Western Rail Corridor

Financial and economic appraisal

June 2020

MOTT MACDONALD

EY
Building a better working world

Overview

Public consultations

This review was informed by a wide variety of opinions

6,572	20	116
Survey responses	face to face meetings	written submissions

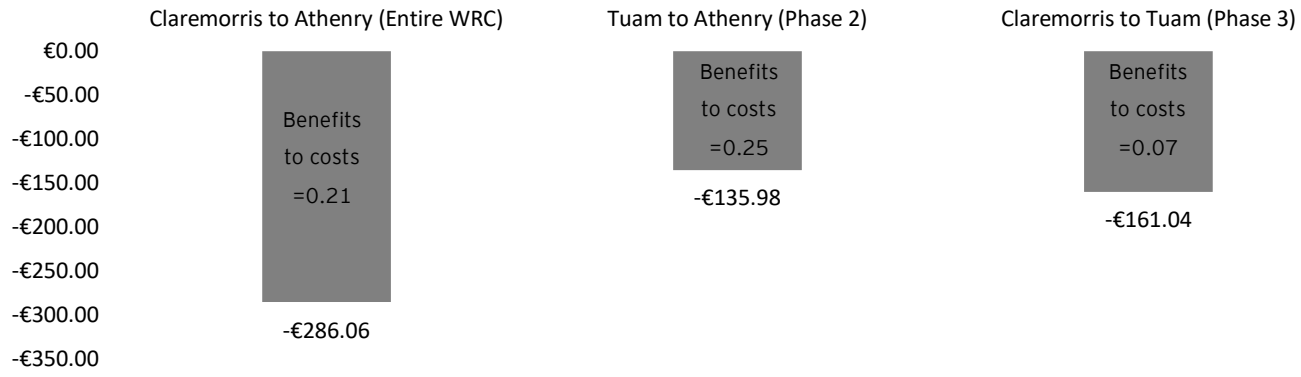
Implications for opening the WRC Athenry to Claremorris

Building on the consultation, detailed analysis was undertaken

Total passengers	Capital cost	Wider benefits
552k pa	€263.8m	€3.1m pa
Based on 15 passenger trains and 1 freight train per day (2030)	Spread over 4 years of construction with line opening in 2026	Covering emissions, travel costs, noise etc (2030).
Ticket revenue	**Operating costs**	**Additional funding**
€2.2m pa	€2.4m pa	2030 - €1.4m pa 2050 – €3.6m pa
plus additional rail access charges for freight (2030)	covering salaries, maintenance and fuel costs (2030)	To cover both infrastructure and operations costs

NPV of the different options

This analysis was done for each of the options considered (NPV over 30 years)



Findings

None of the options generate a positive return on investment with all three having a benefit to cost ratio of less than 1.

Building a better working world

Ernst & Young
Business Advisory
Services
Harcourt Centre
Harcourt Street
Dublin 2
D02 YA40
Ireland

Tel: + 353 1 475 0555
Fax: + 353 1 475 0599
ey.com

Reliance Restricted

Iarnród Eireann
Amiens St
North Dock
Dublin

25 June 2020

Western Rail Corridor: Financial and economic appraisal

Dear Iarnród Eireann,

In accordance with the terms of the engagement letter dated April 2019, we have assisted you in delivering a financial and economic appraisal of the proposed reopening of phases 2 and 3 of the Western Rail Corridor. This report sets out our findings.

Limitations of Scope

We have not, except to such extent as you requested and we agreed in writing, sought to verify the accuracy of the data, information and explanations provided by yourselves, and you are solely responsible for this data, information and explanations. We have therefore relied on the information provided by you to be accurate and complete in all material respects. The report has been provided to you for the above Purpose only and should not be used or relied upon for any other purpose, nor should it be disclosed to, or discussed with, any other party without our prior consent in writing.

Use and distribution of this report

This report is prepared for the purpose set out in the Agreement and may only be used and disclosed, quoted or referred to on the basis set out therein. Ernst & Young only accepts responsibility to the addressees of this letter on the basis of the Agreement and assumes no responsibility whatsoever in respect of or arising out of or in connection with the contents of this letter to parties other than yourselves. If other parties choose to rely in any way on the contents of this letter they do so entirely at their own risk.

We appreciate the opportunity to have provided EY's services toIarnród Eireann. Should you have any queries or comments regarding this report or if we may be of any further assistance, please do not hesitate to contact us.
Yours sincerely

EY

Table of contents

Executive summary

This report has been undertaken by EY-DKM and Mott MacDonald in response to a commitment in the National Planning Framework …

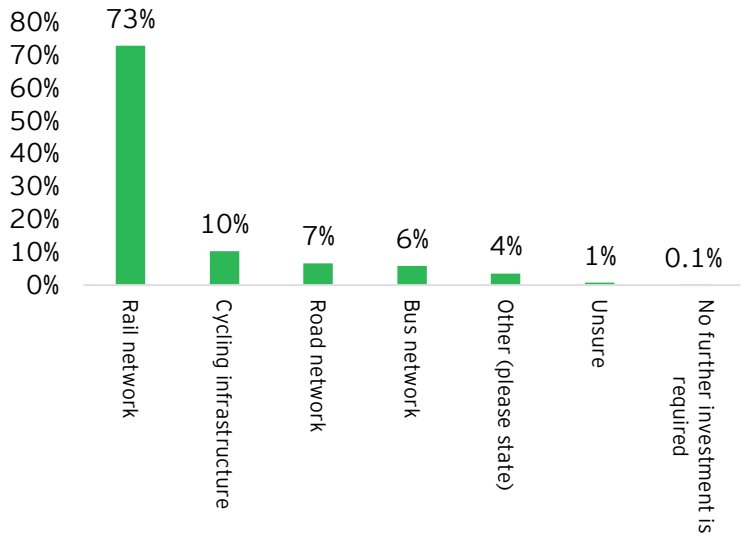
The Western Rail Corridor (WRC) is a railway line spanning the West of Ireland, with one phase of the line (Ennis to Athenry) currently in operation. The remainder of the Western Rail Corridor consists of sections linking Athenry to Tuam (Phase 2), Tuam to Claremorris (Phase 3) and Claremorris to Collooney (Phase 4).

This report is in response to the commitment set out in the National Development Plan 2018 – 2027 (NDP) to undertake an independent review of the economic and financial case for the WRC Phases 2 and 3. This report has been undertaken by EY-DKM Economic Advisory Services and Mott MacDonald.

The aim of this report is to assess whether the investment which would be required to reactivate these two phases can be justified in delivering value for money for the Irish Exchequer. In order to establish whether this is the case, the financial and wider economic implications of the reactivation have been assessed and a Cost Benefit Analysis ('CBA') completed.

… with significant public interest in the Western Rail Corridor, with views both for and against it.

Figure 1: Public views on focus of investment in transport in the West of Ireland



At the start of the assessment phase of this work, a detailed public consultation was undertaken to understand wider views and ensure that they were considered as part of this assessment.

This was broken into three components:

1. Stakeholder meetings: 20 Key stakeholders were invited to take part in consultations
2. Public Survey: an online survey was undertaken which gathered 6,572 unique responses
3. Written submissions: 116 email and postal submissions were received by EY-DKM through a dedicated email address.

This consultation exercise found that there were two main points of view: those who supported the reactivation of the line and those who supported turning the line into a Greenway (a dedicated cycle path along the route of the rail line). As can be seen in Figure 1, the overwhelming majority (73%) of those surveyed felt that the focus of investment should be on rail.

If the line is reactivated it is anticipated that 575,000 passengers will travel on it each year by 2030…

The demand modelling was based on:

- an hourly train service in each direction running over a 15-hour day. 15 services each way, hourly
- 90 mph design speed
- Claremorris to Galway direct
- Stations serviced - stopping at Claremorris, Tuam, Athenry, Oranmore and Galway
- 2 car ICR fleet
- Fare – in line with existing fares
- Interchange at Athenry for Limerick service

Figure 2: Estimated passenger demand for phase 2 and 3 combined (000s)

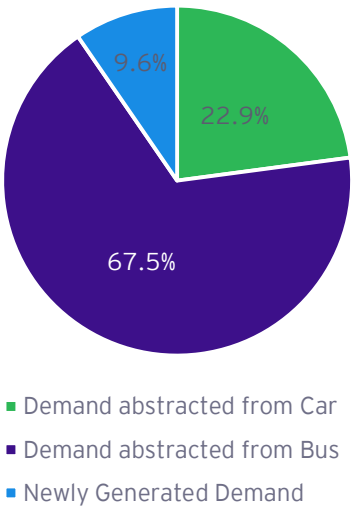
Source: Mott MacDonald

The demand model assumed that the line would be active from 2026 and demand would build up over four years, culminating in 575,000 journeys by 2030 (552,000 locals and 23,000 tourists). After that, demand would grow in line with population forecasts for the Western region.

In addition, it is anticipated that the line would provide additional routing options for freight, providing a better connection to the ports of Waterford and Shannon Foynes (should its proposed line reactivation go ahead). The model therefore assumes that one additional freight train per day will also use the line, removing 18 lorry journeys.

… with 67.5% of passengers swapping from bus journeys and 22.9% from car journeys.

Figure 3: Source of passenger demand



Source: Mott MacDonald

The demand analysis finds that the majority of these passengers will already be users of public transport, primarily buses, with only a moderate number swapping from car to train.

This is because the train line to Galway goes via Athenry, meaning it is a considerably longer distance than the equivalent road journey for many potential passengers (even allowing for congestion in Galway). Therefore, the overall journey time is longer, despite faster train speed.

In addition, there is a good bus service between the key urban centres of Tuam and Galway, with 11 buses daily, meaning that many commuters will already be using public transport.

As a result, the number of cars journeys that would be avoided if the line was reactivated is relatively limited. A total of 315 car journeys a day will be avoided, reducing car journeys during the rush hour by around 86, in 2030. This is not considered to have a significant impact on congestion or journey times.

The total upfront cost of reactivating phases 2 and 3 of the line is anticipated to be just under €264m (ex VAT) over 4 years….

In order to deliver the service which will be required to deliver the schedule described above, a significant amount of engineering work will be required. The total cost of this is projected to be €263.8m (excluding VAT), prior to the inclusion of the shadow price of public funds (as explored in section 7.4.3). In addition to refurbishing the embankments and bridges and restoring the rail line itself, modern signalling and communication technology will need to be installed, safe crossings built where roads cross the tracks and new rolling stock purchased.

The key cost driver for this will be the need to replace the permanent way (the rail line, sleepers and ballast) for the entire length of the line, due to its current poor state. The other key cost driver is the need for new signalling along the route, especially around the large number of level crossings.

Figure 4: Capital costs (€millions), Excluding VAT, 2019 prices

Source: Mott MacDonald

… with the line costing €3.6m in operating and infrastructure maintenance and renewal costs and delivering €2.2m in revenue per annum by 2030, meaning Irish Rail will require an additional funding of €1.4m in 2030.

By 2030, 575,000 passengers will be travelling on the line on an annual basis. Based on revenue data for similar rural lines in Ireland, it is estimated that this will lead to ticket revenue of €2.2m per annum.

This needs to be set against the Railway Undertaking operating costs of €2.4m per annum by 2030. These operating costs will cover the salaries of the train drivers, fuel for the trains and the associated maintenance. In addition, the Infrastructure Manager's maintenance, renewal and operating costs for the line maintaining the line itself will cost €1.2m from 2026 onwards, growing to €4.1m by 2056.

Figure 5: 2030 Operating costs, 2019 prices

Source: Irish Rail

The revenue associated with additional freight trains on the line will be offset by the costs associated with them, resulting in no net gain for Irish Rail.

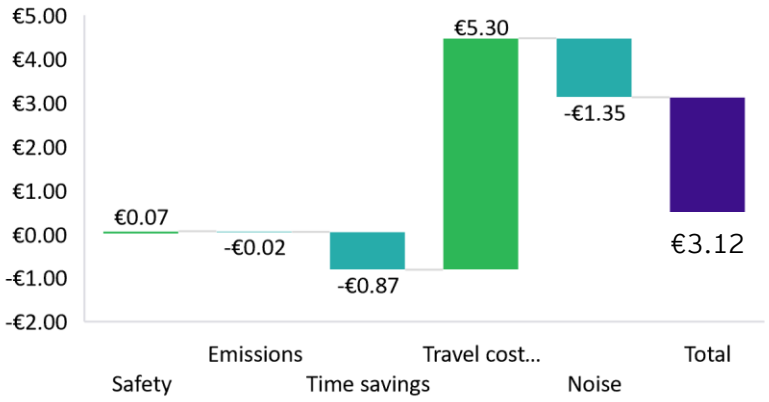
These costs need to be set against quantified economic benefits estimated at €3.1m per annum ….

The revenues arising from the WRC will not cover the operating costs, let alone the capital costs, meaning that the reactivation cannot be justified on a purely financial basis. However, it is necessary also to assess the wider economic benefits.

In order to value these benefits, the methodology set out in the Common Appraisal Framework has been used. This allowed for a valuation of benefits associated with the time and travel cost savings as well as the impact on road traffic accidents and emissions.

The main benefits calculated were associated with travel cost savings, fuel, running and parking costs, due to the reduced number of car and lorry journeys (€5.3m per annum).

Figure 6: 2030 Annual economic benefits (millions)



Source: EY analysis

Due to the longer distance the line needs to travel to arrive at Galway City, road will remain faster (even allowing for congestion). Therefore, car drivers who swap to rail will get a cheaper but slower journey meaning an offsetting cost of time of €0.9m. Journey times do not include time spent waiting for trains at the station meaning this may underestimate the overall gap in travel times and associated costs.

Due to the relatively small numbers of vehicles taken off the road, a number of the benefits, such as safety, are projected to be small. For the same reason, the emissions benefit of reduced vehicles on the road is projected to be completely offset by the increased rail emissions. The impact on congestion into Galway City was also considered; however, as discussed above, these were assessed to be negligible and were therefore not modelled.

Reactivating the rail corridor will also significantly increase background noise levels for houses and businesses close to the line. The cost of this is estimated at €1.4m, however this may underestimate the costs for those households currently living in very quiet parts of the route (i.e. outside of the urban centres). Should the freight service need to run during the night to avoid interfering with passenger services, this is likely to increase the costs even further.

… as well as wider, non-quantified benefits, associated with increased industry, tourism and inclusion.

The benefit calculation of €3.1m above only considers the benefits which can be expressed as a monetary value. A number of the key benefits raised during the consultation process could not be assessed on this basis; however, it is important that they are also considered alongside the quantified benefits.

A key benefit to the line will be its ability to attract additional people into the area, be they tourists or new residents, who will contribute to the wider economic well-being of the West of Ireland and support the goals set out in the National Development Plan. In particular, the WRC should encourage people to move to areas on the North-West Coast (North of Galway City), supporting the development of those communities. However, most of these individuals will likely be drawn from

other locations in Ireland (such as Dublin or Galway City), meaning the benefit to the Irish economy as whole will be limited.

The WRC is also anticipated to support social integration and cohesion by connecting isolated people and communities to the wider range of services which are available in Galway City. Finally, the train can be expected to deliver more reliable journeys than bus trips as it will not be affected by road traffic congestion.

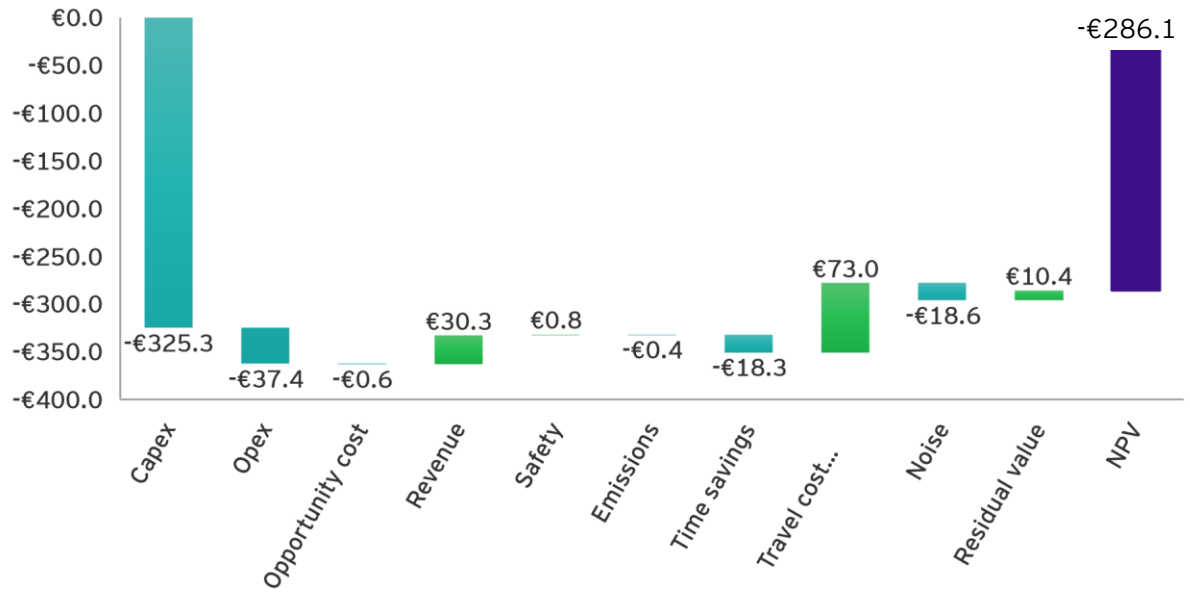
However, reactivating the WRC will require 9 new rail crossings to be introduced, all of which will need to close twice an hour (for the train going in each direction). This will lead to delays for road users held at the barriers, introducing an associated economic cost. Due to the lack of reliable data on some of the quieter roads which would cross the line, it is not possible to estimate the numbers who will be impacted. This means it was not possible to quantify this cost.

The output of this analysis show that the economic benefits associated with the reactivation do not offset the costs, with a Benefit to Cost Ratio ('BCR') of 0.21 …

The costs and benefits discussed above were then drawn together into a single Net Present Value ('NPV') calculation to assess the overall value for money of the WRC[1]. This calculates the present value of both the costs and benefits and then subtracts the costs from the benefits.

Despite the strong economic benefits that the line delivers, they are not found to be sufficient to justify the large capital costs which would be required to reactivate the line. The total NPV for the line (both Phases 2 and 3) was found to be -€286.1m, which implies that for every €1 invested society would only gain €0.21.

Figure 7: Net Present Value (millions) of reactivating the line



Source: EY, Mott MacDonald analysis

This result needs to be balanced against the wider economic benefits which could not be included in the NPV calculation. The value of this is mainly associated with new passenger journeys, which would be associated with passengers gaining access to previously unreachable locations, jobs or

[1] In line with the public sector spending code, all capital and operational costs have been increased by the shadow price of public funds, currently set at 130% (i.e. a 30% increase).

services. However, given the large negative NPV it is not anticipated that these benefits are sufficient to justify the reactivation of the line.

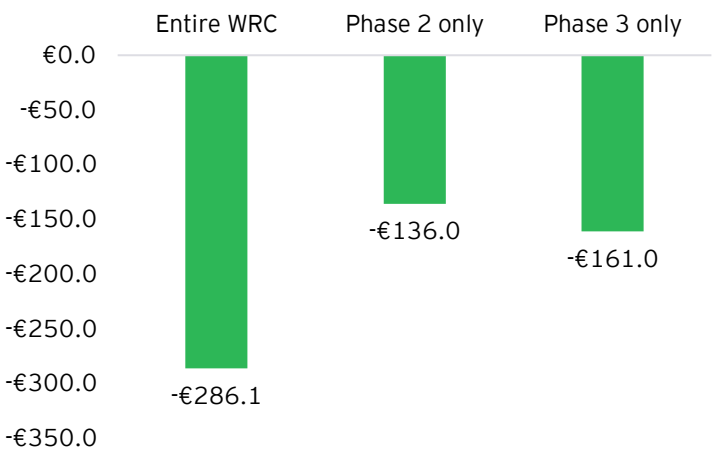
… a conclusion which remains true even if only part of the line is reactivated, with a BCR of 0.25 for Phase 2 and 0.07 for Phase 3 …

As well as considering the case for reactivating the entire WRC, reactivating Phase 2 or Phase 3 individually was also considered. These were therefore both modelled separately to see if a smaller reactivation was more justified.

Both also generated a negative NPV, as well as a BCR which was less than 1.

In both cases the BCR was marginally lower than for reactivating the entire line than for Phase 2 alone. This is due to the loss of all benefits associated with freight under these options, neither Phase 2 or 3 alone would provide any additional connection to the Ballina Freight station.

Figure 8: NPV (millions) of various options for reactivation



Source: EY, Mott MacDonald analysis

… as a result, this report finds that there is not a value for money argument for reactivating the Western rail corridor.

For a project to be considered a priority against other competing requirements for public investments, a Benefit to Cost ratio of greater than 1 would normally be required. Whilst any project with a ratio of 1 or higher generates a return to society, in times of limited available capital, projects with higher ratios would normally be prioritised to gain maximum return for the Exchequer. The return on the Western Rail Corridor is well below this level, meaning that it cannot be justified in terms of quantified benefits.

This result is mainly due to the large capital costs involved in reactivating the line, and it is noted that the operation running costs of the line are justified in terms of the annual economic benefits. The benefits are not sufficient to justify the capital costs due to the limited diversion of passengers from car onto rail, which in turn restricts the wider economic benefits. Testing was undertaken to assess whether a more frequent service would have impacted this result; however, with a strong existing bus service between Tuam and Athenry and good road connection, this was not found to have a major impact on the results. In addition, sensitivity testing was undertaken across a wide range of potential scenarios, including significant increases in passenger demand and reductions in associated car journeys. However, these were not found to raise the Benefit to Cost ratio above 0.31.

Whilst there are wider benefits associated with the line, this analysis suggests that they are not sufficient to justify the costs. Therefore, the reactivation of the WRC is not considered value for money under a reasonable range of assumptions of demand and pricing.

Due to the large gap between the costs and benefits, this is not likely to change as the population in the West rises. Therefore, it is not considered that a delay in reactivating the line would have a material impact on this.

1. Introduction

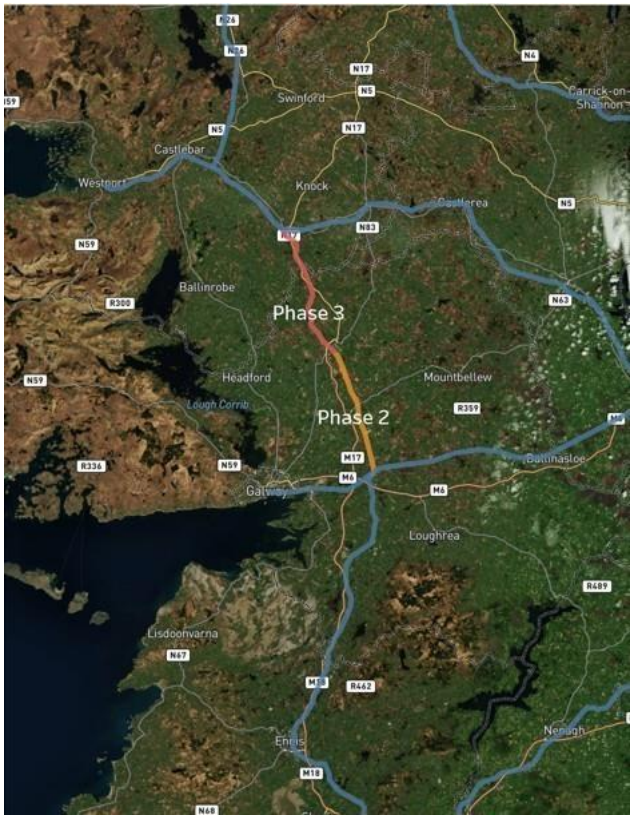
1.1 Background and requirement

The Western Rail Corridor (WRC) is a partially decommissioned railway in the West of Ireland. The only section currently in operation is between Ennis and Athenry (Phase 1), which facilitates journeys between Limerick and Galway.

This assessment is based on the commitment set out in the National Development Plan 2018 – 2027 (NDP). This has a number of National Strategic Outcomes designed, in part, to achieve more balanced regional development. As part of Outcome 2: Enhanced Regional Accessibility, the NDP states:

> *The Western Rail Corridor Phase 2 from Athenry to Tuam, and Phase 3 to Claremorris could play an important role in the Atlantic Economic Corridor. The extension of the WRC could increase passenger, tourist and commercial use. In line with the Programme for Government an independent review will be undertaken immediately. If the findings of the review are approved by Government, the project will be prioritised during this plan.*[2]

Figure 9: Proposed WRC extension



Source: Iárnród Éireann, Mott MacDonald

In order to ensure that the report is fully independent of Iarnród Éireann (IE), this assessment has been undertaken by EY-DKM and Mott MacDonald. The aim of the report is to establish whether there is an economic and financial case for Phase 2 (Athenry to Tuam) and Phase 3 (Tuam to Claremorris) of the WRC to be reactivated. The results of this research will be presented in the form

[2] https://assets.gov.ie/4049/071218131542-81b907e357df447cb8b471788cf6ecfe.pdf

of a Cost Benefit Analysis (CBA) in line with the Public Sector Spending Code (PSC) and the Common Appraisal Framework (CAF) for Transport Projects and Programmes.

The purpose of this report is to set out the costs and benefits of the proposed extension of the WRC into Phases 2 and 3. This document contains a detailed demand model, sets out probable capital and maintenance costs and results in an economic valuation which considers the wider social and environmental costs and benefits of the proposal under various scenarios and assumptions.

1.2 Structure of this report

This report begins by setting out the strategic case for rail and why a case could be made that an investment in the WRC could deliver value for money. It considers the economic and policy drivers which affect the West of Ireland and the role that rail may have in addressing these. It also considers the scope of the project (i.e., the WRC only rather than all rail in the West of Ireland) and sets out the options that will be assessed. **This information can be found in Chapter 2.**

Once this has been set out it goes on to consider the four key tasks that were undertaken to draw together this report. These are:

1. **Stakeholder engagement**: in order to ensure that all relevant evidence was considered, EY undertook a detailed stakeholder consultation. This included an online survey, face to face meetings and written submissions. All views and evidence provided was then fed into the remaining 4 tasks. **The key views expressed as part of this can be found in Chapter 3**.

2. **Demand Modelling**: in order to assess the likely use of the line, a detail demand model was constructed. This was based on information provided by IE and the National Transport Authority (NTA) alongside a model developed by Mott MacDonald. The results were then benchmarked against other similar routes. **Details on the approach and findings can be found in Chapter 4.**

3. **Cost estimates:** a number of detailed work streams were undertaken by Mott MacDonald to estimate likely costs, based on the schedule of services assumed in the demand modelling. This considered both the capital cost required to open the line, alongside the maintenance and upgrade costs which would be required during the lifetime of the railway. **Full costs for all of the major elements can be found in Chapter 5.**

4. **Financial and economic benefits:** this also draws on the demand modelling to assess the likely benefits to the Irish economy, primarily based on the numbers travelling on the route. It is split into two subcomponents:

    a. **Financial benefits:** this examined the direct revenue streams, such as ticket or freight revenues, which would result from the demand estimates. It also considers the likely need for Public Sector Obligation (PSO) subsidies. **The estimates for the financial benefits can be found in Chapter 6**

    b. **Economic benefits:** this looked at the wider benefits to Irish society, such as reduced CO_2 emissions or increased road safety. It also considers potential negative impacts such as increased level of noise along the line itself. **The estimates for the economic benefits can be found in Chapter 7**

The detail of all of this analysis is then drawn together into a single model which assesses whether the costs required to reopen the line and operate the service can be justified based on the benefits that it will be anticipated to deliver. This assessment is based on a calculation of a Net Present Value (NPV) for each option. This NPV calculates the total value of the benefits minus total value of the costs, and therefore a positive NPV is required for the option to represent good value for money. **The approach taken and the NPV for each option can be found in Chapter 8**

In order to ensure that the report remains as readable as possible, only the key details have been included in the main body of the report. In most cases more detailed technical research has been undertaken to support these assessments. Details of this research can be found in the appendixes at the end of this report.

2. Strategic case

2.1 Introduction

This chapter sets out the case for potential investment in rail in the West of Ireland. It looks at how the economy of the West is changing and the policy changes which are both responding to this change and indeed driving it. It reviews in full all available relevant data and shows the trends over the last number of years.

The purpose of this chapter is to set out the likely potential benefits which could be associated with the WRC and the options which are being considered to generate these benefits. It does not attempt to assess whether the likely benefits justify the costs; this is undertaken in the subsequent sections.

2.2 Economic context

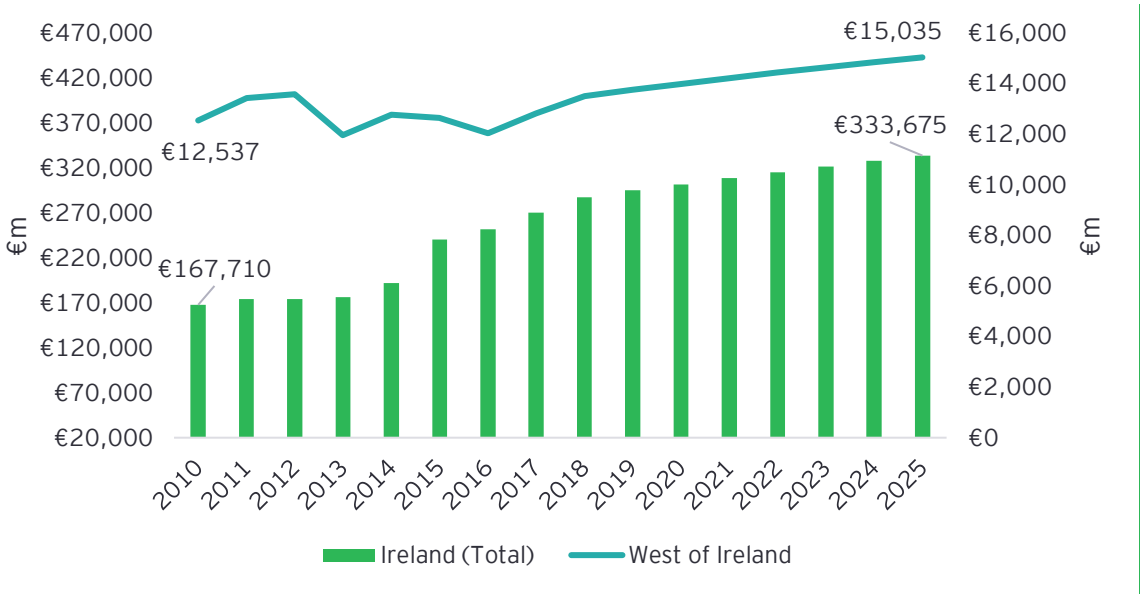
The Irish economy has made a strong recovery since the economic recession of 2008. The West has experienced a marked recovery during this time period, with increased economic output and more people living and working in the area, earning higher wages, spending more in the local economy.

2.2.1 Socioeconomic changes

During the period 2010 to 2018, the economy in the Western Region[3] grew at a rate of 1.2% per annum. Although this is a positive result, it is well below the national level of growth of 4.7% per annum. As can be seen in Figure 10: Aggregate GVA (€m), 2010 to 2025

Figure 10, this growth has picked up since 2016 and is forecast to increase steadily to 2025 and beyond.[4] This is also reflected through an increase in personal consumption: Figure 11 demonstrates personal consumption levels increased in the western region by 1.2% per annum and in Ireland by 2.0% per annum within the period up to 2025.

Figure 10: Aggregate GVA (€m), 2010 to 2025

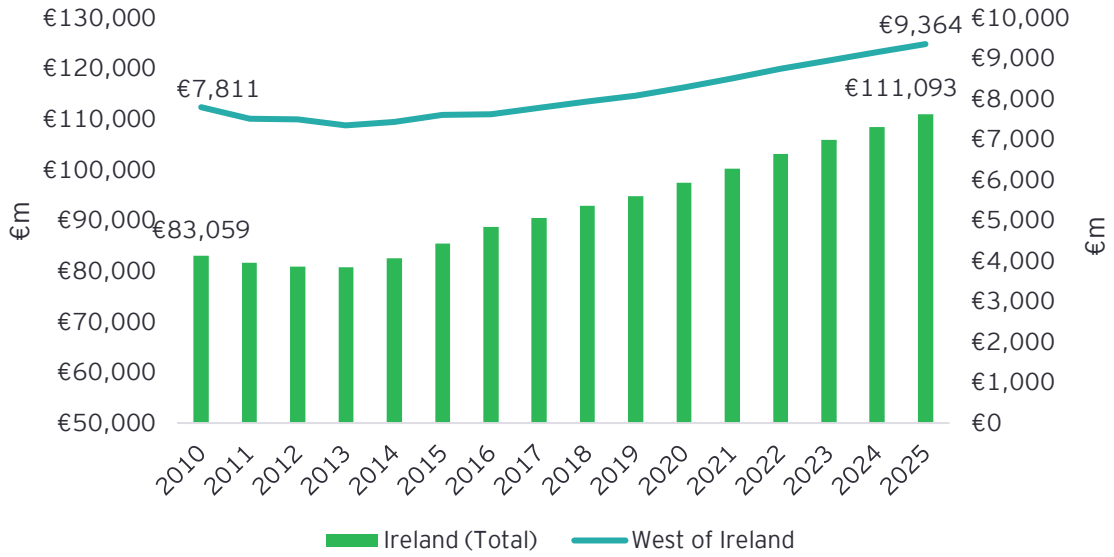


[3] The Western Region is a NUTS III region and consists of the counties of Galway, Mayo and Roscommon with Galway city as the regional capital. It is located on the western seaboard of Ireland with the Atlantic Ocean to the West and the River Shannon delimiting the region to the east.

[4] All forecasts in this section are provided by Oxford Economics

Source: CSO, Oxford Economics

Figure 11: Personal Consumption (€m), 2010 to 2025



Source: CSO, Oxford Economics

Alongside the increase in economic prosperity, there has also been an increase in the population in the West of Ireland. Figure 12 shows that growth within the Western region started to pick up in 2016 and is forecast to continue growing at an annualised rate of 0.6% per annum to 2025 and beyond. The average growth rate of the total population of Ireland is slightly higher at 0.8% per annum to 2025 and beyond.

Figure 12 : Population in Ireland, 2010 to 2025

Source: CSO, Oxford Economics

This economic growth has been reflected in a strengthening labour market. Figure 13 shows total employment levels growing over the period, with employment in the western region forecast to be 38,700 higher in 2025 than in 2010. The annualised growth rate for the West of Ireland is 1.4%,

compared to a national average 1.6% per annum, which represents an employment increase of 494,400 when we compare 2010 and 2025 figures.

Figure 13: Total Employment, 2010 to 2025

Source: CSO, Oxford Economics

In the 2013 to 2018 period, construction (+7,800 jobs), accommodation and food (+4,100) and manufacturing (+3,200) were the three largest sectors in terms of job creation in the West. This trend is forecast to continue across the five-year period to 2025 with Construction (+3,700) and manufacturing (+2,400) remaining as the top sources of job creation.[5]

Unemployment has been falling steadily across the country and there are now 19,000 fewer claimants on the Live Register in the West than there were in 2010. The claimant rate now stands at 4.2%, having fallen from 8.9% over the same period.[6] The fall in the region's ILO unemployment rate[7] is even more striking – falling from 16.6% in 2012 to 5.5% in Q1 2019.[8] This claimant rate is 0.7 percentage points higher than the State average.

As a result of increasing employment and wages, household disposable income in the West has increased significantly over the past few years. Figure 14 shows that real household disposable income, i.e., adjusted for inflation, increased by €630 per month in the West from 2013 to 2018[9] and this is forecast to continue rising at an annualised rate of 1.8% out to 2025. This compares with a national forecast for an annualised rate of 2.1% for the same period 2018-2025.

[5] Oxford Economics

[6] CSO, EY calculations

[7] International Labour Organisation (ILO) unemployment measure captures all unemployment, including those who are not claiming benefits

[8] CSO, Labour force survey

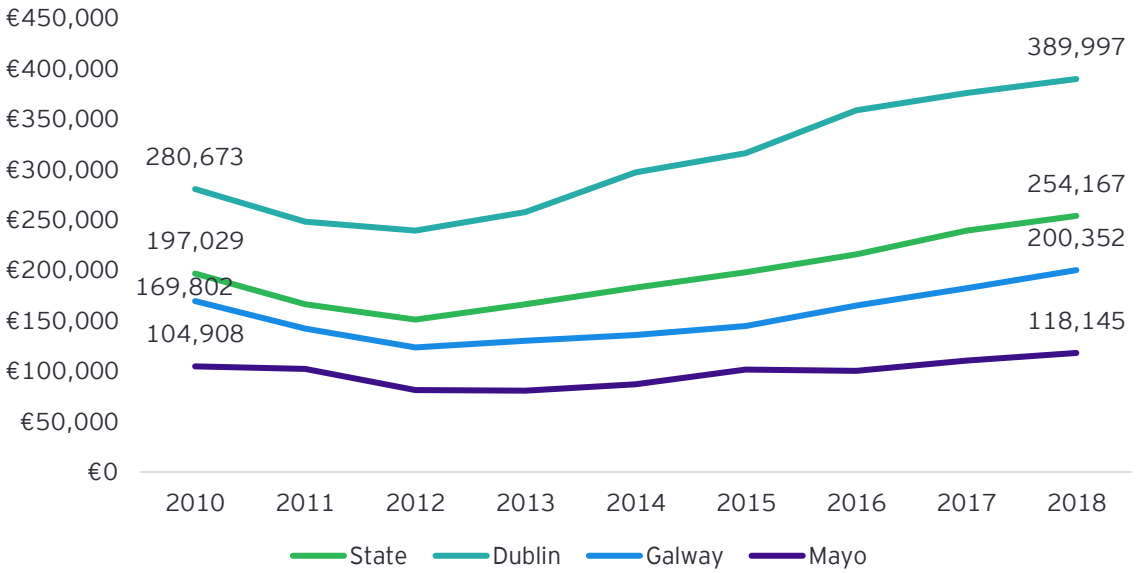
[9] These are in constant 2010 prices

Figure 14: Household Disposable Income (€m), 2010 to 2025

Source: CSO, Oxford Economics

One of the consequences of the economic recovery has been increased pressures on the housing market. This has been experienced across the country. Figure 15 shows the growth in median house prices[10] which have been observed across the country, and in selected counties. The average annual growth rate across the State between 2012 (when house prices started to recover) and 2018 is 9.0%, which is only slightly above Galway's growth of 8.4%, but considerably above Mayo's rate of 6.4%. Galway City is one area where house price pressure is felt. This may encourage a move to towns within commuting distance to these urban centres.

Figure 15: Median house prices, 2010 to 2018



Source: CSO

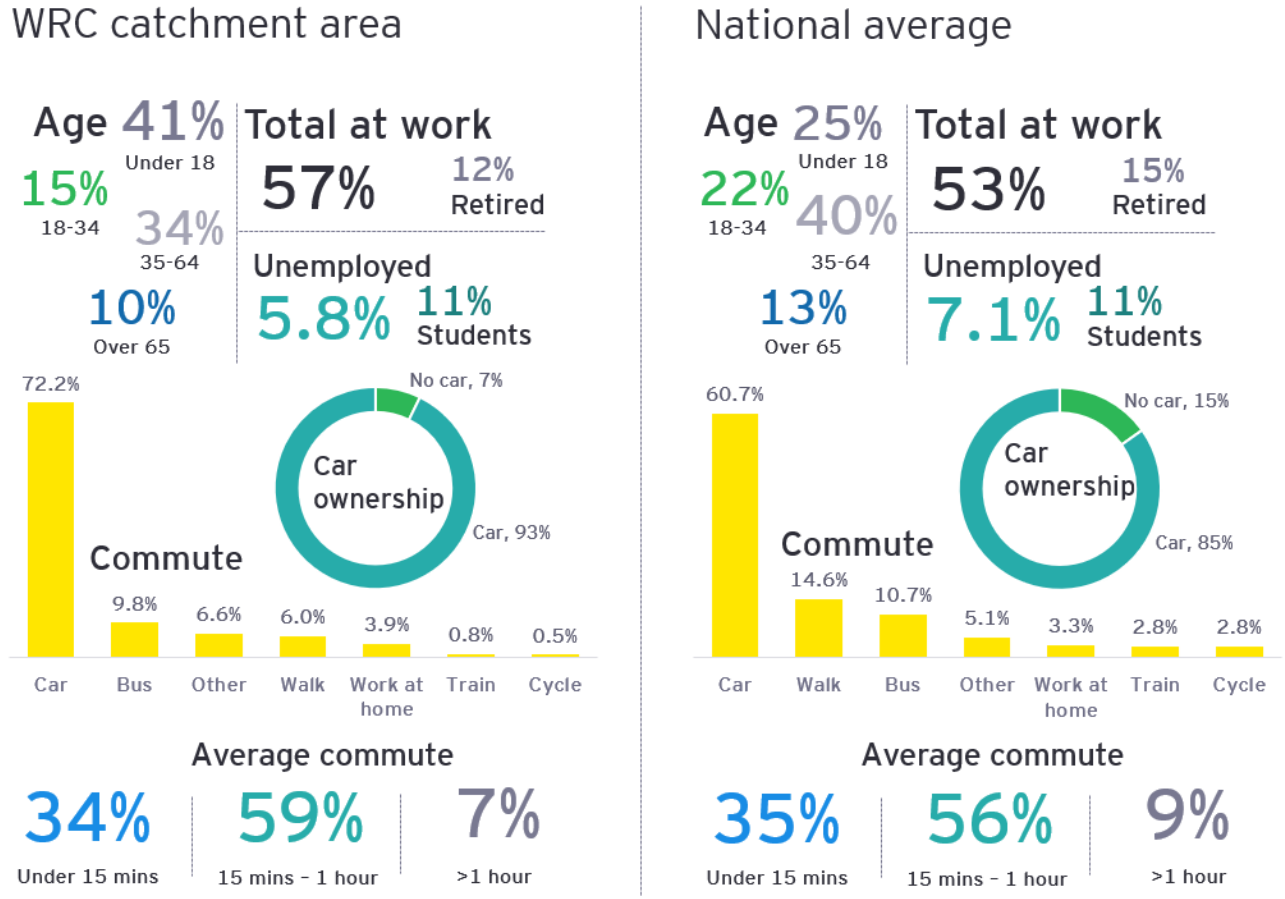
[10] Median house price is defined as the house price which is in the exact centre of all house prices sold during that period

Improving economic conditions in the West, especially in the labour market, are likely to attract additional job seekers to the wider region, particularly given the relatively more affordable housing when compared to Dublin. However, city centres are becoming more expensive and this may lead to an increased number of people seeking to live in the towns surrounding the centres. These additional commuters will place further pressure on the transport systems. As such, there may be a case for additional public transport to support these commuters and to ensure that the strong economic performance in the region is not constrained by public transport issues.

2.2.2 Catchment area

Using the latest CSO 2016 Census data as a snapshot of the area, Figure 9 assesses the specific characteristics of those living in an Electoral Division (ED) within 10km from Phase 2 and Phase 3 of the proposed WRC extension, as shown in Figure 16.[11] This gives context to the demographic needs of the specific catchment compared to the state average, to help to understand the potential future demand for the WRC. However, it is important to note that demographics in the catchment area are likely to have changed since 2016 in line with the population growth as outlined in Figure 12.

Figure 16: WRC catchment area Census 2016 data



Source: CSO Census 2016, EY analysis

There were just under 18,700 households in the electoral divisions that are located within 10km of Phase 2 and Phase 3 of the proposed WRC extension, according to Census 2016. Using CSO population projections for the West region, this is estimated to have grown by over 200 households to 2018.

[11] This data is for all those living in Electoral division within 10kms. Due to the size of the EDs, some of these residents will be more than 10km from the stations.

The WRC catchment area population was younger than the state average at the time of the last Census, with a high proportion of residents aged under 18. Those under 16 are less likely to travel by rail according to a Rail demand forecasting study prepared for the Department for Transport (DfT) in the UK,[12] using National Travel Survey (NTS) data. Older travellers are also less likely to use rail for transport other than commuting or to travel multiple times per week.

Evidence from the UK indicates that employment status and the type of job held strongly influences the likelihood of travelling by rail.[13] The proportion of the population at work in the WRC catchment area in 2016 was higher than the national average, at 57.4% compared to 53.4%, while unemployment was lower, at 5.8% compared to 7.1% nationally. Students, unemployed and retired people are more likely to use rail travel for non-commuting journeys, while those in full-time employment are more likely to use rail than those working part-time.[14] Managerial, professional or administrative occupations were more likely to use rail than other occupations. 44.4% of the population that are employed and living within the WRC catchment area match this employment profile, compared to the state average of 45.7%. 7% of households living within the catchment area in 2016 did not have a car, which indicates that public transport is the main mode of transport. 45% had two cars, which is higher than the national average of 33%, while 9% had three or more. The DfT study found that as the number of cars increases in a household, the propensity to travel by rail falls.

72.2% of the catchment population travelling to work or school did so by car, which is higher than the national average, while only 0.8% took the train, compared with the state average of 2.8%. 9.8% travelled by bus or minibus, whilst only 6.0% walked. 7.4% of those living within the catchment area commuted for over one hour to work, school or college, whilst 32.6% had a commute of 15 minutes or less.

The WRC catchment area has demographic characteristics that both promote the use of rail (high employment, low unemployment) but also offset potential demand sources (young population, high car ownership). The travel profile of the catchment area suggests that people commuting to work or school do so predominantly by car. Given that the use of train is lower than the state average, there may be some scope for residents to switch mode of transport if there were a viable rail alternative. However, the high level of car use means that it may not be convenient to do so. Public policy or cost factors that would influence the level of car ownership, employment patterns and the location of jobs would be the main factor influencing future rail demand in this region.

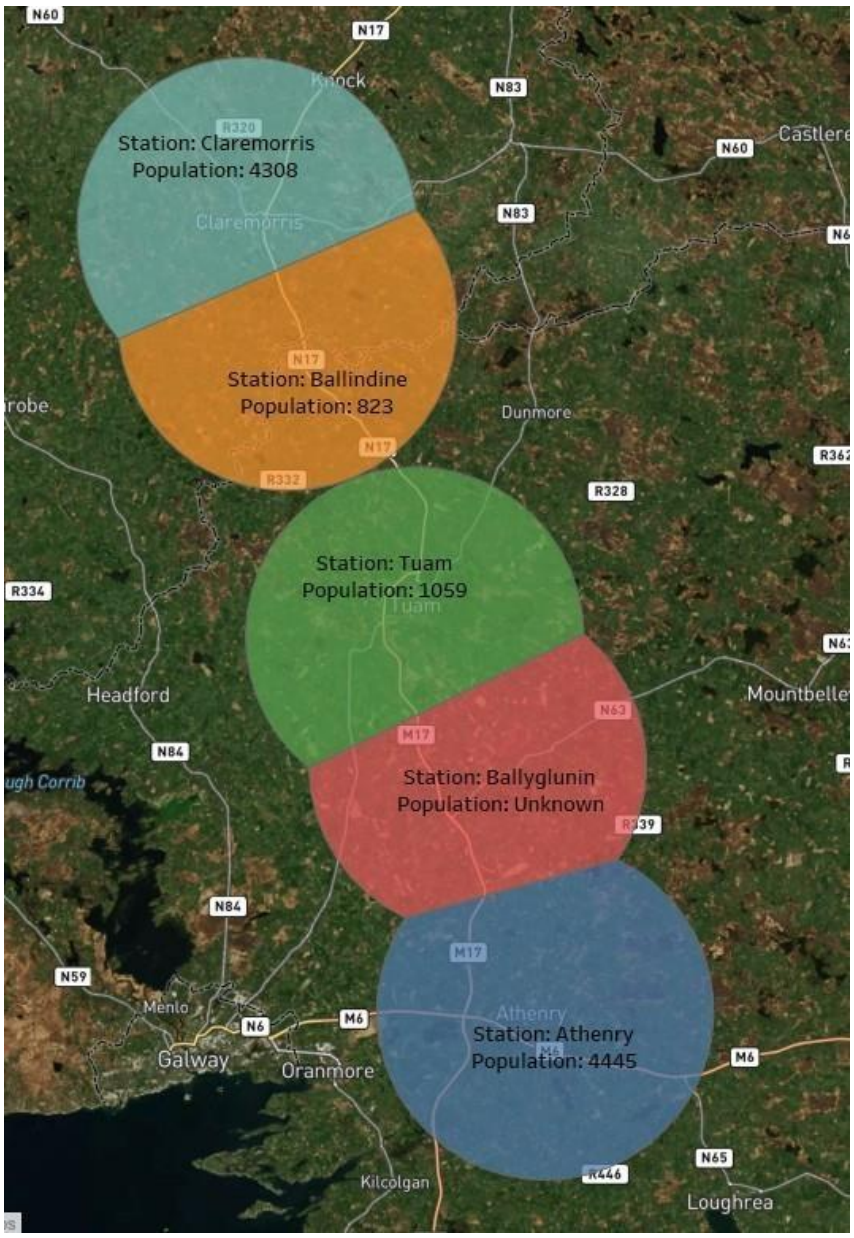
This section provides a snapshot of the information that will be used to inform the demand analysis. It shows both the opportunities and challenges which will be faced but is not a comprehensive analysis of factors which determine rail demand.

[12] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/610059/phase2-rail-demand-forecasting-estimation-study.pdf

[13] http://www.theitc.org.uk/wp-content/uploads/2017/05/ITC-Report-Rail-Passenger-Demand-November-2018.pdf

[14] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/610059/phase2-rail-demand-forecasting-estimation-study.pdf

Figure 17: The Catchment area for the WRC[15]



Source: CSO

2.3 Business context

The economic growth described above has led to a corresponding growth in the number of business enterprises active in the West, with a particular focus on larger enterprises. The total number of active larger enterprises (those employing more than 50 staff) has grown across the State, with Galway and Mayo seeing annualised growth rates of 3.3% and 4.3% respectively (Table 1). Both counties are ahead of the State average of 3.2% annualised growth.

[15] Population figures are based on 2016 survey for the station towns. Ballygunin population is too small to be picked up as an individual town estimate.

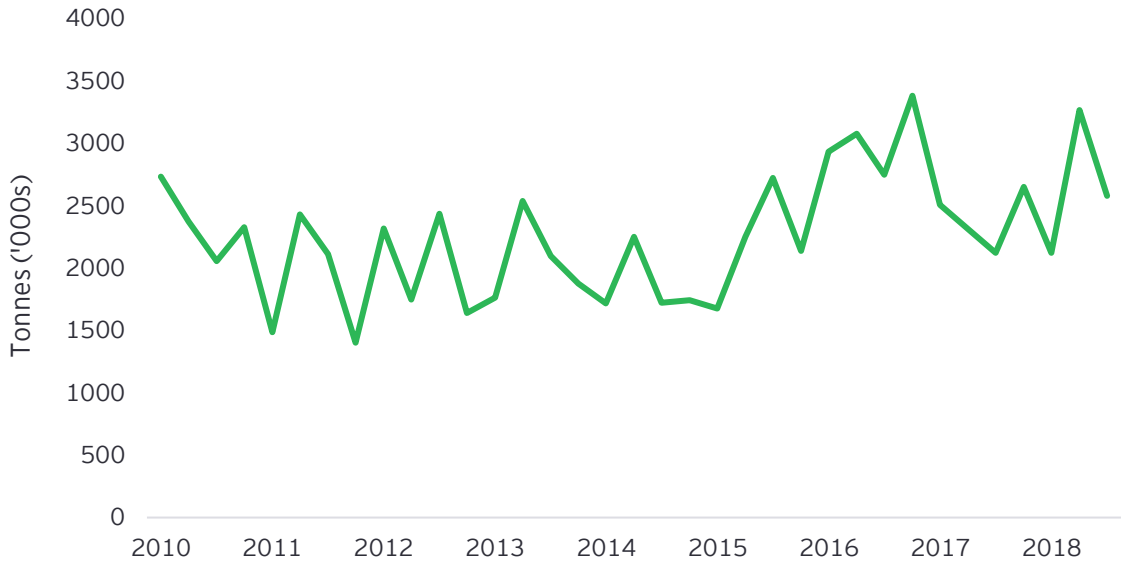
Table 1: Active enterprises employing more than 50 staff, 2010 - 2016

	2010	2011	2012	2013	2014	2015	2016
Ireland	2,870	2,860	2,873	2,973	3,148	3,369	3,585
Dublin	1,325	1,335	1,336	1,409	1,479	1,585	1,683
Galway	148	152	156	163	169	177	186
Mayo	47	48	48	54	58	61	63

Source: CSO

A determinant of the success of some of these businesses will be the ability to move freight. This can be seen in the increase in the total amount of road freight handled in the West of Ireland. Figure 18 shows that the total amount of freight carried has grown significantly since 2010, at an annualised rate of 2.9%, which is slightly below the national average of 3.5%. In order to maintain the economic growth of this region, it will be important to consider whether this is sufficient capacity to manage freight and ensure timely deliveries.

Figure 18: Road freight handed in the West of Ireland (Tonnes 000s), 2010 to 2018



Source: CSO

Whilst the majority of freight is transported by road, due to both speed and convenience, there is also the potential for rail to contribute. Rail tends to cater for freight either in the form of bulk cargos (such as timber, cement, agricultural products) or more general cargo in Twenty Foot Equivalent Unit (TEU) containers.

2.4 Policy context

2.4.1 Local policy objectives

The pressures placed on the transport network in the West of Ireland will be heightened further by a number of key policies being undertaken at both a national and local level. The Government's stated policy is to achieve more balanced growth across the country, and cities such as Galway and Limerick will play key roles in this policy goal. Policies such as Project Ireland 2040, the Mid-West

Area Strategic Plan[16] [17] and the Northern and Western Regional Spatial and Economic Strategy[18] all focus on achieving sustainable growth across all sectors within the West of Ireland.

Project Ireland 2040[19] is the Government's current overarching policy initiative to develop Ireland and to achieve more balanced growth. The National Development Plan (NDP) [20] then sets out a spatial strategy through which to achieve the Project Ireland 2040 policy goals.

As outlined in Section 1.1, the NDP states that reopening Phase 2 from Athenry to Tuam, and Phase 3 to Claremorris could play an important role in enhancing regional accessibility through linking the major centres on the western seaboard in the Atlantic Economic Corridor.

In addition to the national policy drivers, there are a number of policies set out by the key City Councils which seek to drive growth in the West of Ireland.

The Limerick 2030 Economic and Spatial Plan seeks to deliver a new Vision for Limerick:

> Limerick will become a major economic force in the Irish and European economy, a leading centre for commercial investment.

Tourism is an important component of the economic and spatial plan for Limerick. The Limerick plan seeks to grow overseas visitor numbers from the current 380,000 per annum, noting that this is considerably below the figure for Cork, Kerry, Clare and Galway counties and therefore represents an untapped market for the city. This is relevant to the inter-urban railway objectives of the NDP, ensuring that Limerick is linked into the other urban tourist centres in Ireland.

The Galway City Council Development Plan 2017-2023 sets out a strategy for the city within the context of various national and regional strategies, plans and guidelines that impact on proper planning and sustainable development. The development plan recognises that Galway needs to fulfil the role of a gateway and regional growth centre, with a key focus on accessibility and connectedness. It explicitly considers the transport needs of Galway City as a major transport hub in Ireland and the need to increase the frequency of public transport services to and from Galway.

There have also been a number of cross-county initiatives aimed at developing the West of Ireland. In particular, the Atlantic Economic Corridor (AEC), which has brought together businesses and councils from across the entire western seaboard of Ireland. It aims to build and increase collaboration throughout the AEC to attract investment, create jobs and make best use of its existing assets. This initiative aims to mirror the success of the Wild Atlantic Way, attracting businesses in the same way that the Wild Atlantic Way has attracted tourists. [21]

Dublin Port and Waterford Port are the only ports linked to Ballina station which is capable of handling rail freight consignments, meaning that relatively little freight can be handled. There is currently no direct link to other key ports, such as the Port of Cork or Shannon Foynes Port, hence the opportunities for rail freight to support import or export businesses are limited.

[16] The Mid-West Area is a NUTS III region and consists of the counties of Limerick, Clare & Tipperary with Limerick City as the regional capital.

[17] http://www.mwasp.ie/documents/Final%20MWASP%20May%202013%20English.pdf

[18] https://www.nwra.ie/wp-content/uploads/2018/02/Scoping-Report_NWRA-FINAL-1.pdf

[19] https://www.gov.ie/en/campaigns/09022006-project-ireland-2040/?referrer=/2040

[20] https://assets.gov.ie/4049/071218131542-81b907e357df447cb8b471788cf6ecfe.pdf

[21] The Wild Atlantic way is a tourism trail launched in 2014 along the west coast of Ireland and on parts of the north and south coasts. It stretches from Inishowen Peninsula in the north down to the town of Kinsale, Co Cork in the south, passing through nine counties and three provinces on route.

The Government has outlined the possible reopening of a rail link to Foynes Port in Section 5.2 - National Strategic Outcome 6 of Project Ireland 2040 which would be then linked to Ballina should the WRC go ahead:

'The investment programme [for Shannon Foynes Port] will improve international connectivity and increase capacity through the construction of new quay walls and associated port infrastructure and external connectivity with the upgrade of the N69 and the reinstatement of the Limerick-Foynes rail line.'

At the same time, the Mid-West Area Strategic Plan (MWASP) focuses on smaller scale projects. The MWASP has been developed to contribute to the policy framework which will guide the physical and spatial development of the Mid-West region to 2030. This, alongside the Northern and Western Regional Spatial and Economic Strategy, will help to set the specific developmental needs of the area and help to ensure that it delivers against the goals set out in the NDP.

These policies aim to further increase the economic growth and prosperity of the West of Ireland. Should they deliver on their targets, population growth will be significant. This may in turn place further pressure on the transport system, if the balanced growth policies are achieved and areas across the region perform to their envisioned potential.

2.4.2 National Planning Framework

Project Ireland 2040 sets ambitious targets for population growth and sustainable economic growth for Ireland. As set out in the National Planning Framework (NPF), the population of Ireland is set to grow by just under 900,000 people, to almost 5.7m, by 2040.[22] However, while this reflects the baseline forecast, the NPF states that:

'...full achievement of the targets set out in this Framework would accommodate around 1.1 million additional people in Ireland to 2040, which is approximately 25% more than the ESRI baseline projection'.

To accommodate such a significant population increase, a key focus in current Government policy is to encourage 75% of this growth to be outside Dublin and its suburbs. This means that cities such as Galway and Limerick would see significant additional growth.

The long-term strategy for the development of Ireland is also underpinned by a shared set of National Strategic Outcomes set out in the NDP. In particular *'Enhanced Regional Accessibility'* and *'Strengthened Rural Economies and Communities'* commit the Government to investing in a manner which achieves a more equal balance of growth between Ireland's regions and to enable rural areas to grow sustainably. The Northern and Western NUTS II Region (Border and West regions of Ireland) is projected to have a population of 1 million people by 2040, 180,000 more than 2018.

The NPF envisages that both Galway and Limerick will grow significantly, with a projected 50% increase in population by 2040 for both cities. Government strategy is to focus investment to improve the collective 'offer' for Galway and Limerick, i.e., infrastructure, liveability and choice in terms of housing, employment and amenities. Appropriate public transport is key to encouraging and supporting such significant population growth, and investment in rail services has been specifically identified as contributing to enhanced accessibility in the region:

'Over the life of Ireland 2040, increased transport connectivity, including bus and rail services, between the main cities, to the north-west region and along the

[22] http://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf

border region allied to development and promotion of cross border blueways, greenways and walking trails will harness the potential of the island.'

2.4.3 Climate change

The environmental impacts of changing consumer behaviour to use rail instead of cars and buses, and the associated reduction in congestion, will reduce the negative environmental impacts of car or bus use. This will be particularly true if the line is electrified.

Greenhouse gas (GHG) impacts can be measured using Carbon Dioxide (CO_2) equivalent emissions values that contribute to global warming. Improvements in GHG emissions will help towards meeting Ireland's climate change targets, which aim to cut emissions by 20% by 2020 compared with 2005 levels. The forecast actual reduction by 2020 is currently estimated at c.6%.[23] The Paris Agreement aims to cut EU-wide emissions by 40% by the year 2030.

The decrease in emissions of Nitrogen Oxide (NOx) and Particulate Matter (PM) as a result of reduced car usage and congestion will improve air quality and can be measured by the value of the pollutants that are emitted by vehicle type and speed. To measure the environmental impact of reduced emissions, emissions per transport mode and fuel type are assigned a monetary value as per CAF guidance and the savings over the appraisal period are compared with the 'do nothing' scenario.

Due to the changing nature of car usage, and new technologies such as hybrid and electric vehicles, it will be important to consider the impact this will have on this benefit. Scenarios will therefore be generated which consider a changing fleet composition over the assessment period.

2.5 Western Rail Corridor objectives

Section 2.1 to 2.3 above outlines the rapid growth in the West of Ireland, along with the policies in place to further encourage and develop this region of Ireland. If these goals and policy ambitions are to be achieved, then public transport will need to play a role. Failure to invest adequately in public transport solutions when they are needed may hamper the region's development.

This does not, however, make the case for a specific investment, such as the WRC. In order to assess whether such an investment can be justified a number of objectives have been set for the project. These objectives are solution neutral and as set out in the guidance in the Common Appraisal Framework (CAF)[24] the objectives for this project are split into four sections:

1. **Economy**: A transport solution will need to facilitate job growth and development in the region, in this case the Galway and Mayo region, by offering additional opportunities for industry. In particular it should:

    a. Reduce journey times between key urban centres through provision of faster transport links.

    b. Reduce transport costs either through provision of lower cost alternatives or through more reliable transport journeys.

    c. Encourage greater tourist numbers to visit the West Coast of Ireland and encourage those who do visit to travel further to support the economies north of the City of Galway.

[23] https://www.dccae.gov.ie/en-ie/climate-action/topics/eu-and-international-climate-action/2020-eu-targets/Pages/default.aspx

[24] https://www.gov.ie/en/organisation-information/800ea3-common-appraisal-framework/?referrer=/sites/default/files/publications/corporate/english/common-appraisal-framework-2016-complete-document/common-appraisal-framework.pdf/

   d. Increase the pool of labour through encouraging population movements from the East Coast to the West Coast of Ireland.

2. **Safety**: The transport solution will need to improve safety across the network as measured by the total number of fatalities and serious injuries under each option.

3. **Environmental**: The transport solution will also need to support Ireland in achieving it's environmental and sustainability targets. It will need to do this by:

   a. Reducing total emissions of Carbon Dioxide, Nitrogen Oxide and Particulate Matter. In order to achieve this, it will be necessary to encourage transport journeys to be undertaken using the most efficient transport option, i.e. public transport over private vehicles and rail freight over Heavy Good Vehicles.

   b. Encouraging compact growth by providing reliable public transport solutions within urban centres (in this case particularly Athenry and Tuam) which encourage housing developments within these centres.

4. **Integration, Accessibility and Inclusion**: The transport solution should encourage improved social inclusion by increasing the ability of those who do not have private transport to access services, especially in Galway City.

Finally it will be important to ensure that these objectives are achieved in a manner that delivers value for money, that is to say that the benefit that it delivers against these objectives can be justified in terms of the associated costs required.

2.6 Scope of the appraisal

This review focuses on one specific element of potential transport investment in the region: the WRC. As such this review will look at whether the WRC can support the achievement of these objectives.

The scope of this review is to establish whether there is sufficient demand for additional public transport within the West of Ireland and specifically whether Phase 2 and Phase 3 of the WRC can meet this demand in a cost effective manner which delivers value to the Irish economy.

As the study is focused on the WRC, looking at wider public transport solutions outside of the WRC catchment area is considered to be out of scope. Equally, as the focus is on public transport requirements, improvements to the road infrastructure would also be considered to be out of scope. Finally, alternative uses for the land which the WRC currently occupies would be considered to be out of scope (though they will form part of the consideration as to the current value of the WRC land).

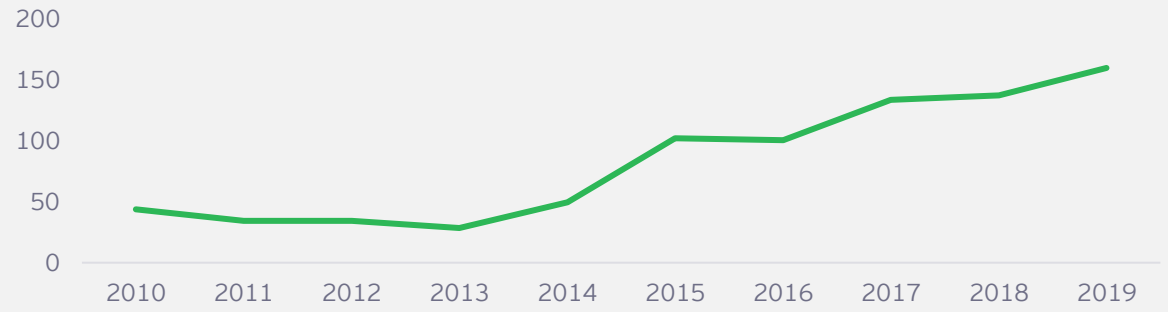
Box 1: The Western Rail Corridor Phase 1

The WRC in its entirety consists of four phases, connecting Limerick to Ballina. These were all progressively deactivated in the 1980s and 90s but were retained in Irish Rail hands. In 2005 the McCann review was undertaken to assess whether there was a case for reopening the WRC and as a result of the recommendations provided by this report, it was decided to give the go ahead to reopen the WRC with explicit permission to begin engineering work on Phase 1. This work was completed in 2010 at a cost of €106m. However, due to the financial crisis no further work was undertaken to reactivate the rest of the WRC.

This engineering work opened the decommissioned line between Ennis and Athenry. This in turn facilitated a direct connection between Galway and Limerick (the third and fourth largest Cities in Ireland) via Ennis, Gort and Athenry. With the population of this four towns and cities totalling over 270,000 it was anticipated that passenger numbers would be high, with 50,000 in 2010 rising to 200,000 per annum by 2015.

In actual fact, only 43,800 passengers travelled on the line in 2010. By 2013 numbers had fallen to only 28,500. Numbers started to grow from 2014 onwards, in part due to the introduction of discounted fares, and by 2019 passenger numbers had risen to 160,100. This was still nearly 40,000 short of the original 2015 target. To date the WRC has generated revenue of €3.9m

Figure 19: Phase 1 (Ennis to Athenry) passenger numbers, (Journeys 000s), 2010 - 2019



Source: Irish rail

There are a number of likely reasons as to why the forecasts were not achieved. These include:

1. The 2008 financial crisis. This saw overall rail passenger numbers drop between 2008 and 2009 by 13%
2. Flooding on the line. There was significant issue of flooding Ballycar in both 2014 and 2016. Whilst this was not directly on the WRC it led to a reduction in passengers moving between Limerick and Galway whilst repairs were carried out
3. The M18 motorway: This was begun in 2010 with the Crusheen and Gort bypass and the road was completed by 2017. This allowed for a highspeed road alternative which facilitated both increased numbers of cars and more rapid bus services.

Whilst these numbers show an increased demand for Phase 1 over the last few years, they are not considered a good indication of the likely demand for Phase 2 and 3. For a start the level of service, at only 4 trains per day, is considered to be low. In addition, Phase 1 covers a very different catchment area with a considerably higher population. As such the demand forecasts provided in Chapter 4 are a fresh approach based on best practice modelling and the socio-demographic characteristics of the catchment area.

2.7 Options under consideration

As set out in the PSSC, a key component of any CBA model is a robust list of options which could achieve the policy objectives set out in Section 2.3. These options have been drawn up by the review team based on the scope set out in Section 2.4, and an initial review of the opportunities and constraints.

As stated in Section 1.2, these options will be kept under review during the stakeholder consultation phase and will be revised should there be a case to do so.

The potential options we have identified currently are as follows:

1. **Do nothing/minimum:** this would involve no additional investment in the WRC and would not lead to the opening of Phases 2 or 3. Phase 1 would remain open and would continue to operate as normal. Any costs required to maintain the Phase 2 and 3 site and ensure that health and safety is maintained and the environment is protected would be included. This option will not explicitly look at alternative uses of the Phase 2 and 3 land, as this is outside of the scope of the review, however this option would leave the land available for alternative uses.

2. **Open Phase 2 only**: this would involve opening the section from Athenry to Tuam and would provide a connection for these towns to Galway City. It would, in particular, allow for better commuter services into Galway and would also connect Tuam to the intercity line to Dublin through a connection at Athenry. It would not however connect Galway to towns such as Westport or Ballina and would therefore not provide additional freight opportunities without the construction of a new freight station.[25]

3. **Open Phase 3 only**: this would involve opening the section from Tuam to Claremorris. It would allow for connection with towns such as Westport and Ballina. It would connect Tuam into the intercity to Dublin via a connection at Claremorris. Whilst it would provide a rail link into Ballina there would be no freight station on this section of the line, and no additional connections to a port, therefore it is not likely to produce additional freight opportunities.

4. **Open Phase 2 and 3:** this would involve opening the full stretch of the line between Athenry and Claremorris and would connect Limerick and Galway with Ballina and Westport. It would also allow for connection with the intercity at both Athenry and Claremorris. The freight station at Ballina would now be connected to the full line, thus linking it to both the Port of Cork, Shannon Foynes Port and Waterford Port, thus increasing potential freight opportunities.

Rather than explicitly include separate options on the electrification of either Phase 2 or 3, these are considered to be a variant to options 2 – 4. Electrification of the line would involve significant additional costs but also benefits (e.g., emissions and noise) and therefore our analysis will consider which variant of the option delivers the best overall outcome for Irish society.

2.8 Conclusions

The evidence presented above shows that the West of Ireland is growing and can expect to see more people, jobs and money. This will benefit both individuals and businesses and will help to support the Government's regional development agenda. This growth is likely to result in more pressure on the transport system and may lead to increased congestion in key areas, such as Galway City. It will also likely mean more businesses and more demand for freight shipments across the region. As such there will be a need to address these challenges and to ensure that there are sufficient public

[1] The construction of a new freight station is considered outside of the scope as this study focuses on the reactivation of the existing line rather than the construction of entirely new facilities (with associated land purchase)

transport options to meet these requirements. At the same time wider policy changes, primarily the need to tackle climate change, means there are wider benefits to consider. The use of public transport can have a significant impact in reducing emissions and increasing health outcomes.

The WRC can potentially help to address these issues. As a significant addition to the transport infrastructure in the West it would have the potential to provide an alternative to the use of the private car. The assessment provided here shows that there are a number of options for delivering the WRC which need to be fully assessed.

This section does not, however, assess the likely scale of the benefits nor whether these benefits are sufficient to outweigh the associated costs. This assessment is heavily dependent on the total numbers of passengers who will choose to use the WRC and in particular those who will shift from cars onto the WRC. This demand assessment is first picked up in the stakeholder consultation, which focused on the self-reported likely use of the line as well as the associated benefits of this use. It is then further assessed in the formal demand modelling

3. Public consultation

3.1 Introduction

In order to ensure that the analysis undertaken was based on the best and widest evidence base, a public consultation exercise was undertaken. The aim of this was to gather as much evidence and as many views as possible. The information gathered during this process was then fed into the analysis which was undertaken by Mott MacDonald and EY.

This chapter sets out the main themes which arose during this process and then links these themes into the analysis contained in the rest of the report. The overall response to the consultation was very positive, with a large number of responses received, with a range of different views presented. It is felt that this consultation process picked up on the issues which are of critical interest to the region itself.

The process was run for 6 weeks, from the 5 June to 17 July 2019.

3.2 Approach

In order to ensure that the maximum number of views was gathered within the time scale available to the project, three separate approaches were used. The three approaches were as follows:

1. **Stakeholder meetings:** key stakeholders were invited to take part in consultations which were held over the month of July in Galway and in Dublin

2. **Public Survey**: an online survey was open to the public for a period of six weeks. During this period 6,572 unique responses were recorded, which highlights the level of public interest in the WRC project

3. **Written submissions:** email and Postal submissions were accepted by EY-DKM to the dedicated email address over the consultation period.

3.2.1 Stakeholder meetings

19 consultations took place in which stakeholders shared their views with EY-DKM. The meetings were designed to cover all key interested parties, with the following groups approached:

- Politicians
- Central and Local Government
- Lobby groups
- Industry and commercial organisations
- Farmers
- Tourist and cultural organisations

A detailed list of those stakeholder consultations can be found in Appendix B.

The findings from the stakeholder consultations and email submissions were reviewed and aggregated into key themes which can be found in Section 3.3

3.2.2 Public survey

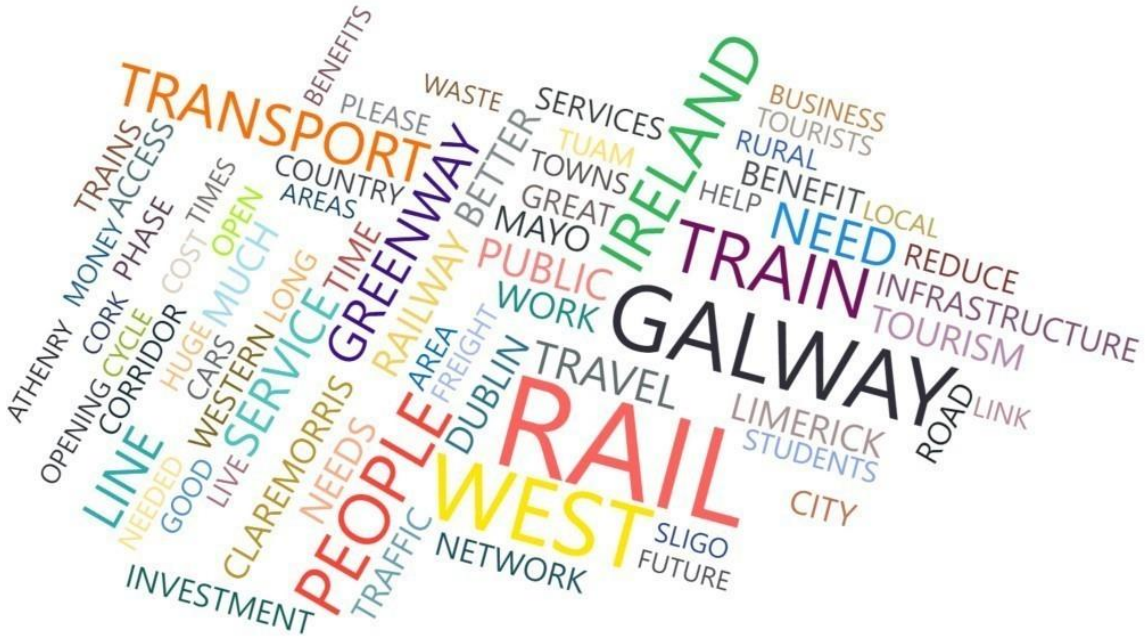
Key findings from the survey included:

- 55% of respondents lived within the vicinity of the WRC

- 37 employers said the WRC would encourage them to employ additional staff or introduce operations in the West
- 66% of respondents currently use cars as the primary mode of transport
- 77% of respondents were very dissatisfied with accessibility of current public transport in the West
- 64% of respondents were dissatisfied with affordability of current public transport in the West
- 78% of respondents were dissatisfied with frequency of current public transport options in the West
- 73% of respondents think that the rail network should be the main focus of public sector investment in transport
- 42% of respondents currently use Phase 1 of the WRC
- 85% of respondents think the WRC would attract tourists to the region and 70% think it would encourage investment

Respondents were also offered the chance to provide additional comments as part of the survey. The word map below summarises the responses and reveals a wide range of views. It picks up a wide range of themes around Railway services alongside a Greenway.

Figure 20: Key words from public consultation survey



The list of survey questions and responses is provided in Appendix C

3.2.3 Written submissions

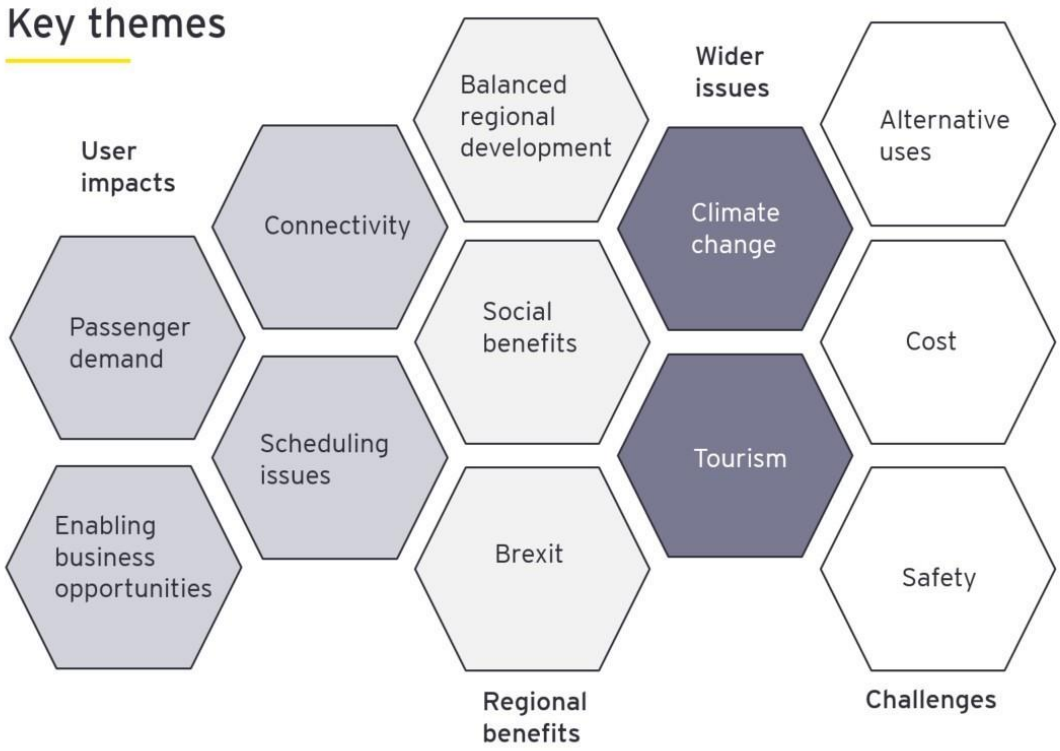
In total, 113 emails and three postal submissions were received, of which 61% were in favour of the extension of the WRC, 28% were against, and 11% did not express a clear opinion in either direction.

Table 2: Written submissions		
Group	No. of submissions	Attachments
In favour of WRC Phase 2 and 3	71	41
Opposed to WRC Phase 2 and 3	32	18
Neither in favour or opposed	13	6

Note: This analysis is based on a review of submissions by the WRC project team to determine attitudes towards reopening Phases 2 and 3 of the WRC.

3.3 Key themes

The most prominent themes arising from the exercise are summarised below.



1. **User impacts**: the WRC may support travel for both business and personal use and connect more people to the key urban centres, but the consultations stressed the importance of having regular services

2. **Regional benefits**: non-users of the service in the region could benefit due to the WRC encouraging tourism, regional development and delivering wider social benefits

3. **Wider issues**: the issues of Brexit and climate change arose in a number of responses. These issues could present additional opportunities for use of the WRC

4. **Challenges**: the main challenges raised were the potential for the use of the WRC land as a greenway, the potential high cost of the WRC and the impact on safety, both as a challenge (in terms of rail crossings) but also an opportunity, in terms of a possible reduction in road traffic accidents.

A number of key issues arose during this process which were fed into the analysis. These are set out in Table 3, alongside a link to the section in the report where the analysis has been undertaken.

Table 3: Summary of key points discussed

	Key stakeholder point	Report analysis section:
User Impacts	The WRC would enable business opportunities and could enhance the economic activity in the region. The WRC would also provide a back-up option to the Ballina-Waterford Port Route.	7.5.4
Connectivity	Rail connections to the ports in the South and South-East are likely to be more crucial to developing the overall freight network than the WRC.	4.3
Passenger demand	Population projections for Galway anticipate fast growth and transport infrastructure should be fit for purpose.	4.6.1
Scheduling Issues	The frequency and speed of the proposed services would need to be sufficient to generate substantial demand; this speed is affected by level crossings on the line.	7.5.1
Balanced Regional Development	Attracting business to the region could reduce the dependence on Dublin for Ireland's FDI and increase the productivity of ports.	7.5.4
Tourism	Currently, it is challenging to promote the West of Ireland to international visitors as it is difficult to travel north of Galway from Irish airports, with no efficient transport options available. The WRC could attract cruise ships to the region, as there is a growing number of tour operators using railways as a unique selling point.	7.5.6
Social Benefits	Students attending college in Galway could commute and pay lower rents. Stress induced as a result of traffic congestion could be reduced if the option to travel to work by train was available.	7.5.5
Climate Change	The possibility of sustainably powering trains in the future would have the potential to significantly reduce emissions. Furthermore, carbon pricing could encourage companies to swap to the most environmentally efficient transport mode in order to reduce tax liabilities.	7.3.2
Brexit	The option of using ports in the South and South-east of Ireland to avoid the UK land bridge could be explored in the event of a no-deal Brexit.	7.5.4
Safety	An increase in rail usage could increase risk for Iarnród Éireann. The WRC involves numerous level crossings. Conversely, the use of rail is historically safer, with less accidents than roads.	7.3.4
Alternative Uses	The current WRC could become a greenway that could revert to a railway in future. Furthermore, the area could be used to further renewable energy goals through the installation of solar panels along the WRC.	7.4.2
Cost	There is a need to balance investment in the WRC against other required transport initiatives.	8.4

3.4 Conclusions

There is clear interest from the public in the WRC project, this can be seen in the volume of responses received as well as the range of views expressed. There are strong views both in favour of the development of the WRC as a railway and for alternative uses such as the Greenway. All of these

key themes are explored in further detail in this report. Should the WRC go ahead, there is a wide range of benefits and costs to be considered.

4. Demand assessment

4.1 Introduction

The public consultation discussed above shows that the respondents felt there was clear demand for the proposed service. However, it is not possible to use this survey to estimate actual demand along the line and therefore a detailed demand model was constructed to provide estimated passenger numbers.

This model is based on a forecasting approach based on the probability of passengers choosing to use the line and the total population of the area in question. This approach allows for the construction of a model which not only estimates total numbers but also what mode of transport those passengers will use.

4.2 Approach

The approach used is a three-stage process to forecast the number of passenger journeys generated by the reactivating the WRC:

1. Construction of a forecasting model to estimate the transfer of passenger journeys from car and bus/coach travel to rail travel, followed by a calculation of total travel market growth based on the overall reduction in the total time and cost of travel, known as Generalised Journey Time (GJT). The resultant forecasts are for the base year (2012) in the model. These forecasts are then grown to show demand in the years following the opening of the WRC

2. Benchmarking of the model forecasts against known rail journey rates per head of population, for comparable rail stations

3. Conversion of the single day stage 1 forecasts into annual forecasts over the life of the forecast period

The model works by calculating the probability of choosing one mode of travel given the GJT for that mode, versus the alternative models. GJT is intended to cover all the key time and cost elements which someone would consider when making a travel choice, including vehicle time, service frequency, access time, fares and parking costs.

The probability of selecting each mode of travel will vary for each origin-destination pair, as the GJT for mode will differ depending where the journey is to and from. The model was set up to forecast journeys between rail station catchment areas. For stations within the core study area the catchment area selected was the population within a 10km radius of the station. The stations further away were grouped stations into a single zone and used wider catchments. The table in Appendix D shows the model zoning.

This type of probability-based model is a commonly-used way to forecast the demand for alternative transport choices, especially when a new model or choice is being introduced. Examples of this type of model include:

- The mode choice module within the Irish National Transport Authority's (NTA) National Transport Model.
- The PLANET Framework Model, which HS2 Ltd and the UK Government is currently using to forecast demand for the High Speed 2 Rail Project.
- The model used to forecast demand for the reopened Borders Railway in Scotland.
- Models used for demand forecasts undertaken by Mott MacDonald globally, ranging from High Speed Rail on the Malay Peninsula, to Hyperloop in California.

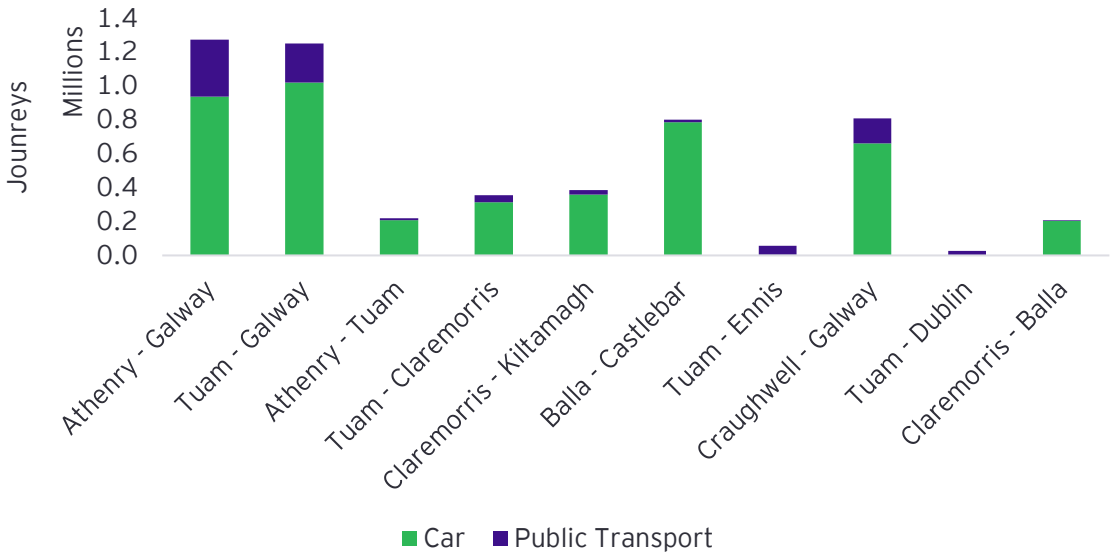
The forecasts for Tuam, Ballyglunin and Milltown have been grouped into a single zone as there is significant overlap between the catchments of these stations, and it is difficulty to be fully confident that the underlying data received from the National Transport Authority (NTA) would support a forecast for travel to/from individual stations at these locations. For the same reason Claremorris and Ballindine have also been grouped.

The model was set up to estimate the number of journeys between selected pairs of zones (known as flows) where there is a substantial current volume of travel between zones, and if the line reopening is likely to materially reduced the rail GJT. To keep the model size manageable, flows were capped at 85% of the current total travel market within the study area, adding the missing 15% to our forecasts ex-poste as journey on 'other smaller flows'.

Using data from a number of sources, including CSO, the NTA and Irish Rail, the model analyses passenger numbers and station usage. These single year projections were grown over the forecast horizon on the basis of population growth.[26]

Figure 21 show the total journeys made across all the key connections for the base year (2012). Figures from the NTA are for a weekday and a scaling factor of 300 to convert to annual figures has been used.

Figure 21: Total number of journeys (millions) origin-destination pairs, 2012



Source: NTA

Having grown the projection over time, a ramp up assumption was applied to model demand over the first three years after assumed opening in 2026.

- 53% of forecast demand is realised in year 1
- 78% of forecast demand is realised in year 2
- 90% of forecast demand is realised in year 3
- 100% of forecast demand is realised in year 4

These assumptions are taken from the Passenger Demand Forecasting Handbook (PDFH - version 6) used in Great Britain. PDFH summarises Rail demand forecasting research in the UK and provides guidance on parameters used for forecasting.

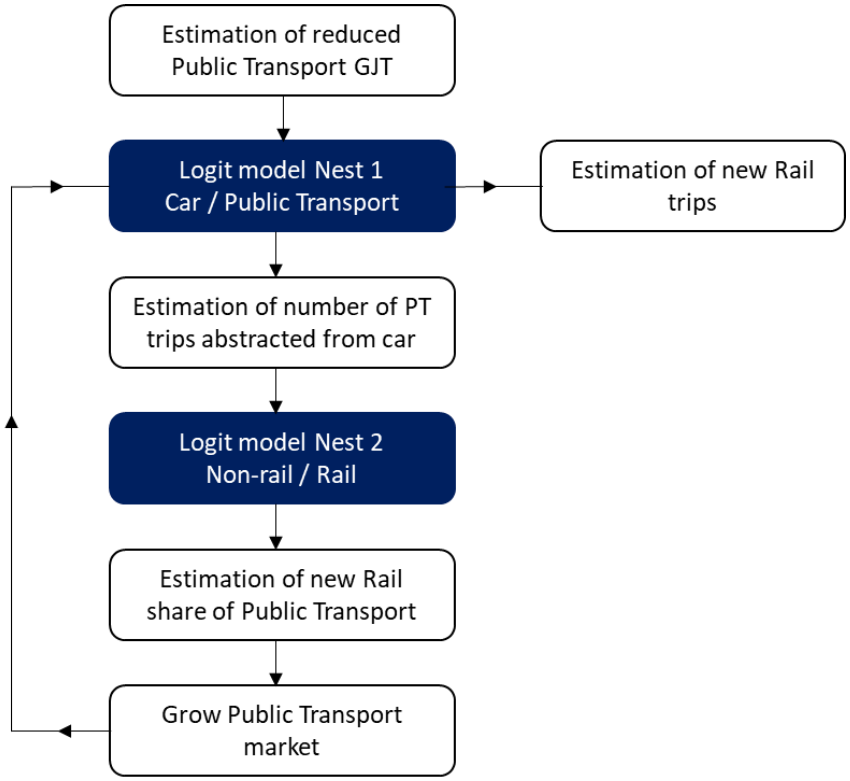
26 Detailed model approach can be found in Table 23

4.3 Modelling approach

The forecast model was produced to predict the transfer from existing modes of transport to rail following the introduction of a reinstated rail link. This was based on a mathematical model which calculates the probability of a passenger choosing one transport mode over an alternative mode, based on GJT (full details of the model can be found in Appendix D).

The model produced first estimated the probability of passengers choosing to travel by car or public transport, and then estimated the probability of public transport passengers selecting rail or bus/coach. This is a standard approach when there are more than two modes of travel available.

Figure 22: Flow diagram of the Probability Model Structure



Source: Mott MacDonald

The model was populated with total car and public transport journeys on each included flow, extracted from the Irish National Transport Model (NTM). This is a multi-modal transport model used by the NTA and its advisors to forecast future travel demand and contains the number of highways journeys made, split into car and public transport.

The base year data is from 2012 and excludes some travel made by non-domestic tourists. The NTM also produce a 2040 reference case and a 2040 do nothing case. The 2040 reference case includes all major planned infrastructure works in Ireland, including the planned bypass around Galway. The 2040 do nothing case assumes that there are no infrastructure changes from 2012. The in between years are calculated as an interpolation between the 2012 base case and the 2040 reference case, so the 2012 base case is the best available dataset for this purpose. Benchmarking was done against other current data as a sense check.

4.4 Model Parameters

GJT was calculated for car, public transport as a whole (bus/coach and rail together), and for bus/coach and rail separately.

Car and public transport parameters were taken from the NTM. They were then sense checked and adjusted if necessary. Car in vehicle time (IVT) was calculated by interpolating between the NTA base 2012 IVT and the 2040 reference case IVT for the year 2026 (the assumed opening year). The journey times for flows to/from Galway were taken from Google Maps and grown based on the interpolation growth rate to 2026 as well.

In addition, a Value of time (VoT) was calculated. This is the opportunity cost to the passenger for the time spent travelling. VoT differs between commuter and leisure passengers, however a weighted average VoT has been used in this model.

Parameter value for bus/coach were estimated by removing the impact of the rail values from our public transport parameter values described above, with adjustments made to ensure consistency between the 2012 public transport values and the 2019 rail values.

Details on all of the parameters and assumptions can be found in Appendix D.

4.5 Scheduling scenarios

Three scenarios based on probable service patters on the WRC were modelled. Moreover, two additional scenarios for each service pattern which include looking at improved journey times or reduced fares have been modelled. The scenarios are as follows:

Table 4: Scheduling Scenarios

Service patterns		Faster journey times		Cheaper rail fares	
Scenario	Description	Scenario	Description	Scenario	Description
A	Hourly service between Claremorris – Athenry	D	As A but with 10% faster journey	G	As A but with 20% reduction in fare
B	Hourly service between Claremorris – Galway	E	As B but with 10% faster journey	H	As B but with 20% reduction in fare
C	Hourly service between Claremorris – Limerick	F	As C but with 10% faster journey	I	As C but with 20% reduction in fare

Source: Mott MacDonald

Scenarios A, B and C assume a 30-minute journey time between Claremorris and Tuam, and a 30-minute journey time between Tuam and Athenry. The assumed journey time for existing railway links is the current average journey time. Therefore, the journey time between Claremorris and Galway is 80 minutes and the journey time between Claremorris and Limerick is 149 minutes. For all scenarios, all other connection times at Athenry to/from other locations are assumed to be a function of service frequency. All scenarios assume 15 trains a day.

It was decided that Scenario B was the most sensible and realistic scenario, and the one which was most in line with the comments received during the public stakeholder consultation. As a result, this was chosen as the central scenario for the assessment. Results for all of the scenarios modelled can be found in Appendix D.

Box 1: central scenario modelled

Level of services
• 15 services each way, hourly • 90 mph design speed • Claremorris to Galway direct • Stations serviced - stopping at Claremorris, Tuam, Athenry, Oranmore and Galway • 2 car ICR fleet • Fare – in line with existing fares • Interchange at Athenry for Limerick service

Source: Mott MacDonald

For each scenario the following was calculated:

- Forecast number of daily journeys split by source of demand:
  - Abstraction from car
  - Abstraction from bus/coach
  - Newly generated journeys
  - Total rail journeys increase as a result of the Claremorris – Athenry opening

  This information uses the NTM base year matrix, so assumes the line was fully open in 2012.

- Forecast annual number of journeys for an assumed opening year of 2026. Here forecast number of journeys per day were multiplied by 300 (a commonly used annualisation factor). A ramp-up has not been applied at this stage, i.e., a reduction in demand to account for the time it takes people to adjust to their travel choices.

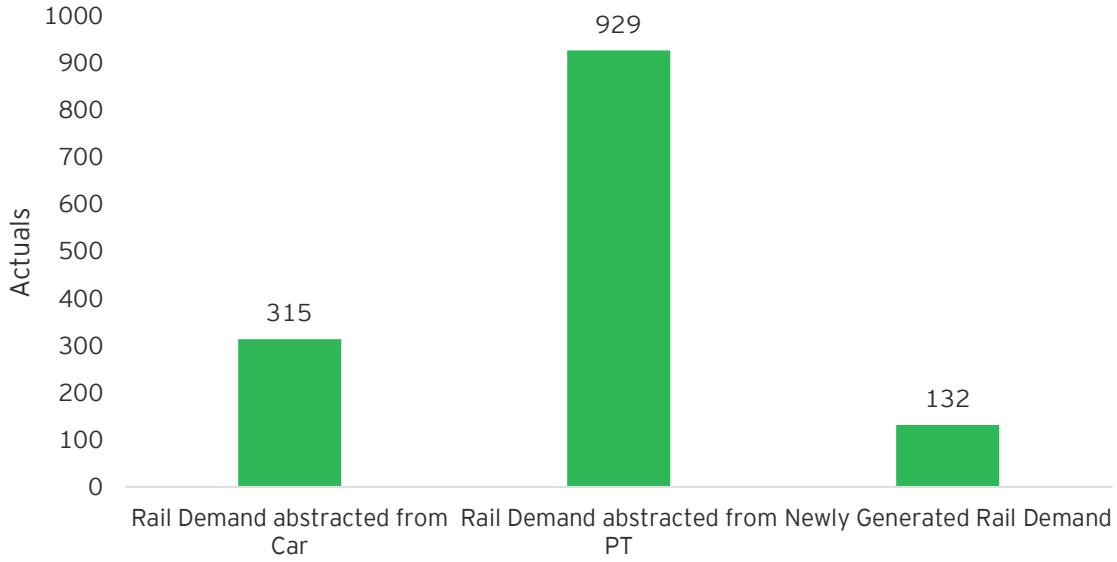
- Forecast Annual revenue. Here rail fares from the logit model were multiplied by forecast journeys, and presented the resultant revenue forecast in 2019 prices.

4.6 Estimated demand

4.6.1 Passenger numbers

Figure 23 shows the total estimated demand from local passengers on a daily basis for the base year (2012). This was then uplifted by population growth and the assumed ramp up period to give actuals for the relevant years.

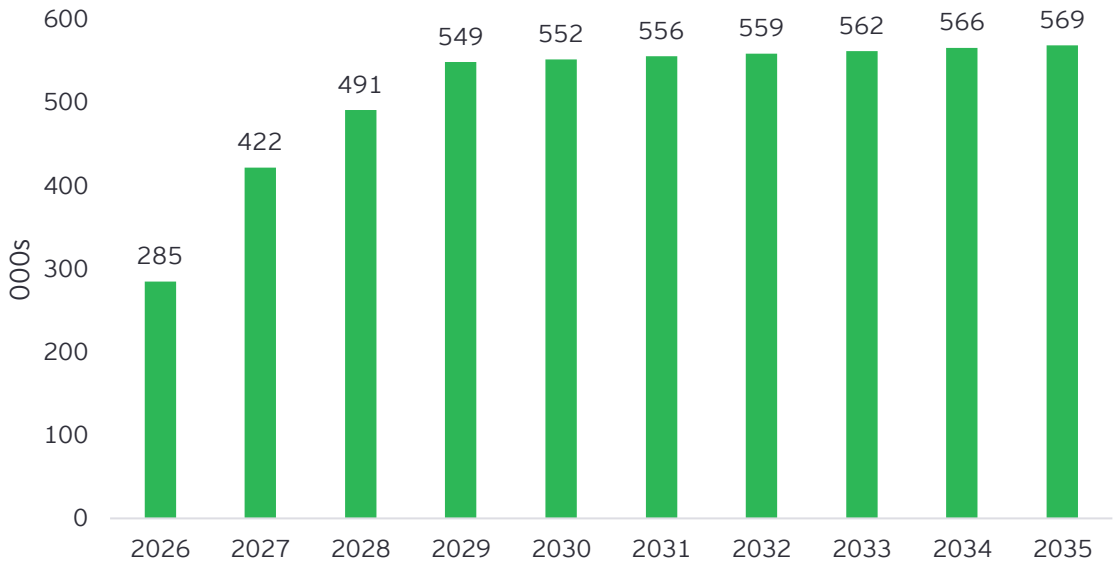
Figure 23: Estimated daily passenger numbers central scenario, Base year 2012



Source: Mott MacDonald Analysis

Annualised figures were then calculated using the standard approach of multiplying by 300. This gave the annualised forecasts for local passenger demand shown in Figure 24. The growth after 2029 is associated with the ongoing population growth expected in the region.[27]

Figure 24: Annualised total local passenger numbers (000s) central scenario, 2026 to 2035



Source: Mott MacDonald Analysis

The demand results suggest that most of the Rail demand will be abstracted from bus/coach. This is due to the fact that rail GJTs would be competitive against bus/coach but not against car trips. GJT includes journey time and fare elements that passengers consider when choosing a mode of

[27] Population forecasts in the base case was based on data provided by Oxford Economic Forecasting. Sensitivity testing for higher growth rates is included in Section 8.4

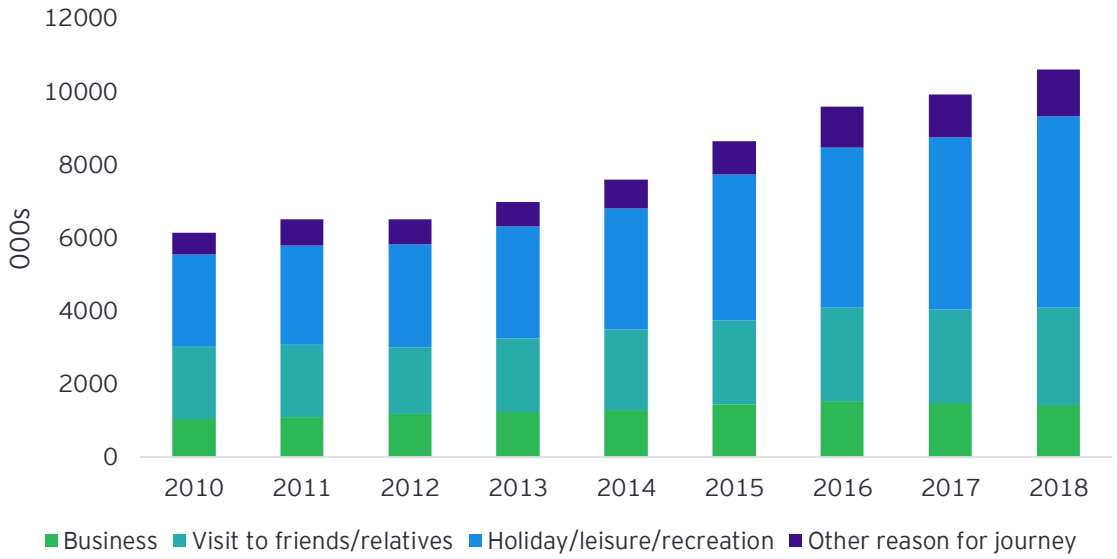
transport. Car GJTs in the WRC tend to be lower than public transport and rail GJTs, so the model attributes fewer abstractions to car journeys. To demonstrate the improvement in rail competitiveness required to capture a greater abstraction from car some alternative scenarios where rail is much faster or more frequent have been tested. Changing journey times and frequency of trains to see what would be required to abstract additional trips from car have also been tested. The results can be found in Section 8.4.

4.6.2 Tourism

The model described above only considers demand for passengers from the region itself, and therefore excludes wider tourism demand. During the stakeholder consultation process, the role of tourism was raised on numerous occasions. 85% of respondents to the public consultation survey thought the reopening of Phases 2 and 3 of the WRC would attract tourists to the region. It is therefore important that the demand generated by these tourists is included in any demand forecast.

This is particularly important given that tourist numbers have been rising strongly over the last 8 years, as shown in Figure 24, and are expected to continue to rise over the coming years. Of the overseas visitors to Ireland, the holiday and leisure section is by far the largest and the fastest growing.

Figure 25: Overseas Visits to Ireland (000s), 2010 to 2018

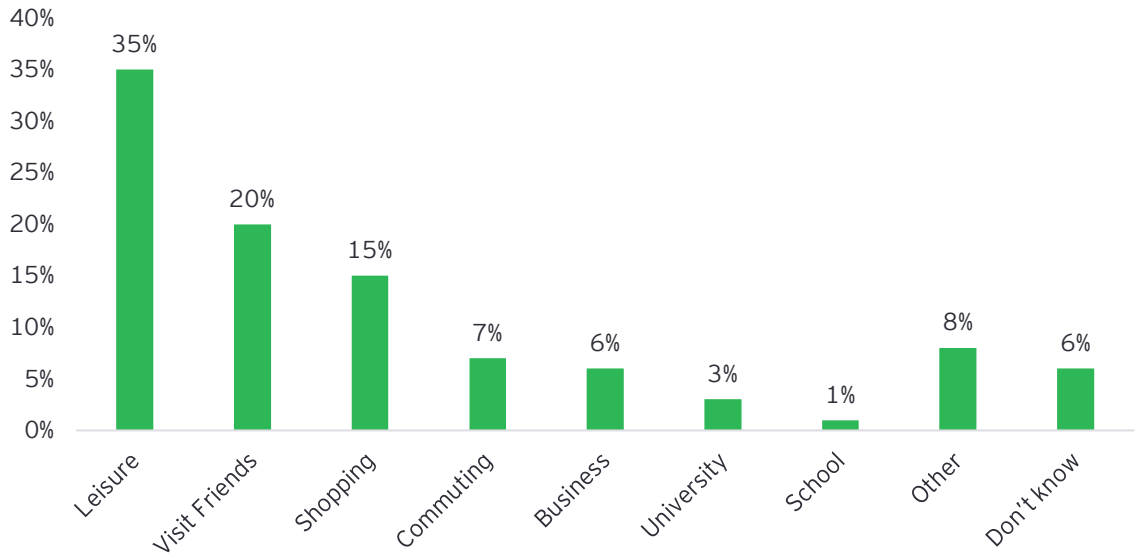


Source: CSO

In order to assess the likely additional demand a number of surveys of tourists and rail users have been used. Figure 26 shows the reason for travel based on Iarnród Éireann' s most recent travel survey.[28] It shows that 35% of all journeys are for leisure purposes. However, many of these will be leisure journeys associated with residents of the area and will therefore have been included in the demand estimates above.

[28] Irish Rail Brand Funnel, B&A Research and Insight

Figure 26: Reasons for using Iarnród Éireann (%), 2019[29]



Source: Iarnród Éireann

As this survey does not include the origin of the leisure travellers, a survey undertaken on the Borders Railway in the UK has been used instead.[30] The Borders railway is in Scotland and was opened in 2015. Linking a major city into a more rural and touristic area of Scotland, it was considered to be a sufficiently similar railway for the survey results to be relevant. One component of this survey specifically targeted leisure trips and asked questions as to where they came from and why they chose to travel by rail. It found that 9% of all of these leisure trips were for UK passengers outside of the region whilst 3% were foreign tourists.

This would therefore suggest that domestic tourists would make up 3.15% of all journeys on the WRC and foreign tourists 1.05%. In order to account for these passengers, the model assumes an additional 4.2% demand over and above the numbers included above. Based on the central scenario described above, this would suggest 23,000 additional tourist journeys a year by 2030. This is in addition to the 552,000 local passenger journeys forecasted by 2030 and illustrated in Figure 23, meaning an overall total of 575,000 journeys by this year.

4.6.3 Freight

Alongside the demand from passengers, there is also the potential to use the WRC for carrying freight. Should this occur, it would potentially provide additional revenue to Iarnród Éireann, through rail access charges (though it would also incur additional costs) and would remove lorries from the road. These financial and non-financial benefits are considered in Section 6.3.2 and 7.3 respectively.

Currently there is very limited rail freight infrastructure in Ireland. Rail freight handling facilities only exist at four points on the network:

1. Dublin Port: Dublin Port has a single-track line, however due to the line location it is necessary to close the Dublin Port Tunnel to allow a train to enter or leave

[29] Figures do not sum due to rounding

[30] https://www.transport.gov.scot/media/41659/sct02189915561.pdf

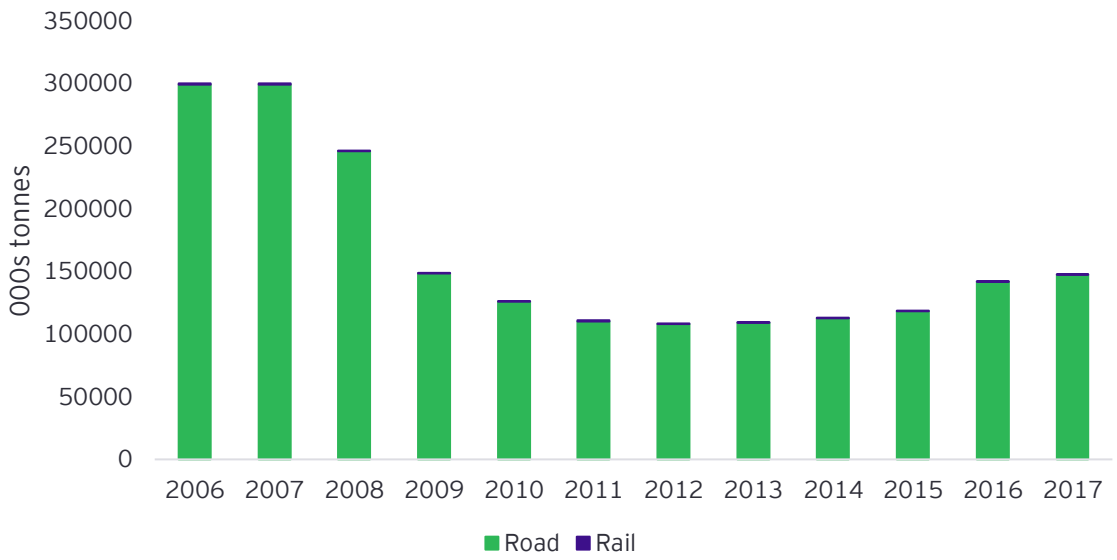
2. Ballina: This is the only inland freight handling facility in Ireland and primarily supports Ballina Beverages (which produces Coca Cola)

3. Tara Mines: This is a privately-operated facility and is purely used for the transportation of mineral ore from the mine

4. Waterford Port: This facility is currently closed down due to lack of demand

As a result of the relatively modest infrastructure, rail freight only forms around 0.4% of the total tonnage carried on a yearly basis (see Figure 27), considerably below the levels seen in other countries.

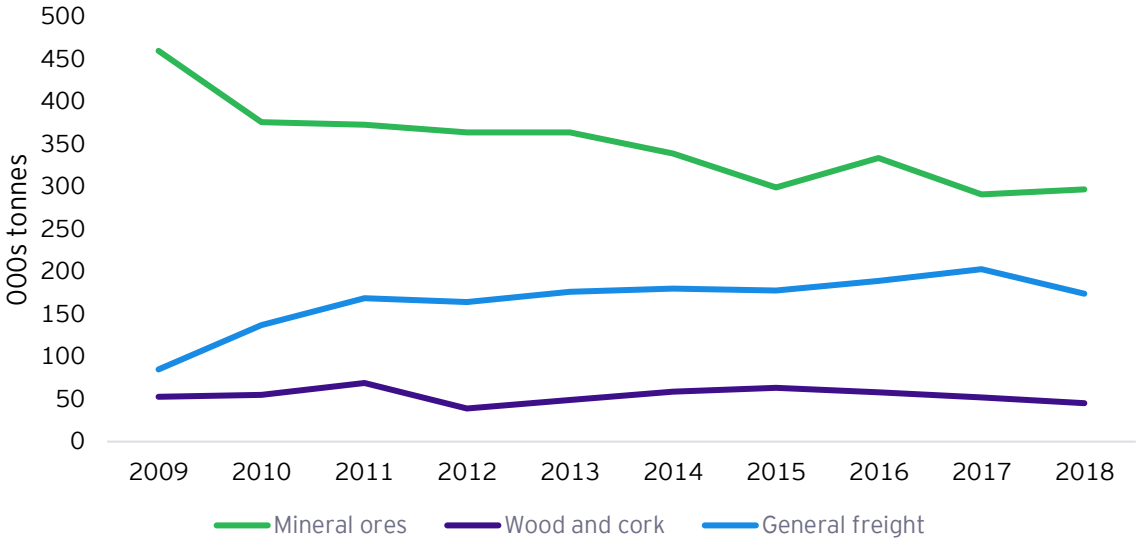
Figure 27: Total freight carried (000's of tonnes), 2006 to 2017



Source: CSO

This also limits the types of goods which are carried by freight. As can be seen in Figure 28, only three types of goods are carried, all of which currently go in or out of Dublin Port. The general cargo carried is primarily to support Ballina Beverages, with the trains picking up logs for export for the return journey to the port.

Figure 28: Total rail freight carried by type of cargo (000'sof tonnes), 2009 - 2018

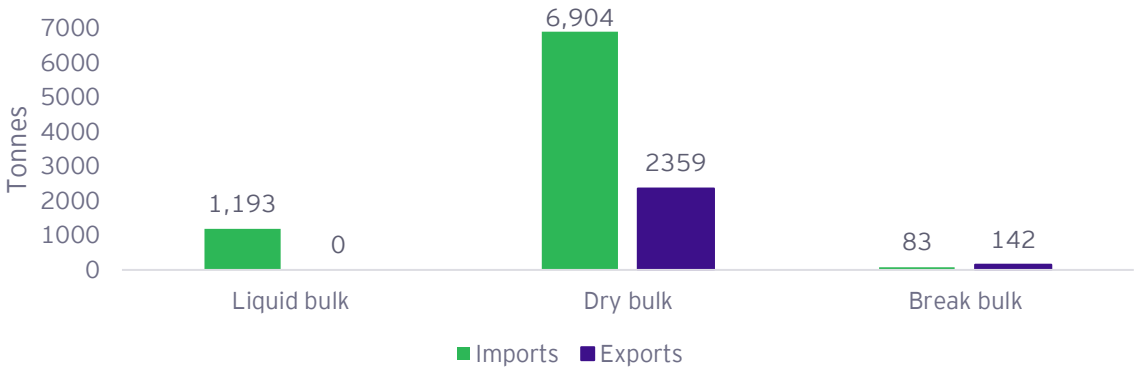


Source: CSO

WRC alone does not provide any additional connection as all four freight handling facilities can be reached using the current network. The WRC would provide better connection to Waterford port, allowing freight trains to avoid the congested Athlone area and potentially increasing the attractiveness of this route, however as Waterford port rail facility is currently closed it is not anticipated that this would be sufficient to lead to it reopening. Discussions with IWT, the main freight operator at Ballina, confirmed that whilst the WRC would be used to transit freight it would not lead to significantly more trains running.

This could change if Shannon Foynes Port were to open a railway station. Currently the masterplan for Shannon Foynes port includes the reactivation of the rail line and assuming that this goes ahead this would open another route for freight. Whilst it would be possible to reach Shannon Foynes from Ballina using the current network, this involves a considerable detour, meaning it is not commercially feasible. The WRC would open a much more direct route, meaning that this journey could potentially become more attractive. Shannon Foynes specialises in importing bulk cargo, see Figure 29, particular fuel products, fertiliser and cement. The fertiliser and cement products are imported to be processed in the on-site factories and are currently then moved by HGV to the final customers. The fuel products require no further processing and are directly shipped by HGV to the final customer.

Figure 29: Imports and Exports through Shannon Foynes (Tonnes), 2018



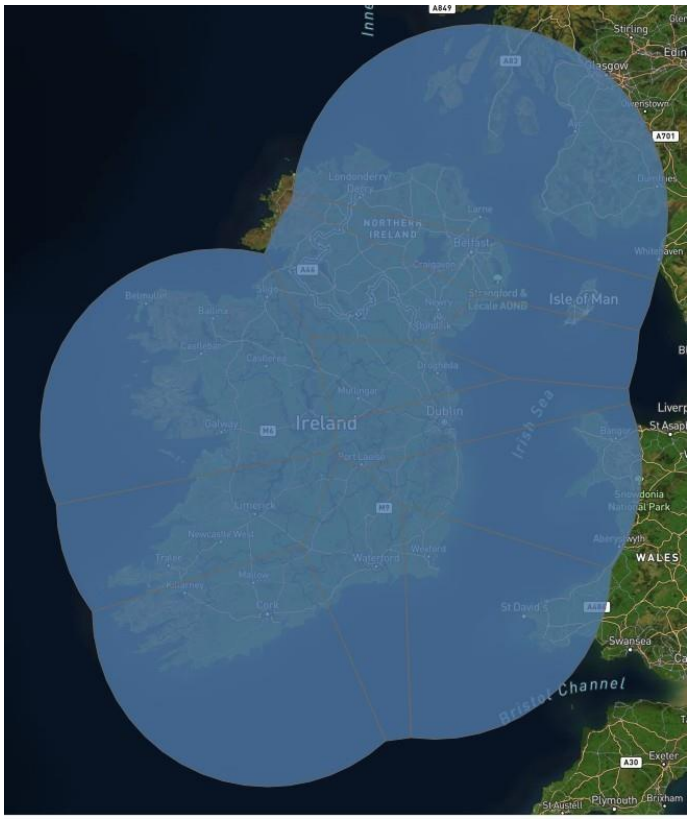
Source: CSO

Shannon Foynes does not have any facilities for handling container or HGV cargo and therefore would not be in a position to import or export any form of manufactured or consumer goods. The main potential for freight is therefore likely to be importing agri-feed or fertilizer to businesses in the Ballina area.

During the stakeholder consultation, it was noted that there was a strong appetite for further use of rail freight. Most of the discussions raised the need for more infrastructure across the network and a change in access charges to facilitate this. In order for the WRC to deliver a wider freight benefit, there would need to be a greater focus on freight across the network. This would require additional investment in both rolling stock and facilities for the handling of freight (both at ports and inland).

However, the challenge facing rail freight in Ireland is the relatively short distances involved in moving freight to and from ports. Research by the EU suggests that rail freight only makes financial sense when the distances involved are greater than 150km, meaning that the area within 150km can be considered to be the road catchment area for a Port [31]. Figure 30 shows that almost the entire of Ireland falls within 150km of a port meaning that the economic case for freight is not as strong in Ireland as it would be in other countries.

Figure 30: Port road catchment areas



Source: EY analysis

Consideration of the wider benefits to carrying greater freight on the rail network, and the associated costs and challenges, are outside of the scope of this appraisal as it would involve changes to wider government policy. As such it is assumed that the wider policy will remain the same and the only investment which has been considered is the WRC itself.

[31] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52007DC0609

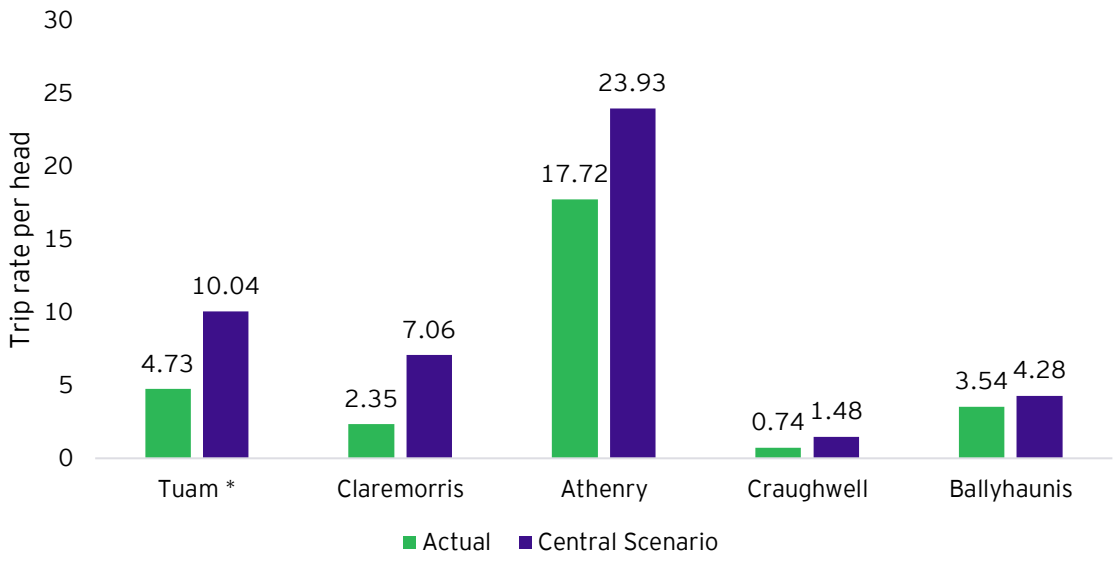
As such the demand for rail freight is anticipated to be muted. Waterford port now no longer accepts rail freight as there was insufficient demand to justify the facilities, meaning the only likely demand for this line is the trains potentially running into Shannon Foynes should the line be reactivated. Whilst this could be potentially up to three trains per day, it is likely that some of this activity would displace trains travelling to Dublin, which is currently at capacity. It is therefore anticipated that demand for rail freight along the line would be between 1 and 2 trains per day, with a single train being taken as the central scenario.

4.7 Benchmarking

The passenger journeys forecasted through the model (less the additional tourist numbers) were benchmarked against current journeys per head of the population for 2018. This was done through using current trip numbers sourced from census data and population numbers taken from the CSO. Using number of trips at a station divided by population within a 10-kilometre radius of a station results in a trip rate per head. This trip rate per head was compared to annual demand numbers forecasted through the model, divided by population with a 10-kilometre radius of each station.

Observed journeys are from the 2018 rail census and the model forecast year was set to 2018, with no ramp up applied. Figure 31. Figure 28 compares the results for five stations: Athenry, Craughwell, Ballyhaunis, Tuam and Claremorris. Tuam does not have an existing rail link, so actual data for Ballinasloe was used as comparison. Athenry has an existing station and railhead, with broadly hourly services to Galway, as well as direct services to Limerick and Dublin.

Figure 31: Actuals v Forecast passenger numbers (trip rate per head), 2018



*Source: Mott MacDonald Analysis, * Ballinasloe used as comparator*

In addition the actual trip rates along the open section of the Western rail corridor are:

- Gort: 0.8
- Ennis: 1.5
- Limerick: 1.8

As can be seen these actual trips rates are markedly lower than our forecasts for the next phase of reopening. One likely reason for this is a very low current train service frequency, relative to the hourly frequency assumed in our work, however these actual figures provide some reassurance that our forecasts are not unduly pessimistic.

In addition, to demonstrate car's competitive advantage over the rail route a test was run to find the rail service frequency and journey time required to achieve a 20% abstraction from car on the Tuam – Galway flow. We forecast that a rail frequency of 8 trains per hour and a journey time of 20 minutes would be required.

The results of this show that, in all cases, the forecast model assumes higher passenger numbers than the current census indicates. This is most likely due to the higher levels of service assumed in the forecasting model (15 trains daily) as compared to current service levels.

4.8 Conclusions

This chapter has provided one of the key elements of this assessment: the likely passenger numbers on the line. It shows that by 2030 total passenger numbers could be in excess of 575,000 per year, encompassing both local and tourist journeys. This could be even greater should the policy objectives of balanced growth be achieved and population growth exceed forecasts. This is therefore considered in the sensitivity analysis in Section 8.4.

The majority of these journeys would replace journeys on buses (67.5%) rather than car journeys (22.8%). This will have significant impact on the likely wider economic benefits many of which are focused on shifts from road to rail. This is discussed in more detail in Section 7.3.

The benchmarking section also shows that this forecast would be greater than currently observed at similar stations due to the improved level of service which has been assumed. This therefore shows the potential demand which can be achieved if the correct level of investment is spent ensuring the line can deliver a high level of service, including ensuring enough rolling stock is available. Therefore, the next chapter of this report will go on to estimate the costs which would be involved in delivering this level of service.

5. Capital and operating costs

5.1 Introduction

The previous chapter set out the demand which could be achieved if a high-quality service was provided should the line be reinstated. Whilst there is an existing line in place, it is inactive and in poor condition. Significant amounts of work would be required to restore the line back to a safe and suitable standard.

This chapter sets out the costs which would be required to reactivate the line, and the assumptions which have been made to support that assessment.

5.2 Approach

The estimate is based on asset information and schedules, walk-over surveys, spot inspections and previous condition surveys. The estimate assumes that the section would be restored to current Rail and Rail Safety Standards that would be capable of providing a modern efficient service to passengers.

5.3 Capital costs

It is assumed that there would be four years of planning and construction, from 2021 to 2025, with the line opening in 2026. On this basis it is estimated that the overall capital costs for the entire WRC are €263.8m (Ex VAT). The cost breakdown for this estimate is as follows:

Table 5: Total Capital Costs, Excluding Vat, (€M) 2019 prices

Type	Phase 2 only	Phase 3 only	Phases 2 and 3
Permanent Way	€31.6	€32.0	€63.6
Signalling	€26.0	€28.3	€54.3
Bridges	€18,4	€12.0	€30.4
Crossings	€0.2	€10.5	€10.7
Civil Engineering	€2.2	€2.2	€4.5
Preliminaries	€23.6	€25.9	€49.5
Passing Loop	€0.0	€0.0	€7.4
Contingency	€8.6	€9.4	€18.5
Rolling stock	€12.5	€12.5	€25.0
Total	€132.2	€132.8	€263.8

Source: Mott MacDonald

The unit costs used to compile the estimate have been derived from Mott MacDonald's own database of costs for Railway Works. These costs are regularly benchmarked against costs from comparable rail projects in Ireland and the United Kingdom. Mott MacDonald's considerable Quantity Surveying involvement with Irish Rail has enabled us to develop a robust rail cost database facilitating reliable benchmarking of permanent way development costs. Likewise Mott MacDonald's UK rail operations have provided costs utilised in the Signalling, Power and Telecom Cost Plans which are based on composite rates that have been used on similar projects in the UK. All the rates used have previously been assured/endorsed by Network Rail on these schemes. These similar projects include East West Rail Phase 2 (reopening up of a previously closed twin track Railway Line).

Allowance has been made for contingency. This contingency should be taken in the context of the level of accuracy of +/-30%. Considerable design effort is required to develop the scheme and to create a design status in which contingency and accuracy levels can be rationalised.

5.3.1 Permanent way

The permanent way is considered to be the railway itself, alongside the sleepers and ballast. Whilst the line does currently have a permanent way at some points along the line, it is heavily degraded and would need to be completely replaced

The total distance of permanent way to be replaced is 52 kilometres. This work will comprise;

- Removal of all old bullhead rail and sleepers
- Removal of all contaminated ballast and formation
- Realignment and installation of approximately 52 kilometres of new track
- Permanent way to be capable of servicing both Passenger and Freight services
- 2 turnouts per passing loop (3 loops) Set for maximum line speed
- All switches and crossings motorised and heated
- New track drainage including outfalls to exiting watercourses
- Ballast and formation
- The route will be continuously welded rail through-out

5.3.2 Signalling

The line between Athenry and Claremorris is required to operate at 15 trains per a day each way. The approach to the signaling has been based around the current operational requirements, Irish Rail standards and in line with Irish Rail's current and future aspirations in technology.
The signaling and level crossing control will be re-controlled to an existing signaling centre
The assumptions that were made for Level crossings are:

- User work crossings would be removed through negotiation.
- Minor roads would be fitted with MSL (Miniature Stop Lights with barriers) crossings with barriers
- Major roads will have CCTV crossings with full barriers

Train detection / Axel counters and LED heads will be fitted throughout the line. Train detection will be via counters as they are in use elsewhere on the network and suited to the long train detection sections required for this route.

5.3.3 Bridges

There are 78 structures along the extend of the route (Athenry – Claremorris). The form and purpose of these structures are summarised in Table 6. All structures will require some works to ensure a satisfactory design life (commensurate with the scale of the project – typically 120 years)

Table 6; Total number of bridges on WRC

Type	No.	Comment
Road Overbridge	14	Rail Line over road
Road Underbridge	7	Rail Line under road
Farm Overbridge	3	Rail Line over Farm Crossing
Farm Underbridge	16	Rail Line under Farm Crossing
River Bridge	36	

Footbridge	2
Total	78

Source: Mott MacDonald

In general, all overbridges are traditional masonry arch structures – and are generally in good condition. The cost estimate has assumed general maintenance and upgrading of road restraint systems (parapets) etc to comply with current Road Design Standards.

It is anticipated that all masonry arch underbridges will require some form of strengthening. Typically, this will consist of a reinforced concrete slab and waterproofing to the top surface of the arch. All metal bridges along the route will need total replacement.

5.3.4 Level crossings

There is a total of 95 listed crossings of the existing route. These are summarised as follows;

Table 7; Total road crossings on WRC

Type	No.	Comment
Field Crossings	71	All closed and alternative access arrangement provided
Occupational Crossings	15	All closed and alternative access arrangement provided
Road Crossings	9	Signal Crossings
Total	95	

Source: Mott MacDonald

All road crossings will remain and will need to have modern crossings installed, with associated signalling as discussed above.

In addition, there is the need to replace the N63 Crossing which was removed during the road upgrade. There is an existing agreement with TII (Transport Infrastructure Ireland) that they will fund the construction of a new road underbridge in order to provide grade separation of the rail and road traffic. An allowance for the provision of this structure and all associated works has been provided and a corresponding offset to reflect a contribution from TII.

5.3.5 Stations

In order to allow for the line to be operated work will need to be undertaken on the stations along the line. As Athenry is already an operating station it is assumed that no further work will be required.

The following work will be required on the other stations:

- Tuam – gauging, new copes, tactile surfacing and other surfaces finishes, Ticket Vending Machines, Access Control CIS, Lighting, CCTV, Carpark upgrade
- Claremorris – gauging, new copes, tactile surfacing and other surfaces finishes, Ticket Vending Machines, Access Control CIS, Lighting, CCTV, Carpark upgrade
- Road – Rail Access Points (RRAP)

5.3.6 Civil engineering

Certain sections south of Tuam have been affected by the removal of peat close to and adjacent to railway. This has caused a significant settlement of the permanent way. This section will require stabilising and reinstatement using innovative geotechnical techniques. An allowance has been made for this in the Cost Estimate.

5.3.7 Passing loop

In addition to the passing loops on the Western Rail corridor itself, an additional passing loop will be required on the Athenry to Galway line. This is because the current single-track line into Galway does not have the capacity to take two extra trains per hour (in and out of Galway). As this would only be required should the proposed service go ahead, the cost of providing this has been included in the overall cost estimate.

It is estimated that this would cost €7.4m, assuming that additional land would not need to be purchased to facilitate this and that the land used had no significant site issues (such as poor drainage).

5.3.8 Rolling stock

Costs associated with procuring new diesel multiple units (DMUs) along with the operating and maintenance costs have been identified along with the assumptions made and the sources used. The passenger service is to be provided by four two-car DMUs.

The current fleet is already at maximum usage to cover the existing network and therefore it was assumed that there would be insufficient spare capacity to provide trains for this line. Therefore, the costs of this line include the purchase of new DMUs to ensure that the required service can go ahead.

5.4 Operating costs

5.4.1 Line Operating costs

The operating costs for the WRC were produced by IE based on a bottom up estimate based on actuals for: payroll, overheads and fuel costs. The total annual operating costs for running the Claremorris to Galway train is €2.2m, as shown in Table 8. Annually, payroll accounts for 39% of the total operating costs which amounts to 12 train drivers (8 on at any one moment in time) and 1 member of station staff. Staff costs were assumed to grow in line with real GDP per person employed, with all other costs assumed to remain constant in real terms over time.

Table 8: Annual Railway Undertaking operating costs, 2019 prices

Category	Projected total annual Cost €m[32]
Payroll	0.9
Total Overheads	0.1
Total Rolling Stock Maintenance	0.7
Total Fuel Costs	0.4
Total Incremental operating costs	2.1
Contingency	0.1
Total	2.2

Source: Irish Rail

This figure excludes the contribution to the Infrastructure management costs, estimated at €530,000. This payment is used in part to offset the costs of maintaining the infrastructure set out below.

5.4.2 Additional Infrastructure Manager annual costs

Once the line has been constructed it will require regular maintenance and renewal to ensure that the line remains safe at a steady state level and that line speeds remain high. This is the role of Infrastructure Manager (IM). The older the line becomes, the greater the cost of maintaining and renewal it will be. In addition, there will be additional IM Operating costs associated with level crossing monitoring and control. It has been estimated that the total additional IM maintenance / renewal / operating costs will rise over the evaluation period from €1.2m per annum to €4.1m, see Table 8.

Table 9: Total Additional IM Costs (€m), 2026 – 2056, 2019 prices

	2026 - 2030	2031 - 2035	2036 - 2040	2041 - 2045	2046 - 2050	2051 - 2056
Total Additional IM costs	1.2m	1.5m	1.8m	2.8m	3.4m	4.1m

This is in addition to the maintenance of the rolling stock which has been included in the Railway Undertaking (RU) operating costs included in Table 7. It is assumed that this rolling stock maintenance and servicing will be provided for at existing Irish Rail Facilities and therefore no new facilities will be constructed.

5.5 Conclusions

As can be seen above, the costs of reactivating the line are significant and it will take five years for the line to be ready to take passengers. In order for this investment to represent value for money the passenger demand will need to deliver even greater financial and economic returns. This will be

[32] Figures may not sum due to rounding

assessed over the next three chapters of this report, beginning by working out the financial implications

6. Financial assessment

6.1 Introduction

The scope of work for this project was to assess the financial and economic case for the reactivation of the WRC. This chapter of the report provides the first of those assessments in the form of the financial implications. This links into the requirement in the Public Sector Spending Code (PSC) to undertake exchequer analysis setting out the implications for the public purse including any PSO subsidies and increased IMMAC funding requirements which would be required in order to ensure the line can operated.

This chapter does not consider any of the wider economic benefits which might also arise should the WRC be reactivated, meaning that it does not consider the full benefits associated with the WRC. These wider benefits are considered in Chapter 7.

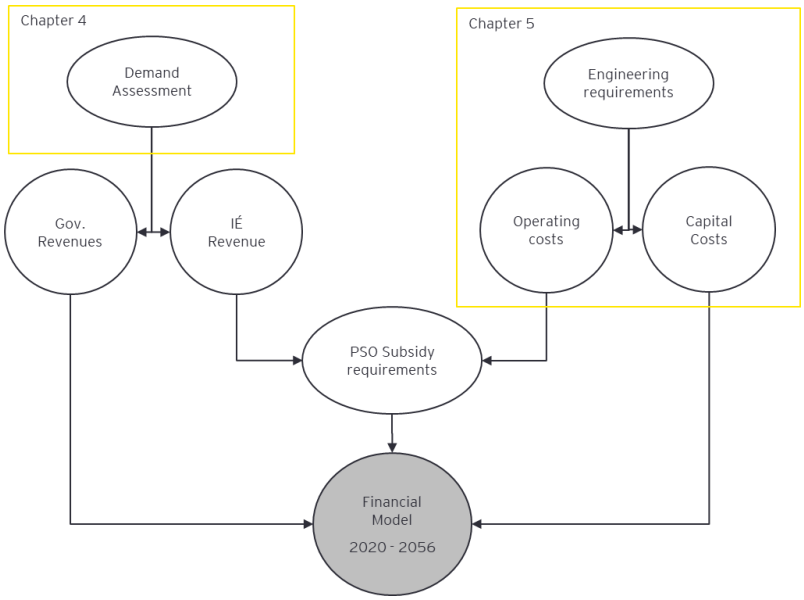
For simplicity all results presented in this chapter are for the reactivation of both Phases 2 and 3. The full assessment of the different options (including only opening Phase 2 or Phase 3) is provided in Chapter 8.

6.2 Approach

6.2.1 Model

In order to assess the financial implications of reactivating the WRC, the inputs of Chapters 4 and 5 were drawn together as set out in Figure 32

Figure 32: Financial modelling process



The financial model designed was built to the standard set out in the PSC and CAF. It provides a full assessment of the financial costs and revenues associated with the WRC over the assessment period. As is standard in such models, the end of the assessment period was set at 30 years subsequent to the line being reactivated (assumed to be 2026). This means that the model assesses the period 2020 to 2056. As is standard with these models all prices are expressed in real terms (i.e., it does not include inflation) and VAT is excluded (as this would represent a payment by the Government to the Government).

The output of this financial model is the yearly financial requirements required to construct and operate the lines. This is then drawn together into a single Net Present Value (NPV) figure for each option. This NPV represents the total net financial position as of 2020.

6.2.2 Key assumptions

Due to the complications involved in assessing financial impacts out beyond 2050, a number of simplifying assumptions are required to build a workable model.

The key assumptions underlying this model are:

- Fares: it is assumed that fares only rise in line with inflation and that there are no significant changes to the fare structure over this period
- Maintenance: the line will be fully maintained to steady state condition and upgraded throughout its life span to ensure no reduction in service levels
- Wages: wages grow faster than inflation and are therefore inflated by real GNP per person employed as per CAF guidance
- Operational expenditure: All non-wage costs remain are assumed to not grow in real terms.
- The discount used for exchequer analysis is 3.09%

6.3 Revenues

6.3.1 Passengers

The passenger numbers set out in Section 4.4 have been used to estimate the ticket revenues which help to fund the costs of operating the line. This is based on the average ticket price paid at each of the stations modelled below. More detail on these ticket prices and the associated revenue calculations can be found in Appendix D.

Table 10: Annual passenger numbers and revenue, 2026 to 2035, 2019 prices

	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual Demand (000's locals)	285	422	491	549	552	556	559	562	566	569
Annual Demand (000's tourists)	12	18	21	23	23	23	23	24	24	24
Annual revenue (€ms)	1.1	1.6	1.9	2.1	2.2	2.2	2.2	2.2	2.2	2.2

Source: Mott MacDonald

6.3.2 Freight

In addition to passenger revenues, it has been assumed that 5 freight trains will run on the line each week. This will be operated by a company such as IWT who will pay rail access charges for using the network. On average the gross revenue is €5,400 per train. However, when the ongoing costs such as drivers, fuel, fleet are considered, it is expected that this will generate a net zero net revenue for Irish Rail.

6.3.3 Subvention requirements

Based on the operating costs, as set out in Section 5.4, and the revenues set out above, it can be seen that the revenues will not fully cover the operating costs. This means that an additional subsidy, known as a PSO subsidy, will be required to ensure that the operating costs can be met. The PSO subsidy is used to cover both the gap in the funding of the operational rail operations as well as a contribution towards maintaining the line itself, known as a track access charge. This charge has been estimated at €530,000.

The level of subsidy required is set out in Table 11. This is based on an assumed ramp up in passenger numbers which is set out in Appendix D.

Table 11: Total additional annual PSO subsidy required (€m), 2026 – 2035, 2019 prices

	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Ticket revenue	1.1	1.7	1.9	2.2	2.2	2.2	2.2	2.2	2.2	2.2
RU Operating costs	(2.6)	(2.5)	(2.4)	(2.4)	(2.4)	(2.4)	(2.5)	(2.5)	(2.5)	(2.6)
Track access charges	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)
PSO required	(1.8)	(1.2)	(0.9)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)

Source: EY and MM analysis

It should be noted that the operating costs are the marginal additional operating costs and therefore do not cover the full costs of operating the line (i.e. they exclude any headquarters staff required to support the line) and as such this does not represent the full PSO requirement for this line, rather it represents the marginal additional subsidy which will be required.

Whilst €500,000 will be directly provided for track maintenance in the form of the track access charge, this does not fully cover the maintenance costs undertaken by the Infrastructure Manager unit of Iarnród Éireann. As shown in Section 5.4, the cost of maintaining the line will be up to €4.1m. This means that up to €3.5m of additional funding will be required to be provided to the IMMAC in order to ensure that the line remains viable over the evaluation period, see Table 12.

Table 12: Total additional annual IMMAC Exchequer Funding required (€m), 2026 – 2056, 2019 prices

	2026 - 2030	2031 - 2035	2036 - 2040	2041 - 2045	2046 - 2050	2051 - 2056
Total additional IMMAC costs	1.2	1.5	1.8	2.8	3.4	4.1
Track access charge	0.5	0.5	0.5	0.5	0.5	0.5
Additional IMMAC funding	0.7	1.0	1.3	2.3	2.9	3.6

The maintenance of the line is undertaken as part of the Infrastructure Manager Multi Annual Contract (IMMAC). Whilst some of this additional cost will be provided through the track access charge (€0.53m per annum) this will still leave a significant short fall which will also need to be made up by additional government funding.

6.3.4 Wider government revenues

Whilst there are direct financial benefits associated with the increased use of the rail network, there are some offsetting reductions to other areas of government revenue. This is due to reduced car usage meaning less road tax and fuel duties being paid.

Road tax reductions will only occur as a result of lorries being removed off the road due to the small increase in rail freight, however the reduction in use of buses, cars and lorries will all directly result in less fuel being consumed and less tax therefore being paid. It is, however, noted that the

reduction in fuel consumption will have significant environmental benefits which are assessed in the next chapter.

Based on the demand assessment, wider government revenues are expected to fall by up to €3.0m per annum by 2030.

6.3.5 Residual values

The assessment period for this model is 30 years following reactivation, however it is unlikely that the rail line will cease to operate at the end of this period. Railway lines tend to have long lives (some lines have been open for more than 100 years) and as such the line will still have value at the end of the assessment period. It is therefore necessary to include a residual value in the financial assessment to allow for this.

In order to calculate the residual value of the line, the life expectancy of the different components of the capital spend were assumed to be as follows:

Table 13: Life expectancy of capital investment

Item	Life Expectancy
Permanent way redevelopment costs	40 years with maintenance
Signalling	30 years
Telecoms	30 years
Electric & Power	30 years
Under/Overbridges remediation/replacement costs	120 years with maintenance
Crossings	30 years
Civils	120 years with maintenance
Passing loop	50 years
Rolling stock	30 years

Source: Mott MacDonald

Straight line depreciation was then applied to all the items to calculate the overall residual value of the line.

6.4 Exchequer position

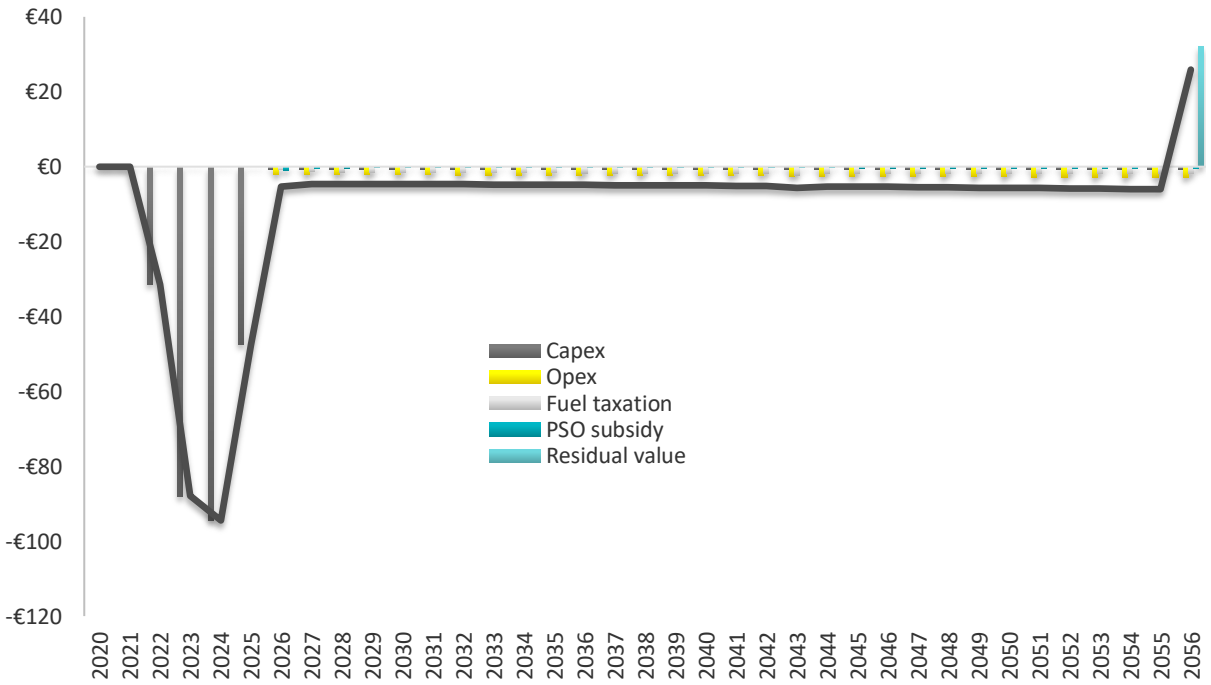
Combining the capital and operating costs, as set out in Chapter 5, with the revenue assumptions set out above, allows for a calculation of the overall exchequer analysis position as set out in The revenue being generated by both passenger and freight operations is offset by the operating costs and loss of wider Government revenues.

Figure 33 below.

This analysis shows that the line will not generate an overall financial return to the exchequer in any year of operating, except for the final year due to the assumptions around residual value. The

revenue being generated by both passenger and freight operations is offset by the operating costs and loss of wider Government revenues.

Figure 33: Exchequer analysis position (€m), 2020 to 2056



Source: EY Analysis

6.5 Conclusions

Based on the analysis set out in the last three chapters, it can be seen that the line will not generate a financial return and will have an overall negative impact on the exchequer finances throughout its lifetime.

However, this is true of many public investments and is not, in itself, a reason not to invest. The purpose of tax revenue is to deliver value to the whole of Irish society rather than to generate returns to the Government itself.

It is therefore vital to consider what wider returns the WRC would generate to assess whether these can justify the costs set out above. This analysis is undertaken in the wider economic benefits chapter below.

7. Wider economic benefits

7.1 Introduction

This chapter builds on the analysis set out in the previous chapter, considering the wider economic costs and benefits. It provides the analysis to support the second task, the economic assessment of the WRC. These two pieces of analysis will then be brought together in Chapter 8 to provide an assessment of whether the costs required to reactivate the line can be justified based on both the financial and economic benefits likely to be achieved. For simplicity all results presented in this chapter are for the reactivation of both Phases 2 and 3. The full assessment of the different options (including only opening Phase 2 or Phase 3) is provided in Chapter 8.

7.2 Approach

The wider economic benefits have been separated into three categories as follows:

1. **Monetised benefits**: these are all benefits where there is a recognised approach to assessing the value of this benefit to society. For instance, a reduction in CO_2 emissions can be valued using a price per tonne of CO_2.

2. **Monetised costs**: in addition to the benefits associated with the WRC there are a number of costs, in particular the impact of noise on rural housing close to the line, which can be quantified.

3. **Non-monetised benefits**: finally, there are some benefits for which there is no approach to quantification. These are still important and are also fully assessed.

The approach taken to monetising these costs and benefits is to use the parameters set out in the Common Appraisal Framework (CAF).[33] The CAF sets out the Department for Transport Tourism and Sport's (DTTAS) guidance on undertaking CBAs and is therefore considered to be the appropriate source for such details. All monetised costs and benefits are then included in the economic model which is discussed in Chapter 8.

7.3 Monetised benefits

7.3.1 Travel time

One of the benefits for passengers opting for rail travel is time saved. Trains are, in general, faster than cars and buses and thus travel time will be decreased, which will deliver a time saving benefit. The exact benefit will depend on what this time would otherwise be used for, with the general assumption being that time spent at work is more valuable than time spent on leisure activities.

The CAF monetises this benefit on a € per hour basis.

[33] https://www.gov.ie/en/organisation-information/800ea3-common-appraisal-framework/?referrer=/sites/default/files/publications/corporate/english/common-appraisal-framework-2016-complete-document/common-appraisal-framework.pdf/

Table 14 Value of time, 2011

Value of time €/hour	Market Price (€)
In work	34.33
Leisure	12.75
Commute	14.03

Source: CAF

The modelling in Section 4.6 shows that more passengers will choose to substitute the bus for rail than cars. The more direct road route, in comparison to the WRC going via Athenry, means that for many of the bus journeys, travel time is actually shorter. However, this does not allow for time to reach the station/stop or wait for the public transport to arrive. It is assumed that people will decide to use the different modes of public transport based on convenience and that there will be no overall impact on journey times.

Cars are direct, and users can choose when to depart and when to arrive at their destination, meaning that for drivers taking the train will actually take longer (around 15 minutes on average), though this will be offset by lower travel costs (as set out in the next section). This increase in travel time was calculated on the assumption that 45% of journeys were for commuting, 27.5% work related, and 27.5% leisure related.

The inclusion of one freight train per day will remove 18 fewer lorries travelling to Shannon Foynes or Waterford port. This will save significant time for those drivers (up to four hours for driving to Waterford) who can now undertake other tasks. This benefit has been measured at the "in work" value of time.

However, there is an offsetting cost in terms of the nine rail crossings which would need to be installed should the line be reactivated. As these would each need to be closed twice an hour (one for the service in each direction) this would lead to delays for road users who would be forced to wait. As it is not possible to estimate the likely delays associated with this it is not possible to quantify this cost.

7.3.2 Travel costs

In addition to the value of the time saved, passengers who choose to swap to the train will also potentially save on travel costs. This will mainly be for those who swap from car journeys, as train journeys tend to be a comparable price to bus ones. For those who swap from car journeys to rail journeys, they will save in terms of car running costs, fuel and parking costs. As discussed in the previous section, the WRC will also remove 18 lorries a day from the long journeys from Ballina to the ports, with associated cost savings to the lorry drivers or haulage companies.

The CAF provides a framework for assessing car fuel efficiency and maintenance costs for both private and commercial vehicles which was combined with the latest fuel price information. Average journey times, speeds and distances, based on the origin and destination of journeys, were calculated for both the existing situation (i.e. without the WRC) and if the WRC were to be reactivated. The cost saving was then the difference in the travel costs between these two calculations.

7.3.3 Climate change and emissions

Climate change is a key social challenge and all areas of the economy need to support the drive to a low carbon future. The environmental impacts of changing consumer behaviour to use rail instead of

cars and buses will reduce the negative environmental impacts of car or bus use. This will be particularly true if the line is electrified.

Greenhouse gas (GHG) impacts can be measured using Carbon Dioxide (CO_2) equivalent emissions values that contribute to global warming. Improvements in GHG emissions will help towards meeting Ireland's climate change targets, which aim to cut emissions by 20% by 2020 compared with 2005 levels. This is particularly important as the forecast actual reduction by 2020 across Ireland is currently estimated at c.6%.[34] The Paris Agreement aims to cut EU-wide emissions by 40% to 2030.

In addition, the decrease in emissions of Nitrogen Oxide (NO_x) and Particulate Matter (PM) as a result of reduced car usage and congestion will also improve air quality, delivering improved environmental and health benefits.

The CAF provides a value for each tonne of these three emissions that the WRC would reduce.

Table 15: Price of emissions (€ per tonnes), 2019

	2019 Prices
CO2	€20
NOx	€5,688
PM	€194,660[35]

Source: CAF

The CAF provides average emissions for both road and rail vehicles which was combined with the total kilometres travelled to calculate the emissions for each vehicle type. As with the previous section, the total emissions before and after the reactivation of the WRC were calculated and the total benefit to the WRC was the difference between these two.

The Irish government are committed to increasing the use of low and zero emission vehicles. There is a current target of making electric cars equal to 10% of all road vehicles by 2020 and they have set another target of stopping the sale of new non-zero emission vehicles by 2030.[36] This will mean that these benefits are likely to reduce over time as the vehicle fleet becomes increasingly environmentally efficient. As this will have a major impact on this benefit, scenarios were generated which consider a changing fleet composition over the assessment period. This assessment is shown in the sensitivity testing in Section 8.4.

7.3.4 Safety

In 2018 there were 146 road deaths and 6,277 accidents in Ireland, but no rail accidents. This means that another benefit of the passengers switching from road transport to rail is that trains are safer than cars. This type of benefit will therefore be felt by all in the local communities, rather than just those using the WRC.

The CAF provides an estimate for the value to society of each accident, as set out in Table 16. In order to calculate the safety impact of the reactivation of the WRC, the national accident rates were transformed into a rate per km travelled. The predicted accident rates with and without the WRC were calculated and the benefit was taken to be the difference between these two calculations.

[34] https://www.dccae.gov.ie/en-ie/climate-action/topics/eu-and-international-climate-action/2020-eu-targets/Pages/default.aspx

[35] Rural values have been used for this assessment

[36] Climate Action Plan 2019, Government of Ireland

Table 16: Value of accidents avoided (€ 000s), 2011

Type	Value (000s)
Fatal	€2,311
Serious	€331
Minor	€31
Total	€2,673

Although trains are safer than cars, it is important to note the trends seen in Figure 34 which shows there are decreasing numbers of road fatalities over time. This can be attributed to stricter driving regulations, improved car technology and advances in medical technology. This means that although trains are safer than road travel, the monetised benefit of this is likely to decline over time as the frequency of road accidents and fatalities continues to reduce. This will be considered as part of the sensitivity analysis.

Figure 34: Road fatalities, 2000 to 2017

Source: CSO

7.3.5 Congestion

One of the potential benefits to the WRC is the reduction in congestion. While use of the road network is often associated with economic growth, congestion holds back further growth by preventing people participating in productive activities. It also imposes a significant cost on those who get stuck in this traffic. This is particularly important for the approaches to Galway which currently experience significant congestion during rush hour traffic.

The time savings values by journey activity used in the CAF are presented below.[37]

[37] As the costs provided are in 2011 prices these are updated using GDP per person growth as a measure of increased wealth over that period. This is common for most of the CAF values.

Table 17: Value of Time (€ per hour), 2011 prices

Type of travel activity	€ per hour
In work	€34.33
Commuting	€12.75
Leisure	€14.03

Source: CAF

The overall assessment of the value of this benefit is based on the demand numbers set out in Section 4.4. This showed that a total of 315 car journeys on a daily basis would be prevented as a result of the WRC. As these are one-way journeys this means roughly 158 fewer car journeys (two ways). The model assumes that 55% of these journeys would be during rush hour, therefore this would reduce traffic into Galway by a total of 86 cars.

This reduction is unlikely to have a major impact on congestion and is outside of the modelling accuracy of the congestion model available. As a result, it is not possible to provide an accurate assessment of the total economic benefit of this, however it is assessed to be negligible and as such has not been included in the final valuation of the economic benefits.

Table 18: Total annual benefits to reduced congestion, 2026

Type of travel activity	€ per hour
In work	negligible
Commuting	negligible
Leisure	negligible
Total	negligible

Source: EY analysis

7.4 Monetised costs

7.4.1 Noise

One of the potential negative effect of the WRC is the increased noise levels associated with trains running along the line, on the surrounding area. The effects of the this increase in noise will have a particularly large impact on this area as the proposed route for the WRC is largely through quiet, less built up areas. There are three potential primary sources of noise in the construction and operational context of the proposed development;

- Rail Activities
- Changes in traffic flow on the local road network as result of potential modal change in traffic
- Construction activities associated with the works

As part of the engineering assessment undertaken to support this analysis, an assessment of the likely noise impact was undertaken. This considered the number of houses close to the line and the likely additional noise impact, as shown in Table 19.

Table 19: Average noise levels (Decibels), 2019

Bands (m)	Distance (m)	Residential houses	No. people	Average additional noise levels (dBs)
0 to 50	25	155	431	20
50 to 100	75	268	745	12
100 to 150	125	372	1034	8
150 to 200	175	432	1201	6
200 to 500	225	351	976	1

Source: MM and EY Analysis

As it was not possible to accurately assess the numbers in each house, census data was used, which showed that on average houses in that area have 2.78 people living in them.[38] The CAF proposes a value of €30 per person per year per decibel. Thus, the formula used to calculate the noise impact was:

Residential houses in a band x Average number of people in a household x Additional Decibels x €30

This calculation was carried out for each band mentioned in Table 19 and then summed up to arrive at a final figure.

This overall figure is likely to underestimate the true cost of noise as it does not account for those currently living in very low noise areas (such as in the countryside). These households will experience significant additional noise should the WRC be reactivated. In addition, it might prove necessary to operate the freight trains at night to avoid impacting on the passenger service. If this is the case, then the cost would be significantly higher due to the impact it would have on people close to the route.

7.4.2 Opportunity cost

Whilst the land occupied by the WRC belongs to Iarnród Éireann, this does not mean that the land can be considered to be free. Should the land not be used for the WRC, it would be freed up for alternative uses which would potentially deliver value to society. The land could be sold for agricultural or construction purposes or could be transformed into a Greenway similar to the Great Western Greenway.[39]

To account for this, an opportunity cost is included in the model. An opportunity cost, as set out in the Common Appraisal Frame (CAF), is defined as *'The value of a resource in its most productive alternative use'*.[40] The CAF sets out that the opportunity should be assess based on the market price of the resource in question.

The opportunity cost has therefore been based on the market value of the land. As a strong potential alternative use for the WRC would be a Greenway, the opportunity cost has been assessed as the cost of purchasing a suitable alternative route for the Greenway should the WRC proceed. The WRC is 53.03km from Claremorris to Athenry. This would suggest that it covers approximately 270,000m^2 or 65.5 Acres.[41] Agricultural land prices vary significantly, however the average price is

38 https://www.cso.ie/en/census/

39 http://www.greenway.ie/

40 https://assets.gov.ie/25189/cdea5497ba07424fb16dbe6e1597a831.pdf

41 This is based on the assumption of the line being roughly 5 metres wide.

around €9,250 per acre.[42] This would suggest a land value of around €605,000. However, given that there would be additional costs involved in purchasing the land, such as agency fees and planning permissions, this cost has been increased to €1m.

7.4.3 Shadow price of public funds

As shown in Section 5.3, the overall capital costs for reactivating the entire line have been assessed at €263.8m, spread over a four-year construction period, which will need to be funded from the public purse. As taxation is the key source of funding for the public purse, and taxation can distort the economy by reducing overall efficiency, a shadow price has been applied to the capital estimates to represent this cost to society. As detailed in the Public Sector Spending Code, this shadow price has been set at 130%, i.e. the cost to society of this taxation is €1.30 for every €1 raised in taxes. As a result, the total present cost to society of the construction work has been estimated at €298.3m (i.e. with the shadow price and discounting applied). This shadow price has also been applied to the operational subsidies which would be required to support the running of the lines.

7.5 Non-monetised benefits

In addition to the benefits which can be monetised, and therefore included in the model discussed in Chapter 8, there are many additional benefits. Whilst it is not possible to fully monetise these benefits, this should not be taken to mean that they are not important. These benefits have been fully assessed and considered as part of the findings

7.5.1 Travel reliability

One potential benefit of the WRC is that it will provide more reliable journey times than equivalent car journeys and that the certainty of arrival time will be of benefit to those using the service. This may offset, for some passengers, the longer journey time required when using the train over a car.

Galway has experienced significant problems and inefficiencies in terms of movement through the city. The Galway Transport Strategy (GTS) has been created in order to identify the causes of these issues and seek to solve them. Through its research they identified a number of key issues including an over reliance on private cars, peak hour congestion and journey time unreliability for all motorised transport.

This can be contrasted with rail travel with Irish Rail publishing how certain routes across its network are performing in terms of punctuality and reliability. They define punctuality as a measurement of time keeping, for trains this means within 10 minutes of scheduled time. On average trains arriving into Galway are 95% punctual. They further define reliability as whether the train operates or not. On average trains arriving into Galway are 99.9% reliable. As such they are likely to be more reliable than the associated car journeys.

Such reliability is mainly of value to those who have an appointment or schedule to keep to. As such they will be most likely travelling for business, educational or commuting purposes. The WRC would therefore be of benefit to the 17% of travellers who use the train for non-leisure purposes such as for education and work. They could rely on arriving into Galway at a specific, pre-determined time and as such these travellers would gain an extra benefit associated with the train journey. However, as it is not possible to quantify this benefit, it is not included in the CBA. Railways also allow commercial travellers to work during their travel time, which will be of additional value.

[42] https://assets-us-01.kc-usercontent.com/41e5ba55-3cfa-00fb-3156-624bb4e88935/ec68ac40-2b09-468f-b239-43e438b1178a/Irish%20Agricultural%20Land%20Market%20Q3%202018%20Review%20-%20HR.PDF

7.5.2 Integration and land-use

Integration considers the extent to which the project being evaluated promotes integration of transport networks and is compatible with Government policies, including national spatial and planning policy. It focuses on land use integration, transport integration, geographical integration and other government policy integration.

As discussed in Section 2.4, a requirement to consider this was set out in the NDP, as this could play an important role in enhancing regional accessibility through linking the major centres on the western seaboard in the Atlantic Economic Corridor.

Galway and Limerick both have economic and spatial strategies in place which seek to increase tourism and promote sustainable development. Galway in particular has a focus on accessibility and connectedness, explicitly considering the transport needs of Galway City as a major transport hub in Ireland and the need to increase the frequency of public transport services to and from Galway.

While the reopening of the WRC would enhance choice in public transport for its users, the existence of a well-developed road and bus network significantly limits the ability for the WRC to transform these regions. In particular, the journey times anticipated to be achieved by the WRC are lower than the equivalent vehicle journey. This means that it is unlikely to lead to the relocation of either households or industry to areas such as Tuam, meaning it is not anticipated that there will be any significant changes to land use should the WRC be reactivated.

7.5.3 Agglomeration and labour market effects

Agglomeration effects arise because firms may derive productivity benefits from being close to each other. Greater productivity in agglomerations arises from the fact that, in such locations, firms have access to larger product, input and labour markets. Similarly, lower transport costs increase competition by extending the geographical reach of a firm, increasing the level of competition that it faces. This economic impact is most likely to occur where new transport links are being created or significantly improved by providing a step change in accessibility. The labour market may also benefit from efficient and competitive integrated public and private transport services, particularly through labour mobility which promotes equality of access to employment opportunities.

These themes arose during the stakeholder consultation process, in that it was suggested that the WRC may support travel for business and personal use and connect more people to urban centres; whilst the ability for shops, cafés and other businesses to locate close to WRC stations could enhance economic activity and improve accessibility to the area.

As discussed in the previous section, it was found that both bus and car journeys would be similar or faster than taking the train, and therefore uptake was relatively low. This finding implies that transport routes into the study area are already operating efficiently, and the inclusion of a rail option is unlikely to have a dramatic effect on the decision for business to cluster together in new areas or to reduce travel costs from their current levels. As a result, it is not expected that the reopening of the WRC will provide significant additional agglomeration or labour market effects.

7.5.4 Commercial freight benefits

As noted in Section 4.4 the WRC may support additional rail freight. Whilst the total volume of freight likely to be carried will be relatively small it is likely that this will be mainly bulk product supporting the local agricultural industry rather than the containerised traffic required to support manufacturing. This may have a small benefit to those industries in terms of reduced transport costs and a more diverse supplier base, however the inability to connect to a major containerised traffic port means that it is not anticipated that the freight line will lead to significant additional industry coming into the area.

In addition, there may be benefits to existing exporting businesses who might be able to take advantage of this new freight route, ensuring better reliability and potentially slightly lower transport costs. This benefit is not anticipated to be large as haulage forms a very small part of most businesses cost base and most businesses are relatively close to a suitable port. It is not anticipated that there would be any benefit to businesses which do not import or export, as there are no suitable inland facilities to handle rail freight.

7.5.5 Social integration and cohesion

This report is not solely focused on the economic value of the WRC but also the social value it could create within the West and North-West of the country. Any initiative which has the ability to add societal value through increased mobility of the elderly and disabled, and in turn increase independence, is a relevant indicator of the worth of the project. The stakeholder meetings highlighted the number of people living in the West and North-West who rely on adequate public transport in order to get in and out of Galway city on a regular basis, be it for work, college or healthcare appointments.

Research suggests that there is a correlation between access to and availability of public transport and social integration and cohesion. A 1999 study identified areas where access to transport can have a notable effect on people in surrounding environments. Where there are effective public transport networks in place, citizens:

- Enjoy greater independence
- Have ease of access to work, education, healthcare & entertainment activities
- Are less likely to suffer both mentally and physically from loneliness
- May enjoy greater financial welfare since owning a private vehicle can be costly.

Social integration and cohesion are severely lacking in many areas of Ireland, but particularly in those with poor public transport links, as is the case in rural Ireland. A 2014 study by Trinity College Dublin showed that loneliness has a significant negative impact on physical wellbeing, leading to increased rates of depression, hypertension, and in some cases, death.

Loneliness primarily exists as a result of decreased mobility and independence, particularly among those aged 65+ and those with a disability. It is now commonly recognised as a major public health issue. In April 2019, the Government announced a €3m fund which will go towards combatting loneliness across Ireland. All policy decisions now made at Government level should work in tandem with transport policy to combat loneliness and increase social integration and cohesion at a community level.

The WRC would provide benefits to society as rail is the only form of transport which is fully disability-friendly. Many people living along the WRC have not had the capacity to travel to Galway city as regularly as they would have liked previously due to either a lack of public transport services in the area, not having the personal capacity to drive or not having access to a private vehicle of their own or that of a relative or carer.

7.5.6 Tourism

Tourism is important across the country but particularly so, in areas of lower unemployment and higher deprivation. While pockets of tourism exist within the region, such as Galway City, in general the West is not as popular as its Eastern counterpart, as can be seen in Figure 35 In particular, Dublin accounts for 42% of all foreign visitors, who spend 62% more than domestic tourists.[43] Therefore, in order to achieve balanced regional development, encouraging tourism in the area will be important.

43

http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/5_International_Tourism_Trends/Tourism-Facts-2017_1.pdf?ext=.pdf

Figure 35: Tourist destinations (000s), 2017

Source: Fáilte Ireland

The reopening of Phases 2 and 3 of the WRC may have two direct impacts on tourism in the West and North-West of the country. Firstly, it may have an impact on how people choose to travel within Ireland. Rather than renting a car to travel north of Galway city, international travellers not comfortable driving on Irish roads, or those looking to travel by train rather than by car for environmental reasons, may opt to use the WRC. Secondly, it is possible that the improved connectivity may increase the total number of tourists deciding to visit Ireland.

In a recent Fáilte Ireland Survey,11% of businesses said that improved transport links are the main positive factor affecting tourism business in the last year. This means that the WRC could act to encourage more tourists to visit the area north of Galway, which currently does not see many tourist visits.

This may be particularly true for the American market. The USA is Ireland's 2nd largest source of international visitors after the UK, it saw growth of 17% or 217,000 additional visitors to Ireland in 2017 and is garnering increased appeal year on year. It ranked the highest for tourism spend, with Americans generating €1.3b for the Irish economy, which is higher than any of its European counterparts. The American market is one such group who may be particularly interested in the potential Quiet Man film re-enactment at Ballyglunin station.

In addition, since the closure of Galway Airport to flights in 2013, Ireland West Airport (IWAK) in Knock, Co Mayo has grown substantially and there may be an increase in international tourists flying into the airport who wish to visit Galway City and need to travel south towards the main tourist attractions. Whilst there is no plan to link the WRC to IWAK, it would be a relatively short bus ride to Claremorris (roughly 45 minutes) meaning that tourists would have better connectivity across the region. It is therefore possible that the WRC may attract tourists from Dublin and into the West of Ireland. While Galway city itself is a hugely popular destination, less than 10% of visitors to the city choose to travel north of the city. The increased connectivity which would result from reopening phases 2 and 3 of the WRC may see tourists opting to visit areas such as Westport in Co Mayo, which is already a popular holiday town for domestic holiday makers. This may have quite a significant effect on the local economy, with international visitors opting to spend longer in the region instead of moving to a new location.

However, it is more likely this uptake would be among visitors already planning visits to Ireland. This is because the level of public transport provision is not considered to be a major reason for selecting Ireland as a holiday destination. In addition, the tourist attractions such as Kylemore Abbey &

Gardens in Galway, which was the largest fee-paying tourist attraction in the Western region, and Connemara National Park, which was the most popular free tourist attraction in the area, are located too far away from the WRC route to have any significant effect on passenger demand. Anyone visiting these areas will still require the use of a bus or car. Instead, it is more likely to lead to more tourists opting to complete a day's rail tour package, such as those offered by Rail Tours Ireland (RTI) (which includes multiple activities over a full day's travel) or choosing to visit towns further north for part of their stay.

In the Border's railway survey, discussed in Section 4.4 25% of leisure users said they would not have made the journey if the line had not been in existence. This would suggest that 3,625 additional tourist journeys per annum would be made north of Galway. This would mean additional tourist revenues to this area, however much of this benefit would be offset by the reduction in spend in areas such as Galway City. It is not possible to estimate the net benefit to society of this, and therefore it has not been included as a quantified benefit.

As it is not considered likely that many tourists already in possession of a hire car would choose to make part of their journey by train, it is assumed that the remaining 10,875 journeys would displace bus journeys. This would have a benefit in terms of safety and emissions and therefore has been picked up in the Sections 7.3.4 and 7.3.2.

7.5.7 Biodiversity and water impacts

A desktop appraisal was undertaken to identify important areas of international ecological significance within the study area. The proposed study area has been limited to include a 500m corridor either side of the centreline of existing railway line. However, it is noted that the proposed project has the potential to impact on international ecological sites beyond the footprint of the project study area itself.

The study area provides the setting for a range of wildlife habitats and species. The existing WRC transverses Lough Corrib SAC numerous locations along its corridor.

The reopening of the railway line has the potential to negatively impact on protected ecological sites and the sensitive species for which they are designated, leading to significant direct and indirect impacts on the integrity of designated sites. Potential impacts which would need to be managed may include;

- Loss of, or damage to, plant and animal populations and due to landtake or habitat fragmentation including impacts due to the disruption of dispersal pathways
- Impacts on plant and animal populations due to changes in the movement or quality of water resources
  Or
- Disturbances to birds and other animals from the reopening of the railway. There may however be potential for positive impacts such as habitat creation and enhance of sites for wildlife.

In addition, any works that take place in close proximity to a water body have the potential to impact on the biology, water quality morphology and hydrology of the receiving watercourses. There are currently five major river crossings along the alignment of the existing railway line, namely, River Clare and its tributaries Abbert River, Grange River, River Nanny, and its tributary at Claureen and Robe River south of Claremorris.

Full detail on the assessment of bio-diversity, land use and flooding considerations have been include in Appendix E.

7.5.8 Cultural heritage considerations

There is a risk that the reactivation of the WRC could have an impact on the cultural heritage of the area. A desktop assessment was therefore undertaken to identify important archaeological, architectural and cultural heritage sites and locations within 500m distance either side of the

centreline of the existing railway. Cultural Heritage can be divided loosely into the archaeological resource covering sites and monuments from the prehistoric period to the 18th century, and the built heritage resource, encompassing standing structures and sites of cultural importance of a post-18th century date.

This appraisal provided information on the known archaeological data and on the known sites of architectural significance within the study area. As illustrated in the table below, there is a rich archaeological heritage within the study area:

Table 20: Number of Cultural Heritage Sites/Monuments within the study area

			NIAH Rating			
County	RPS	NIAH	National	Regional	Local	SMR
Mayo	Not available	23	-	23	-	18
Galway	89	107	1	106	-	176

Source: Mott MacDonald

Due to the significant archaeological and architectural heritage detailed above within the study area, it is evident that there are potentially significant cultural heritage costs which could occur should the WRC be reactivated. In addition, it should be noted that in areas of rich heritage, there is significant potential for additional elements of archaeological or architectural heritage to be identified during the construction phase.

7.6 Conclusions

As has been demonstrated, there is a wide range of potential benefits that could be reasonably expected to occur should the WRC be reactivated. In terms of the quantified benefits, these are mainly focussed on removing cars and lorries from the road, thus increasing safety and reducing emissions. As a result, the primary driver of monetised benefits are the demand calculations set out in Section 4.1. In particular the ratio of journeys extracted from public transport versus private transport is a key determinant of the overall level of benefits. Under the central scenario, only 20.6% of total current journeys are currently car journeys and as a result this means the monetised benefit is not as high as it might otherwise have been.

The total annual economic benefits in 2030 of the WRC are assessed as €3.1m, as shown in Table 21. As can be seen, a number of the potential economic benefits were found to actually be costs to society. The assessment shows that emissions will rise slightly due to the WRC, as the reduction in car journeys is insufficient to offset the increased rail emissions. Average journey times were also found to slightly increase, leading to a negative value for time savings. This was because the train is slower than car journeys, though this is offset by the additional savings as rail is considerably cheaper than car journeys.

Table 21: Annual wider economic benefits (€m), 2030

Benefit	Annual value
Safety	€0.1
Emissions	-€0.2
Time savings	-€0.9
Travel cost-savings	€5.3
Noise	-€1.4
Total	€3.1

Source: EY analysis

In addition to these monetised benefits, there is a wide range of additional non monetised costs and benefits which have also been considered. As a result, the figure provided above should be considered to be a partial estimate of the total benefit, though it is not possible to say if this is an over or underestimate.

Whilst it is clear that there are benefits associated with the reactivation of the WRC, these need to be set against the associated costs to determine whether the benefits can be justified in terms of the cost. This will then enable a conclusion to be reached as to whether the WRC represents value for money. This assessment is carried out in the next chapter.

8. Cost benefit analysis

8.1 Introduction

This chapter of the report brings together all of the analysis presented in the previous chapters in order to assess the value for money of the different options under consideration. It aims to assess whether the costs can be justified in terms of the benefits that will be achieved.

Unlike the previous chapters, results for all of the options are presented in this section. The aim is to calculate an NPV figure for each of the options. This NPV will represent the monetised value of each option and will facilitate a direct comparison across the options. The option with the highest NPV will be considered as delivering the best value for money.

As with all CBAs it is important to ensure that there is a "Do nothing" option, as this is a standard requirement in the PSC and sets out the counterfactual. In this case the "Do nothing" option means the line remains deactivated and in its current state. This is assumed to have zero costs and benefits and therefore the NPV of this option is €0. [44]

As discussed in the previous chapter, not all of the benefits could be assigned a monetary value. This means that the NPV alone cannot be used to fully assess the preferred option. Therefore, this NPV figure must be set against these wider benefits as well.

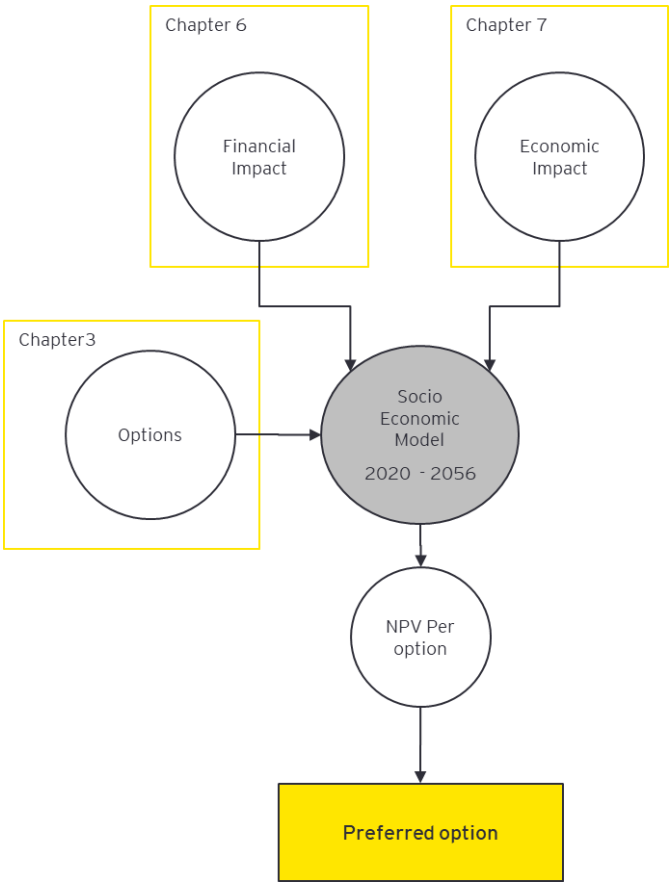
8.2 Approach

8.2.1 Model

In order to bring together all of the monetised sections of this report a standard CBA model was developed in line with the PSC, as show in Figure 36. As with the financial model, the time frame was set to be 2056. All the costs and benefits for each option were profiled across the entire period of the assessment with the assumption of scaling up of passenger numbers included.

[44] There are some very small costs associated with maintaining the line in its current state, but these are not sufficient to have a material impact on the assessment.

Figure 36: Socio-Economic modelling approach



Once this was done, the standard discount factor of 4% was then used to calculate the current value of both the costs and benefits streams. The NPV for each option was then calculated by subtracting the present value of costs from the benefits. As such, a positive NPV represents a positive outcome for society, whereas a negative value would mean the costs cannot be justified.

8.2.2 Key assumptions

In addition to the assumptions set out in Section 6.2.2, a number of additional assumptions were made to complete this element of the work. The key additional assumptions made are as follows:

- NPV is calculated in 2019 prices
- CAF values are in 2011 prices which were then raised to relevant 2019 using Real GNP per person employed
- Shadow price for public funds included at 130% but shadow price for labour not included (due to strong labour market)
- Construction works begins in 2022, and completes in 2025
- Evaluation window out to 2056
- Discount rate of 4%
- Population growth is based on Oxford Economic Forecasting West of Ireland projections as they provide robust CSO based forecast for the region of interest [45]

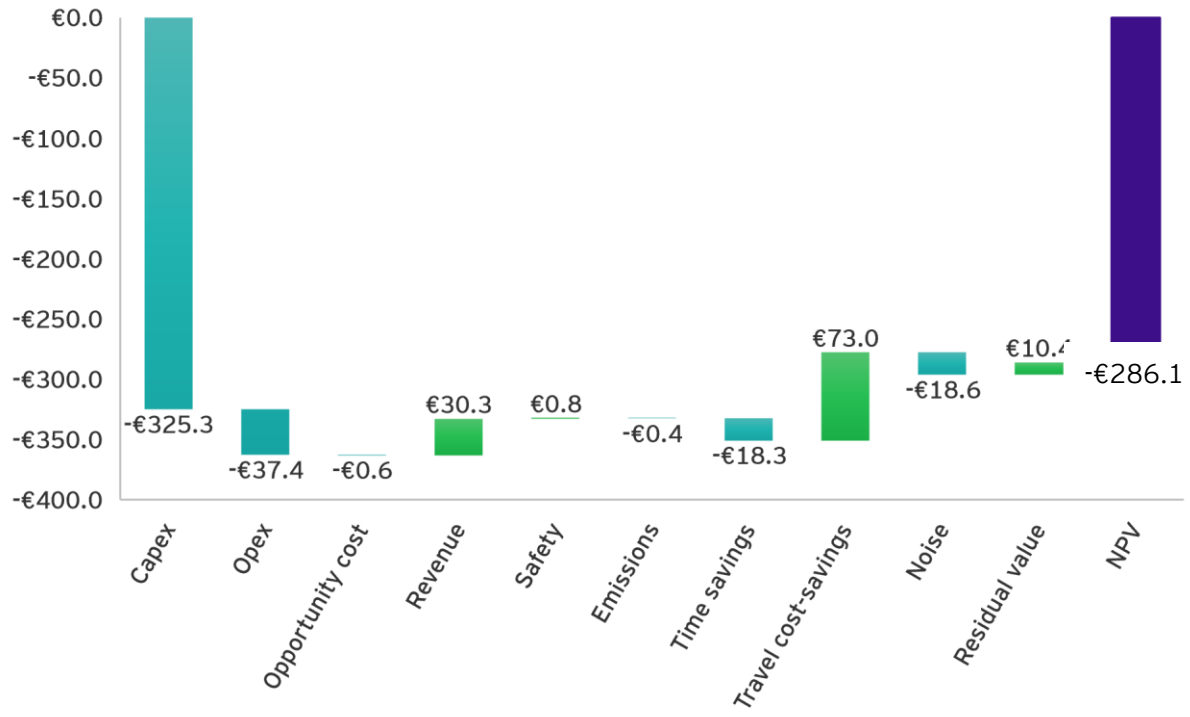
[45] https://www.oxfordeconomics.com/

8.3 Economic valuation

8.3.1 Entire Western Rail Corridor

The results of the CBA model are set out in Figure 37. Despite the strong economic benefits that the line delivers, they are not found to be sufficient to justify the large capital costs which would be required to reactivate the line. The total NPV for the line (both Phases 2 and 3) was found to be -€286m. This gave a Benefit to Cost Ratio (BCR) of 0.21, which implies that for every €1 invested society would only gain €0.21. Appendix F contains more detailed tables for the results presented below.

Figure 37: NPV Calculation for reactivation of the entire WRC (€m)

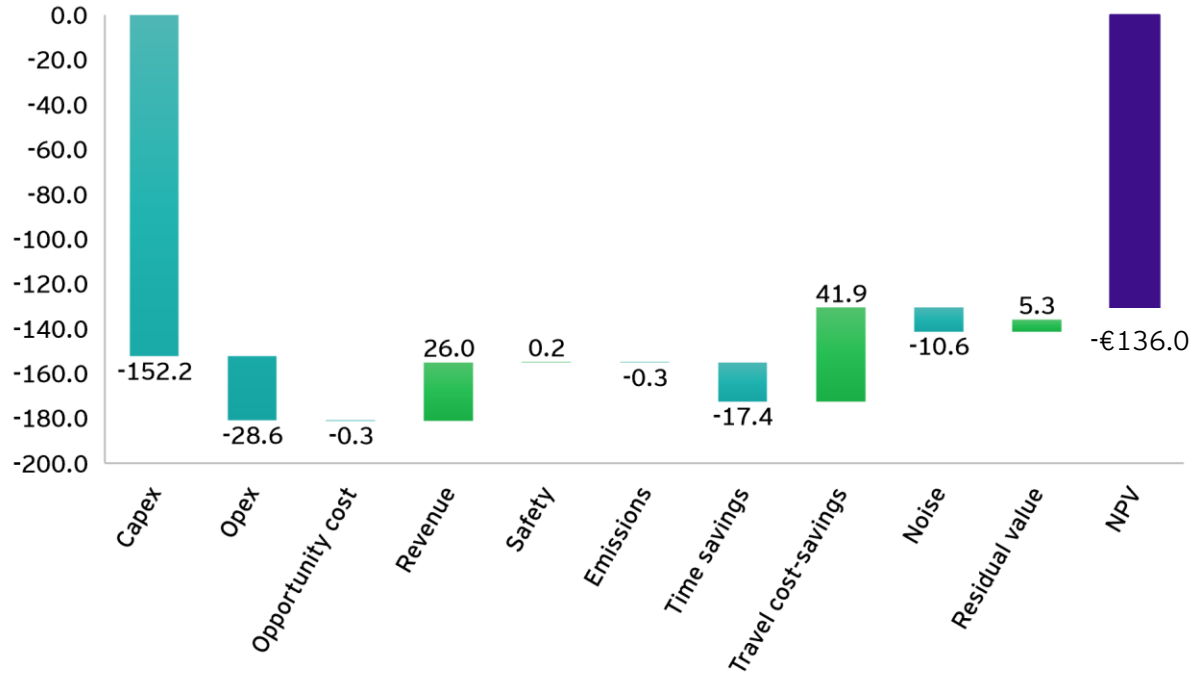


Source: EY analysis

8.3.2 Phase 2

These results were replicated for Phase 2 only. This gave an NPV of -€136.0 and a BCR of 0.25. The Benefit to Cost ratio was marginally higher than for reactivating the entire line. This is due to the lower capital costs associated with Phase 2 combined with the relatively high demand.

Figure 38: NPV Calculation for reactivation of the Phase 2 (€m)

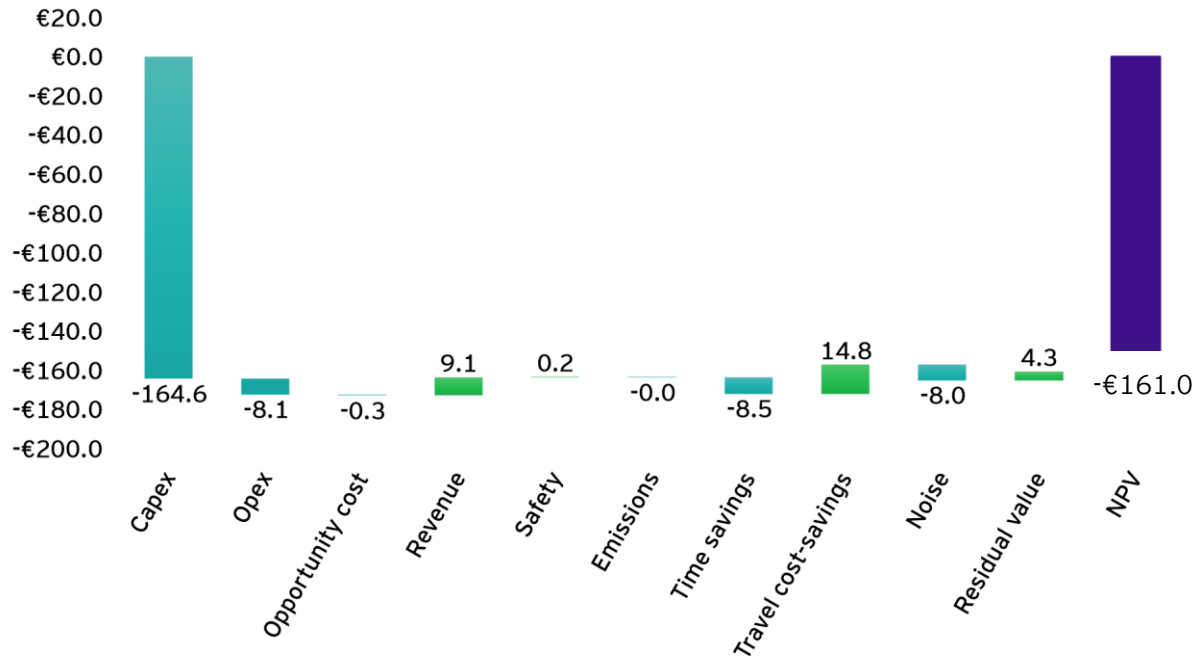


Source: EY Analysis

8.3.3 Phase 3

Phase 3 only gives the lowest BCR at 0.07 with an NPV of -€161.0m. This is because this means it is not possible to link into Galway City and therefore the demand is significantly lower for this option that for Phase 2 only.

Figure 39: NPV Calculation for reactivation of the Phase 3 (€m)

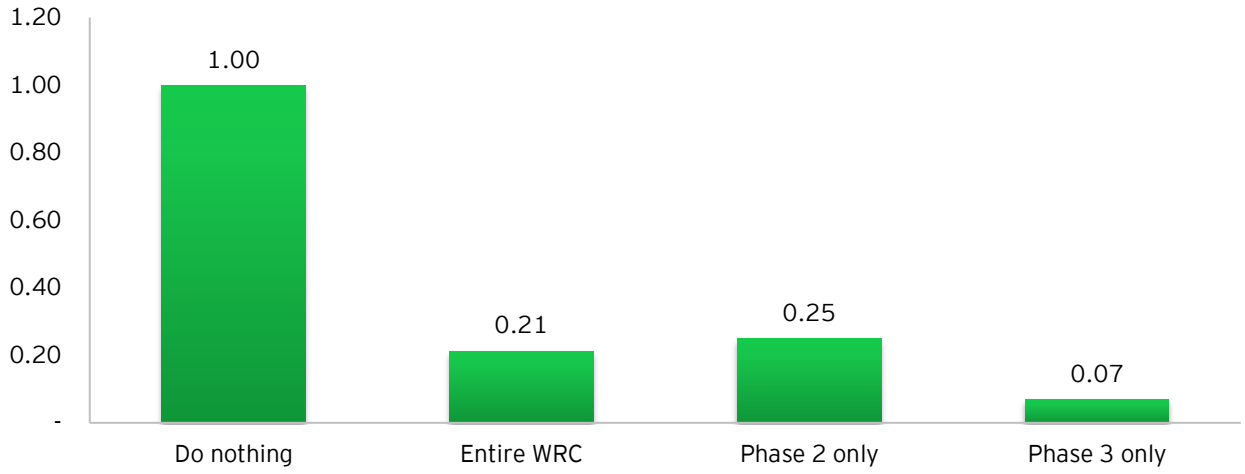


Source: EY analysis

8.3.4 Option ranking

As has been shown above all three options have negative NPVs. However, due to the different capital requirements for each of the three options, the ranking has been based on the BCR instead.

Figure 40: Options ranking by BCR



Source: EY analysis

Figure 40 shows that the options with the best BCR is the do-nothing option (i.e. do not reactivate the line). This is because it delivers neither costs nor benefits. Of the three WRC options, reactivating the entire WRC provides the next best option with a BCR of 0.25, however this is considerably below the do-nothing scenario.

8.4 Sensitivity analysis

In order to establish the robustness of the NPV estimates above, sensitivity analysis was undertaken. This looked at the impact on the results of changing the assumptions around certain key variables. Five scenarios were generated; the base case (presented above); two cases where the assumptions are moved in favours of the reactivation; and two cases where the results were moved in favour of not reactivating the line.

A number of different assumptions were adjusted:

1. Costs: the impact of increasing/decreasing capital and operating costs was included

2. Demand: the impact of increasing/increasing passenger demand and rail freight demand was also considered. In addition, an increase in the number of those passengers who transfer from cars was also modelled

3. Population: demand is based on population growth forecasts for the West of Ireland calculated by Oxford Economic Forecasting. The impact of increasing/decreasing this forecast was also modelled

4. Electric vehicles: the base model assumes no increase in the numbers of electric vehicles. A steady increase in the fleet (aligned to Government targets in this area) were considered in the less favourable cases

5. Road safety: the base case also assumes that the current levels of road safety will continue. However, as shown in Section 7.3.4, safety has improved year on year and therefore an ongoing trend of improved road safety was also considered in the less favourable cases

Table 22: Sensitivity assumptions

Assumption	Best	Better	Base	Worse	Worst
Capex cost	-20%	-10%	0%	10%	20%
Opex	-20%	-10%	0%	10%	20%
Passenger Demand	20%	10%	0%	-10%	-20%
Bus to car transfer	20%	10%	0%	-10%	-20%
Freight demand	20%	10%	0%	-100%	-20%
Population annual improvement	20%	10%	0%	0%	0%
Electric cars/HGVS improvement	OFF	OFF	OFF	ON	ON
Safety improvement for road	OFF	OFF	OFF	OFF	ON
Bus to car transfer	20%	10%	0%	-10%	-20%

Source: EY

The overall NPV for reactivating the entire WRC was recalculated for each of the scenarios and the results are present in Figure 41. Even the best-case scenario does not provide a positive NPV, and this suggests that the results are robust to even large changes in the key assumptions.

Figure 41: FULL WRC sensitivity test results NPV values (€m), 2019 prices

Source: EY Analysis

Figure 42: Phase 2 only sensitivity test results NPV values (€m), 2019 prices

Source: EY Analysis

8.5 Conclusions

The results above show the quantified costs and benefits and balance the two against one another, with the NPV calculation showing the total benefits minus the total costs. In all of the three options assessed, the monetised benefits were found to be less than the costs meaning that the overall NPV in all three cases was negative. This is also reflected in a BCR for each option which is less than 1 (a positive NPV would give a BCR greater than 1).

This result is robust to a wide range of different assumptions, with even the most positive set of assumptions still leaving a gap between the costs and benefits. This means that the "do nothing" option of leaving the line inactive is the preferred option based on this CBA.

As discussed in Section 7.5, there are wider economic benefits which were not considered as part of this NPV calculation. These need to be considered alongside this result. These are important benefits and should not be forgotten about. These were often raised during the consultation as important to the local community and as such have been carefully assessed as well.

These benefits are mainly linked to new journeys being undertaken as a result of the WRC rather than journey swapping from bus to rail. For instance, social cohesion will increase when an isolated OAP is able to travel into Galway for medical support when previously they were unable to do so. It will not increase if a commuter swaps from bus to rail. As such the percentage of total demand which are new journeys is critical. The relatively small number of additional journeys mean that any benefits to the wider community are likely to be muted and as such would not be sufficient to achieve a positive NPV, let alone deliver an NPV sufficiently high to be considered value for money.

This is reinforced by the sensitivity testing which shows that the BCRs remain low even if the demand is significantly increased over the forecasted numbers or if more people switch from cars to rail. Therefore, the reactivation of the WRC is not considered value for money under a reasonable range of demand and pricing assumptions.

Appendix A Glossary of terms

Table 23: Abbreviations used in the report	
AEC	Atlantic Economic Corridor
BCR	Benefit to Cost Ratio
CRR	Commission for Railway Regulation
CBA	Cost-Benefit Analysis
CAF	Common Appraisal Framework
DMU	Diesel Multiple Units (A train)
DTTAS	Department for Tourism Transport and Sport
ENVE	European Commission for the Environment, Climate Change and Energy
EU	European Union
EY	Ernst & Young
EY- DKM	Ernst & Young DKM (Economics Advisory Practice)
FDI	Foreign Direct Investment
GHG	Greenhouse gases
GMIT	Galway May Institute of Technology
GJT	Generalised Journey time
HGV	Heavy Goods Vehicle
IÉ	Iarnród Éireann
IEA	Irish Exporters Association
IFA	Irish Farmers Association
IM	Infrastructure management
IMMAC	Infrastructure management multi annual contract
IVT	In Vehicle time
IWT	International Warehousing and Transport
IDA	Industrial Development Authority
Lo-lo	Lift on, lift off
Mayo Co Co	Mayo County Council
MNE	Multi-national Enterprise
MASP	Metropolitan Area Strategic Plan
NDP	National Development Plan
NTA	National Transport Authority
NTM	(Irish) National Transport Model
NWRA	Northern-Western Regional Assembly
NUIG	National University of Ireland Galway
OAP	Old Aged Pensioner

Table 23: Abbreviations used in the report	
PDFH	Passenger Demand Forecasting Handbook
PSC	Public Sector Spending Code
PSO	Public Sector Obligation
Quiet Man	Quiet Man Greenway Group
Ro-ro	Roll on, roll off
RSA	Road Safety Authority
RU	Railway Undertaking (i.e. railway operations)
TII	Transport Infrastructure Ireland
TD	Teachta Dála (member of Dáil Éireann)
UK	United Kingdom
USA	United States of America
USP	Unique Selling Point
VoT	Value of Time
WDC	Western Development Commission
WICRC	Western Inter-County Railway Committee
WoT	West on Track
WRC	Western Rail Corridor

Appendix B Themes arising from consultation exercise

Theme	Discussion
Enabling business opportunities	A Port had customers in the North-West in the past that they would like to start doing business with again. There was a rail connection to the port up until a few months ago.
	A Haulier wishes for a mature supply chain, and in order to create this, they need alternatives and choice which they currently do not have. Ballina to Dublin port is a 'one-trick pony.'
	A haulier forecasts that should the WRC go ahead, the demand for rail freight services would outstrip the current supply of rolling stock. The current Ballina to Dublin route is at maximum capacity.
	There is one pharmaceutical company in the West of Ireland that has the potential to transport the equivalent of five trains per week should they make the move from road to rail.
	There is room for more inland dry ports in Ireland, particularly in the South-West of the country.
	There may be a possibility of building complementary infrastructure along the rail line, e.g., cafes/shops.
	An energy producer is querying the possibility of using rail freight for biomass pellets.
	Exports from mines (heavy bulk) at Shannon Foynes has a short lifespan due to eventual exhaustion of mine extracts. The short period of time makes the initial cost more difficult to justify.
	There is private stakeholder interest in brown field sites such as the Tuam Sugar factory in Airglooney.
	A food producer produces approximately 30 containers per day for international export. This was previously transported by rail but now travels by road due to cost.
	The Oranmore land bank of the IDA has advanced planning permission for a large bio-pharma facility
	Logistic and transport hubs in the UK are investigating using Knock airport as a hub.
	There is potential for biomass to be transported by rail in the future, to Shannon Foynes Port in particular.
	Quality of life is crucial to attracting the brightest and best talent. The WOI will be an extremely attractive place for companies to locate their business and consequently drive economic growth
	A link to Knock airport is not feasible due to its location on top of a hill (no airports in Ireland have rail links).
	A respondent has undertaken a lot of research in the area of rail freight and produced a report on its potential in Ireland recently.
	Certain respondents are of the belief that it is cheaper to reinstate rail than to build from scratch.

Theme	Discussion
	Lack of HGV drivers is a European wide problem. It would be challenging for a haulier to replace their one train driver from Ballina to Dublin with the necessary equivalent 18 HGV drivers.
	The most important element for a haulier, regarding cost effectiveness of rail freight, is ensuring goods are travelling in both directions.
	There were, and in some cases continue to be, a lot of very unhappy importers and exporters given the delay in time from the immediate cut of services by IÉ to the reinstatement through IWT in 2009.
	It would be difficult to justify the modal shift as it would first require a change in mindsets away from road. However, supply creates demand – 'Seeing is believing.'
	The UK is finding it difficult to make rail freight cost effective because of a lack of distance to travel
	Rail access charges are a major inhibitor of change from road to rail. The rail access charges in Ireland are one of the highest in Europe. The track access charge is the same for passenger and freight per km which IWT believe is unfair. There is a lack of government subsidies in relation to rail freight.
	Past experience indicates that cargo must be low-value and non-time-sensitive in order to be transported by rail rather than by road.
	Public transport by bus is restricted to a maximum of 100kph. Hence, there is not the same propensity to reach the same high speeds that rail can achieve.
Connectivity	Of huge appeal to a port is a connection with the airports, e.g., Shannon airport for the large passenger vessels possibly coming from Cobh. Buses are not suitable given the large no. of people involved. Potential for a future connection from Knock airport to the WRC also.
	Reopening Phases 2 and 3 of the WRC would expand the current transport network significantly along the Atlantic Economic Corridor. Athenry could be the link for road and rail with the M18.
	The connection of Galway to the rest of the region is a priority given it is the capital of the region.
	By reopening Phases 2 and 3 of the WRC, the rail line could go all the way to Waterford port. This is important as a lot of MNEs in Mayo do not want to go via Dublin.
	Problems with the phased approach; reopening of Phases 2 and 3 together is key.
	Rail connections into the ports will achieve more than the reopening of Phases 2 and 3 alone. There is little value to a segregated network.
Passenger demand	Lack of infrastructure in Galway city. Galway is the worst city in Ireland regarding traffic. The area is not particularly well-served by buses because there are no bus lanes close to the city. Arup modelling suggest that the creation of a ring-road around Galway city would lead to a 38% increase in carbon emissions. Galway City is the fastest growing city in Ireland for over 50 years and the population of Galway MASP projected to grow from 94,075 (Census 2016) to 145,816 by 2040. It is imperative to seek innovative ways to alleviate pressure and unnecessary congestion within the MASP area.

Theme	Discussion
	Bus services are limited to 100kph, whereas trains are capable of 165kph.
	WDC believe rural dwellers will continue to use cars (maybe electric cars) for portions of their journeys at least. Therefore, future transport expenditure for the western region will have to be multi-modal.
	There is a proposed Strategic Development Zone at Knock airport, close to Claremorris. There are plans for 4,000 jobs which would create additional demand.
	Bus services such as Go Bus operate daily services from Mayo to Galway for as little as €5 per day, so it would be difficult for a rail line to compete.
	The current profile of passengers on Phase 1 of the WRC signifies the strong demand for rail transport. Park and Ride facilities at stations along the route will be key to maximising utilisation.
	The focus of future Rail demand could be on student travel, with cheaper fares and greater frequency. This could be relevant for WRC due to the location of NUIG and GMIT.
Service quality constraints	Frequency of service and fare price is vital to success. Need for a minimum of three trains on the WRC line at peak times in the morning and evening. The Government committee on rural and community development have decided to do a piece on train fares (rural versus urban price discrepancies).
	Where trains are needed, train stations do not currently exist, e.g., at Ballybrit and GMIT.
	Speed: ▸ Up to 1.5 hours is considered an acceptable length of time for commuting. ▸ New motorway to Dublin has had a big impact on the Galway-Dublin train line. The number of level crossings has a big impact on the amount of speed the train can build up
	Consideration should be given to extending the current TaxSaver Initiative to include those who are self-employed, not just on WRC but across the board.
	Consideration should be given to running additional student trains on Friday and Sunday
	Current 10-minute target for punctuality is too generous and could be reduced as part of a drive to improve efficiency.
Balanced regional development	Reopening Phases 2 and 3 of the WRC would help to counter-balance the dependence on Dublin Port
	Around one million square feet of office space has been approved through the planning system in Galway city centre in the last year.
	An imbalance exists in terms of how the economy is structured. There is a poor attitude towards the WOI at Government level. The EU sympathise with the lack of transport networks in the WOI.
	There is a need to be a visionary around the potential of the WRC, like that of Knock airport in the past, in the creation of a stronger regional identity so that it may act as a catalyst for other regional developments.

Theme	Discussion
	The West and North-West of Ireland are at a competitive disadvantage compared to the East of Ireland given the lack of a high-speed railway network.
	Extending the WRC might attract more people into rural housing markets, growing population levels in many towns along the proposed extended route. The NPF indicates a doubling of population in Galway
	Construction of goods depots could help many job-starved towns and villages in the WOI.
Tourism	Many employers currently have teams of employees flying into Irish airports where it is a necessity to rent cars with no other options to travel to the WOI for business. Lack of transport options for tourists
	WRC extension may help to further the development of the WAW and IHI.
	Railway Preservation Society propose making a steam train available at Ballyglunin with actors re-enacting scenes from Quiet Man film, ran at off-peak times for tourist enjoyment to increase utilisation
	Extending rail lines to the ports could encourage cruise liners to visit the area. There is a growing no. of niche tour operators using railway lines as a USP.
	Only 10% of tourists to Galway hire a car and make a journey north of the city.
	An upgraded rail line would not attract many extra tourists to the West of Ireland as most tourists would prefer to follow the WAW along the coast by car and not travel point-to-point inland.
Social benefits	There is an increase in students commuting rather than paying rent. There is a considerable number of people travelling from Mayo to NUIG and GMIT in particular.
	The stress of sitting in traffic as part of a daily work commute is bad for physical and mental health.
	Extension would allow families, tourists and people who cannot afford the running costs of their own private vehicle due to insurance costs, the opportunity to commute to work or to explore the vibrant towns of the West and North-West.
	Any initiative that keeps or brings people into rural Ireland deserves to be fully supported.
	Rail is the only genuine satisfactory public transport mode for disabled and wheelchair bound passengers. Rail enables mobility and is socially inclusive.
Climate change	A modal shift from road to rail freight would likely reduce overall carbon emissions.
	Given the strong possibility of carbon-pricing being introduced, in the long-run there is likely to be a cost-saving for companies by choosing rail over road.
	Transport by sea is, in certain cases, more sustainable than by rail e.g., Whitegate Oil refinery owned by Irvin Oil will continue to use sea over rail as they are already shipping from Cork to Galway.
	Need to balance the desire for growth with the aim of a low carbon future.

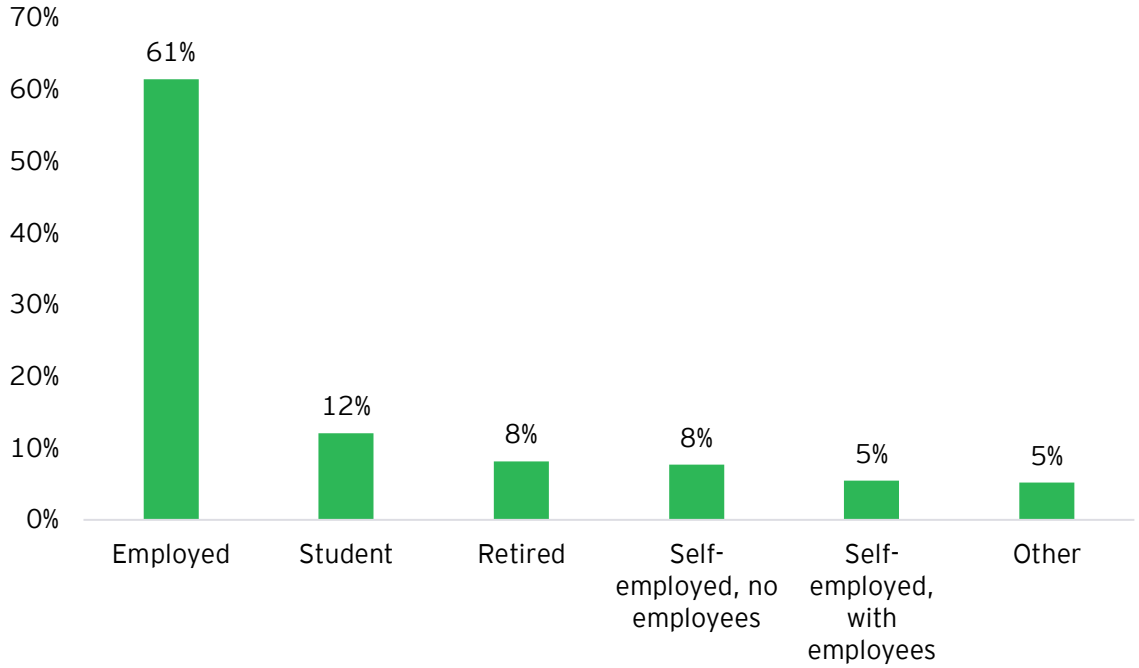
Theme	Discussion
	Environmental benefits are high on the agenda of international procurement officers.
	There could be a reduction in car ownership should adequate rail infrastructure come to fruition.
	Climate change activists have put a new focus on rail in the EU as an action against climate change
	European Committee of the Regions ENVE Commission intends to apply the current water and waste principle to freight. They intend to tax road freight off the road and onto rail. This is in line with the aim for the EU to be a lower carbon economy by 2050.
	There is an increase in demand for the electrification of railway lines. If this switch to electrification was powered by wind energy, it would significantly reduce the carbon footprint of our rail network.
	The delivery of the WRC infrastructure would play a major part in the implementation of Galway City Council's Climate Adaption Strategy.
	In the future, self-driving/automated road vehicles will offer an alternative to current forms of public transport and this could make some transport systems virtually redundant.
	Rail freight generates less than a quarter of the emissions of road haulage.
	A 2016 study by the UK's Department of Transport found that 'every tonne of freight transported by rail reduces carbon emissions by 76% compared to road and each freight train removes 43-76 lorries from the roads.
	The average passenger kilometre creates approximately 60g of greenhouse gases (GHGs) for rail compared with 210g of greenhouse gases (GHGs) for road vehicles.
	Rail transport of freight uses 15-25% of the direct energy per tonne-kilometre compared with transport by road (INFRAS/IWW, 2000. SEI Aug 2004).
Brexit	Brexit is likely to cause a reverse flow of goods traffic, from North to South
	Ireland not ready for the consequences of Brexit. Current supply chain could grind to a halt.
	IWT recognise that options to go out of ports in the South and South-East that avoid the UK land bridge could be significant should a hard Brexit materialise. Ports like Rosslare (Ro-Ro) and Waterford (Lo-Lo) have the necessary capacity and correct location to assist with Brexit management
Safety	Will the extension introduce new risk to IÉ's current level?
	If IÉ were currently looking for authorisation to place the service, it would be under the EU Operability Directive 2008/57. This was however recently re-cast and implementation in-country will be complete by June 2020. There are no additional safety burdens in the new directive.
	There is an issue where the rail line engages with members of the public, e.g., at level crossings, either on public road or through private farm land. There are 12 private farm and one public road crossing within Phase 2 and 12 private farm and 12 public road crossings within Phase 3. How IÉ propose to guard these level crossings will be relevant to the overall cost.

Theme	Discussion
	The level of safety on rail with freight is no different to that of rail with no freight. Rolling stock is covered under EU and Irish legislation. Signalling and automatic train protection becomes critical when a rail line is utilised up to maximum capacity.
	It is seldom to hear of fatalities on Irish railways; it is not seldom to hear of fatalities on Irish roads. If you take trucks off the road and you reduce exposure, it should pay safety dividends, i.e., by reducing the number of collisions and fatalities.
	There is potential for severe collisions if they occur on motorways, but overall motorways are the safest form of roads.
Alternative uses	The rail line is an asset to be used, whether as a rail service or as an alternative use. Rail line would have to be first classified as an abandonment if it was to become a greenway.
	A greenway would create tourism and jobs, protect the closed railway route, create civic pride and increase local amenities. It would support the Atlantic Economic Corridor. Activity tourism is on the rise in Ireland thanks to the Wild Atlantic Way, greenways etc. and people want long distance activities; people wish to eat, drink and sleep along the route
	Where possible, putting facilities such as fibre, road and rail onto the same corridor should be considered to reduce the total impact on farmers and communities. Farmers would lean towards rail if there was no opportunity to do both at the same time. It would support industrial development and a greenway could be located elsewhere. There is a pathway alongside the rail line for approx. a mile outside Galway City. In the countryside, this could then diverge from the rail line.
	There are issues around operating a greenway parallel to the railway: ▸ Under EU legislation there are essential requirements in relation to how you would structure a greenway parallel to a railway and still restrict access to the line by members of the public ▸ Usually when a heavy rail line is running through private property it is restricted by boundaries and ditches ▸ The problem is not insurmountable, but it would pose issues as regards physical safety separation between the greenway and the railway It is unrealistic to think that you will fit a greenway and a railway line adjacent where only one railway line previously existed
	Landowners may have concerns over new infrastructure being built through their land.
	Do not support a greenway given that the countryside is of a relatively low value in comparison to other routes such as the Great Western Greenway which runs along the coast. Other inland greenways are reported to have low numbers of visitors.
	Power lines could be more readily and cheaply routed along rail routes, to minimise disruption to roads
	Solar panels could be installed along the rail line to maximise use in the immediate future while decisions are made for the future. The panels can help generate energy which translates into revenue, while also assisting the state in reaching our renewable energy goals.
Cost	The development and subsequent closure of Galway airport offered a lesson on public expenditure: building expensive infrastructure for which

Theme	Discussion
	there is no plausible demand is a waste of scarce funds. There is a need to consider the balance of investment. There is a need to consider if the WRC is the absolute best use of available funds.
	The reactivation of the line would require suitable compensation or additional infrastructure to farmers to mitigate impacts.
	Investment would not offer a good return with a low population density along the route and location of train stations making it wholly unfeasible.
	TII have given a public undertaking to pay in full for the replacement railway-bridge and associated works where the N63 and Railway intersect.
	There is a major cost saving when reopening closed lines compared with the cost of constructing new rail lines. The WRC rebuilding cost was exceptionally low for Phase 1 at just €1 million per mile for track renewal.
	At an EU level, the WRC extension may qualify for up to 55% of EU funding, thus dramatically reducing the investment required from the national Exchequer.

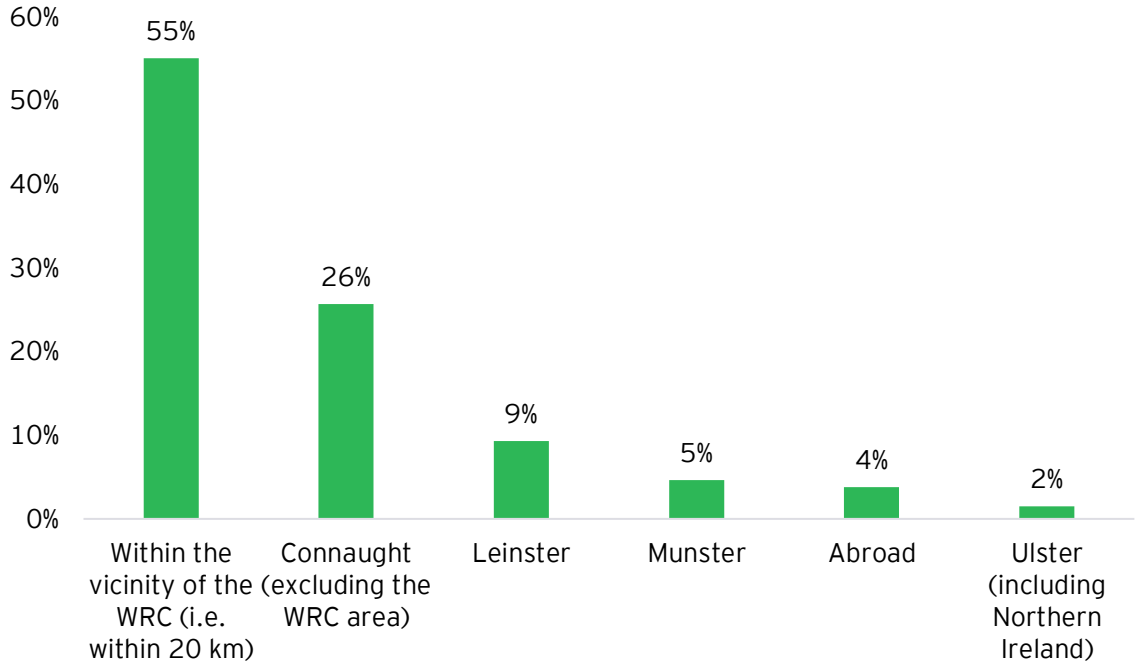
Appendix C Public survey results

Q1. Which of the following best describes you?

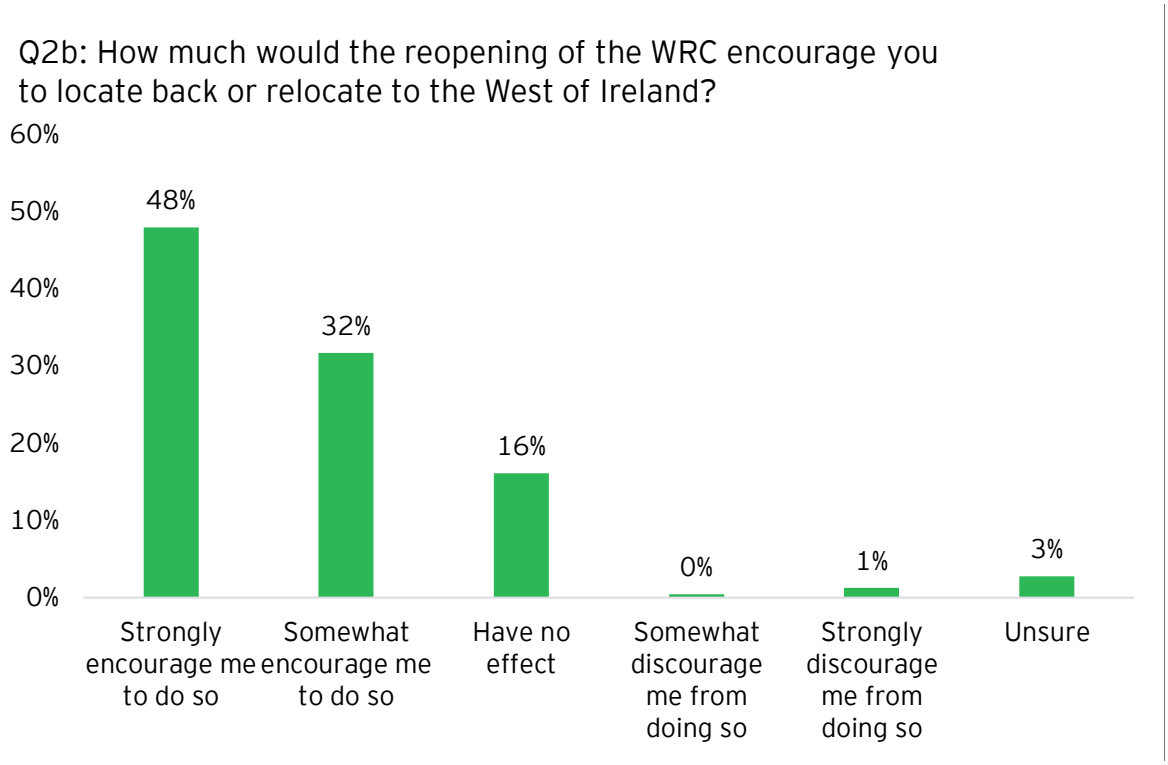


n = 6,572

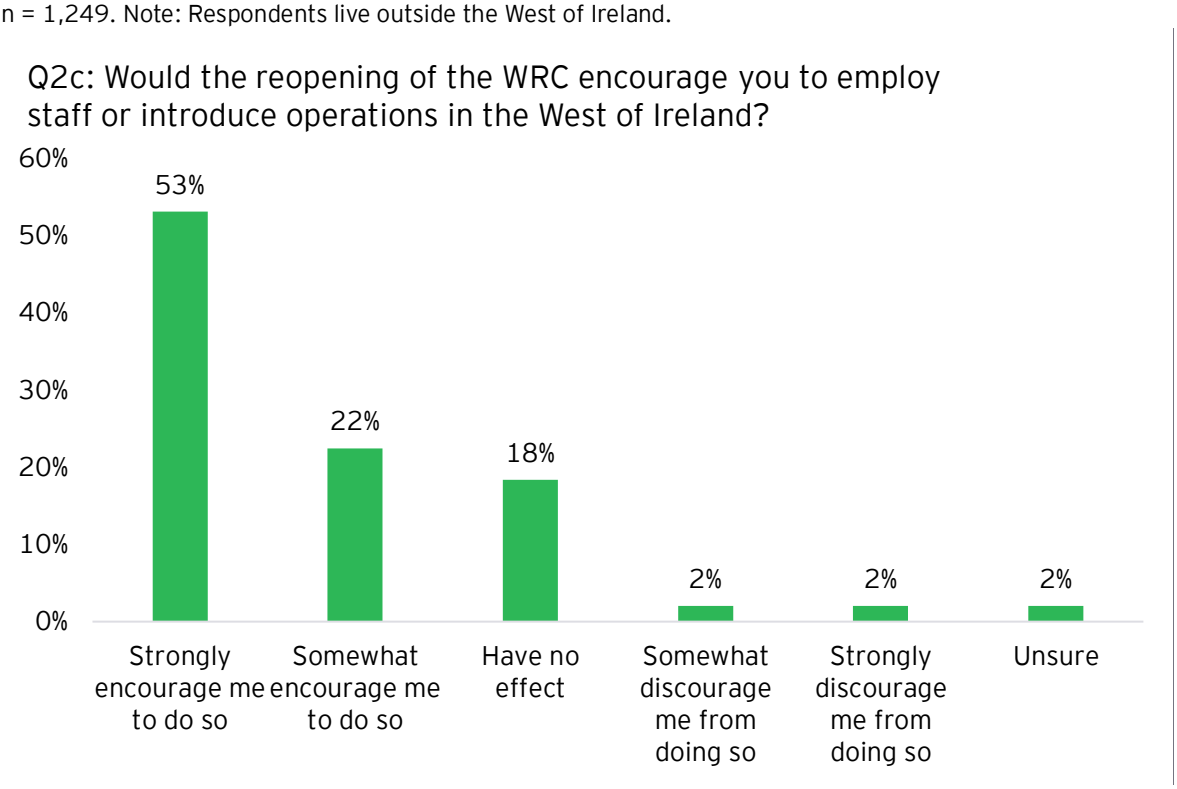
Q2a: Where are you currently based?



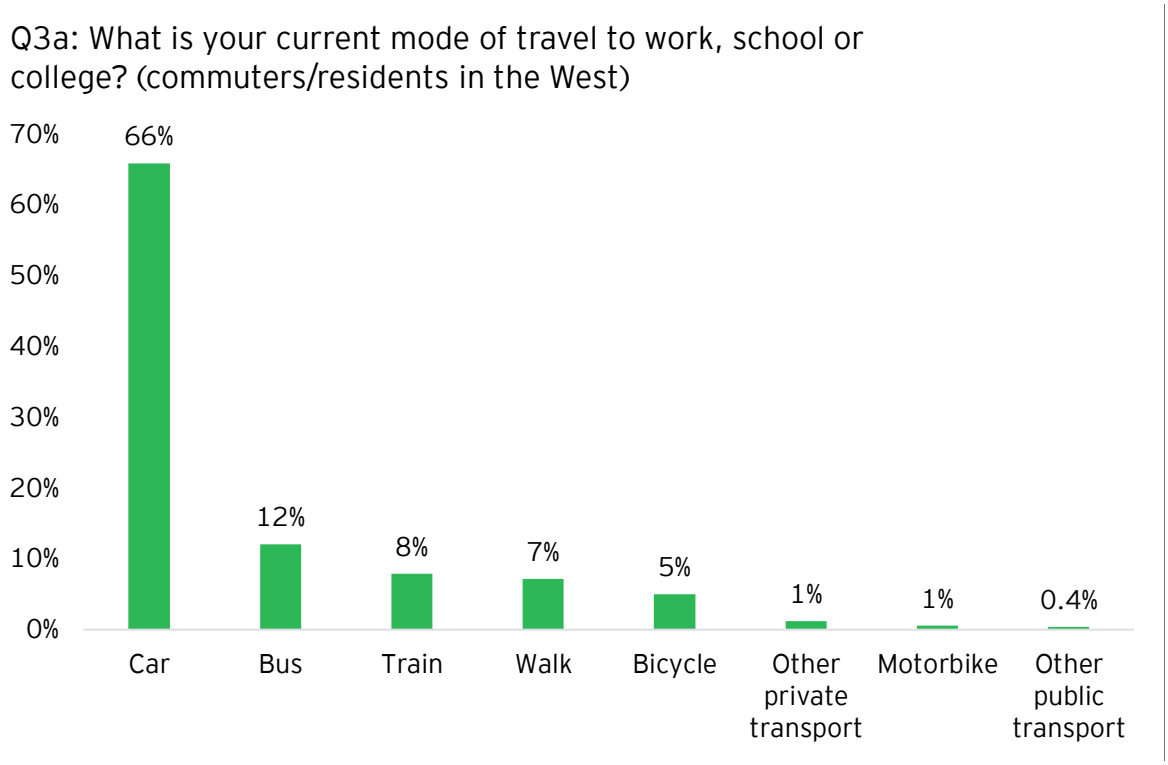
n = 6,572



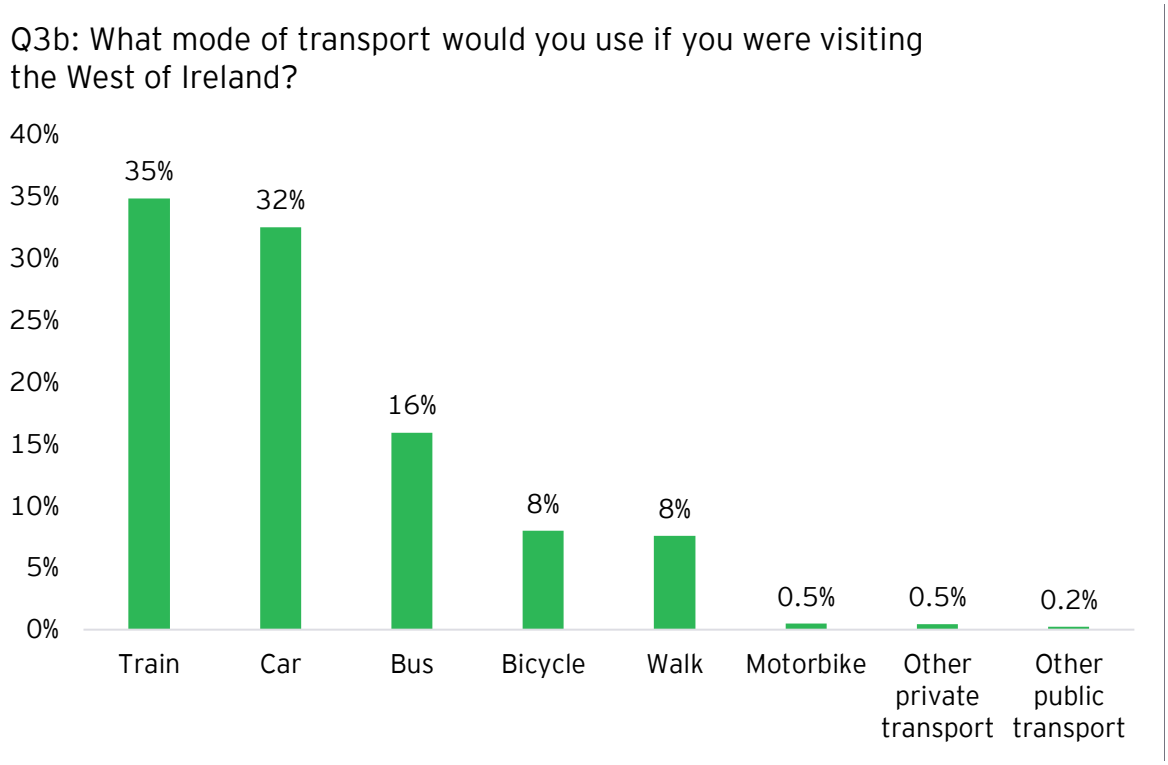
n = 1,249. Note: Respondents live outside the West of Ireland.



n = 49. Note: Respondents are employers.

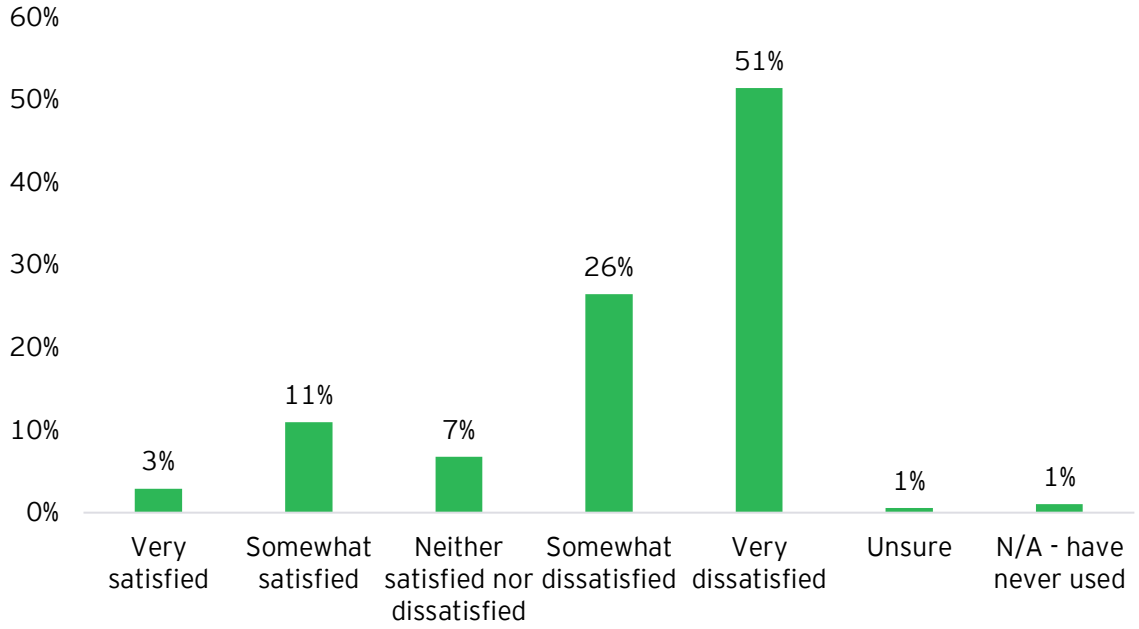


n = 5,323. Note: Respondents live within the West of Ireland.



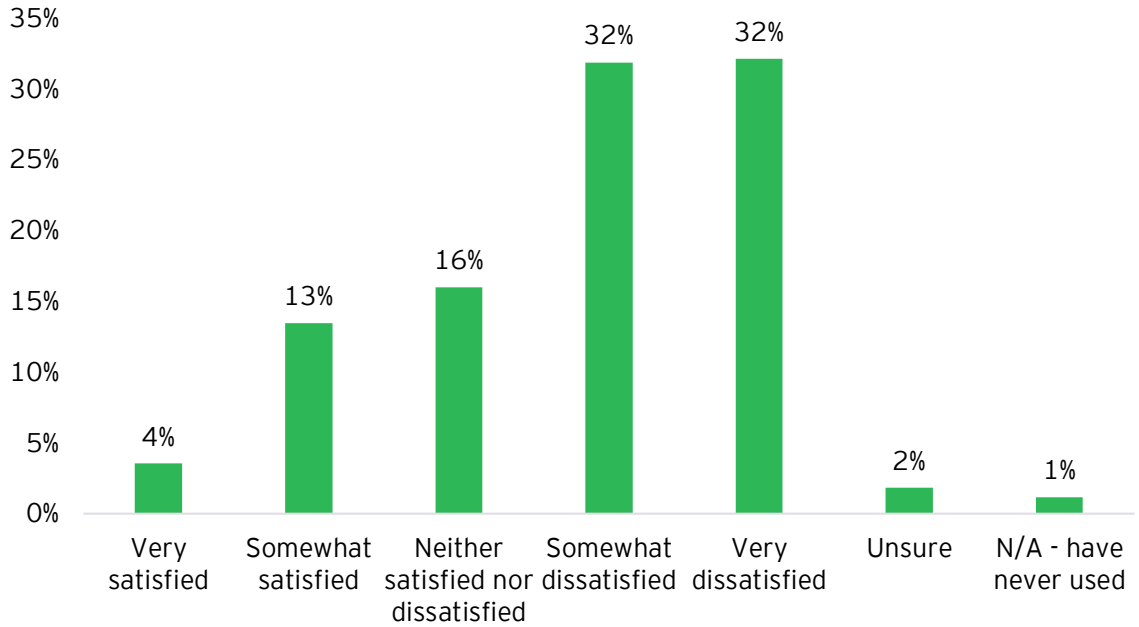
n = 1,249. Note: Respondents live outside the West of Ireland currently.

Q4a: Are you satisfied with the accessibility of current public transport in the West of Ireland?



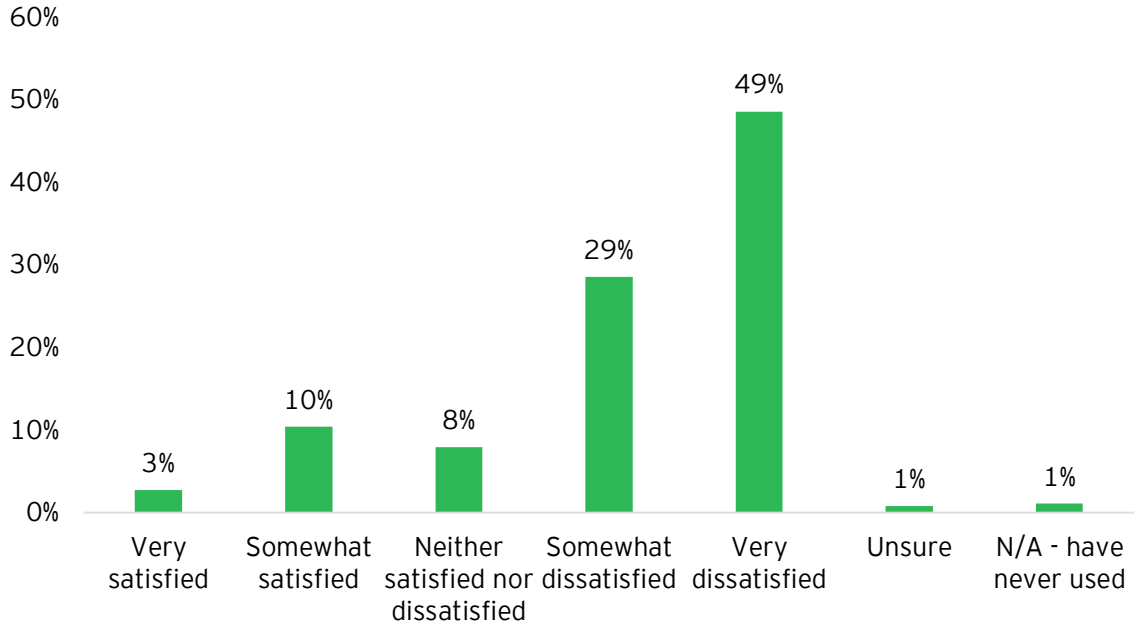
n = 6,572

Q4b: Are you satisfied with the affordability of current public transport in the West of Ireland?



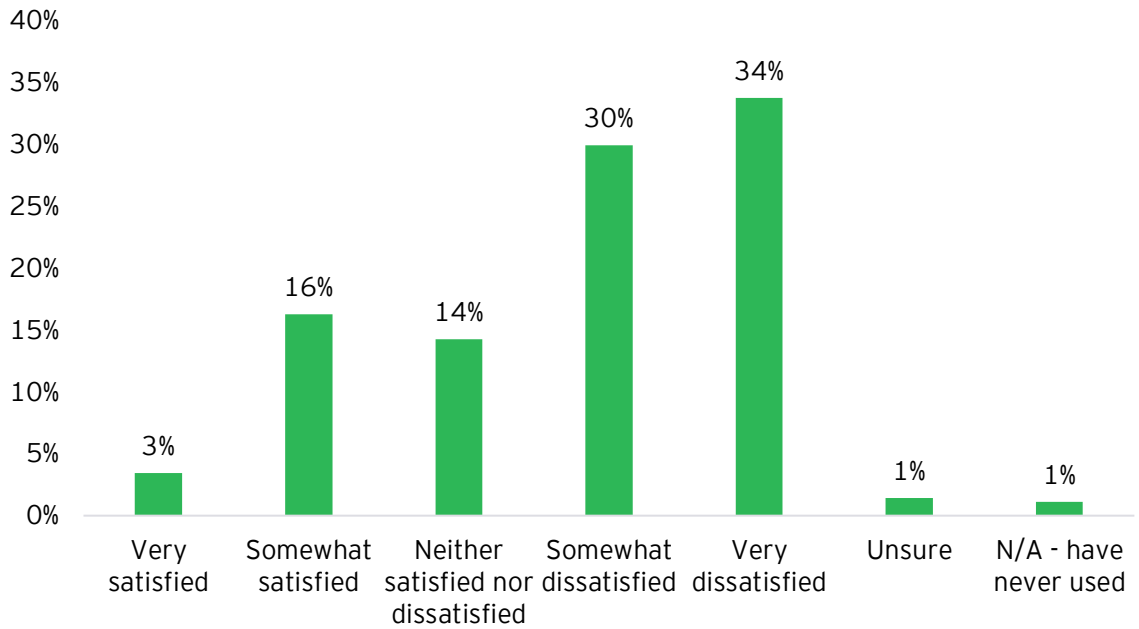
n = 6,572

Q4c: Are you satisfied with the frequency of current public transport services in the West of Ireland?



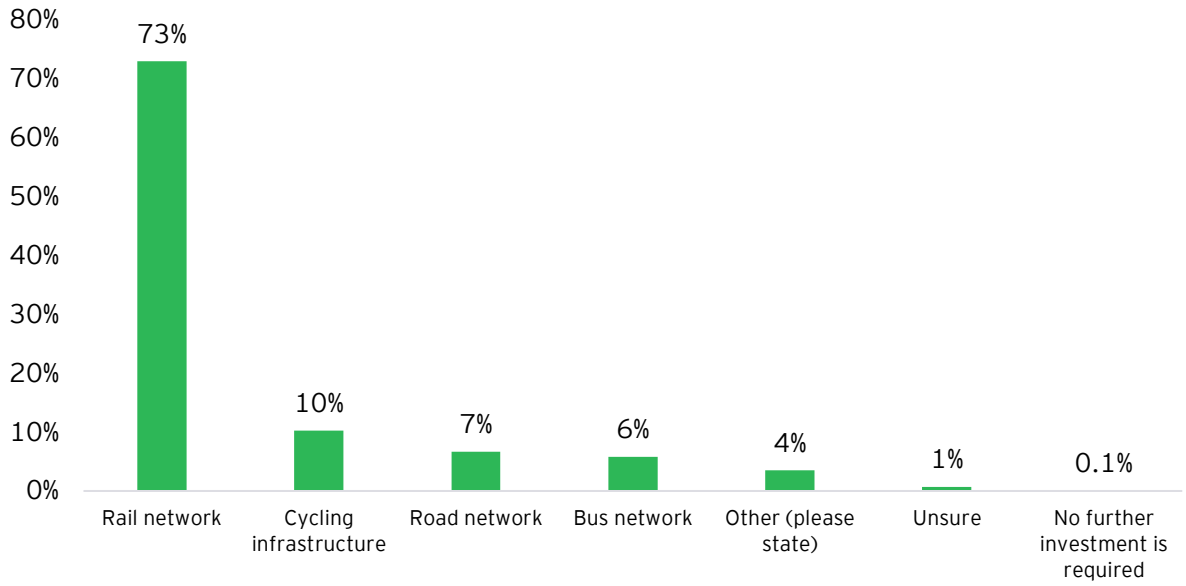
n = 6,572

Q4d: Are you satisfied with the journey times offered by current public transport services in the West of Ireland?



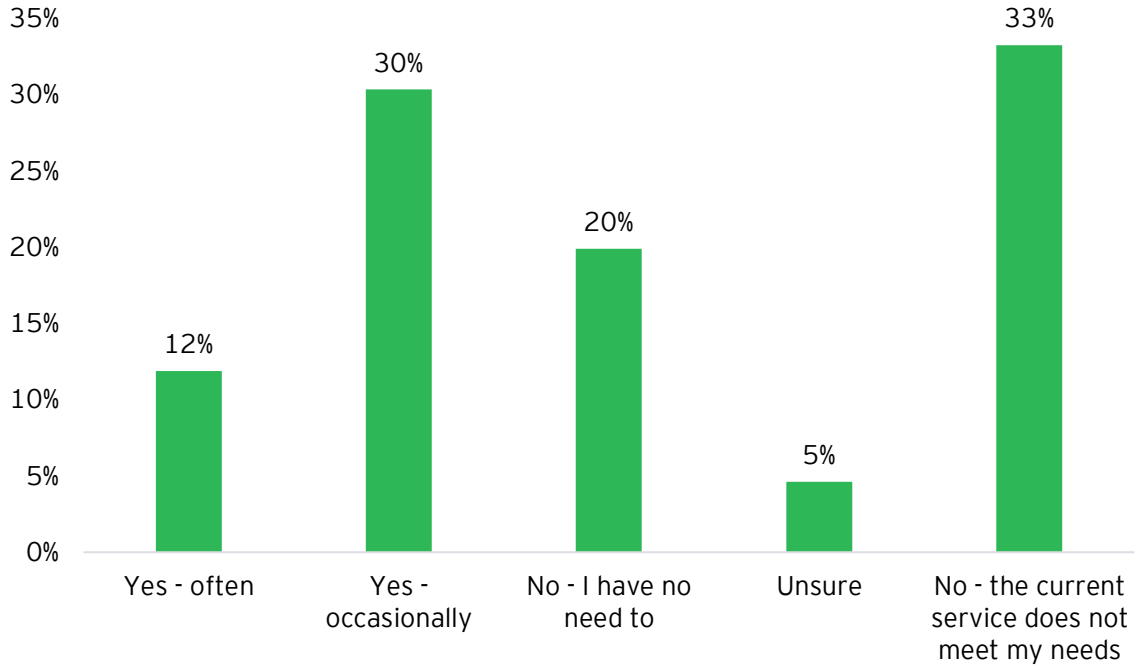
n = 6,572

Q5: What do you think should be the focus of public sector investment in transport in the West of Ireland?



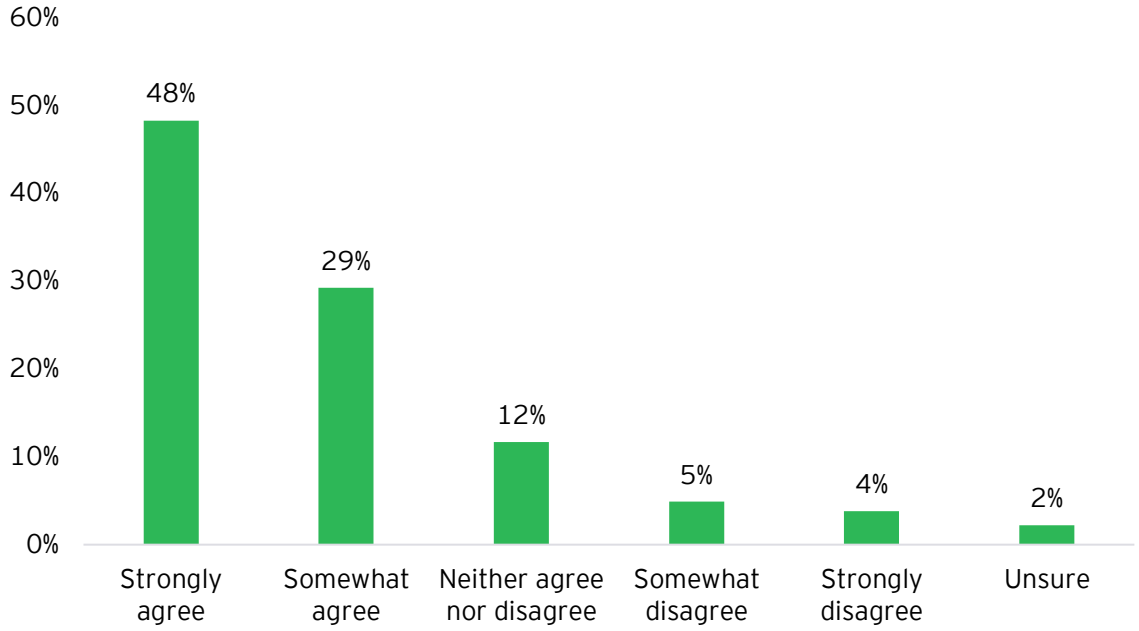
n = 6,572

Q6a: Have you used phase 1 of the WRC?



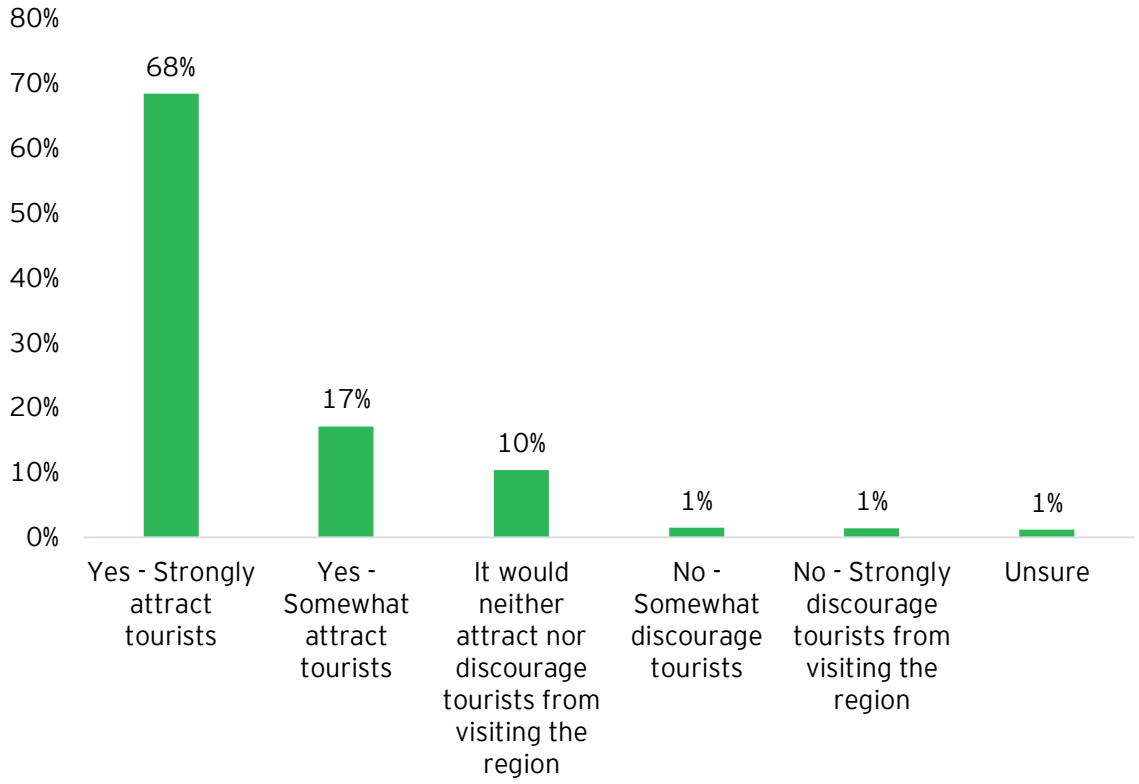
n = 6,572

Q6b: Did you find this service a cost-effective alternative to other transport options?



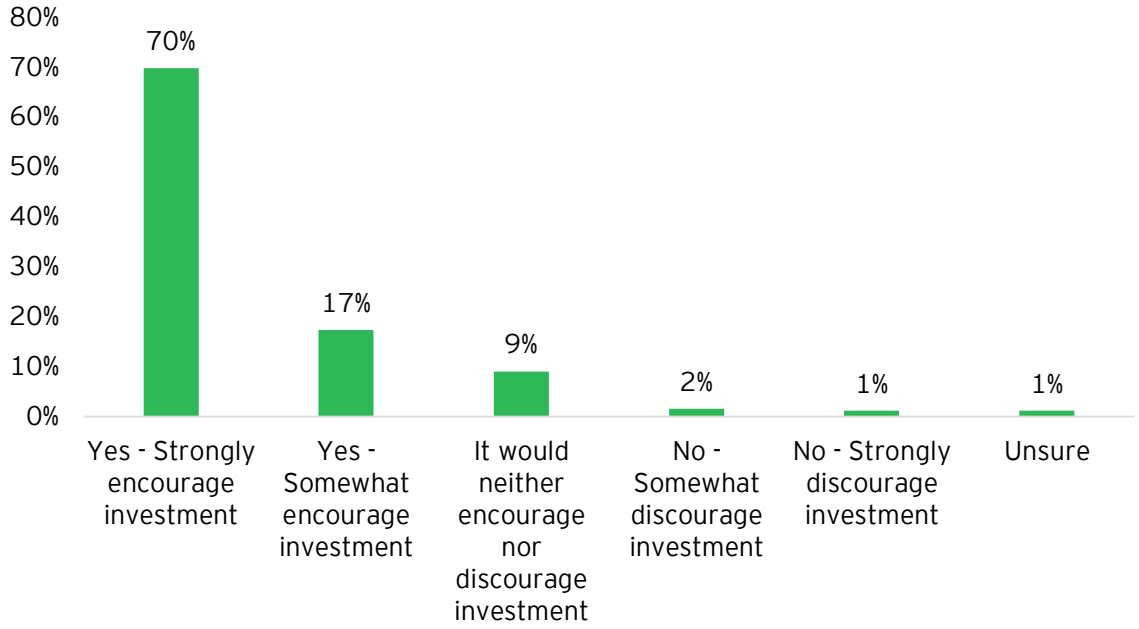
n = 2,779

Q7: Do you think that phases 2 and 3 of the WRC will attract tourists to the region?



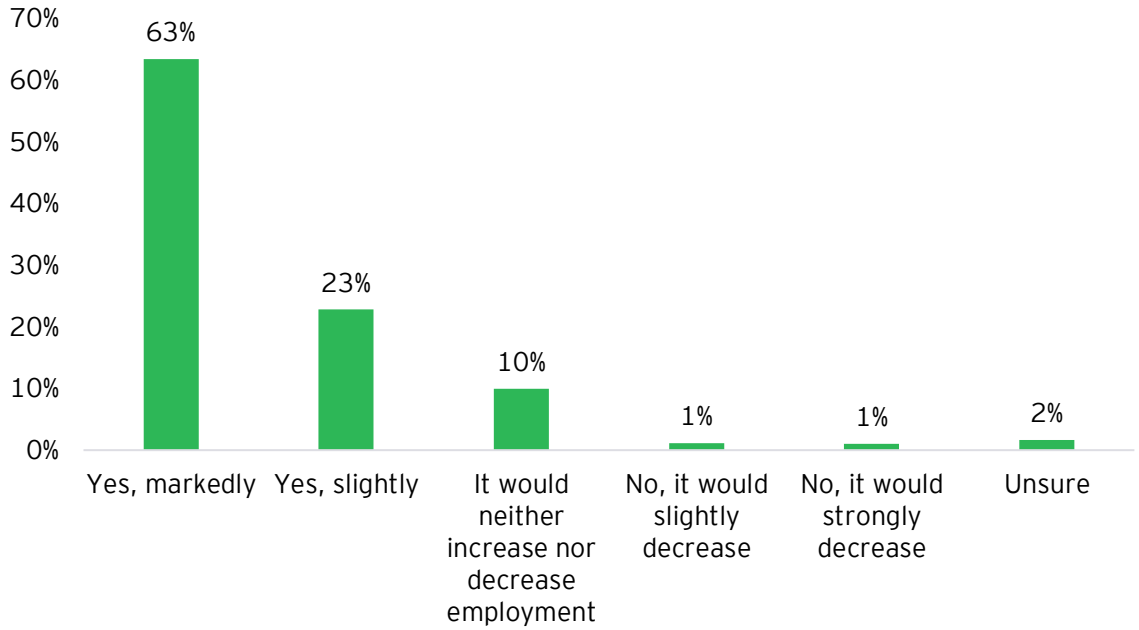
n = 6,572

Q8: Do you think opening phase 2 and 3 of the WRC would encourage investment into the area?



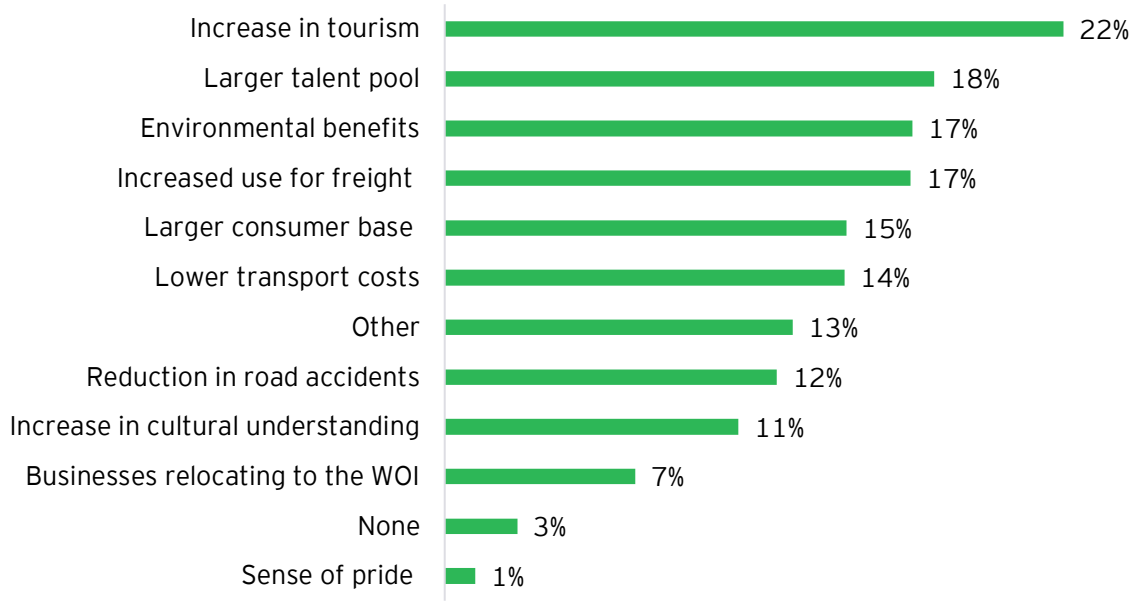
n = 6,572

Q9: Do you think that employment will increase in the region if the WRC were in use?



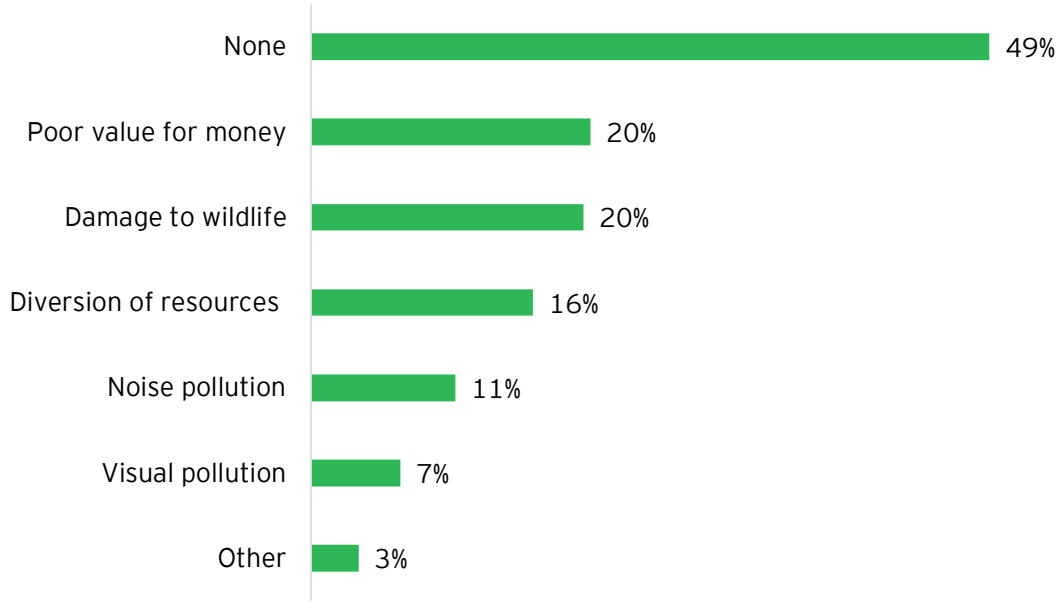
n = 6,572

Q10: What benefits, if any, do you think would occur should phases 2 and 3 of the WRC go ahead?



n = 6,572. Note: does not sum to 100% as respondents could choose more than one answer.

Q11: What do you think would be the negative consequences, if any, associated with phases 2 and 3 of the WRC?



n = 6,572. Note: does not sum to 100% as respondents could choose more than one answer.

Appendix D Demand modelling

Introduction

Background

Mott MacDonald in partnership with EY has been commissioned to investigate the feasibility of reinstating and reopening the disused rail line between Athenry and Claremorris in the west of Ireland. This disused line is the missing link in the Western Rail Corridor (WRC) from Westport in the North West to Limerick in the central/south west. The re-opening of the WRC would be completed in two phases. Phase 2 would see the re-opening of the railway line between Athenry and Tuam, and Phase 3 would see the re-opening of the railway line connecting Tuam and Claremorris. Phase 1 has already been completed and was the opening of the railway line connecting Limerick and Athenry.

Part of this feasibility study is to produce demand and fares revenue projections for the rail services which would use the reinstated line. The purpose of this paper is to present the methodology and data used to produce these projections, as well as the forecast journeys and revenue.

Contents

The rest of this paper is set out as follows:

a. Section 2 describes the methodology and data used to produce the revenue projections
b. Section 3 presents forecast journeys and revenue under various scenarios:
   Service patterns
   a. Hourly Claremorris – Athenry
   b. Hourly Claremorris – Galway
   c. Hourly Claremorris – Limerick
   Faster journey times
   d. Option a with faster journey times
   e. Option b with faster journey times
   f. Option c with faster journey times
   Cheaper rail fares
   g. Option a with cheaper rail fares
   h. Option b with cheaper rail fares
   i. Option c with cheaper rail fares

Summary of the forecasting approach

We have used a three-stage process to forecast the number of passenger journeys generated by the reinstated line. This is as follows:

1. Construction of a Logit Model to estimate the transfer of passenger journeys from car and bus/coach[46] travel, to rail travel. Then calculation of total travel market growth based on the overall reduction in the total time and cost of travel, known as Generalised Journey Time (GJT). The resultant forecasts are for the base year (2012) in the model. These forecasts are then grown to show demand in the years following the opening of the WRC.
2. Benchmarking of the logit model forecasts against known rail journey rates per head of population, for comparable rail stations.
3. Conversion of the single day stage 1 forecasts into annual forecasts over the life of the forecast period.

[46] Bus and coach were treated as a single mode of travel

Main forecasting model

Logit Model structure and approach

A Logit Model was produced to forecast the transfer from existing modes of transport to rail following the introduction of a reinstated rail link. The model works by calculating the probability of choosing one mode of travel given the GJT for that mode, versus the alternative models. GJT is intended to cover all the key time and cost elements which someone would consider when making a travel choice, including in vehicle time, service frequency, access time, fares, and parking costs.

We produced a nested Logit Model which first estimated the probability of passengers choosing to travel by car or public transport, and then estimated the probability of public transport passengers selecting rail or bus/coach. This is a standard approach when there are more than two modes of travel available. Our model formulae and structure are shown below.

Logit Model Nest 1 - Car/Public Transport:

- Car selection probability formula:

$$P_{car} = e^{-\lambda * GJT_{car}} / (e^{-\lambda * GJT_{car}} + e^{-\lambda * GJT_{PT}})$$

- Public Transport (PT) selection probability formula:

$$P_{PT} = e^{-\lambda * GJT_{PT}} / (e^{-\lambda * GJT_{car}} + e^{-\lambda * GJT_{PT}})$$

Logit Model Nest 2 - Public Transport non-Rail modes/Rail:

- Bus/Coach (B/C) selection probability formula:

$$P_{nR} = e^{-\lambda * GJT_{Bus/Coach}} / (e^{-\lambda * GJT_{Bus/Coach}} + e^{-\lambda * GJT_{Rail}})$$

- Rail (PT) selection probability formula:

$$P_{Rail} = e^{-\lambda * GJT_{Rail}} / (e^{-\lambda * GJT_{Bus/Coach}} + e^{-\lambda * GJT_{Rail}})$$

Where λ is the spread parameter estimated in the model calibration (see section 2.25)

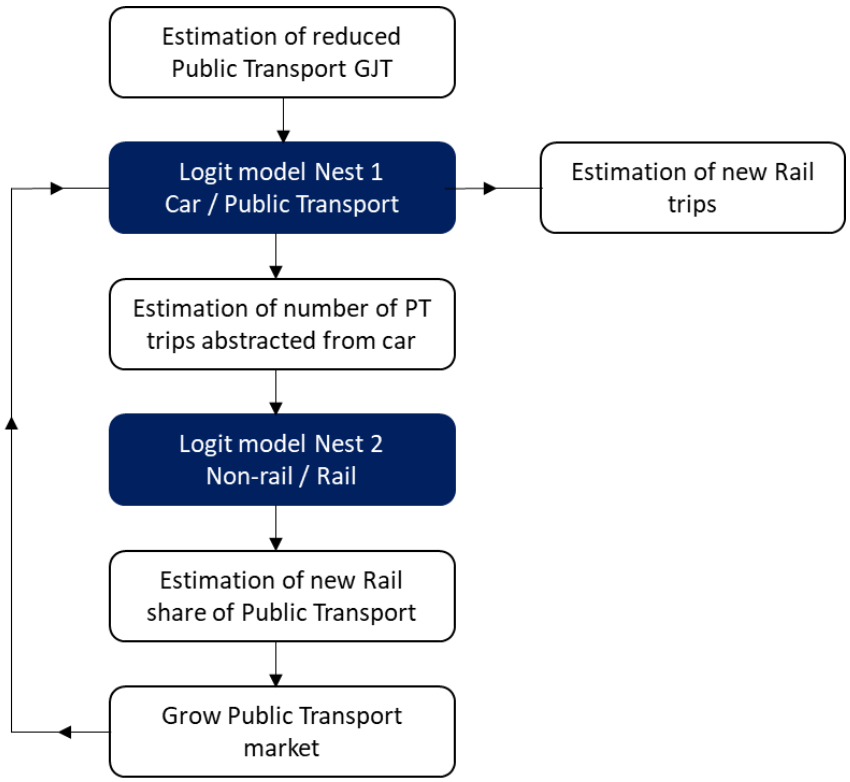


Chart 1: Flow diagram of the Logit model structure

Logit Model zoning

The probability of selecting each mode of travel will vary for each origin-destination pair, as the GJT for mode will differ depending where the journey is to and from. We set up the model to forecast journeys between rail station catchment areas. For stations within our core study area we defined the catchment as the population within a 10km radius of the station. For stations further away, we grouped stations into a single zone and used wider catchments. The table below shows our model zoning.

We have grouped our forecasts for Tuam, Ballyglunin and Milltown into a single zone as there is significant overlap between the catchments of these stations, and we are not confident that the underlying data we received from the National Transport Authority (NTA) would support a forecast for travel to/from individual stations at these locations.

For the same reason we have grouped Claremorris and Ballindine.

The model was set up to estimate the number of journeys between selected pairs of zones (known as flows) where there is a substantial current volume of travel between zones, and if the line reopening is likely to materially reduced the rail GJT. To keep the model size manageable, we capped the number of flows at 85% of the current total travel market within the study area, adding the missing 15% to our forecasts ex-poste as journey on 'other smaller flows'.

The table below provides the list of flows used in the model. We have separated the Phase 2 and Phase 3 flows.

Table 24: Modelled flows list (2-way)

Phase 2	
From/To	To/From
Athenry	Galway
Craughwell	Galway

Phase 3	
From/To	To/From
Kiltamagh	Balla
Milltown	Ballyhaunis

Athenry	Tuam
Ballyglunin	Galway
Ballyglunin	Tuam
Tuam	Galway
Tuam	Ennis
Tuam	Athlone
Tuam	Dublin
Limerick	Tuam
Athenry	Ballyglunin

Ballyhaunis	Ballindine
Tuam	Ballindine
Castlereagh	Claremorris
Ballina	Kiltamagh
Balla	Westport
Claremorris	Kiltamagh
Milltown	Galway
Ballindine	Claremorris
Claremorris	Galway
Tuam	Milltown
Kiltamagh	Castlebar
Ballindine	Galway
Claremorris	Balla
Kiltamagh	Galway
Tuam	Ballyhaunis
Ballyhaunis	Kiltamagh
Milltown	Claremorris
Tuam	Claremorris
Milltown	Ballindine
Balla	Castlebar

Base demand

The model is populated with total car and public transport journeys on each included flow. This data has been extracted from the Irish National Transport Model (NTM). This is a multi-modal transport model used by the NTA and its advisors to forecast future travel demand and contains the number of highways journeys made, split into car and public transport.

The base year data is from 2012 and excludes some travel made by non-domestic tourists. The NTM also produce a 2040 reference case and a 2040 do nothing case. The 2040 reference case includes all major planned infrastructure works in Ireland, including the planned bypass around Galway. The 2040 do nothing case assumes that there are no infrastructure changes from 2012. The in between years are calculated as an interpolation between the 2012 base case and the 2040 reference case, so the 2012 base case is the best available dataset for this purpose. We benchmarked against other current data as a sense check. As an aside, we considered using the NTM to produce an alternative forecast to our own, however this was not possible in the time available.

The table below shows the base (2012) number of journeys made. Figures from the NTA are for a weekday and we have used a scaling factor of 300 to convert to annual figures. This is based on previous experience of this type of work.

Table 25: Main flows demand for car and public transport in 2012 (source: NTA)

		Daily journeys			Annual journeys		
Rank	Flow (2-way)	Car	Public Transport	Total	Car	Public Transport	Total
1	Athenry - Galway	3,126	1,116	4,242	937,800	334,800	1,272,600
2	Tuam - Galway	3,394	768	4,162	1,018,200	230,400	1,248,600
3	Athenry - Tuam	693	37	730	207,900	11,100	219,000
4	Tuam - Claremorris	1,049	137	1,186	314,700	41,100	355,800

5	Claremorris - Kiltamagh	1,199	84	1,283	359,700	25,200	384,900
6	Balla - Castlebar	2,624	46	2,670	787,200	13,800	801,000
7	Tuam - Ennis	14	171	185	4,200	51,300	55,500
8	Craughwell - Galway	2,208	480	2,688	662,400	144,000	806,400
9	Tuam - Dublin	5	81	86	1,500	24,300	25,800
10	Claremorris - Balla	683	11	694	204,900	3,300	208,200
Subtotal top 10		14,995	2,931	17,926	4,498,500	879,300	5,377,800
Other modelled flows		3,062	203	3,265	918,600	60,900	979,500
Other smaller flows (not modelled)		-	-	5,868	-	-	1,760,265
Total		33,052	6,065	44,985	9,915,600	1,819,500	13,495,365

Model parameters

We calculated GJT for car, public transport as a whole, bus/coach and rail.

Car and public transport parameters were taken from the NTM. They were then sense checked and adjusted if necessary. Car in vehicle time (IVT) was calculated by interpolating between the NTA base 2012 IVT and the 2040 reference case IVT for the year 2026 (the assumed opening year). The journey times for flows to/from Galway were taken from Google Maps and grown based on the interpolation growth rate to 2026 as well.

The table below shows the variables used to calculate GJT for car and public transport, as well as any weighting applied to these parameters, and the source of the parameter values and weightings.

Table 26: Generalised journey time components and weightings, car

Car		
Parameter	Weighting in GJT units	Source
In-vehicle time	1.0	NTM for time and weighting
Parking cost	Parking cost/2/VoT*	Internet search for cost, NTM for VoT
Vehicle operating cost	0.1€/km × distance (km)/VoT	NTM
Walk to/from car time	2.0	NTM for weighting, MM for time

* *It is assumed that the parking cost is split between the outward and inward journey*

Table 27: Generalised journey time components and weightings, public transport

Public Transport		
Parameter	Weighting in GJT units	Source
In-vehicle time	1.0	Irish Rail/MM for time, NTM for weighting
Waiting time at origin	1.5	Frequency-based time estimation, NTM for weighting
Waiting time at interchange	2.5	Frequency-based time estimation, NTM for weighting
Interchange penalty	12 minutes per interchange*	NTM
Walk time	2.0	MM for time, NTM for weighting
Ticket fare	Fare/VoT	Irish Rail for existing links, MM distance-based estimation for new links, NTM for VoT

*Except for Tuam-Galway where 20 minutes was used to reflect the increased sensitivity which passengers are likely to have to interchange when simple/direct car and bus access exists, as well as the opportunity to drive directly to Athenry. The value is taken from the Passenger Demand Forecasting Handbook – which summarises Rail demand forecasting research in the UK and provides guidance on parameters used for forecasting.

Parameter values for rail were sourced from the Irish Rail website. Value of time (VoT) is the opportunity cost to the passenger for the time spent travelling. VoT differs between commuter and leisure passengers, however we have used a weighted average VoT in this model.

Parameter value for bus/coach were estimated by removing the impact of the rail values from our public transport parameter values described above, with adjustments made to ensure consistency between the 2012 public transport values and the 2019 rail values.

To remove the impact of rail from the public transport it was necessary to estimate the 2012 split of rail and bus/coach demand, to enable weighting of the impact of the rail parameter values on the overall public transport parameter values.

This was done by comparing rail journeys data provided by Irish Rail with the public transport journeys data from the NTM, for a selection of model zones where the data overlapped.

Having estimated the rail and therefore bus/coach share of the total public transport market, the following formula was applied to calculate the bus/coach parameter values:

$$IVT_{PT} = IVT_{Bus/Coach} \times Share_{Bus/Coach} + IVT_{Rail} \times Share_{Rail}$$

$$IVT_{Bus/Coach} = (IVT_{PT} - IVT_{Rail} \times Share_{Rail}) / Share_{Bus/Coach}$$

8.5.1 Model calibration

The car versus public transport nest of the Logit Model was calibrated to replicate 2012 mode shares. This was undertaken through the use of a spread parameter, which is standard in this type of forecasting. Without a spread parameter the model will allocate 100% of journeys to the mode with the lowest GJT. This is unrealistic as individuals have differing values of time and face differing travel choices depending on their specific circumstances such as their ultimate origin and destination, party size, and the activity they are undertaking. For example, a person who works next to a bus or rail station and is planning to meet a friend for an alcoholic drink after work would be likely choose public transport, even if travel by car has a slightly lower GJT. Use of a spread parameter accounts for these individual differences.

The table below shows our estimated mode shares post calibration, versus 2012 base (observed) mode shares. As can be seen, there is little variance for the largest flows, and in overall terms the difference between the forecast and observed mode share is around 1%, which we consider reasonable.

The parameter weights, values of time, and the spread parameter from the car versus public transport nest were also used in the rail versus bus/coach nest. We did not attempt to calibrate the rail versus bus/coach nest, and there was insufficient data available on the current mode shares. We had this for some stations, but not for all flows.

The table below shows a comparison between the observed demand split between public transport (PT) and car and the demand split calculated through the calibration logit model for the top 10 flows. Total demand observed and total demand calculated can be seen on the top row.

Table 28: Observed demand vs demand calculated through calibrated logit model

	Observed Split		Calculated Split		Difference PT mode share calculated vs observed
O/D pair	Car	PT	Car	PT	
Total Demand	90,527	20,256	89,480	21,303	1%
Athenry - Galway	82%	18%	81%	19%	1%
Galway - Athenry	73%	27%	75%	25%	-2%
Craughwell - Galway	75%	25%	73%	27%	2%
Westport - Castlebar	86%	14%	81%	19%	4%
Balla - Castlebar	80%	20%	79%	21%	0%
Castlebar - Westport	95%	5%	96%	4%	-1%
Ballyglunin - Galway	77%	23%	82%	18%	-5%
Castlebar - Balla	82%	18%	82%	18%	1%
Galway - Craughwell	96%	4%	99%	1%	-3%
Galway - Ardrahan	87%	13%	82%	18%	5%
Athenry - Galway	82%	18%	81%	19%	1%

Generation

The Logit Model approach was used to estimate total Rail demand from mode transfer. We therefore made a separate estimate of newly generated travel by calculating the reduction in the GJT for all modes of travel (so from the car versus public transport nest), then applied an elasticity of -1 to represent how responsive the market is to GJT changes. This elasticity is based on our experience from other similar forecasting work, and the formula used to calculate the uplift is shown below:

$$(GJT_{old}/GJT_{new})^{\varepsilon}$$

Where ε is the elasticity value.

Revenue

Revenue projections were produced by multiplying forecast journeys by assumed rail fares. The table below lists the fares used.

Table 29: Fare categories and prices (€), 2019

From/To	From/to	Fare Category	One-way average fare
Athenry	Galway	B	4.28
Craughwell	Galway	B	4.28
Balla	Castlebar	A	2.80
Ballyglunin	Galway	B	4.28
Ballyglunin	Tuam	A	2.80
Tuam	Galway	C	4.11
Ballindine	Claremorris	A	2.80
Claremorris	Kiltamagh	A	2.80

From/To	From/to	Fare Category	One-way average fare
Tuam	Milltown	B	4.28
Kiltamagh	Castlebar	B	4.28
Claremorris	Balla	B	4.28
Athenry	Ballyglunin	B	4.28
Ballyhaunis	Kiltamagh	B	4.28
Milltown	Claremorris	B	4.28
Tuam	Claremorris	C	4.11
Milltown	Ballindine	A	2.80
Tuam	Ballyhaunis	C	4.11
Kiltamagh	Balla	B	4.28
Milltown	Ballyhaunis	B	4.28
Ballyhaunis	Ballindine	B	4.28
Tuam	Ballindine	B	4.28
Castlereagh	Claremorris	C	4.11
Ballina	Kiltamagh	C	4.11
Balla	Westport	B	4.28
Tuam	Ennis	G	7.01
Milltown	Galway	D	4.82
Athenry	Tuam	C	4.11
Claremorris	Galway	G	7.01
Tuam	Athlone	G	7.01
Tuam	Dublin	G	7.01
Ballindine	Galway	E	5.24
Limerick	Tuam	G	7.01
Kiltamagh	Galway	G	7.01

Source: Irish Rail, MM analysis

Benchmarking

A Trip Rate model was created using population data provided by EY and the number of trips ends per station provided by the NTA. The population data was provided by electoral division for the Western Corridor. With this information we were able to create three distance bands – a band that includes only the population within the town limits, sourced from Ireland's online population census, a band that includes population within 10 kilometres of a station and a band that includes population within 20 kilometres of a station. Looking at the characteristics of each station area, we established that the 10-kilometre band was the most appropriate.

Irish Rail has provided passenger census data for the services which it operates. This data shows the number of passengers boarding and alighting at each station on the network on all trains in operation during a single representative day of the year. We can therefore establish the number of passengers who use each station. We have divided the total boarders and alighters at each station by two as a proxy for the total number of originating passengers and divided by the population

located within a 10km radius as a measure of the trip rate per head of population. We then multiplied the daily trip rates by 300 to provide annual figures.

As our forecasts were produced at an origin-destination level we have summed total station origins to produce comparable statistics.

For stations which already exist (and have a rail service) we have added total forecast additional journeys post reopening of the line, to current journeys.

Comparison of forecast and observed journeys at key stations on the network was used as a sense check of our forecasts.

Applying annual growth over the forecast horizon

Our single year projections were grown over the forecast horizon on the basis of expected population growth. Population data produced by Oxford Economics, was supplied to us by EY. We discussed this approach with EY and agreed that it is a prudent and conservative way to growth demand over time.

Having grown our projection over time we applied ramp up assumptions to suppress demand over the first threes after assumed opening in 2026

- 53% of forecast demand is realised in year 1
- 78% of forecast demand is realised in year 2
- 90% of forecast demand is realised in year 3
- 100% of forecast demand is realised in year 4

These assumptions are taken from the Passenger Demand Forecasting Handbook (version 6) used in Great Britain.

Forecast journeys and revenue

Introduction

This chapter presents our forecasts of journeys and revenue under the scenarios listed in Chapter 1.

For each scenario we present:

- Forecast number of daily journeys split by source of demand
  - Abstraction from car
  - Abstraction from bus/coach
  - Newly generated journeys
  - Total rail journeys increase as a result of the Claremorris - Athenry opening

  This information uses the NTM base year matrix, so 2012 (assuming the line was fully open in 2012)
- Forecast annual number of journeys for an assumed opening year of 2026. Here we have multiplied the forecast number of journeys per day by 300 (a commonly used annualisation factor) and grown background demand from 2012 to 2026 using the approach described in section 2.4 We have not applied any ramp-up at this stage, i.e., a reduction in demand to account for the time it takes people to adjust their travel choices.
- Forecast Annual revenue. Here we have multiplied the rail fares from our logit model by forecast journeys, and presented the resultant revenue forecast in 2019 prices. We do not have data on the average yield (revenue per journey) at an origin-destination level, so we recommend strongly that the assumed fares are checked with Irish Rail.
- Total annual forecast journeys and revenue. Here we have applied background demand growth and ramp-up as explained in section 2.4.

Please note that the results are aggregated into the top 10 rail journey flows for each scenario, so the list of flows are not exactly the same from scenario to scenario.

We then present a comparison of the summary results for all options.

Finally, we present a benchmarking of our forecasts against the number of current rail journeys per head for comparable rail stations.

Scenario B (hourly trains between Claremorris and Galway) is the assumed central case scenario. As such, we have presented additional figures for this scenario:

- Assuming only Phase 2 is completed
- Assuming only Phase 3 is completed
- Assuming Phase 2 and Phase 3 are completed

All other scenarios assume that Phase 2 and Phase 3 are completed.

Scenario A: Hourly Claremorris - Athenry

Under this scenario we have an hourly service in each direction between Claremorris and Athenry, calling at Tuam. Assumed journey times are 30 minutes Claremorris – Tuam and 30 minutes Tuam - Athenry. We have assumed that connection times at Athenry to/from other locations are a function of the service frequency.

Table 30: Scenario A daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from Car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth (daily)
1	Tuam - Galway	-	391	-	391
2	Tuam - Claremorris	67	69	57	193
3	Athenry - Tuam	74	20	52	145
4	Claremorris - Kiltamagh	4	52	1	58
5	Balla - Castlebar	21	20	9	50
6	Tuam - Ennis	-	37	-	37
7	Craughwell - Galway	31	-	-	31
8	Tuam - Dublin	-	25	-	25
9	Athenry - Galway	20	-	-	20
10	Claremorris - Balla	7	5	6	18
11	All Other Flows	2	61	-	63
	Total	225	679	126	1,030

Tuam-Galway does not currently have an existing rail link, which is why this flow has resulted in the largest demand growth. The model suggests that all of this demand will be abstracted from Bus/Coach. This is because rail GJT would be competitive against bus/coach but not against car trips. In reality we would expect a more even split between abstraction from car and bus/coach. To demonstrate the improvement in rail competitiveness required to capture a greater abstraction from car we have tested some alternative scenarios where rail is unrealistically fast or frequent. We have tested changing journey times and frequency of trains to see what would be required to abstract additional trips from car. The results can be found in section 3.11.

Table 31: Scenario A total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	129,827	482,509
2	Tuam - Claremorris	64,138	238,374
3	Athenry - Tuam	48,282	182,502
4	Claremorris - Kiltamagh	19,274	48,807
5	Balla - Castlebar	16,557	41,927
6	Tuam - Ennis	12,117	76,849
7	Craughwell - Galway	10,221	39,597
8	Tuam - Dublin	8,254	52,348
9	Athenry - Galway	6,545	25,355
10	Claremorris - Balla	6,069	21,272
	All Other Flows	20,925	108,980
	15% of Other flows (not modelled)	51,331	197,778
	Total	393,541	**1,516,297**

Table 32: Scenario A Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	213	316	367	411	413	416	418	421	423	426
Annual revenue	811	1,202	1,396	1,561	1,571	1,581	1,590	1,600	1,609	1,618

Scenario B: Hourly Claremorris - Galway

Scenario B is the central case scenario. Under this scenario we have an hourly service in each direction between Claremorris and Galway, calling at Tuam. Assumed journey times are as above, with current average journey times assumed for the portion of the journey on the existing network. The Claremorris – Galway journey time is therefore 80 minutes. We have assumed that connection times at Athenry to/from other locations are a function of the service frequency. Scenario B is presented separately for Phase 2, 3 and 2&3 below.

Phase 2 Only

Phase 2 of the project assumes that a railway line is opened between Athenry and Tuam only.

Table 33: Scenario B (Phase 2) daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth (daily)
1	Tuam - Galway	-	529	-	529
2	Athenry - Galway	96	106	-	202
3	Athenry - Tuam	74	20	52	145

4	Tuam - Ennis	-	37	-	37
5	Craughwell - Galway	31	-	-	31
6	Tuam - Dublin	-	26	-	26
7	Tuam - Claremorris	1	13	-	14
8	Tuam - Ballyhaunis	-	14	-	14
9	Balla - Westport	-	12	-	12
10	Castlereagh - Claremorris	-	6	-	6
	All Other Flows	4	26	1	31
	Total	205	788	53	1,046

The biggest rail growth is Tuam-Galway. Which is to be expected due to the fact that there is currently no direct rail or bus link. The number of abstracted trips for Tuam-Galway in this scenario is slightly lower than in the scenario including Phase 2&3, this is due to the fact that we have aggregated Milltown flows into Tuam flows, however Milltown would not be included in a Phase 2 only scenario. As per scenario A the logit approach suggests no abstraction from car, however in reality we would expect a more even split.

Table 34: Scenario B (Phase 2) total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	175,677	669,313
2	Athenry - Galway	67,060	266,332
3	Athenry - Tuam	48,282	187,086
4	Tuam - Ennis	12,117	78,779
5	Craughwell - Galway	10,221	40,592
6	Tuam - Dublin	8,622	56,057
7	Tuam - Claremorris	4,615	17,582
8	Tuam - Ballyhaunis	4,590	17,486
9	Balla - Westport	4,134	16,417
10	Castlereagh - Claremorris	2,020	7,696
	All Other Flows	10,227	41,255
	15% of Other flows (not modelled)	52,135	209,789
	Total	399,700	**1,608,385**

Table 35: Scenario B (Phase 2) Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	217	321	373	417	420	422	425	427	430	432
Annual revenue	872	1,292	1,500	1,678	1,688	1,699	1,709	1,719	1,729	1,739

Table 36 Scenario B-low frequency total annual demand and total annual revenue generated assuming opening year 2026, without ramp up (€ 2019)

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	30,199	115,054
2	Athenry - Galway	50,110	199,015
3	Athenry - Tuam	10,749	40,952
4	Tuam - Ennis	36,078	139,799
5	Craughwell - Galway	4,590	11,916
6	Tuam - Dublin	17,341	45,014
7	Tuam - Claremorris	2,031	13,203
8	Tuam - Ballyhaunis	10,221	40,592
9	Balla - Westport	1,383	8,993
10	Castlereagh - Claremorris	2,227	8,002
	All Other Flows	11,598	55,910
	15% of Other flows (not modelled)	31,839	124,849
	Total	**208,367**	**803,297**

Table 37Scenario B-low frequency annual demand (in 000's) and annual revenue (€000 2019) assuming 2026 opening year including ramp up

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	132	196	228	255	256	258	260	261	263	264
Annual revenue	519	769	893	999	1,005	1,011	1,017	1,023	1,029	1,035

Phase 3 Only

Phase 3 of the project assumes that a railway line is opened between Tuam and Claremorris only. This would not include the link to Galway for Tuam and other towns further north, impacting all flows from Claremorris to Galway and Limerick.

Table 38: Scenario B (Phase 3) daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth (daily)
1	Tuam - Claremorris	67	69	57	193
2	Claremorris - Kiltamagh	4	52	1	58
3	Balla - Castlebar	21	20	9	50
4	Craughwell - Galway	31	-	-	31

5	Athenry - Galway	20	-	-	20
6	Claremorris - Balla	7	5	6	18
7	Tuam - Ballyhaunis	-	15	-	16
8	Balla - Westport	-	12	-	12
9	Castlereagh - Claremorris	-	6	-	6
10	Kiltamagh - Castlebar	-	6	-	6
	All Other Flows	1	8	-	10
	Total	151	194	74	420

The largest demand flow when only Phase 3 is considered is between Tuam-Claremorris. This is due to the fact that there is currently no rail link between these two cities. The overall figures for Phase 3 are significantly lower than for either Phase 2 only or Phase 2&3.

There is overlap in the demand numbers between Phase 2 and Phase 3, as some of these flows already have a rail link. The flows Castlereagh-Claremorris and Craughwell-Galway are included in both Phase 2 and Phase 3 only, therefore summing demand figures from Phase 2 and Phase 3 would result in double counting.

Table 39: Scenario B (Phase 3) total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Claremorris	64,138	244,361
2	Claremorris - Kiltamagh	19,274	50,033
3	Balla - Castlebar	16,557	42,980
4	Craughwell - Galway	10,221	40,592
5	Athenry - Galway	6,545	25,992
6	Claremorris - Balla	6,069	21,806
7	Tuam - Ballyhaunis	5,254	20,016
8	Balla - Westport	4,134	16,417
9	Castlereagh - Claremorris	2,020	7,696
10	Kiltamagh - Castlebar	1,998	7,936
	All Other Flows	3,210	13,833
	15% of Other flows (not modelled)	20,913	73,749
	Total	160,333	**565,410**

Table 40: Scenario B (Phase 3) Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	87	129	150	167	168	169	171	172	173	174
Annual revenue	307	454	528	590	594	598	601	605	609	612

Phase 2&3

The forecasts presented below assume that both Phase 2 and Phase 3 of the railway line are opened.

Table 41: Scenario B daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth (daily)
1	Tuam - Galway	5	535	2	542
2	Athenry - Galway	96	106	-	202
3	Tuam - Claremorris	67	69	57	193
4	Athenry - Tuam	74	20	52	145
5	Claremorris - Kiltamagh	4	52	1	58
6	Balla - Castlebar	21	20	9	50
7	Tuam - Ennis	-	37	-	37
8	Craughwell - Galway	31	-	-	31
9	Tuam - Dublin	-	25	-	25
10	Claremorris - Balla	7	5	6	18
	All Other Flows	10	61	5	75
	Total	315	929	132	1,376

This scenario assumes the hourly service extends from Claremorris to Galway instead of Athenry – increasing the service frequency between Athenry and Galway as well. This result shows a much higher abstraction for the flow between Galway and Athenry. As expected, there is also a higher demand abstracted from PT for the flow Tuam-Galway, as well as some minor car abstraction. The car abstraction is a result of the aggregated flows from Milltown, which is not included in the Phase 2 only modelling.

Table 42: Scenario B total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	180,194	686,521
2	Athenry - Galway	67,060	266,332
3	Tuam - Claremorris	64,138	244,361
4	Athenry - Tuam	48,282	187,086
5	Claremorris - Kiltamagh	19,274	50,033
6	Balla - Castlebar	16,557	42,980
7	Tuam - Ennis	12,117	78,779
8	Craughwell - Galway	10,221	40,592
9	Tuam - Dublin	8,254	53,663
10	Claremorris - Balla	6,069	21,806
	All Other Flows	24,979	120,412

15% of Other flows (not modelled)	68,572	268,885
Total	525,719	**2,061,450**

Table 43: Scenario B Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	285	422	491	549	552	556	559	562	566	569
Annual revenue	1,118	1,656	1,923	2,151	2,164	2,178	2,191	2,204	2,217	2,230

Scenario C: Hourly Claremorris - Limerick

Under this scenario we have an hourly service in each direction between Claremorris and Limerick, calling at Tuam and Athenry. Assumed journey times are as above, with current journey times assumed for the portion of the journey on the existing network. The Claremorris – Limerick journey time is therefore 149 minutes. We have assumed that connection times at Athenry to/from other locations are a function of the service frequency.

Table 44: Scenario C daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	-	391	-	391
2	Tuam - Claremorris	67	69	57	193
3	Athenry - Tuam	74	20	52	145
4	Claremorris - Kiltamagh	4	52	1	58
5	Tuam - Ennis	-	54	-	54
6	Balla - Castlebar	21	20	9	50
7	Craughwell - Galway	31	-	-	31
8	Tuam - Dublin	-	25	-	25
9	Athenry - Galway	20	-	-	20
10	Claremorris - Balla	7	5	6	18
	All Other Flows	2	62	-	64
	Total	225	697	126	1,048

Demand between Tuam and Ennis has improved due to the improvement in the service between Tuam and Limerick. The flow between Tuam and Limerick has also improved from 5 to 7 people abstracted per day, however it has not improved sufficiently to put it in the top 10 flows by demand.

Table 45: Scenario C total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	129,827	484,024
2	Tuam - Claremorris	64,138	239,122
3	Athenry - Tuam	48,282	183,075
4	Claremorris - Kiltamagh	19,274	48,960
5	Tuam - Ennis	17,829	113,429
6	Balla - Castlebar	16,557	42,059
7	Craughwell - Galway	10,221	39,722
8	Tuam - Dublin	8,254	52,512
9	Athenry - Galway	6,545	25,435
10	Claremorris - Balla	6,069	21,338
	All Other Flows	21,164	94,427
	15% of Other flows (not modelled)	52,224	201,615
	Total	400,385	**1,545,718**

Table 46: Scenario C Annual demand (000's) and Annual revenue (€000), 20126 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	217	322	374	418	420	423	426	428	431	433
Annual revenue	838	1,242	1,442	1,612	1,622	1,632	1,642	1,652	1,661	1,671

Scenario D: Hourly Claremorris – Athenry, faster journey times

Under this scenario we have assumed the service pattern and connection times from scenario A, with an assumed ten-minute journey time improvement, split 5 minutes Claremorris – Tuam, and 5 minutes Tuam – Athenry.

Table 47: Scenario D daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	-	399	-	399
2	Tuam - Claremorris	80	67	70	218
3	Athenry - Tuam	83	19	63	165
4	Claremorris - Kiltamagh	4	52	1	58
5	Balla - Castlebar	21	20	9	50
6	Tuam - Ennis	-	37	-	37
7	Craughwell - Galway	31	-	-	31
8	Tuam - Dublin	-	25	-	25

9	Athenry - Galway	20	-	-	20
10	Claremorris - Balla	7	5	6	18
	All Other Flows	2	61	1	64
	Total	248	685	150	1,084

There is a small increase in the abstracted journeys for Tuam-Galway due to improved journey times between Tuam and Athenry. All flows between Claremorris and Athenry show an improved demand for this reason.

Table 48: Scenario D total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	132,589	488,135
2	Tuam - Claremorris	72,390	266,508
3	Athenry - Tuam	54,801	205,200
4	Claremorris - Kiltamagh	19,274	48,347
5	Balla - Castlebar	16,557	41,532
6	Tuam - Ennis	12,127	76,183
7	Craughwell - Galway	10,221	39,224
8	Tuam - Dublin	8,328	52,317
9	Athenry - Galway	6,545	25,116
10	Claremorris - Balla	6,069	21,071
	All Other Flows	21,113	91,864
	15% of Other flows (not modelled)	54,002	203,325
	Total	414,016	**1,558,822**

Table 49: Scenario D Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	224	333	386	432	435	437	440	443	445	448
Annual revenue	845	1,252	1,454	1,626	1,636	1,646	1,656	1,666	1,676	1,686

Scenario E: Hourly Claremorris - Galway, faster journey times

Under this scenario we have assumed the service pattern and connection times from scenario B, with an assumed ten-minute journey time improvement, split 5 minutes Claremorris – Tuam, and 5 minutes Tuam – Athenry.

Table 50: Scenario E daily Rail demand, base year 2012

OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth (daily)

1	Tuam - Galway	7	538	2	547
2	Tuam - Claremorris	80	67	70	218
3	Athenry - Galway	96	106	-	202
4	Athenry - Tuam	83	19	63	165
5	Claremorris - Kiltamagh	4	52	1	58
6	Balla - Castlebar	21	20	9	50
7	Tuam - Ennis	-	37	-	37
8	Craughwell - Galway	31	-	-	31
9	Tuam - Dublin	-	25	-	25
10	Claremorris - Balla	7	5	6	18
	All Other Flows	13	61	7	81
	Total	342	931	159	1,431

There is no improvement for demand between Athenry and Galway, as journey time improvements are exclusively between Claremorris-Tuam and Tuam-Athenry. Tuam-Claremorris and Athenry-Tuam see passenger numbers.

Table 51: Scenario E total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	181,811	686,317
2	Tuam - Claremorris	72,390	273,266
3	Athenry - Galway	67,060	263,885
4	Athenry - Tuam	54,801	210,403
5	Claremorris - Kiltamagh	19,274	49,573
6	Balla - Castlebar	16,557	42,585
7	Tuam - Ennis	12,127	78,115
8	Craughwell - Galway	10,221	40,219
9	Tuam - Dublin	8,328	53,644
10	Claremorris - Balla	6,069	21,605
	All Other Flows	26,768	130,622
	15% of Other flows (not modelled)	71,311	277,535
	Total	546,717	**2,127,769**

Table 52: Scenario E Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	296	439	510	571	574	578	581	585	588	592
Annual revenue	1,154	1,709	1,985	2,220	2,234	2,248	2,262	2,275	2,288	2,302

Scenario F: Hourly Claremorris - Limerick, faster journey times

Under this scenario we have assumed the service pattern and connection times from scenario C, with an assumed ten-minute journey time improvement, split 5 minutes Claremorris – Tuam, and 5 minutes Tuam – Athenry.

Table 53: Scenario F daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	-	399	-	399
2	Tuam - Claremorris	80	67	70	218
3	Athenry - Tuam	83	19	63	165
4	Claremorris - Kiltamagh	4	52	1	58
5	Tuam - Ennis	-	56	-	56
6	Balla - Castlebar	21	20	9	50
7	Craughwell - Galway	31	-	-	31
8	Tuam - Dublin	-	25	-	25
9	Athenry - Galway	20	-	-	20
10	Claremorris - Balla	7	5	6	18
	All Other Flows	2	62	1	16
	Total	248	705	150	1,055

There is an improvement in passenger numbers between Tuam and Galway because there is an improvement in in journey time between Tuam and Athenry, which also reduced journey time between Tuam and Galway. The same effect can be seen for passenger numbers between Tuam and Ennis.

Table 54 Scenario F total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	132,589	489,682
2	Tuam - Claremorris	72,390	267,353
3	Athenry - Tuam	54,801	205,850
4	Claremorris - Kiltamagh	19,274	48,500
5	Tuam - Ennis	18,324	115,481
6	Balla - Castlebar	16,557	41,664
7	Craughwell - Galway	10,221	39,349
8	Tuam - Dublin	8,328	52,483
9	Athenry - Galway	6,545	25,196
10	Claremorris - Balla	6,069	21,138
	All Other Flows	21,344	94,645

	15% of Other flows (not modelled)	54,966	210,201
	Total	421,409	**1,611,541**

Table 55: Scenario F Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	228	339	393	440	442	445	448	451	453	456
Annual revenue	874	1,294	1,503	1,681	1,692	1,702	1,712	1,722	1,732	1,742

Scenario G: Hourly Claremorris – Athenry, cheaper fares

Under this scenario we have assumed the service pattern, journey times and connection times from scenario A, with an assumed 20% reduction in rail fares. The rail fares reduction only occurs in between stations that are part of the main western corridor flow (i.e., all stations between Claremorris and Athenry) so these are the flows that have seen greatest improvement

Table 56: Scenario G daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from Car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	-	391	-	391
2	Tuam - Claremorris	78	67	69	215
3	Athenry - Tuam	85	19	65	169
4	Claremorris - Kiltamagh	4	52	1	58
5	Balla - Castlebar	21	20	9	50
6	Tuam - Ennis	-	37	-	37
7	Craughwell - Galway	31	-	-	31
8	Tuam - Dublin	-	25	-	25
9	Athenry - Galway	20	-	-	20
10	Claremorris - Balla	7	5	6	18
11	All Other Flows	2	61	-	63
	Total	248	677	151	1,076

There is an improvement in passenger numbers in flows between Claremorris and Athenry, as these are benefitting from reduced fares.

Table 57: Scenario G total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	129,827	477,206
2	Tuam - Claremorris	71,396	262,432
3	Athenry - Tuam	56,173	210,005
4	Claremorris - Kiltamagh	19,274	48,271
5	Balla - Castlebar	16,557	41,466
6	Tuam - Ennis	12,117	76,004
7	Craughwell - Galway	10,221	39,162
8	Tuam - Dublin	8,254	51,773
9	Athenry - Galway	6,545	25,077
10	Claremorris - Balla	6,069	21,038
	All Other Flows	20,925	90,739
	15% of Other flows (not modelled)	53,604	201,476
	Total	410,962	**1,544,649**

Table 58: Scenario G Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	223	330	383	429	432	434	437	439	442	445
Annual revenue	838	1,241	1,441	1,611	1,622	1,632	1,641	1,651	1,661	1,670

Scenario H: Hourly Claremorris - Galway, cheaper fares

Under this scenario we have assumed the service pattern, journey times and connection times from scenario B, with an assumed 20% reduction in rail fares. The rail fares reduction only occurs in between stations that are part of the main western corridor flow (i.e., all stations between Claremorris and Galway) so these are the flows that have seen greatest improvement

Table 59: Scenario H daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	7	538	2	548
2	Athenry - Galway	119	141	-	260
3	Tuam - Claremorris	78	67	69	215
4	Athenry - Tuam	85	19	65	169
5	Claremorris - Kiltamagh	4	52	1	58
6	Balla - Castlebar	21	20	9	50
7	Tuam - Ennis	-	37	-	37

8	Craughwell - Galway	31	-	-	31
9	Tuam - Dublin	-	25	-	25
10	Claremorris - Balla	7	5	6	18
11	All Other Flows	10	61	5	76
	Total	363	965	158	1,487

There is an improvement in overall demand for all the flows between Claremorris and Galway, driven mainly from greater abstraction from Car due to reduced fares.

Table 60: Scenario H total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	182,005	690,238
2	Athenry - Galway	86,437	341,710
3	Tuam - Claremorris	71,396	270,763
4	Athenry - Tuam	56,173	216,672
5	Claremorris - Kiltamagh	19,274	49,803
6	Balla - Castlebar	16,557	42,783
7	Tuam - Ennis	12,117	78,417
8	Craughwell - Galway	10,221	40,405
9	Tuam - Dublin	8,254	53,416
10	Claremorris - Balla	6,069	21,706
	All Other Flows	25,340	122,194
	15% of Other flows (not modelled)	74,077	289,216
	Total	567,921	**2,217,323**

Table 61: Scenario H Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	308	456	530	593	596	600	604	607	611	615
Annual revenue	1,202	1,781	2,069	2,314	2,328	2,343	2,357	2,371	2,385	2,399

Scenario I: Hourly Claremorris - Limerick, cheaper fares

Under this scenario we have assumed the service pattern, journey times and connection times from scenario C, with an assumed 20% reduction in rail fares. The rail fares reduction only occurs in between stations that are part of the main western corridor flow (i.e., all stations between Claremorris and Athenry) so these are the flows that have seen greatest improvement

Table 62: Scenario I daily Rail demand, base year 2012

	OD pair	Rail demand abstracted from car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth (daily)
1	Tuam - Galway	-	391	-	391
2	Tuam - Claremorris	78	67	69	215
3	Athenry - Tuam	85	19	65	169
4	Claremorris - Kiltamagh	4	52	1	58
5	Tuam - Ennis	-	54	-	54
6	Balla - Castlebar	21	20	9	50
7	Craughwell - Galway	31	-	-	31
8	Tuam - Dublin	-	25	-	25
9	Athenry - Galway	20	-	-	20
10	Claremorris - Balla	7	5	6	18
11	All Other Flows	2	61	-	64
	Total	248	695	151	1,094

There are improved passenger figures for all flows between Athenry and Claremorris in this scenario, due for the most part to greater abstraction from car. We have assumed that ticket prices between the new railway links in the western rail corridor will benefit from lower fares, however fares to/from Limerick and Ennis remain the same, so these demand numbers remain stable.

Table 63: Scenario I total Annual demand and total Annual revenue (€), 2019

	OD pair	Total rail demand growth	Total revenue
1	Tuam - Galway	129,827	478,721
2	Tuam - Claremorris	71,396	263,265
3	Athenry - Tuam	56,173	210,672
4	Claremorris - Kiltamagh	19,274	48,424
5	Tuam - Ennis	17,829	112,186
6	Balla - Castlebar	16,557	41,598
7	Craughwell - Galway	10,221	39,286
8	Tuam - Dublin	8,254	51,937
9	Athenry - Galway	6,545	25,156
10	Claremorris - Balla	6,069	21,105
	All Other Flows	21,096	93,132
	15% of Other flows (not modelled)	54,486	207,822
	Total	417,727	**1,593,305**

Table 64: Scenario I Annual demand (000's) and Annual revenue (€000), 2026 to 2035

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual demand	226	336	390	436	439	441	444	447	449	452
Annual revenue	864	1,280	1,486	1,662	1,672	1,683	1,693	1,703	1,713	1,722

Sensitivities

All the scenarios notably have a low abstraction from car journeys. Particularly the flows from Claremorris-Galway and Tuam-Galway have a very low abstraction from this. This is due to the fact that generalised journey time (GJT) for the car trips is significantly lower than the rail GJT for this flow. In table 61 you can see a comparison between car, non-rail and rail GJTs for the Tuam-Galway flow specifically.

Table 65: GJT per transport mode for the Tuam-Galway flow

Mode	GJT
Car	72
PT (Bus/Coach)	116
Rail	123

GJT is made up of cost and time components that are the factors that passengers would consider when choosing a mode choice. The GJT components for car were provided by the NTA, except for the journey times to/from Galway, which we searched on Google Maps. The cause of the higher GJT for rail is due to journey times, which are higher for rail journeys than car, as well as the waiting time for rail journeys. Waiting time is a function of train frequency – the higher the frequency the lower the waiting time. To be able to abstract greater numbers from cars, the GJT would have to be lowered by either decreasing journey times for rail or increasing frequency. We have therefore tested both reducing journey times and increasing frequency of trains on the Tuam-Galway flow as sensitivities. We have tested the following sensitivities on scenario B:

- 3 trains per hour between Tuam-Galway, 50-minute journey time
- 20 trains per hour between Tuam-Galway, 50-minute journey time
- 1 train per hour between Tuam-Galway, 15-minute journey time
- 1 train per hour between Tuam-Galway, 25-minute journey time
- 3 trains per hour between Tuam-Galway, 25-minute journey time

We have looked at Scenario B specifically as it is the central scenario. Clearly some of the sensitivities are unrealistic, however we have tested them to demonstrate the service level required to compete with car. The assumed line speeds for a 25-minute journey is ca. 101 kph; assumed line speed for a 15-minute journey is ca. 140 kph. Results for daily journeys abstracted and total daily Rail demand growth are shown below.

Table 66: Sensitivity 1 - Scenario B with 3 trains per hour, base year 2012

	OD pair	Rail demand abstracted from Car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	53	542	22	617
2	Tuam - Claremorris	172	56	206	434

3	Athenry - Galway	158	190	-	348
4	Athenry - Tuam	148	15	170	332
5	Craughwell - Galway	29	39	-	69
6	Claremorris - Kiltamagh	4	52	1	58
7	Balla - Castlebar	21	20	9	50
8	Tuam - Ennis	-	37	-	37
9	Claremorris - Galway	16	7	12	36
10	Tuam - Dublin	-	27	-	27
11	All Other Flows	19	65	14	99
	Total	621	1,051	435	2,107

There are circa 3,300 car trips on the Tuam Galway flow in the do-nothing assumption (assumes no change in infrastructure, so no WRC). Of the core scenarios, scenario H has the highest abstraction from car on the Tuam-Galway flow (7 trips per day). By increasing frequency to 3 trains per hour, we have managed to abstract 52 daily trips, around 1.5% of car journeys in the Tuam-Galway flow.

Table 67: Sensitivity 2 - Scenario B with 20 trains per hour, base year 2012

	OD pair	Rail demand abstracted from Car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	132	535	64	731
2	Tuam - Claremorris	231	49	332	612
3	Athenry - Tuam	185	13	263	461
4	Athenry - Galway	196	231	-	426
5	Craughwell - Galway	29	39	-	69
6	Claremorris - Kiltamagh	4	52	1	58
7	Balla - Castlebar	21	20	9	50
8	Claremorris - Galway	19	7	18	44
9	Tuam - Ennis	-	38	-	38
10	Tuam - Dublin	-	28	-	28
11	All Other Flows	23	67	18	108
	Total	841	1,078	705	2,624

This sensitivity is unrealistic considering the current infrastructure, however it shows the effect of frequency of service on car abstraction. PT abstraction is lower here, however with 152 car trips abstracted per day this is around 4% of all car journeys on the Tuam-Galway flow abstracted.

Table 68: Sensitivity 3 - Scenario B with 15-minute Journey Time, base year 2012

	OD pair	Rail demand abstracted from Car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	158	533	84	774

2	Athenry - Galway	96	106	-	202
3	Tuam - Claremorris	67	69	57	193
4	Athenry - Tuam	74	20	52	145
5	Claremorris - Kiltamagh	4	52	1	58
6	Balla - Castlebar	21	20	9	50
7	Tuam - Ennis	-	37	-	37
8	Craughwell - Galway	31	-	-	31
9	Tuam - Dublin	-	25	-	25
10	Claremorris - Balla	7	5	6	18
11	All Other Flows	10	61	5	75
	Total	467	927	214	1,608

A 15-minute journey time assumes a line speed of 140 kph. Due to the infrastructure on the Western Rail Corridor and the number of crossings, it is unlikely that this speed could be reached, however reducing journey times to 15 minutes has abstracted nearly 5% of car journeys from the do nothing Tuam-Galway flow. It is important to note that although 15 minutes is a faster journey time that would be achieved by car, GJT includes additional time penalties for things like boarding and egress times, as well as walking time to/from stations – these factors tend to be higher for rail than for car.

Table 69: Sensitivity 4 - Scenario B with 25-minute Journey Times, base year 2012

	OD pair	Rail demand abstracted from Car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	61	542	28	631
2	Athenry - Galway	96	106	-	202
3	Tuam - Claremorris	67	69	57	193
4	Athenry - Tuam	74	20	52	145
5	Claremorris - Kiltamagh	4	52	1	58
6	Balla - Castlebar	21	20	9	50
7	Tuam - Ennis	-	37	-	37
8	Craughwell - Galway	31	-	-	31
9	Tuam - Dublin	-	25	-	25
10	Claremorris - Balla	7	5	6	18
11	All Other Flows	10	61	5	75
	Total	370	936	158	1,465

A 25-minute journey time assumes a line speed of circa 101 kph. This is likely still unattainable on the WRC due to the current infrastructure. Under this sensitivity there is a 2% abstraction from do nothing car journeys on the Tuam-Galway flow.

Table 70: Sensitivity 5 - Scenario B with 3 trains per hour and a 25-minute journey time, base year 2012

	OD pair	Rail demand abstracted from Car	Rail demand abstracted from PT	Newly generated rail demand	Total rail demand growth
1	Tuam - Galway	373	508	239	1,120
2	Tuam - Claremorris	172	56	206	434
3	Athenry - Galway	158	190	-	348
4	Athenry - Tuam	148	15	170	332
5	Claremorris - Kiltamagh	8	53	2	63
6	Balla - Castlebar	28	20	14	62
7	Tuam - Ennis	-	38	-	38
8	Tuam - Dublin	-	30	-	30
9	Craughwell - Galway	29	-	-	29
10	Claremorris - Balla	10	5	9	24
11	All Other Flows	20	63	13	96
	Total	945	978	653	2,577

This last sensitivity combines a reduced journey time with increased train frequency, which has resulted in an 11% abstraction from do nothing car journeys on the Tuam-Galway flow.

Results summary

Figure 39 below compares forecast Annual demand for all modelled scenarios (for phase 2&3 – not including sensitivities).

Figure 43: Annual demand forecast with ramp up, 2026 -to 2035

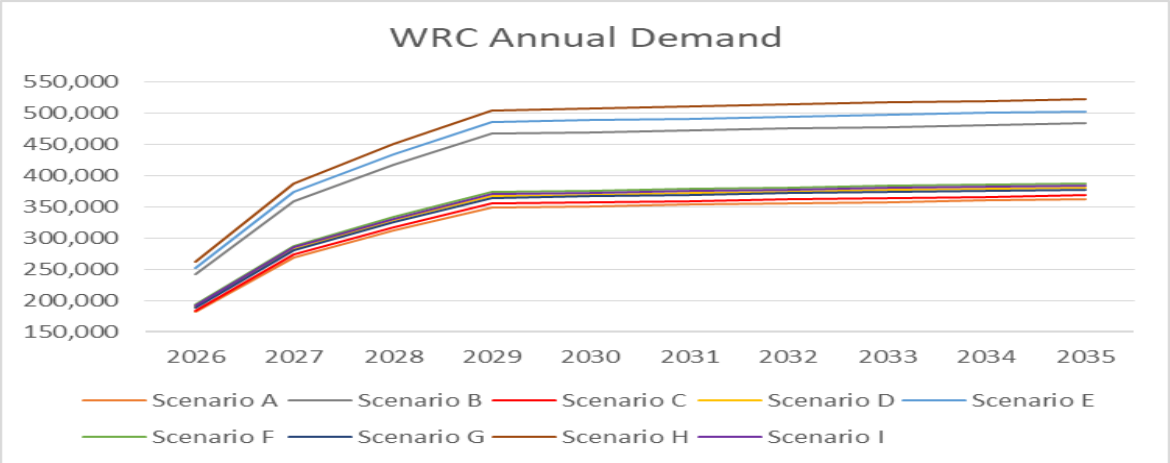


Figure 40 assumes an opening year of 2026 and includes a three year ramp up period as per PDFH after which growth is assumed to be population growth for the region of Western Ireland. The same ramp up was applied to all scenarios. Scenario G and Scenario D have similar demand and therefore the curve for Scenario G is slightly hidden. As the figures show, Scenario H which assumes a 20% reduction in fares results in the most optimistic demand forecasts.

Figure 44 Annual revenue forecast, with ramp up (€), 2026 -to 2035

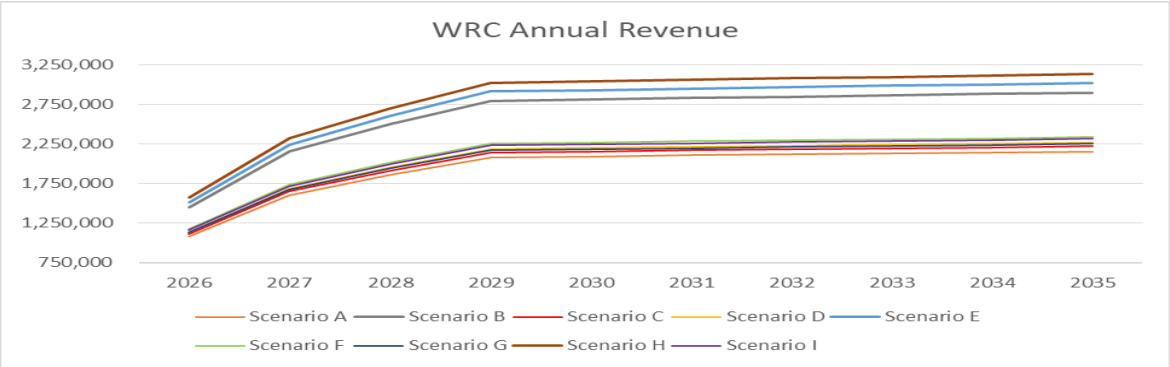
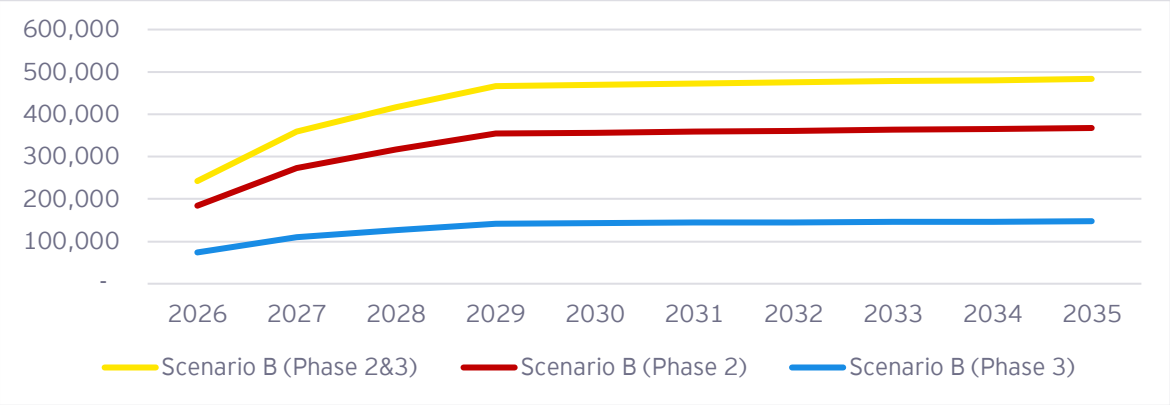


Figure 41 shows a comparison between Scenario B Phase 2 & 3, Scenario B Phase 2 and Scenario B Phase 3.

Figure 45: Scenario B demand by Phase of railway



Benchmarking

We have benchmarked the forecast journeys against journeys per head of the population for 2018. This was done through using current trip numbers sourced from census data provided by EY and population numbers provided by EY. Using the number of trips divided by population within a 10km radius of a station, we have come up with a trip rate per head. This trip rate per head was compared to Annual demand numbers we forecast, divided by population within a 10km radius.

Observed journeys are from the 2018 census and our model forecast year was set to 2018, with no ramp up applied. The 'Actuals' row shows the trip rate per head calculated from current trips.

Table 67 below compares the results for five stations; Athenry, Oranmore, Ballinasloe, Tuam and Claremorris. Tuam does not have an existing rail link, so we have used actuals for Oranmore and Ballinasloe as comparison.

Athenry is an existing station and railhead, with broadly hourly services to Galway, as well as direct services to Limerick and Dublin. The observed number of annual journeys per head is 17.7.

Oranmore and Ballinasloe both have frequent, albeit less than hourly services to Galway and some direct trains to Dublin. Oranmore also has some direct services to Limerick. Both stations have around four and a half trips per head each year.

Claremorris is relatively lightly served with only a few direct services per day to locations such as Westport and Dublin. This is reflected in a lower trip rate per head of 2.4 per year.

Our forecast range of journeys per head for Tuam is circa 9 trips per year, with the variance explained by the assumed service patterns, journey times and fares. This is higher than current trip rates at Oranmore and Ballinasloe. This is likely driven by the fact that Tuam will have a higher service frequency and will also connect to other towns in the north (Claremorris and Westport).

Our forecast range of journeys per head for Claremorris is circa 7 per year, this is 3 times more than currently and is also higher than current trip rates at Oranmore and Ballinasloe.

Our forecast range for Athenry implies an increase in trip rate per head of 20.45 to 25.27

Our forecast range for Craughwell is an increase in trip rate per head of 1.48 to 1.7.

Our forecast range for Ballyhaunis is an increase in trip rate per head of 4.28 to 4.29.

Table 71: rail forecast journeys per head of population

	Annual rail journeys from origin station per head of catchment population*						
	Tuam**	Clare-morris***	Athenry	Craugh-well	Bally-haunis	Ballin-asloe	Oran-more
Actual		2.35	17.72	0.74	3.54	4.73	4.50
Scenario A	8.28	7.06	20.45	1.48	4.28		
Scenario B	10.04	7.06	23.93	1.48	4.28		
Scenario C	8.50	7.02	20.45	1.67	4.28		
Scenario D	8.71	7.62	20.81	1.48	4.29		
Scenario E	10.40	7.62	24.30	1.48	4.29		
Scenario F	9.03	7.59	20.81	1.70	4.29		
Scenario G	8.61	7.57	20.89	1.48	4.28		
Scenario H	10.43	7.58	25.27	1.48	4.28		
Scenario I	8.90	7.54	20.89	1.67	4.28		

** Population within a 10km radius of the station*

*** Tuam, Ballyglunin and Milltown combined*

**** Claremorris only for observed demand, Claremorris and Ballindine combined for forecast demand*

Appendix E Detailed environmental assessment

Noise considerations

The introduction of a new rail services has the potential to change the noise levels in proximity to the reopened Western Rail Corridor. There are three potential primary sources of noise in the construction and operational context of the proposed development;

- Rail Activities
- Changes in traffic flow on the local road network as result of potential modal change in traffic
- Construction activities associated with the works

The proximity of noise sensitive receptors to the proposed development is an important factor is determining the potential noise impacts. The frequency of the proposed services is another factor in determining noise levels.

A high-level desktop review was carried out to determine the number of noise sensitive receptors in proximity to the proposed development. This appraisal was based on the accessibility of GeoDirectory dataset. The proposed route passes through a number of population centres, namely Athenry, Tuam, and Claremorris. All sensitive receptors within the study area (i.e., 500m corridor either side of the centreline) have been identified and included on accompanying constraints drawings. The number of receptors (i.e., residential properties, commercial properties etc.) were counted within 500m of the centreline of the existing railway corridor, subdivided into distance bands of 0-50m, 50-100m, 100 to 150m and 150-200m and 200 to 500m. For the purpose of this appraisal a minimum set back buffer distance of 50m around each property is also indicated on the accompanying constraints drawings.

Table 72: Assessed noise impacts

GeoDirectory Q2_19 building user					
Bands (m)	Total	Residential	Commercial	Both residential & commercial	Unknown
0-50	217	155	31	10	21
50-100	347	268	48	19	12
100-150	442	372	28	36	6
150-200	551	432	72	37	10
200-500	3107	2462	398	179	68

Source: Mott MacDonald analysis

The transport modal change as a result of the reopening of the railway line has the potential to have a positive impact on noise sensitive receptors in proximity to the existing road network and a potential for adverse impact on those in proximity to the existing rail corridor. Details of the proposed services along the reopened rail line is not known at this stage however, it is assumed that no night time services will occur.

Noise levels from a development is often assessed in using noise threshold/standards. Impacts will arise through either noise changes or through exceedance of noise limits. By comparing the levels of noise that are expected to be generated against baseline noise level, as an indication of likely annoyance or disturbance. There are no Irish statutory requirements of acceptable criterion in relation to rail development however, the acceptable UK Noise Insulation (Railway and other Guided Transport System) Regulation 1995 are considered appropriate in this instance. The Regulation impose a duty upon the developer to offer noise mitigation to properties subject to rail noise levels equal to, or in excess of 68 dB LAeq, 18hr (daytime) or 63 dB, 18hr (night time).

There are no Irish guidance or standards, however an acceptable assessment methodology is based on the UK's Calculation of Railway Noise guidance.

Significance rating criteria given in the Institute of Acoustics and Institute of Environmental and Management's guidance on the Assessment of Environmental Noise (2014) is used. This criterion is based on the absolute increase in noise level over the baseline noise level.

Table 73: Noise classification

Change from baseline noise	Impact classification
< 3 dB	Negligible
3-5 dB	Minor
6-10 dB	Moderate
<10 dB	Major

Source: Mott MacDonald

As noted above there are a significant number of residential properties sited within 500m distance band of the centreline of the existing rail line. The reopening of the rail line has the potential to change the existing noise environment at these properties and have significant adverse impacts on these properties. Rail noise abatement measures such as noise barriers, can achieve a noise reduction up to approximately 10 dB. However, in the first instance priority should be given to noise reduction measures at the source (vehicles and tracks). If measures at the source complement the barriers, the length and/or height of barriers can be reduced resulting in a more sustainable approach to mitigation.

Biodiversity assessment

A desktop appraisal was undertaken to identify important areas of international ecological significance within the study area. The proposed study area for the purpose of this appraisal has been limited to include a 500m corridor either side of the centreline of existing railway line. However, it is noted that the proposed project has the potential to impact on international ecological sites beyond the footprint of the project study area itself. National Guidance[47] states that screening for Appropriate Assessment should be carried out for any European Site within the likely 'Zone of Influence' of a plan or project. For projects, the guidance recommends that the Zone of Influence (ZoI) must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, the sensitivities of the ecological receptors, and the potential for in combination effects. Sites and areas of international ecological significance within the study area only have been identified and included on accompanying constraints drawings.

A network of sites of conservation importance hosting habitats and /or species identified in the Habitat (92/43/EEC) and Birds (2009/147/EC) Directives as needing to be either maintained at or restored to favourable conservation status have been identified by each Member State. The two designations detailed below are collectively known as the Natura 2000 network.

- Special Areas of Conservation (SACs) are areas with habitats protected by the designation under the Habitats Directive (92/43/EEC), as amended
- Special Protection Areas (SPA's) are sites designated for the protection of habitats used by bird species. These areas are designated under the Birds Directive (2009/147/EC), the codified version of 79/4089/EEC as amended)

The study area provides the setting for a range of wildlife habitats and species. The existing western railway corridor transverses Lough Corrib SAC numerous locations along its corridor. The table below provides a list of the features of interest associated with the SAC. As noted above, this appraisal is focused on European Sites within the footprint of the project study area itself, it is noted that the Lough Corrib SAC overlaps with Lough Corrib SPA (004042) to the west and to Galway Bay Complex SAC (000268) to the southwest.

Table 74: Biodiversity considerations

International Designated Site	Site Code	Features of Interest (* [48] *indicates a priority Annex I habitat under the Habitats Directive*)
Lough Corrib SAC	000297	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]
		Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/*or Isoeto-Nanojuncetea* [3130]
		Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]
		Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]
		Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]
		Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
		Active raised bogs * [7110]

[47] Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities, Department of the Environment, Heritage and Local Government, 2009

[48] Priority habitats, are in danger of disappearing within the EU territory, are highlighted with an asterisk

International Designated Site	Site Code	Features of Interest (* [48] indicates a priority Annex I habitat under the Habitats Directive)
		Degraded raised bogs still capable of natural regeneration [7120]
		Depressions on peat substrates of the *Rhynchosporio*n [7150]
		Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* * [7210]
		Petrifying springs with tufa formation (*Cratoneurion*)* [7220]
		Alkaline fens [7230]
		Limestone pavements * [8240]
		Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]
		Bog woodland * [91D0]
		Margaritifera (Freshwater Pearl Mussel) [1029]
		Austropotamobius pallipes (White-clawed Crayfish) [1092]
		Petromyzon marinus (Sea Lamprey) [1095]
		Lampetra planeri (Brook Lamprey) [1096]
		Salmo salar (Salmon) [1106]
		Rhinolophus hipposideros (Lesser Horseshoe Bat) [1303]
		Lutra (Otter) [1355]
		Drepanocladus vernicosus (Slender Green Feather-moss) [1393]
		Najas flexilis (Slender Naiad) [1833]

Source: Mott MacDonald analysis

Lough Corrib SAC

Condition of the site and management

The site is adjacent to Galway Bay Complex SAC (000268) and the SAC overlaps with Lough Corrib SPA (004042). The SAC site designation includes for 15 habitats which are listed on Annex I of the E.U. Habitats Directive, six of which are priority habitats, and nine species which are listed on Annex II. 5 Red Data Book plant species, good populations of Freshwater Pearl Mussels, Crayfish, and Lamprey. The site also supports an important population of Salmon. Important for wintering and breeding birds. The lake is also internationally important for birds and is designated as a Special Protection Area. The Natura 2000 Standard Data Form lists the SAC of immense importance for the occurrence of scarce and specialised habitats, as well as animal and plant species. Lough Corrib is the second largest oligotrophic lake in the country and is a superb example of a hardwater system. The lake can be divided into two parts: a relatively shallow basin, underlain by Carboniferous limestone, in the south, and a larger, deeper basin, underlain by more acidic granite, schists, shales and sandstones to the north. The surrounding lands to the south and east are mostly pastoral farmland, while bog and heath predominate to the west and north. A number of rivers are included within the SAC site as they are important for Atlantic salmon. These rivers include the Clare, Grange, Abbert, Sinking, Dalgan and Black to the east. In addition to the rivers and lake basin, adjoining areas of conservation interest, including raised bog, woodland, grassland and limestone pavement, have been incorporated into the SAC site.

The Natura 2000 Standard Data Form lists threats to the site include agricultural practices such as agricultural intensification, invasive non-native species, diffuse pollution to surface waters due to household sewage and waste waters, and other human intrusions and disturbances.

Site specific conservation objectives (SSCO) for each of the features of Interests identified in the above table can be sourced directly from conservation objectives documents (accessed online at

www.npws.ie). SSCOs aim to define the favourable conservation condition for a SCI species at that European site. The favourable conservation status of a species is achieved when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis

Favourable conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, are stable or increasing
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future
- The conservation status of its typical species is favourable.

From an ecological perception potential legal challenge to the reopening of the railway line would relate to the potential for significant effects on the Natura 2000 site listed above plus potential for other Natura 2000 which are determined to be linked to the proposed development.

The reopening of the railway line has the potential to negatively impact on protected ecological sites and the sensitive species for which they are designated, leading to significant direct and indirect impacts on the integrity of designated sites. Potential impacts may include;

- Loss of, or damage to, plant and animal populations and due to landtake or habitat fragmentation including impacts due to the disruption of dispersal pathways
- Impacts on plant and animal populations due to changes in the movement or quality of water resources
  Or
- Disturbances to birds and other animals from the reopening of the railway. There may however be potential for positive impacts such as habitat creation and enhance of sites for wildlife.

It is important that the conservation objectives of protected sites are considered throughout the project process. Further assessments will be required at a later stage of the project process to determine the extent and nature of designated sites, when more localised, site specific ecological impacts are considered.

The Habitats Directive requires that where a plan or project is likely to have a significant effect on a European Site, while not directly connected with or necessary to the nature conservation management of the site, it will be subject to 'Appropriate Assessment' to identify any implications for the European site in view of the site's Conservation Objectives. Specifically, Article 6(3) of the Habitats Directive states. '*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives*'.

The assessment of the implications for the Natura 2000 sites, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the Natura 2000 sites concerned and, if appropriate, after having obtained the opinion of the general public.

Appendix F CBA outputs

Table 75 Full WRC

Annual													
2019 prices	2020	2021	2022	2023	2024	2025	2026	2027-2030	2031-2035	2036-2040	2041-2045	2046-2050	2051-2056
Costs													
IÉ Capex	-	-	40.9	114.3	122.8	64.9	1.5	6.2	9.7	11.7	18.0	22.2	31.7
IÉ Opex	-	-	-	-	-	-	2.6	9.8	12.4	13.1	13.9	14.9	19.4
Opportunity cost	-	-	-	-	-	-	0.8	-	-	-	-	-	-
Total costs	-	-	36.8	102.9	110.5	55.7	3.9	15.9	22.1	24.8	32.0	37.1	58.7
Benefits													
Revenue	-	-	-	-	-	-	1.1	7.9	11.0	11.3	11.7	12.0	14.9
Total safety benefit	-	-	-	-	-	-	0.1	0.3	0.3	0.3	0.2	0.2	0.2
Total emissions benefit	-	-	-	-	-	-	(0.0)	(0.0)	(0.1)	(0.1)	(0.2)	(0.2)	(0.3)
Total time savings benefit	-	-	-	-	-	-	(0.1)	(2.8)	(4.8)	(5.6)	(8.4)	(11.1)	(15.8)
Total other cost-saving benefits	-	-	-	-	-	-	5.1	30.7	41.9	43.0	43.8	44.8	55.2
Total Exchequer taxation benefits	-	-	-	-	-	-	(1.9)	(11.0)	(15.1)	(15.7)	(16.2)	(16.9)	(21.1)
Total noise benefits	-	-	-	-	-	-	(1.3)	(5.4)	(6.9)	(7.1)	(6.3)	(6.3)	(7.8)
Residual value	-	-	-	-	-	-	-	-	-	-	-	-	44.5
Total benefits	-	-	-	-	-	-	7.7	19.6	26.3	26.1	24.7	22.5	74.2
Annual discounted costs	-	-	36.4	97.7	100.9	51.3	3.8	11.0	12.8	11.8	12.5	11.9	13.2
Total discounted benefits	-	-	-	-	-	-	2.3	13.4	15.2	12.4	9.7	7.2	17.0
Cumulative benefits	-	-	-	-	-	-	2.3	42.0	125.5	192.9	247.3	287.6	395.9
NPV (2019 prices) (286.1)													

Table 76 Phase 2 WRC

Annual													
2019 prices	2020	2021	2022	2023	2024	2025	2026	2027-2030	2031-2035	2036-2040	2041-2045	2046-2050	2051-2056
Costs													
IÉ Capex	-	-	19.3	52.7	56.6	31.7	0.7	2.9	4.6	5.5	8.6	10.5	15.0
IÉ Opex	-	-	-	-	-	-	1.9	7.4	9.7	10.2	10.9	11.7	13.7
Opportunity cost	-	-	-	-	-	-	0.4	-	-	-	-	-	-
Total costs	-	-	36.8	102.9	110.5	55.7	3.9	10.4	14.3	15.8	19.4	22.2	33.3
Benefits													
Revenue	-	-	-	-	-	-	1.0	6.8	9.5	9.7	10.0	10.3	12.8
Total safety benefit	-	-	-	-	-	-	0.0	0.1	0.1	0.1	0.1	0.0	0.0
Total emissions benefit	-	-	-	-	-	-	(0.0)	(0.0)	(0.1)	(0.1)	(0.1)	(0.2)	(0.3)
Total time savings benefit	-	-	-	-	-	-	(0.5)	(3.6)	(5.5)	(6.2)	(7.2)	(8.3)	(11.8)
Total other cost-saving benefits	-	-	-	-	-	-	2.5	17.8	24.9	25.6	26.4	27.2	33.7
Total Exchequer taxation benefits	-	-	-	-	-	-	(1.2)	(6.9)	(9.4)	(9.8)	(10.1)	(10.5)	(13.2)
Total noise benefits	-	-	-	-	-	-	(0.8)	(3.1)	(3.9)	(4.1)	(3.6)	(3.6)	(4.5)
Residual value	-	-	-	-	-	-	-	-	-	-	-	-	22.6
Total benefits	-	-	-	-	-	-	7.7	11.1	15.5	15.3	15.5	14.9	42.2
Annual discounted costs	-	-	17.1	45.0	46.5	25.0	2.3	7.1	8.3	7.5	7.6	7.1	7.5
Total discounted benefits	-	-	-	-	-	-	0.8	7.6	9.0	7.3	6.0	4.8	9.6
Cumulative benefits	-	-	-	-	-	-	0.8	21.2	69.5	109.2	141.8	168.2	233.8
NPV (2019 prices) (136.0)													

Table 77 Phase 3 WRC

Annual													
2019 prices	2020	2021	2022	2023	2024	2025	2026	2027-2030	2031-2035	2036-2040	2041-2045	2046-2050	2051-2056
Costs													
IÉ Capex	-	-	20.4	57.8	62.2	32.3	0.8	3.2	5.1	6.2	9.5	11.7	16.7
IÉ Opex	-	-	-	-	-	-	0.6	2.1	2.7	2.8	3.0	3.2	4.2
Opportunity cost	-	-	-	-	-	-	0.4	-	-	-	-	-	-
Total costs	-	-	36.8	102.9	110.5	55.7	3.9	5.3	7.8	9.0	12.5	14.9	23.9
Benefits													
Revenue	-	-	-	-	-	-	0.3	2.4	3.3	3.4	3.5	3.6	4.5
Total safety benefit	-	-	-	-	-	-	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total emissions benefit	-	-	-	-	-	-	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Total time savings benefit	-	-	-	-	-	-	(0.2)	(1.7)	(2.7)	(3.0)	(3.5)	(4.1)	(5.8)
Total other cost-saving benefits	-	-	-	-	-	-	1.2	8.1	11.4	11.7	12.1	12.4	15.4
Total Exchequer taxation benefits	-	-	-	-	-	-	(0.7)	(4.3)	(5.9)	(6.1)	(6.3)	(6.5)	(8.2)
Total noise benefits	-	-	-	-	-	-	(0.6)	(2.3)	(3.0)	(3.1)	(2.7)	(2.7)	(3.4)
Residual value	-	-	-	-	-	-	-	-	-	-	-	-	18.5
Total benefits	-	-	-	-	-	-	7.7	2.2	3.2	3.0	3.1	2.8	21.7
Annual discounted costs	-	-	18.1	49.4	51.1	25.5	1.4	3.7	4.5	4.3	4.9	4.8	5.4
Total discounted benefits	-	-	-	-	-	-	0.0	1.5	1.9	1.4	1.2	0.9	5.0
Cumulative benefits	-	-	-	-	-	-	0.0	3.6	13.5	21.5	28.0	33.1	48.7
NPV (2019 prices) (161.0)													

EY | Assurance | Tax | Transactions | Advisory

About EY
EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organisation, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. Information about how EY collects and uses personal data and a description of the rights individuals have under data protection legislation are available via ey.com/privacy. For more information about our organisation, please visit ey.com.

105172.pptx. Produced by Creative (Ireland). 09/19. ED none.

The Irish firm Ernst & Young is a member practice of Ernst & Young Global Limited. It is authorised by the Institute of Chartered Accountants in Ireland to carry on investment business in the Republic of Ireland.

Ernst & Young, Harcourt Centre, Harcourt Street, Dublin 2, Ireland.

ey.com