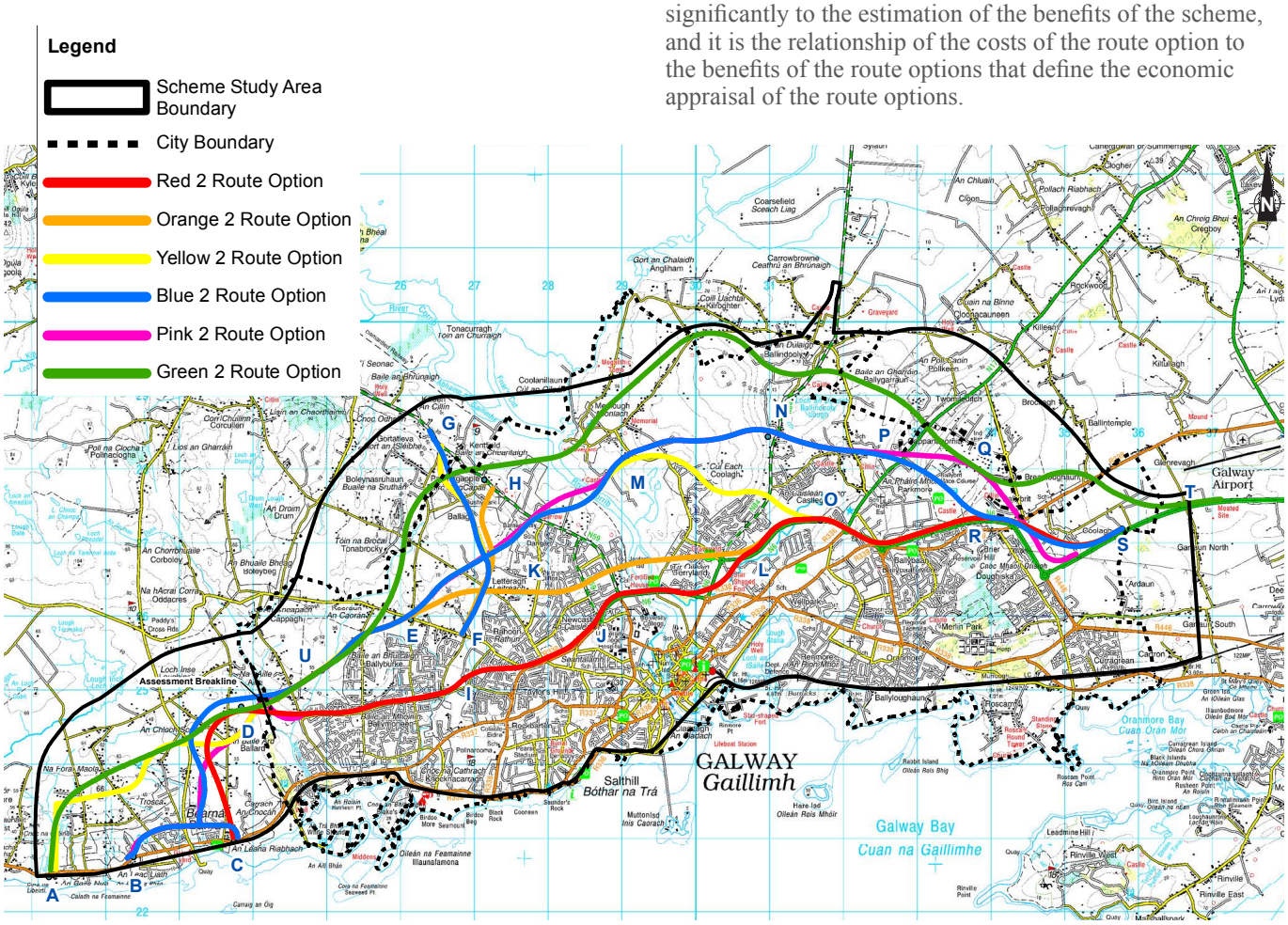



Figure 12 Stage 2 Route Options

### 4.2.1 Engineering Appraisal

The engineering assessment forms part of the economic appraisal in so far as engineering features contribute to both the costs and the benefits. The basis for the assessment of each criterion is outlined as follows:

- Geometry is an assessment of the horizontal and vertical alignment standards of each route option, with the route option achieving the desirable minimum standards or better being the most preferred;
- Length of the route options is an assessment of the travel distance along the route from the western tie-in at Bearna to the N6 tie-in at the east, with the shortest length being the most preferred;
- Junction strategy comprises an assessment of junction provision in terms of connectivity to attract traffic to the route option whilst also minimising delay to mainline traffic through over-provision of at-grade junctions;
- Assessment of the structures quantifies the total number of bridges and tunnels and the route option with the least number of structures was deemed most preferred due to having the lowest constructions costs and ongoing structural maintenance costs;
- Earthworks comprises an assessment of the balance of cut volumes and fill volumes along the route with the preferred route option being the route with the smallest difference in volumes i.e. most balanced;
- Constructability is linked to the extent of on-line construction as interfaces with existing residential areas and existing traffic are higher for on-line construction. Consideration is also given to the complexity associated with tunnel construction in this assessment; and
- The traffic assessment is based on the ability of the route option to meet the project objectives including providing connectivity from east to west across the city and the attractiveness of the route option to entice traffic away from local and street networks to the new road which ultimately provides relief to traffic congestion within the city centre.

A summary of the Engineering Appraisal is included below in Tables 4.2.1.1 and 4.2.1.2.

From an engineering perspective, the most preferred route options in Section 1 are the Red2 and Orange2 Route Options and in Section 2 are the Green2 and Pink2 Route Options.

For Section 3, the preferred junction arrangement at the N6 tie-in is the Pink2 Route Option as the convergence of all movements at this single junction occurs in an area where the existing N6 already dominates the landscape, which in turn reduces the impacts to the receiving environment at Coolagh Village in terms of traffic. It also provides a clear terminus to the western end of the M6.

Table 4.2.1.1 Engineering Summary – Section 1

| Route Options | Geometry | Length | Junctions | Structures | Earthworks | Constructability | Traffic | Overall Assessment |
|---|---|---|---|---|---|---|---|---|
| **Red 2** | I | **P** | **P** | I | LP | **P** | LP | **P** |
| **Orange 2** | I | **P** | **P** | I | LP | **P** | LP | **P** |
| **Yellow 2** | LP | LP | LP | **P** | **P** | I | I | I |
| **Blue 2** | LP | I | LP | I | **P** | LP | **P** | LP |
| **Pink 2** | LP | I | LP | **P** | I | LP | **P** | LP |
| **Green 2** | **P** | I | I | LP | LP | I | I | I |

Note: P = Preferred, I = Intermediate, LP = Least Preferred

Table 4.2.1.2 Engineering Summary – Section 2

| Route Options | Geometry | Length | Junctions | Structures | Earthworks | Constructability | Traffic | Overall Assessment |
|---|---|---|---|---|---|---|---|---|
| **Red 2** | LP | I | I | LP | LP | LP | **P** | LP |
| **Orange 2** | I | **P** | LP | LP | LP | LP | I | LP |
| **Yellow 2** | I | I | LP | **P** | I | I | I | I |
| **Blue 2** | I | I | I | I | I | **P** | I | I |
| **Pink 2** | I | I | I | I | **P** | **P** | I | **P** |
| **Green 2** | **P** | LP | **P** | I | I | **P** | LP | **P** |

Note: P = Preferred, I = Intermediate, LP = Least Preferred

### 4.2.2 Cost Benefit Analysis

Cost Benefit Analysis was undertaken for each route option. At route selection stage, the benefits and costs of the proposed scheme are assessed using agreed traffic growth scenarios. The "Do-Minimum" scenario (i.e. not to progress with the scheme) is compared with a number of "Do-Something" scenarios (i.e. the scheme options) which determines whether benefits resulting from each scheme option will outweigh the costs of construction and future maintenance.

The Stage 2 engineering assessment of each route option has been detailed above in order to fully understand the output from the cost estimates and the cost benefit analysis. As noted earlier, factors such as route option length and significant structures impact on the overall costs, whilst factors such as traffic volumes, junction connectivity and delay contribute significantly to the estimation of the benefits of the scheme, and it is the relationship of the costs of the route option.

The ranking of the cost benefit analysis is carried forward as the conclusion of the appraisal of the Stage 2 Route Options under the Economy criterion as it is representative of the accumulation of the contributing factors to the economic appraisal. This ranking shows Pink2, Green2 and Yellow2 Route Options as preferred, with Red2 Route Option as intermediate and Orange 2 Route Option as least preferred.

## 4.3 Safety Appraisal

All six route options were assessed in terms of safety benefits. An independent Road Safety Audit was undertaken for each route option to outline the impacts on road safety of the route options. A number of criteria were used to assess the route options such as route length, collision risk, travel time, access control, number of structures, geometry, attractiveness, consistency and vulnerable road user provision. Based on these criteria, the Pink1 Route Option was preferred with the Blue2 and Green2 Route Options also demonstrating high safety benefits. The Yellow2 and Orange2 Route Options were less preferable and the Red2 Route Option is least preferred.

In terms of an economic assessment of the safety benefits, all route options will deliver safety benefits as all options are forecast to deliver significant safety benefits to the network as a result of transferring high levels of traffic on to newer, safer roads. The on-line and partial on-line options such as the Red2, Yellow2 and Orange2 Route Options have the highest level of traffic transferred on to newer, safer roads. These options will demonstrate a higher economic value of safety benefits than the Blue2, Pink2 and Green2 Route Options when the transfer of traffic is considered in isolation. However, this transfer of traffic to new network also facilitates reallocation of road space on the existing network which is not assessed as part of the economic assessment of the safety benefits at this stage of the design.

Therefore, the routes are ranked equal from a safety perspective at this time as all options have the potential to deliver significant safety benefits.

## 4.4 Accessibility and Social Inclusion

Accessibility and Social Inclusion seeks to improve facilities for those without a car and to reduce access severance. The guidelines indicate that transport appraisals should assess the impacts of a road on vulnerable groups and deprived geographic areas.

The 'Do-Nothing' and 'Do-Minimum' options will allow traffic to continue to increase on the existing network and will stifle the possibility of any improvements to the public transport options as capacity will be restricted. Therefore, these route options will not offer any possibility of improving the modal shift to public transport and do not facilitate those without access to a private vehicle.

All of the route options seek to resolve the transportation issues in Galway which will free capacity for further improvements to the public transport network, which in turn will remove traffic from the city streets. This will allow improvement of the streetscapes to enable workers/ school children to commute by walking and cycling, thereby reducing the very high percentage of short commutes by providing a safe environment for such a change in behaviour.

Therefore all of the route options will facilitate the provision of improved public transport to a much greater extent in Galway by alleviating congestion and freeing capacity.

## 4.5 Integration Appraisal

All decisions must align with Government policy to ensure that the project is in line with land use integration, geographical integration and other Government policies. Options which provide resolution of the transportation issues in Galway must be compatible with the Government's objectives in the National, Regional and Local policy documents.

Transport integration aims to provide improved road linkages between key centres, improved connectivity between roads and other modes, improved public transport, and improved access to other transport infrastructure such as ports and airports. All of the route options have the potential to improve public transport by providing faster and more reliable routes, both at the higher level to connect Galway City with the other major cities and locally by relieving capacity for the further provision of local bus services. This is in line with National Spatial Strategy 2002 which outlines the need for improvement of Ireland's transport networks in order to improve regional accessibility and development. This in turn will support balanced regional development by revitalising these areas of the West.

The National Development Plan also supports development of all regions in Ireland within a co-ordinated, coherent and mutually beneficial framework with balanced regional development central to the investment strategy of the Plan. This is reinforced in the Regional Planning Guidelines.

Galway County Development Plan and City Development Plan seek to provide better connections to the trans-national network, relieve areas of congestion, provide multi-modal choice of travel and improve safety levels on all public roads, all of which bring markets closer together and serve to close the regional periphery gap.

Therefore all of the route options will improve integration in Galway by alleviating congestion and freeing capacity, all of which are not provided by the 'Do-Nothing' and 'Do-Minimum'.

## 4.6 Environmental Appraisal

Environment encompasses many disciplines, with the emphasis and importance of the different disciplines varying depending on the particular association and interaction with the receiving environment. A ranking assessment methodology was adopted for each of the environmental specialist assessments within the Environment criterion. Human Beings, Ecology, Landscape and Visual, and Material Assets – Non Agricultural are key disciplines under the Environment criterion. The Environmental Appraisal is outlined under each discipline heading below.

### 4.6.1 Ecology

A key factor in determining the order of preference from an ecological perspective was the potential for each of the route options to impact on Lough Corrib cSAC, given that it is the sole European designated site within the scheme study area that all route options must cross, and given the legal constraints that apply in relation to European protected sites under Articles 6(3) of the EU Habitats Directive 92/43/EEC, under the transposition of that Directive into Irish law, and under how the Directive is interpreted by relevant case law.

Of the six route options considered in this report, two were found likely to result in adverse effects on the integrity of Lough Corrib cSAC (Green2 and Yellow2 Route Options). Four were therefore considered equal with respect to their potential to adversely affect the integrity of European sites (Red2, Orange2, Pink2 and Blue2 Route Options).

In addition to considering the potential impacts on Lough Corrib cSAC in ranking the route options, other ecological impacts to other ecological receptors were also considered in determining the order of preference.

**Section 1**

The Orange2 and Red2 Route Options are preferred from an ecological perspective in Section 1.

**Section 2**

The Orange2 Route Option is one of the four route options which would not adversely affect the integrity of this cSAC and is the preferred route option overall (Sections 1-3 combined) in terms of ecology as it avoids direct impacts on Lough Corrib cSAC. In addition, as a significant length of the Orange2 Route Option is either predominantly online or underground, it has a reduced impact on many of the other ecological receptors identified within the scheme study area.

This is followed by the Red2 Route Option is second most preferred as, despite being one of the route options which would not aversely affect the integrity of this cSAC, there will some degree of works within the cSAC boundary. However, compared with the Blue2 and Pink 2 Route Options the impact on Lough Corrib cSAC will be less. It also has the lowest impact on Annex I habitats across the scheme study area of all the route options and, by virtue of being predominantly online, is likely to have the least impact on most other ecological receptors

The Pink2 and Blue2 Route Options are next in order of ranking as although they would not adversely affect the integrity of Lough Corrib cSAC and avoid any impacts to Annex I habitats within the cSAC boundary, they will result in some degree of habitat loss within the designated site. However, the potential for such habitat loss is less than that associated with the Green2 and Yellow2 Route Options. Blue2 Route Option is more preferred than Pink2 Route Option due to its smaller footprint within Lough Corrib cSAC and lesser impact on Annex I habitat overall in this section. These route options, along with the Green2 and Yellow2 Route Options, are likely to result in the greatest impacts to the local Lesser horseshoe bat population, and the local Barn owl population.

The Green2 Route Option is next in the order of ranking, one of the two route options likely to adversely affect the integrity of Lough Corrib cSAC. It is preferred over the Yellow2 Route Option as the degree of impacts to Qualifying Interests (QI) habitats is less.

As the route option with the greatest potential for impacts to QI Annex I habitat within Lough Corrib cSAC, and therefore the greatest degree of adverse effect on site integrity, the Yellow2 Route Option is the least preferred route option.

**Section 3**

There are two key ecological constraints in identifying the preferred junction with the existing N6 in the east: impacts to Annex I habitats and impacts to the local Barn owl population. As the Green2 Route Option has the greatest potential to affect the local Barn owl population and the Pink2 Route Option impacts on the greatest areas of Annex I habitats, both these route options are considered to be the least preferred. The Blue2, Red2, Orange2, and Yellow2 Route Option are therefore preferred on the basis that the loss of Annex I habitat is less than that associated with the Pink2 Route Option but greater than Green2 Route Option, and the potential for impacting on Barn owl is less than that likely to be associated with the Green2 Route Option.

These assessments are summarised in the matrices in Section 4.6.13 below.

### 4.6.2 Soils and Geology

The key factors to consider in terms of soils and geology are:

- Depths of principle cuts and the heights of fill sections;
- Extents of tunnels and tunnel construction methodologies (i.e. vary from cut and cover to bored tunnel); and
- Impact of soft ground and the potential technical solution to deal with such occurrences.

Each of the route options is also assessed under the following headings:

- Ground conditions and features in Karst Limestone Areas;
- Historical Land use;
- Economic Geology; and
- Geological Heritage Areas.

**Section 1**

Over Section 1, the route options are broadly similar with marginal differences between the route options.

**Section 2**

Over Section 2, the Green2 Route Option is marginally preferable to the Yellow2, Blue2 and Pink2 Route Options. The Green2 Route Option does not involve a bored or cut and cover tunnel and the associated risks of tunnelling. However, the River Corrib crossing is located in a soft ground area and would likely require complex pile foundations in an area with extensive soft soil deposits.

The Pink2 Route Option, Blue2 Route Option and Yellow2 Route Option have a more favourable River Corrib crossing location than the Green2 Route Option. Bedrock would likely be encountered at 5m to 10m below ground level. The tunnel sections on the Pink2 Route Option and Blue2 Route Option carry more risk at this stage than surface options on the Yellow2 Route Option.

The Red2 Route Option is predominantly in an urban environment and includes a tunnel in a residential area requiring excavation of granite to achieve the appropriate depth of excavation. This route option passes over the River Corrib and is routed through very soft, compressible soils in the Terryland River Valley which are likely to require pile foundations or significant ground improvement measures.

Over Section 2, the Orange2 Route Option is the least preferred route option from a soils and geology perspective. The route option involves the construction of a bored tunnel through a variety of bedrock conditions.

**Section 3**

The Green2 and Pink2 Route Options are the preferred route options in Section 3.

These assessments are summarised in the matrices in Section 4.6.13 below.

### 4.6.3 Hydrogeology

The route options were assessed to identify potential impacts on hydrogeological features, groundwater flow and groundwater quality which may subsequently impact on receptors such as groundwater dependent terrestrial ecosystems (GWDTE) or groundwater abstraction with the potential impact differing depending on the underlying geology.

The hydrogeological characteristics between the west and east of the scheme study area are substantially contrasting. In the west (Section 1 and part of Section 2), the poor bedrock aquifers tend to have limited flow paths and cause ponding above rock head and in the subsoils. In the east (part of Section 2 and all of Section 3), the limestone is a regionally important aquifer and all recharge goes to ground. In this regard there is significant storage in the limestones of the east and a relatively low storage in the granites of the west. As the limestone aquifer is karstic, there is also a high connectivity via fracture and conduit pathways and these also include surface landforms such as springs, turloughs and enclosed depressions.

Receptors which may be impacted by changes in groundwater flow, level or quality include GWDTE and abstractions.

Key GWDTE on the eastern part of the scheme study area include Coolagh Lakes, Ballindooley Lough, an area of marsh and wet grassland at Terryland, four turloughs and a wetland complex which is part of Lough Corrib cSAC. Key GWDTE on the western part of the scheme study area include heaths and bog complexes and part of the Lough Corrib cSAC. The features in the east are more likely to be more sensitive to significant changes in groundwater flow whereas recharge to the bogs and wet heaths in the western part of the scheme study area is likely to be dependent on surface water and localised perching or ponding of shallow groundwater.

Groundwater abstractions may be springs, wells or boreholes which are utilised by domestic, agricultural, commercial, industrial, local authority or group water scheme users. Abstractions may be impacted by the reduction in groundwater level, reducing the supply available, and deterioration of groundwater quality. With the exception of two key abstractions, a group water scheme located in Knocknacarra on the west and an industrial supply well for a commercial property on the east, the remainder of the abstractions are considered to be individual agricultural or domestic use.

**Section 1**

All route options in Section 1 avoid WDTE and the differentiating factor between the route options being the proximity of cuts to WDTE. The Orange2, Pink2 and Green2 Route Options have the least potential impacts and are ranked highest.

**Section 2**

All the route options have cuttings in Section 2 which may have a significant potential impact on a receptor. The Pink2 and Blue2 Route Options may have a significant/ profound potential impact on WDTE at Coolagh Lakes from the proposed tunnel at Lackagh Quarry. However, by the application of modern tunnelling techniques and construction controls, the risk of the tunnel affecting the existing hydrogeological regime is as low as reasonably practical, potentially reducing possible hydrogeological impacts to moderate which are temporary impacts. The Pink2 and Blue2 Route Options are also considered to have a potential significant impact on a large groundwater abstraction near Ballindooley. Therefore, the Pink2 and Blue2 Route Options are ranked lowest in Section 2. On assessment the Red2 Route Option is considered the preferred route option.

**Section 3**

All the cuttings in Section 3 have the potential to slightly impact on a nearby groundwater abstraction with little difference in the ranking of the N6 Junction.

These assessments are summarised in the matrices in **Section 4.6.13** below.

### 4.6.4 Hydrology

The route options were assessed to identify potential impacts on hydrology features, groundwater flow and groundwater quality which may subsequently impact on receptors. The key hydrological considerations in the impact assessment are:

- Watercourses and lake (permanent and seasonal loughs) crossings and floodplain encroachments, in particular River Corrib, and water quality impacts;
- Road Drainage Issues - urbanised area, pumping of tunnel drainage, lack of surface drains in eastern section of the scheme study area and proximity to streams for outfalling;
- Flood Risk Area (pluvial, fluvial, groundwater and coastal flood sources);
- Public Water supply – Galway City Council's Terryland Water Treatment Plant drinking water abstraction; and
- Hydro-ecology impacts aquatic habitats and species such as Wet heath, Blanket bog, Transmission mires, Wet heaths, Calcareous fens, Salmonid waters and the Natura 2000 sites (Lough Corrib cSAC and the Galway Bay Complex cSAC).

Across all three sections, from a hydrological perspective, all of the route options considered are acceptable and will not result in any significant hydrological impact that cannot be mitigated.

However, within Section 1, the Red2/Orange2 Route Option is the preferred route option. Within Section 2, the Orange2 Route Option is the preferred route option, with the Pink2 Route Option ranked as second. Within Section 3, the Green2 Junction Option is the preferred option and the Pink2 Junction is the least preferred.

### 4.6.5 Landscape and Visual

Development of any of the route options presents a significant challenge in terms of the landscape/townscape and visual environments. It is clear that each and every route option will result in very significant negative landscape and visual impacts both during construction and in operation. This is a result of the constrained nature of the physical landscape – shoehorned as it is between the city to the south and Lough Corrib to the north; the attractiveness and quality of the local landscape – and especially of the river/lake corridor; the developed and established extent of the city suburbs, with its diverse mix of residential, commercial, community, open space, recreational, and social land uses; the presence of architectural and cultural features; and the noted prominence and density of primarily – but not exclusively – residential development radiating out along and between local, regional and national roads throughout the scheme study area.

**Section 1**

The difference between the various route options is marginal within Section 1.

**Section 2**

By contrast impacts tend to be more expansive, intense and of greater duration and scale within Section 2. The intensity of proposed route options in combination with the nature, scale and duration of impact means that the Red2, Yellow2, Blue2 and Green2 Route Options are least preferable in landscape/townscape and visual terms. Whilst still having some very significant landscape/townscape and visual impacts, the Pink2 Route Options ranks as an intermediate preference. As a result of the long section of bored tunnel - and notwithstanding very significant construction impacts at portal sites - the Orange2 Route Option is considered to be most preferable in terms of landscape/townscape and visual effects.

**Section 3**

Within Section 3, the difference is less distinct between the route options, whilst noting that the impacts due to the Pink2 Route Option are localised in an area already dominated by the existing junction.

These assessments are summarised in the matrices in Section 4.6.13 below.

### 4.6.6 Archaeological, Architectural and Cultural Heritage

A detailed route options assessment has been carried out in order to identify potential impacts upon the archaeological, architectural and cultural heritage resource. Key considerations in this assessment are as follows:

- National Monuments in State guardianship or ownership. A national monument receives statutory protection. There are no national monuments located within any of the route options under assessment;
- Sites protected by Preservation Orders List and/or Temporary Preservation Orders, as they are deemed to be in danger of injury or destruction. There are four sites that possess Preservation Orders within the corridors of the route options under assessment;
- Demesne landscapes, most notably Menlo Castle;
- Protected structures identified in the City and County Development Plans namely Menlo Castle and Bushypark House;
- Thatched houses that are listed as protected structures within the village of Menlough;
- Archaeological constraints located within the Galway Racecourse comprising a deserted medieval settlement, tower house, enclosure, ringfort and an undated house. All of the sites are recorded monuments and further protected with Preservation Orders; and
- A possible ecclesiastical enclosure (along with the site of a church and graveyard) dating from the medieval period at Rahoon.

**Section 1**

The Red2 and Orange2 Route Options are preferred for Section 1 with the remaining four route options all ranked as intermediate.

**Section 2**

The Green2 is least preferred in Section 2 as it is the longest route and has the highest amount of direct impacts on both the recorded and previously unrecorded archaeological, architectural and cultural heritage resource. It impacts on Menlo Castle, Menlough Village and three demesne landscapes in the vicinity of the N59 namely Menlo Castle, Genlo Abbey and Bushypark House. Red2 Route Option is also least preferred due to its impacts on a recorded church site, graveyard and ecclesiastical enclosure within the former demesne of Rahoon House.

The Orange2 Route Option is the preferred route option from an archaeological, architectural and cultural heritage perspective in Section 2 as no profound direct impact upon the archaeological or built heritage resource have been identified. These assessments are summarised in the matrices in Section 4.6.13 below.

### 4.6.7 Material Assets – Agriculture

Each of the route options were assessed for potential impacts on agricultural land, farm yards and equine enterprises. The shortest route options and the more urban route options will be the least damaging from an agricultural perspective.

**Section 1**

Within Section 1, Red2 and Orange2 Route Options are preferred. All other Route Options are considered acceptable because all route options are located on a low sensitivity agricultural environment.

**Section 2**

Within Section 2 the agricultural environment is low – medium sensitivity. The Red2 Route Option is preferred and the Green2, Blue2 and Pink2 Route Options are least preferred.

**Section 3**

Within Section 3 the agricultural environment is low – medium sensitivity. The Red2, Orange2 and Yellow2 Route Options are preferred and Green2 is least preferred.

These assessments are summarised in the matrices in Section 4.6.13 below.

### 4.6.8 Material Assets – Non-Agriculture

The assessment of material assets – non-agriculture includes an assessment of impacts on residential properties, impacts on commercial and industrial properties and impacts on the infrastructure of public and private utilities/service providers.

For the purposes of assessing direct impacts on properties the footprint for each of the route options were considered to include all lands required to construct the proposed road plus an additional area known as a buffer zone from the edge of the earthworks, within which drainage and maintenance access tracks are accommodated.

On analysis, the impacts on the utility infrastructure was minimal in comparison with the impact on residential and commercial properties. Therefore, the ranking of the route options was based on the property impact assessment.

**Section 1**

Within Section 1, the Yellow2 Route Option is preferred due to the significantly lower number of direct impacts than all other route options. There are an additional 15 homes to be fully acquired on the Green2 Route Option and it is considered the least preferred.

**Section 2**

Within Section 2 the route options passing through the urban areas have a significant impact on residential homes. The Pink2 and Orange 2 Route Options are preferred and the Yellow2 Route Option is least preferred, with the impacts on the Yellow2 Route Option more than double that of the most preferred route option.

**Section 3**

Within Section 3 there are fewer residential homes in the areas already occupied by road infrastructure. Therefore, the Pink2 Route Option is preferred as it has minimal property acquisition.

These assessments are summarised in the matrices in Section 4.6.13 below.

### 4.6.9 Air Quality and Climate

Baseline data for air quality was obtained from the Environmental Protection Agency (EPA) data; this was used to describe existing local air quality conditions within the scheme study area in relation to nitrogen dioxide (NO2) and particulate matter (PM10). The air quality assessment then considers impacts on the number of sensitive receptor locations within 50m of the carriageway of all road links that would experience a significant increase or decrease in traffic emissions i.e. 10% or more, for each of the route options.

Sensitive receptor locations are defined as residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. Designated habitats are also potentially sensitive receptors.

As there are sensitive receptors within close proximity to route options, it is necessary to predict pollutant concentration. Concentrations of both nitrogen dioxide and PM10 at a number of receptors are calculated for the year of opening. Predicted values are then added to future background levels to determine cumulative impacts and compared to air quality standards. When these total levels are compared to the air quality standards, all predicted results are in compliance with the air quality standards for NO2 and PM10.

From an air and climate perspective, the preferred route option is the route option with the lowest NOx and PM10 index and the least preferred route option is the option with the highest NOx and PM10 index.

**Section 1**

For Section 1, the preferred route options from an air quality and climate perspective are the Red2, Orange2 and Yellow2 Route Options, with very little variation between the NOx and PM10 index for these three options.

**Section 2**

For Section 2, the preferred route options from an air quality and climate perspective are the Yellow2, Blue2 and Pink2 Route Options, and again there is very little variation between the NOx and PM10 index for these route options.

These assessments are summarised in the matrices in Section 4.6.13 below.

## 4.6.10 Noise and Vibration

In terms of operational noise, the NRA guidelines set the design goal for Ireland and outline a structured approach which should be taken in order to ameliorate as far as practicable road traffic noise through the consideration of mitigation measures.

A 3D model of the scheme study area was developed using ground contour mapping and OS mapping. A 3D model of each route option was developed based on the horizontal and vertical alignment. A noise contour grid was calculated for each route option taking account of the traffic volumes, speeds and other factors affecting the propagation of sound. The number of noise sensitive properties falling beneath the design goal noise contour line was determined from the noise contour grid. Finally, the route options which were found to have the least overall noise impact to the surrounding environment were ranked in order of preference.

**Section 1**

Overall, in Section 1 the most preferred route options are the Red2 and Orange2 Route Options whilst the least preferred route option is the Yellow2 Route Option, followed by the Blue2, Pink2 and Green2 Route Options.

**Section 2**

In Section 2, the most preferred route option is the Pink2 Route Option whilst the least preferred options are the Red2, Orange2, Yellow2 and Green2 Route Option.

**Section 3**

In Section 3, the most preferred is the Pink2 Route Option whilst all others are ranked intermediate. These assessments are summarised in the matrices in Section 4.6.13 below

## 4.6.11 Human Beings

Impacts on human beings that are typically associated with road development fall into four principal categories, namely:

- Journey characteristics, accessibility and connectivity, i.e. potential impacts on journey time, journey time reliability and travel patterns including accessibility and connectivity;
- Community severance with regard to the use of community facilities, particularly those used by older people, children or other vulnerable groups. The category includes both new severance and relief from severance;
- Amenity, i.e. impacts on individual and community well-being due to exposure to the environmental impacts of traffic (e.g. safety, noise, dirt, visual intrusion and air quality); and
- Impacts that could affect economic growth prospects and employment.

Impacts can be positive or negative with their significance dependent, amongst other considerations, on the scale of impact, nature of the environment affected, number of people affected, the duration of an impact and the probability of its occurrence.

The assessment generally addresses impacts at a community level rather than for individuals or identifiable properties, although impacts for individual businesses are considered where these are located beside a route option or are very dependent on road traffic or accessibility.

This section can be read in conjunction with Material Assets Non-Agriculture which contains details of residential properties and, by association, constraints in terms of individual dwellings. The Air Quality and Climate and Noise and Vibration sections also address constraints in terms of human beings. Landscape and Visual also includes for constraints relative to amenities enjoyed by individuals.

This section of the report focusses on the impacts of journey characteristics, community severance, amenity and economic considerations across the three sections of the options assessment.

**Section 1**

The Yellow2 Route Option in Section 1 is the preferred Route Option. The Red2 and Orange2 route options are least preferred in terms of socio-economic and human impacts.

**Section 2**

In Section 2, there are some key impacts of high significance to the welfare of human beings. For the Green2 Route Option, there are three significant severance and amenity impacts applying to the communities of Ballagh, Ballindooley and, especially, Menlough. For the Blue2 Route Option, there are significant severance impacts in Upper Dangan, in the crossing of the NUIG Recreational Facilities and at the Galway Racecourse.

By comparison, the alignment of the Pink2 Route Option has a lesser impact on the recreational facilities and commercial premises, but a greater relative impact on residential properties in Dangan while avoiding a direct impact on the racetrack at Galway Racecourse. The link to the N59 offered by the Orange2 Route Option has the least impact of the link options considered.

The Red2 Route Option takes the scheme through the city. Potentially, there are benefits to improved traffic flow and relief from severance at locations that already present significant adverse impacts to the local community posed by the existing road. However, any gains would be achieved at the expense of a considerable number of demolitions and a long construction period during which there will be very significant severance and amenity impacts.

In Section 2, the order of preference is the Orange2, Pink2, Blue2, Yellow2, Green2 and Red2 Route Options. These assessments are summarised in the matrices in Section 4.6.13 below.

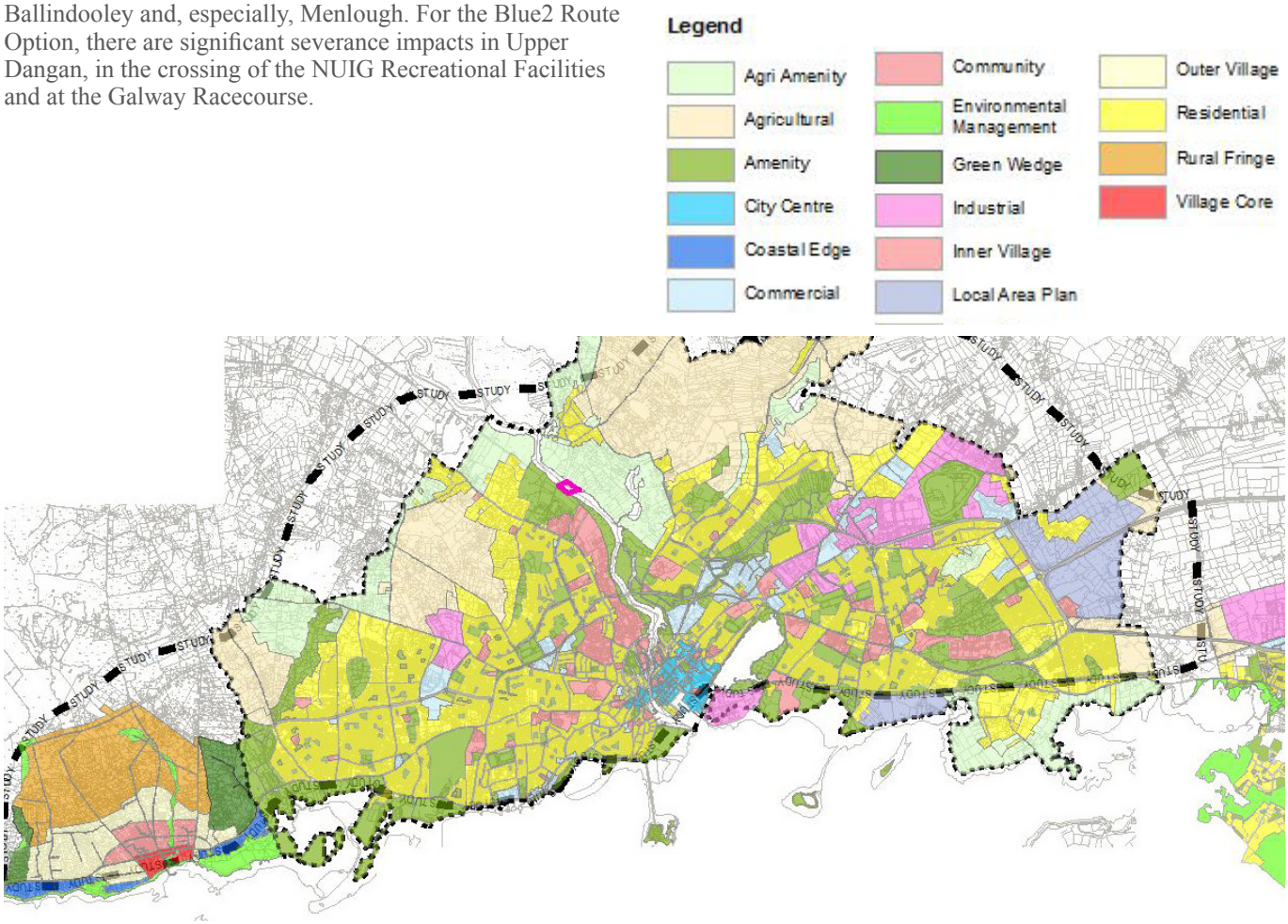



Figure 13 Preferred Route Option with land use mapping

## 4.6.12 Planning

Planning policy assessment focuses on the city and county planning policy and how it interacts with the route options. Policies and objectives in both the City and County Development Plans seek to enhance the natural and built environment, continue to improve economic competitiveness, and deliver an integrated land use and sustainable transport system.

The proposed N6 Galway City Transport Project seeks to respond to the broad policy objectives of the County and City Plans, and the six route options proposed seek to balance the wider county and city objectives with local objectives. All of the route options provide the potential to improve public transport infrastructure through the removal of through traffic from the city street network, allowing public transport and public realm improvements to take place, facilitating the modal shift to public transport and other non-private vehicles modes such as walking and cycling, as per Government and local policy.

In addition, each of the route options will facilitate the delivery of the planned new town at Ardaun (east Galway) as per the City and County Development Plan objectives. Regeneration of key land banks in the city centre, including at Ceannt Station and the port, will also be facilitated through the easing of congestion on the city street network, making their regeneration more attractive in city-building terms, thus achieving the city's objective of city consolidation and a strong land use mix in the city core.The proposed route options seek to deliver on broad planning policy objectives and to work with national, regional, county, city and local objectives, minimising impacts where possible, in order to achieve an overall transport solution for the Galway Metropolitan Area.

**Section 1**

The Yellow2 and Green2 Route Options are preferred in Section 1, due to the benefit of linking more westerly to the R336, west of Bearna Village and therefore largely respecting the integrity of the village, and its connection to Galway City.

**Section 2**

The Pink2 Route Option is preferred in Section 2. The Pink2 Route Option has the benefit of running just beyond the city's main built up area, largely protecting the integrity of the city proper, and providing the infrastructure to create a more compact city structure. It has a route which runs north of the racetrack at Galway Racecourse, more northerly of NUIG than the Yellow2 and Blue2 Route Options, and south of Menlough/Menlo Castle & Demesne.

**Section 3**

The Pink2 Route Option is preferred in Section 3, due to its early tie-in with existing road infrastructure to the east at the N6, and minimised impact on the integrity of Coolagh, Briarhill and its ability to serve the future planned town at Ardaun. These assessments are summarised in the matrices in Section 4.6.13 below.

## 4.6.13 Environmental Summary Matrix

An overall summary of the rankings for each of the environmental appraisals for each of the three sections is included in Tables 4.6.13.1 to 4.6.13.3 below. The Yellow2 Route Option is the preferred for Section 1 as it has the least number of least preferred rankings and got a preferred ranking on three key environmental disciplines shown in italics.

Table 4.6.13.1 Environmental Summary Matrix – Section 1

| Route Options | *Ecology** | Soils & Geology | Hydrogeology | Hydrology | *Landscape & Visual** | Archaeology & Heritage | Material Assets - Agri | *Material Assets - Non Agri** | Air & Climate | Noise & Vibration | *Human Beings** | Planning | Overall Ranking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Red 2** | **P** | I | LP | **P** | LP | **P** | **P** | LP | **P** | **P** | LP | LP | LP |
| **Orange 2** | **P** | **P** | I | **P** | LP | **P** | **P** | LP | **P** | **P** | LP | LP | LP |
| **Yellow 2** | LP | I | LP | I | **P** | I | I | **P** | **P** | I | **P** | **P** | **P** |
| **Blue 2** | I | **P** | LP | I | LP | I | I | I | LP | LP | I | LP | I |
| **Pink 2** | I | I | **P** | LP | I | I | I | I | LP | LP | I | LP | I |
| **Green 2** | LP | LP | I | I | LP | I | LP | LP | I | LP | I | **P** | LP |

Note: P (bold & underlined) = Preferred, I = Intermediate, LP = Least Preferred

The Orange2 and Pink2 Route Options were both the preferred for Section 2. The Orange2 Route Option has the greatest number of preferred rankings (six), two intermediate ranking and four least preferred. Whilst the Orange2 Route Option has four least preferred rankings, none of these were for key environmental disciplines. The Pink2 Route Option has the second highest number of preferred rankings (four), six intermediate rankings and two least preferred. The Pink2 Route Option has the lowest number of least preferred rankings taking all environmental disciplines into consideration.

The Pink2 Route Option is the preferred junction option for Section 3. All route options have a similar number of preferred, intermediate and least preferred rankings however the Pink2 Route Option has the most number of preferred rankings (four). Taking into consideration how many of these route options were preferred for key environmental disciplines, the Pink2 Route Option also has the highest number of preferred rankings.

Table 4.6.13.2 Environmental Summary Matrix – Section 2

| Route Options | *Ecology** | Soils & Geology | Hydrogeology | Hydrology | *Landscape & Visual** | Archaeology & Heritage | Material Assets - Agri | *Material Assets - Non Agri** | Air & Climate | Noise & Vibration | *Human Beings** | Planning | Overall Ranking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Red 2** | **P** | LP | **P** | I | LP | LP | **P** | LP | LP | LP | LP | LP | LP |
| **Orange 2** | **P** | LP | I | **P** | **P** | **P** | I | **P** | LP | LP | **P** | LP | **P** |
| **Yellow 2** | LP | I | I | I/LP | LP | I | I | LP | **P** | LP | LP | LP | LP |
| **Blue 2** | I | I | LP | I | LP | I | LP | I | **P** | I | I | LP | I |
| **Pink 2** | I | I | LP | I | I | I | LP | **P** | **P** | **P** | I | **P** | **P** |
| **Green 2** | LP | **P** | I | I | LP | LP | LP | I | I | LP | LP | **LP** | LP |

Note: P (bold & underlined) = Preferred, I = Intermediate, LP = Least Preferred

Table 4.6.13.3 Environmental Summary Matrix – Section 3

| Route Options | *Ecology** | Soils & Geology | Hydrogeology | Hydrology | *Landscape & Visual** | Archaeology & Heritage | Material Assets - Agri | *Material Assets - Non Agri** | Air & Climate | Noise & Vibration | *Human Beings** | Planning | Overall Ranking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Red 2** | **P** | I | I | I | LP | **P** | **P** | LP | LP | I | I | LP | I |
| **Orange 2** | **P** | I | I | I | LP | **P** | **P** | LP | LP | I | I | LP | I |
| **Yellow 2** | **P** | I | I | I | LP | **P** | **P** | LP | LP | I | I | LP | I |
| **Blue 2** | **P** | I | I | I | LP | **P** | LP | I | LP | I | I | LP | I |
| **Pink 2** | LP | **P** | LP | LP | **P** | LP | LP | **P** | I | **P** | I | **P** | **P** |
| **Green 2** | LP | **P** | I | **P** | I | LP | LP | I | **P** | I | I | LP | I |

Note: P (bold & underlined) = Preferred, I = Intermediate, LP = Least Preferred

### 4.6.14 N59 Link

A review of the constraints and the potential impacts of the N59 Link options was completed in order to select the optimum N59 link connection. There are three options to connect the N59 to the mainline when the mainline is offset from the N59:

- Orange2 N59 Link;
- Yellow2 N59 Link/Pink2 N59 Link; and
- Blue2 N59 Link.

The principal differences between the link options are the locations of the tie-in on the N59. The various link options impact on residential communities, local roads and private accesses to varying degrees. An engineering assessment was completed and this showed that the Orange2 N59 Link is the shortest link with minimal interaction with the surrounding local road network and when tested in the traffic model with the emerging preferred route corridor, the traffic volumes on this link were greater than any of the other link options under consideration. Therefore, from an engineering perspective the preferred N59 Link is the Orange2 N59 Link.

An environmental appraisal was also carried out on the N59 Link with the key differences being consideration of human beings and non-agricultural material assets.

On review of the engineering and the environmental assessments of the N59 Link, the overall preference is the Orange2 N59 Link.

## 4.7 Summary Appraisal

A project appraisal of Stage 2 Route Options was carried out using the project appraisal matrix (comprising the 5 Common Appraisal Criteria of Economy, Safety, Environment, Accessibility and Social Inclusion and Integration). A matrix of this project appraisal for each of the three sections is included. The Galway City boundary line represents the assessment breakline, between Section 1 and Section 2, as this is the point at which route options merge and it becomes possible to switch between route options. An additional break down at the N6 tie-in at Briarhill, Coolagh has been incorporated in order to compare the junction layouts at the N6 tie-in for the Stage 2 assessment. This section is referred to as Section 3.

### 4.7.1 Project Appraisal Matrix

Table 4.7.1 below presents the project appraisal for the route options in Section 1 . The location of the breakline between Section 1 and Section 2 is along the Galway City boundary to the east of Bearna Village. Section 1 extends from the R336 to the Galway City boundary.

Table 4.7.1 Project Appraisal – Section 1

| Route Options | Economy* | Safety | Environment | Accessibility | Integration | Overall |
|---|---|---|---|---|---|---|
| **Red 2** | - | Similar | LP | Similar | Similar | LP |
| **Orange 2** | - | Similar | LP | Similar | Similar | LP |
| **Yellow 2** | - | Similar | **P** | Similar | Similar | **P** |
| **Blue 2** | - | Similar | I | Similar | Similar | I |
| **Pink 2** | - | Similar | I | Similar | Similar | I |
| **Green 2** | - | Similar | LP | Similar | Similar | LP |

Note: P = Preferred, I = Intermediate, LP = Least Preferred

**A cost benefit analysis (COBA) was undertaken for each route option in its entirety and informed the overall rankings under the heading of Economy. As the economy criterion did not influence the route selection for Sections 1 and 3 it is included in Section 2 only and omitted from Sections 1 and 3.*

Table 4.7.2 below presents the project appraisal for the route options in Section 2. Section 2 extends from the Galway City boundary to the existing N6 in the east of the city.

Table 4.7.2 Project Appraisal – Section 2

| Route Options | Economy | Safety | Environment | Accessibility | Integration | Overall |
|---|---|---|---|---|---|---|
| **Red 2** | I | Similar | LP | Similar | Similar | LP |
| **Orange 2** | LP | Similar | **P** | Similar | Similar | LP |
| **Yellow 2** | **P** | Similar | LP | Similar | Similar | LP |
| **Blue 2** | **P** | Similar | I | Similar | Similar | I |
| **Pink 2** | **P** | Similar | **P** | Similar | Similar | **P** |
| **Green 2** | **P** | Similar | LP | Similar | Similar | LP |

Note: P = Preferred, I = Intermediate, LP = Least Preferred

Table 4.7.3 below presents the project appraisal for the route options in Section 3. An additional breakline at the N6 tie-in at Coolagh has been incorporated in order to compare the junction layouts at the N6 tie-in for the Stage 2 assessment. This section is referred to as Section 3

Table 4.7.3 Project Appraisal – Section 3

| Route Options | Economy* | Safety | Environment | Accessibility | Integration | Overall |
|---|---|---|---|---|---|---|
| **Red 2** | - | Similar | I | Similar | Similar | I |
| **Orange 2** | - | Similar | I | Similar | Similar | I |
| **Yellow 2** | - | Similar | I | Similar | Similar | I |
| **Blue 2** | - | Similar | I | Similar | Similar | I |
| **Pink 2** | - | Similar | **P** | Similar | Similar | **P** |
| **Green 2** | - | Similar | I | Similar | Similar | I |

Note: P = Preferred, I = Intermediate, LP = Least Preferred

As can be seen from the above tables, the Yellow2 Route Option is preferred for Section 1, the Blue2 and Pink2 Route Options are intermediate and the Red2, Orange2 and Green2 are least preferred.

In Section 2 the Pink2 Route Option is preferred, with the Blue2 Route Option ranked as intermediate and Red2, Orange2, Yellow2 and Green2 being least preferred.

The preferred route option in Section 3 is the Pink2 Route Option.

**A cost benefit analysis (COBA) was undertaken for each route option in its entirety and informed the overall rankings under the heading of Economy. As the economy criterion did not influence the route selection for Sections 1 and 3 it is included in Section 2 only and omitted from Sections 1 and 3.*

### 4.7.2 Pair-wise Comparison - Section 2

A 'Flaw Analysis' was carried out on each route option in Section 2 as one mechanism to qualitatively assess the Stage 2 Route Options which in turn could be used to test the assessment ranking of each route option and the selection process. Each route option through Section 2 was reviewed in turn and each discipline identified their most critical flaws. A switch from the Green2 Route Option to the Blue2 Route Option was also included in the pair-wise comparison. This 'Green2 - Blue2 Switch Route Option' provided an alternative route option which included the Green2 Route Option from the R336 to and including, the River Corrib crossing point and then connects with the Blue2 Route Option before entering into Lackagh Quarry and followed the path of the Blue2 Route Option to the existing N6. This is referred to as the 'Green2 – Blue2 Switch Route Option'.

The consensus from this comparative assessment was that the Red2, Yellow2 and Orange2 Route Options through Section 2 are not feasible in so far as they are not deliverable or realisable due to flaws identified. Equally as further mitigation by avoidance is unlikely to improve these route options, these route options were not included in the pair wise comparison. A pair-wise comparison analysis was carried out on the remaining route options through Section 2 with the outcome of this pair-wise comparison validating the project appraisal matrix process – Pink2 Option is the preferred option over Section 2.

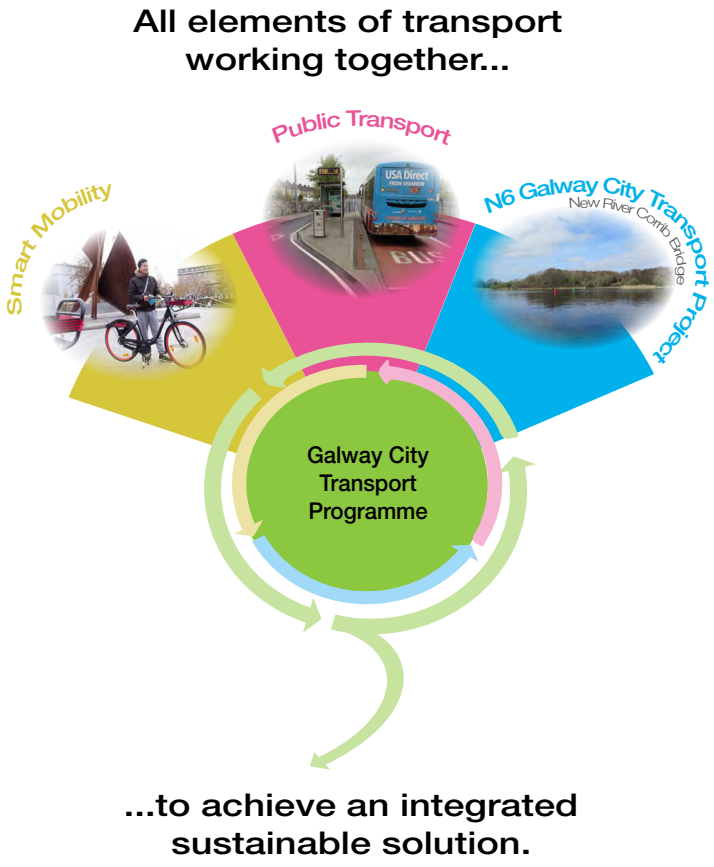
## 4.8 Emerging Preferred Route Corridor

Upon completion of the project appraisal outlined above, the Emerging Preferred Route Corridor was developed as an amalgamation of different route options over two sections, namely R336 to the Galway City boundary and the Galway City boundary to N6.

The preferred route option for Section 1 is the Yellow2/ Green2/Pink2 Route Option and for Section 2 is the Pink2 Route Option. The N59 Link associated with the Orange2 Route Option is preferred to that of the Pink2 Route Option as it has a lesser impact on residential properties and it is also preferable in terms of traffic. This Emerging Preferred Route Corridor is referred to as the Maroon Route Option.

Therefore, the Maroon Route Option is the Yellow2/Green2 Route Option over the initial part of Section 1, connecting the Pink2 Route Option at Barr hAille and follows the path of the Pink2 Route Option to its termination at the N6 in Coolagh, with the exception of the N59 Link. The N59 Link will comprise the link as presented in the Orange2 Route Option with a slight modification to tie to the Pink2 Route Option.

The Emerging Preferred Route Corridor is presented on **Figure 14.**



# 5 Emerging Preferred Route Corridor

## 5.1 Public Display No. 3

Public Display No. 3 took place on 25 and 26 May 2015 at the Menlo Park Hotel, Galway and the Westwood Hotel, Galway respectively. The Emerging Preferred Route Corridor on display at Public Consultation No. 3 is shown on **Figure 14.**

Galway City Council in conjunction with the National Transport Authority (NTA) also consulted with the public over this two day period on the details of the Integrated Transport Management Programme (ITMP).

The joint presentation and consultation on the overall solution was very worthwhile as it afforded the public an opportunity to see how the component parts of the solution fit together to deliver an overall transport solution.

The general feedback included the need to implement improved public transport and smart mobility measures which in turn may lead to a reduced need for road infrastructure and thus lesser impacts on residential communities. Work to integrate all three components will form part of the next phase to ensure that the ultimate scheme progressed represents the optimum solution for Galway's transport infrastructure for the future.

## 5.2 Recommendation

The recommendations of this Route Selection Report are:

- As a road component is needed, adopt the preferred route corridor of the N6 Galway City Transport Project as the optimum corridor for additional road infrastructure which meets the objectives; and
- Review the extent of provision of road infrastructure necessary within this preferred route corridor in conjunction with the wider integrated management transport programme for Galway which will identify the level of service requirements for each mode of transport; including walking, cycling, public transport and private vehicle.

The parallel processes of identification of a preferred route corridor for the road component and the identification of the maximum service provision by other transport modes, will ensure delivery of an overall sustainable transport solution in order to meet both the current and future travel needs of Galway.

Work will continue through Phase 3 to continue to refine the design within the preferred route corridor to minimise impacts of the proposals on the receiving environment.

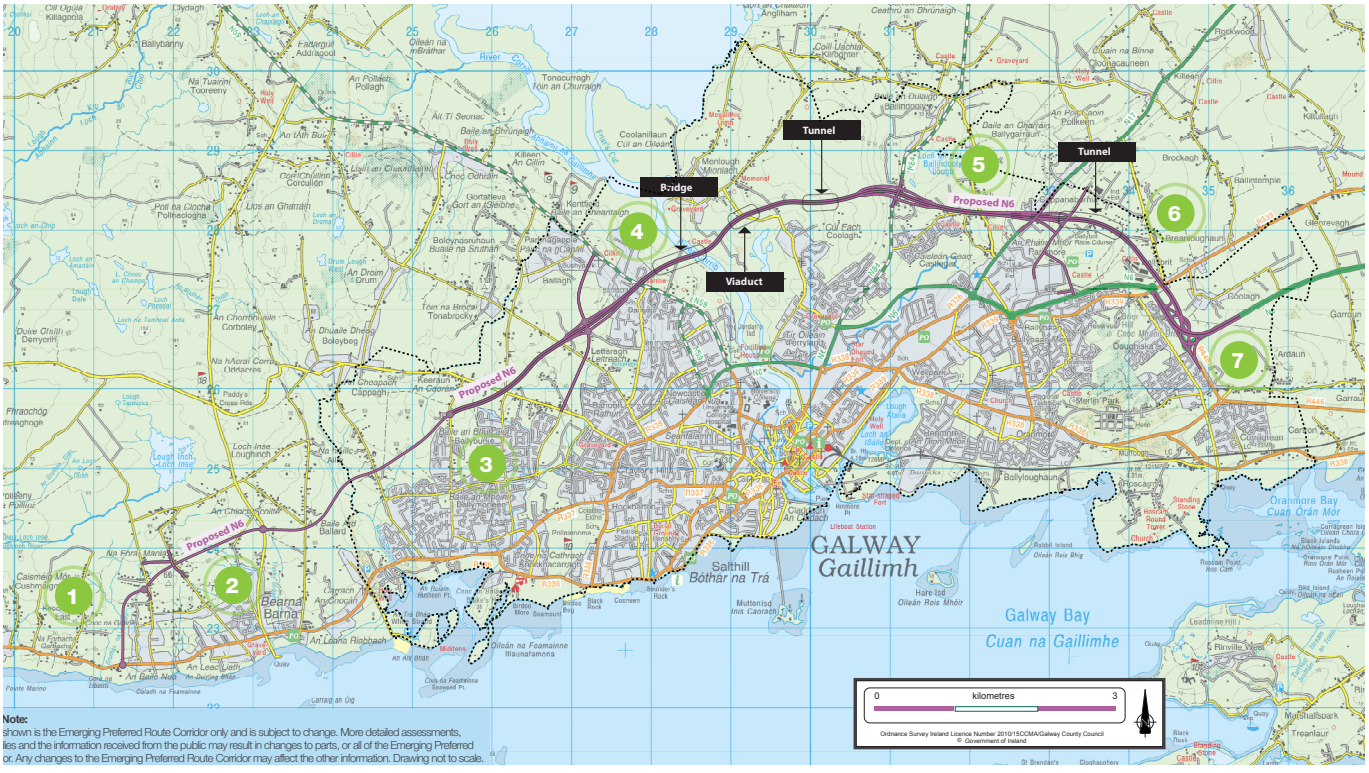



Figure 14 Emerging Preferred Route Corridor