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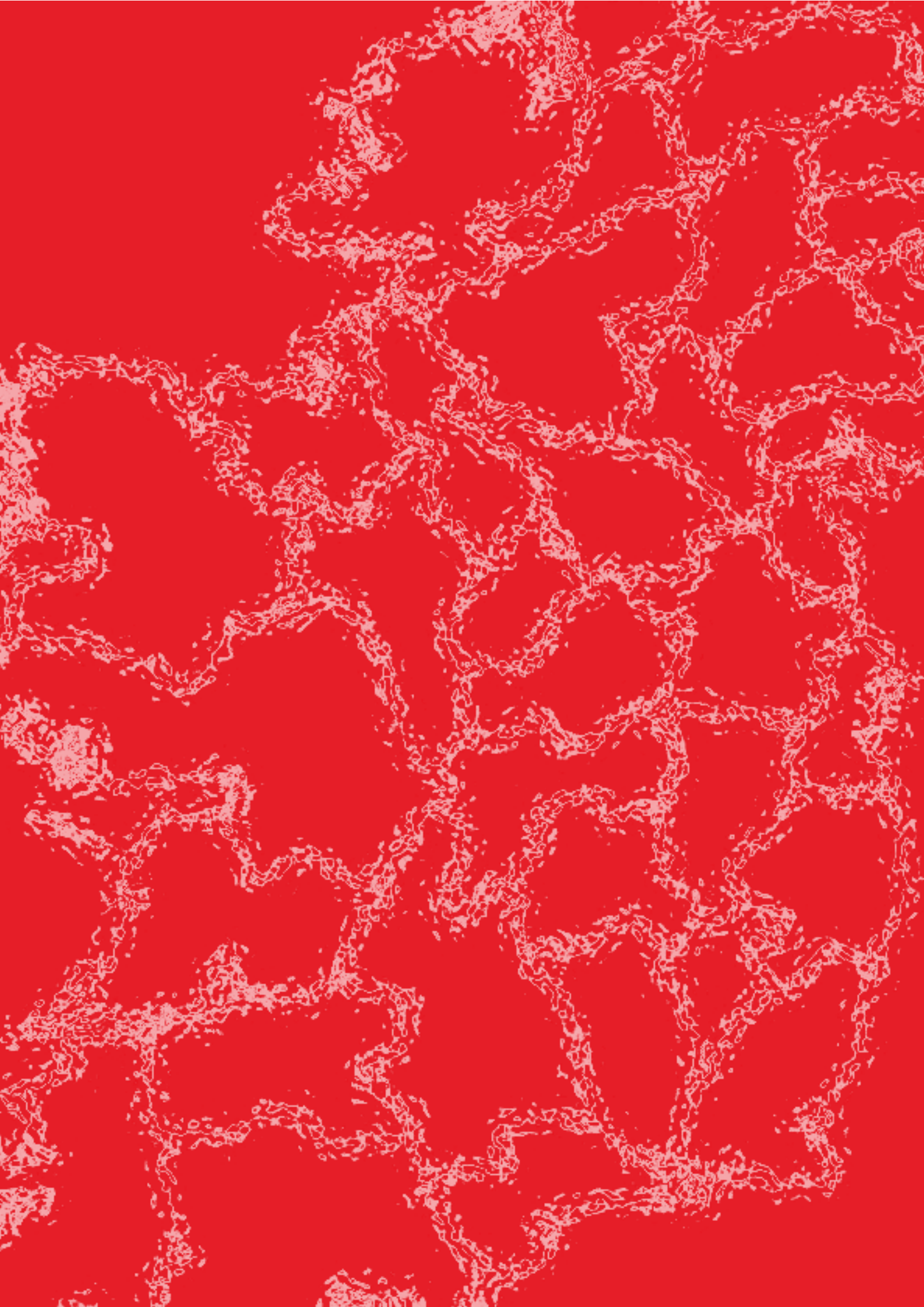
Department of Transport and Department for Infrastructure

All-Island Strategic Rail Review

Final Report

31 July 2024



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Job number 283571

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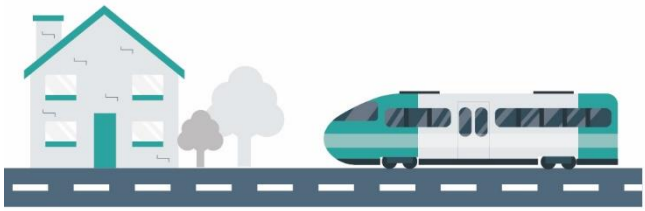
If the recommendations in this Review were delivered:

80% of train kms would be delivered by electric trains, and the remaining could be delivered by battery electric and hydrogen traction.

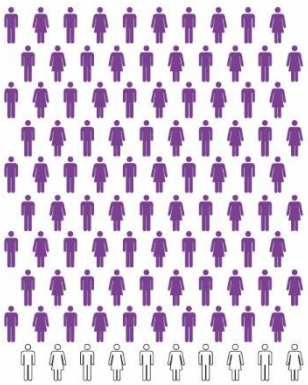
The carbon footprint of a passenger rail journey could be **80%** lower than an equivalent journey by an electric vehicle.

700,000 more people would live within **5km** of a railway station – representing an increase of **25%** on today's catchment.



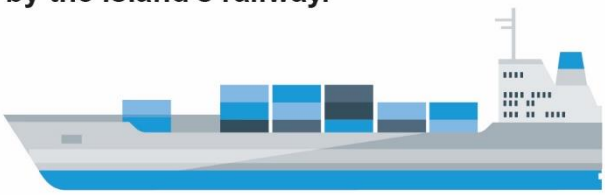
Rail journey times between the island's major cities would be significantly reduced, by **50%** in some cases. There would be **hourly** services between key cities, increasing to **half-hourly** on busiest routes.

Dublin, **Belfast**, **Cork**, **Limerick**, **Galway**, **Waterford** and **Derry~Londonderry** would be able to boost local services and enable the whole island to double passenger rail market share.



90% of the island's commercial aviation passengers would be able to access their airports by rail.

66% of the island's freight tonnage would pass through ports served by the island's railway.



There would be a **€20bn/£17bn** boost to the island's economy, based on 2011 prices.

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Contents

Glossary

BCR	Benefit to Cost Ratio
CAF	Common Appraisal Framework
CSO	Central Statistics Office
DART	Dublin Area Rapid Transit
DART+	A programme to expand DART services
DKK	Danish Krone
EU	European Union
GHG	Green House Gas emissions
LoLo	Lift-on/lift-off
OHLE	Overhead Line Electrification
TAG	Transport Analysis Guidance
UK	United Kingdom

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Executive Summary

Introduction

This Report presents the final findings and recommendations from the **All-Island Strategic Rail Review** ("the **Review**"), which was launched in April 2021 by the Minister of Transport for the Irish Government and the Minister for Infrastructure for the Northern Ireland Executive.

This Report takes account of feedback gathered through two public consultations, including a Draft Strategic Environmental Assessment (SEA), which was published alongside a Draft Final Report from July to September 2023. A summary of the findings and actions arising from the SEA consultation is provided in **Appendix A**. Final versions of supporting documents, including the SEA and Appropriate Assessment, are published alongside this Report.

The Review aims to inform policy and provide a future strategic vision for the railways in both jurisdictions on the island of Ireland. It has examined how the island's railways are currently used, what role rail could play in future, and how the island's railway could better serve the people of both jurisdictions.

The Review has focused on how the rail network across the island could contribute to the **decarbonisation** of the island's transport systems, promote **sustainable connectivity** into and between major cities, enhance **regional accessibility**, and support **balanced regional development**. It has also considered the interactions between proposed improvements and existing, or planned, commuter rail services. The time horizon for this Review covers the period from today to 2050, to align with both jurisdictions' stated goals of achieving net zero carbon emissions by this milestone.

Opportunities and challenges

Rail has the potential to deliver on **accessibility, climate, connectivity, economic growth, environmental** and **regional development** goals across the whole island – both for passenger and freight flows. It can change the economic landscape of the island by unlocking regeneration and growth opportunities, attracting investment, and supporting sustainable development.

As one of the **lowest emitters of carbon** for passenger and freight trips, rail can help both jurisdictions deliver their commitments to achieving a net carbon zero transport system and economy. As both jurisdictions plan to decarbonise while the island's population continues to grow, rail can play a role as the **stronger 'backbone' of the public transport system** in facilitating more compact development around transport hubs, enhancing connections between cities, and growing its share of travel.

To realise this role, rail will need to grow its market (or mode) share of travel. However, there are several challenges preventing rail from realising its full potential on the island of Ireland. These are listed below:

- There are **significant gaps** in the rail network's coverage.
- Service **frequencies and speeds are relatively low compared** to similar railways (such as those in Scotland and Denmark).
- Ireland has the **lowest level of electrified railway** in the European Union.
- The **quality of service** offered does not consistently meet customer expectations.
- Station **access is inconsistent** and, in some places, poor.
- No major Irish **airport** is currently served by passenger rail services.
- **Integration** across cities (notably Dublin), modes, and jurisdictions is inconsistent.
- Current **infrastructure limits opportunities** to deliver affordable, transformational improvements.
- **Demographics** on the island are not particularly conducive to supporting high density, high frequency railway networks in many places.
- The island's **natural assets** present some constraints to future rail development on some corridors.

These challenges mean that the railway is currently unable to achieve high passenger and freight mode share, which is driving undesirable socioeconomic and environmental outcomes.

This evidence is supported by the responses received to an **initial public consultation** held between November 2021 and January 2022, which asked the public and wider stakeholders in both jurisdictions about their aspirations for the railway. This exercise showed there is significant interest from stakeholders in both jurisdictions in improving rail services across the whole island, especially in areas that are currently poorly served by the railway.

Vision, Goals, and Objectives

Policies and plans at every level of government in both jurisdictions have clear aims to increase the share of passenger travel by sustainable modes: public transport, walking and cycling.

Public policy recognises that rail is well placed to address wider challenges and opportunities for the island of Ireland. As the stronger backbone of a sustainable transport system, rail can support a growing and aging population, enable housing growth and development, mitigate congestion in cities, and deliver more equitable outcomes for all regions of the island.

Both jurisdictions are **committed to investing in public transport to** address the challenges the island faces. However, to unlock this investment, there will need to be a framework for delivery. This Review therefore aims to present a **strategic vison** for delivering a railway that meets the aspirations of the people and businesses it serves and supports the development of a prosperous, equitable, and sustainable future. To realise the opportunities and address the challenges outlined above, the Review has developed a **Vision** Statement, six overarching **Goals**, and 13 **Objectives**.

These are presented in **Table E.1** along with some key outcomes that the Review's recommendations could deliver.

Recommendations

The Review has developed **recommendations** for policymakers that, together, provide a route to achieving the Review's Goals and Objectives. **These recommendations do not represent official policy for either jurisdiction**, but aim to provide a constructive, evidence-based approach for delivering the Goals and Objectives of this Review. The recommendations cover six key themes, which are aligned to the Goals and Objectives of this Review. In total, the Review makes **32 recommendations** that range from relatively quick to implement service improvements (e.g., direct Cork – Limerick – Galway services) through to **major, long-term infrastructure projects** (e.g., a new railway from Belfast to Derry~Londonderry via Portadown).

An overview of how a future railway might look if all recommendations are implemented in 2050 is listed in **Table E.2** and presented in **Figure E.1**.

Benefits

If the Review's recommendations were implemented, then this would:

- Deliver **transformational improvements** in the **quality**, **speed**, and **frequency** of rail services across the island. Many journey times would be significantly faster than by car.
- Enable **more direct services** between the island's largest cities, significantly improving connectivity from the North East to the South West of the island, and on some routes potentially quadrupling service frequencies between key cities.
- Boost **reliability and resilience**, as there will be more capacity to absorb shocks, and more segregation between different services.
- **Reduce carbon emissions while doubling demand** through decarbonising rail operations and promoting modal shift.
- Provide much **more access** to the railway. The number of people living within 5km of a railway station could grow by over 700,000, representing a 25% growth from today's population catchment.
- Boost **patronage and revenue** for the railway – the number of passenger journeys and mode share undertaken on the island's rail network could double from 3% to more than 6% of passenger kms (before additional demand management measures are delivered, which could increase mode share further).
- Support planned improvements to **public transport connectivity in the island's largest cities**. Capacity would be unlocked for local services in Dublin, Belfast, Cork, and Limerick, while journeys to, from, and across **Dublin City Centre** would be significantly enhanced.
- Deliver **direct airport rail** links for Dublin, Belfast, and Shannon – over 90% of commercial aviation passengers would be able to access their airports by rail.
- Help the **rail freight industry** rebound by providing better routes between the island's ports and cities, delivering inland facilities, and lowering the costs of rail freight.

Vision Statement		
To deliver an accessible, efficient, safe and sustainable transport system that supports communities, households and businesses.		
Goals		**Objectives**
 **Goal 1** Decarbonisation	**Contribute to decarbonisation**	• Reduce the carbon emissions associated with rail's construction, operation, and maintenance
		• Reduce the carbon emissions from motor vehicle travel
 **Goal 2** Intercity	**Improve connectivity between the Island's major cities**	• Provide an attractive public transport choice for travel between the seven cities of Dublin, Belfast, Cork, Limerick, Derry~Londonderry, Galway, and Waterford
 **Goal 3** Regional and Rural	**Enhance regional and rural accessibility**	• Give people in rural and regional areas better access to economic opportunities, and public services
		• Improve inter-regional accessibility
 **Goal 4** Sustainable Cities	**Encourage sustainable mobility**	• Manage demand through compact growth and better integration of public transport with land use
		• Enhance the integration of rail with other transport modes
		• Minimise negative impacts on the environment
 **Goal 5** Freight and Economy	**Foster economic activity**	• Contribute to balanced economic growth between urban and regional areas
		• Support the efficient movement of goods and people between economic centres and international gateways
 **Goal 6** Economic Feasibility	**Achieve economic and financial feasibility**	• Plan investment in rail that is financially feasible
		• Access potential funding
		• Ensure investment in rail is considered alongside meeting objectives

Table E.1 | Vision, Goals, Objectives, and potential outcomes of this Review

Please note: This is an indicative artistic interpretation of the recommendations presented within this document. The pathways delineated on this illustration are conceptual in nature and should not be interpreted as a precise or literal depiction of potential routes or route corridors.

Figure E.1 | A future all-island railway

Decarbonisation recommendations

1. Develop and implement an All-Island Rail Decarbonisation Strategy that includes an electrified intercity network.
2. Develop plans to invest in the skills, supply chains, and rolling stock to deliver decarbonisation.
3. Procure hybrid and electric rolling stock in the medium term.

Intercity recommendations

4. Upgrade the cross-country rail network to a dual-track railway (and four-track in places) and increase service frequencies.
5. Upgrade the core intercity railway network to top speeds of 200km/h (125mph).
6. Develop short sections of new railways on congested corridors.
7. Develop a cross-Dublin solution.

Regional and rural recommendations

8. Provide more direct services between Ireland's West and South Coasts.
9. Ensure regional and rural lines have at least one train per two hours.
10. Increase line speeds to at least 120km/h (75mph).
11. Upgrade Limerick Junction and the Limerick Junction – Waterford line.
12. Reinstate the Western Rail Corridor railway between Claremorris and Athenry.
13. Extend the railway into Tyrone, Derry~Londonderry, and Donegal.
14. Reinstate the South Wexford Railway.
15. Develop the railway to boost connectivity in the North Midlands.
16. Integrate bus service and rail service timetables to connect communities where direct rail access proves to be unviable.

Sustainable cities recommendations

17. Connect Dublin, Belfast International, and Shannon Airport to the railway and improve existing rail-airport connections.
18. Extend double tracking in the Belfast area.
19. Segregate long-distance/fast services from stopping services.
20. Explore the case for developing new stations in the Belfast, Cork, Derry~Londonderry and Limerick – Shannon city regions.

Freight recommendations

21. Develop a sustainable solution for first-mile-last-mile rail access for Dublin Port.
22. Reduce Track Access Charges for freight.
23. Strengthen rail connectivity to the island's busiest ports.
24. Develop a network of inland terminals close to major cities on the rail network.

Customer experience Recommendations

25. Continue to invest in initiatives that deliver a seamless customer journey.
26. Continue to benchmark and monitor service quality and deliver continuous improvement.
27. Ensure future rolling stock specifications are aligned to the infrastructure-led interventions outlined in this Review.
28. Invest in improving integration within rail and between rail and other transport options.
29. Deliver 'clock-face' timetable calling patterns.
30. Develop cross-border structures to improve the effectiveness of cross-border infrastructure and rail service planning.
31. Invest in a rolling programme of accessibility improvements, including step-free access.
32. Review and update the All-Island Strategic Rail Review once a decade, taking account of latest policies and developments.

Table E.2 | Review Recommendations

More broadly, a transformed railway would help **reduce congestion** on the island's road networks, **reduce accidents**, **improve air quality**, **reduce noise**, and **reduce the carbon footprint** of the transport sector. It would also deliver a **significant boost** to the **productivity** of the economy in both jurisdictions through promoting agglomeration (productivity arising from pooling and sharing of resources and knowledge across labour markets) across the island of Ireland.

Costs and impacts

In 2021 prices, the total capital cost of the recommendations included in this Review is estimated to be in the order of **€32bn/£27bn.** Additional annual costs for operating and maintaining a larger rail network on the island are estimated to be circa **€600m/£500m**, which would be partly offset by increased revenue. This **excludes costs associated with existing spending commitments** such as the DART+ programme and MetroLink subway in Dublin. A high level of allowance for **Optimism Bias** has been included to allow for **uncertainty**. This investment would take the best part of **25 years to deliver**, which suggests an annual capital spend of the order of **€1.3/£1.1bn** would be required in addition to existing commitments (2021 prices, excl. VAT). Updated cost estimates in 2023 prices are provided in **Appendix D**.

While significant, these costs would represent a similar annual spend as was committed in the middle of the 2000s when Ireland expanded its motorway network, and they would be shared across both jurisdictions.

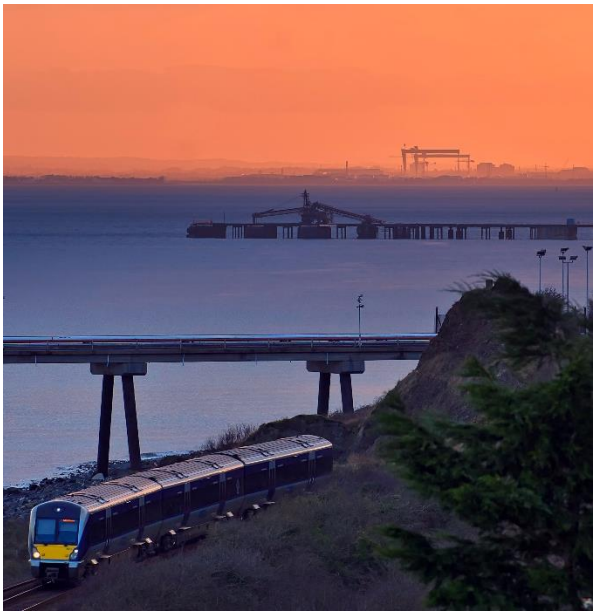
Some costs would be offset by future revenue, while others could be met by government funding. In addition, there would be other impacts arising from the delivery of some interventions, particularly during their construction.

This includes potential disruption to communities, townscapes, severance, biodiversity, landscapes, noise, and carbon emissions driven by the construction of new railways. These **impacts and trade-offs have been carefully considered** and have shaped many of the recommendations.

In general, most of this Review's recommendations focus on existing railways and corridors, which minimises their impact, though some new lines/re-opening of old lines is proposed. The Review also recommends tunnelled interventions in urban areas to reduce their impact.

The Review does not recommend constructing new railways through the North West coastal region, partly because of concerns about the impact of this on the environment, as well as value for money considerations. Similarly, the Review has also ruled out developing a large high speed rail system, related to concerns that the carbon generated from its construction would not be offset by downstream carbon emission reductions, and value for money issues.

Going forward, each intervention would be subject to **rigorous economic, equality, and environmental impact assessments**, which will help strengthen benefits, control costs, and mitigate environmental impacts.



Appraisal and roadmap

The Review undertook a thorough assessment and appraisal exercise of several packages of interventions and used insight drawn from this work to develop the recommendations outlined above. Under the Irish Department of Transport's Common Appraisal Framework guidance, the economic appraisal of the recommendations included in this report shows that, when taken together, they deliver **net economic benefits** for the island of Ireland and deliver the Vision, Goals and Objectives outlined above.

Roadmap for delivery

The Review has developed the recommendations outlined in this Report to create a **plausible Roadmap** for achieving the Goals and Objectives of this Study. This Roadmap presents a broad timeline for the possible future development and delivery of interventions between the near future and 2050.

One of the first actions that will need to be taken is to develop a more detailed **Delivery Plan** to provide a framework for long term investment.

It will also be important for authorities in both jurisdictions to implement planning policies that **safeguard land** for future railways and stations.

SEA Public consultation

The Review held a second public consultation from July to September 2023. The technical remit of this consultation was to formally consult on a Draft Strategic Environmental Assessment (SEA), which was published alongside the Draft Final Report for the Review. A large majority of responses focused on non-SEA topics.

One of the most cited issues in this consultation was concerns about the absence of proposals to extend rail services to Enniskillen in Co. Fermanagh. There were also requests for the Review to reopen more railways and include more new stations in the recommendations, to examine the role of tourism in boosting demand, and to make firmer commitments to delivering a more accessible railway. The feedback from this consultation was carefully analysed and motivated the project team to commission further research – including into the potential role of tourism demand in strengthening the case for investment, as well as sensitivity tests relating to rail to Enniskillen. A summary of the findings and actions arising from this consultation is provided in **Appendix A**.

Conclusion

This Review has examined the strategic role rail could play in delivering a **prosperous economy** for the island of Ireland as the **stronger backbone** of a **high-quality** and **sustainable** transport system. It has identified opportunities and interventions that, collectively, could **transform transport connectivity and access**, as well as **accelerate the island's transition to a net carbon zero economy**. It also provides an evidence base that underpins recommendations for policymakers to consider as they develop investment plans for the island's railway.

The future development of railways in both jurisdictions will be directed by their respective governments and legislatures. More work is needed to test the feasibility of many recommendations included in this Report, and each recommendation would be subject to appraisal, environmental assessment, and decision in line with applicable governance processes.

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Chapter 1 | Purpose

Introduction

In April 2021, the Minister for Transport for the Irish Government and the Minister for Infrastructure for the Northern Ireland Executive announced an **All-Island Strategic Rail Review** ("the Review"). This Report presents the final findings and recommendations from this Review. It aims to inform policy and future strategy for the railways in both jurisdictions on the island of Ireland. It represents a significant moment in the history of the island's railways, as it is the first time both jurisdictions have worked together to deliver a strategic rail study of this nature.

The Review takes account of feedback gathered through two public consultations, including an initial public consultation held from November 2021 to January 2022, as well as a public consultation on a Draft Strategic Environmental Assessment (SEA) published alongside a Draft Final Report from July to September 2023. A summary of the findings and actions arising from the latter consultation is provided in **Appendix A**.

Final versions of supporting documents for this Review, including the SEA and Appropriate Assessment, are published alongside this Report.

Scope of this Review

The Review has examined how the island's railways are currently used, what role rail could play in future, and how the island's rail network could evolve to better serve the people of both jurisdictions. It has considered a wide range of opportunities for improving the railways, from reopening railways in rural areas to examining the feasibility of developing higher speed (200km/h) and new high speed (300km/h or higher) railways. It has considered both passenger and freight opportunities across the island.

The Review has focused on how the rail network across the island could contribute to the **decarbonisation** of the island's transport systems, promote **sustainable connectivity** into and between major cities, enhance **regional accessibility**, and support balanced **regional development** and **growth**.

While the scope was not focused on commuter rail services in major cities or other types of public transport, the Review has carefully considered the interactions between proposed improvements and existing, or planned, **commuter rail services**. The time horizon for this Review covers the period from today to **2050** to align with both jurisdictions' stated goals of achieving **net zero carbon emissions** by this date.

Delivering this Review

The Review was guided by a **Steering Group** formed of representatives and stakeholders from the Irish Government and Northern Ireland Executive departments, the rail operators in both jurisdictions (Iarnród Éireann and Translink), Ireland's National Transport Authority and the Commission for Railway Regulation.

Furthermore, the work was supported by technical experts from the European Investment Bank (JASPERS), who assisted the Department of Transport in the scoping, oversight, and preparation of the Review. The technical content of the Review has been delivered by **Arup**. The Review was also informed by two public consultations as referred to above.

A summary of the approach used to deliver this Review is provided in **Appendix B**.

Structure of this Report

This Report explores the case for investing in the island's railways and highlights the role the railways could play in delivering a balanced and sustainable economy and society.

In **Chapter 2** this Report presents the railway as it is today and describes the wider context of the railway's development across the island of Ireland.

In **Chapter 3** the Report outlines the key challenges and opportunities the railway faces and sets out the Vision, Goals, and Objectives for this Review.

In **Chapter 4** the Report presents a range of recommendations that this Review considers are best placed to deliver the Goals and Objectives presented in **Chapter 3.**

The benefits and costs of the recommendations outlined in Chapter 4 are summarised in **Chapter 5**, and a route for delivering the recommendations is provided in **Chapter 6**.

Final versions of supporting documents that were produced for the Review, along with the Final Strategic Environmental Assessment and Appropriate Assessment are published alongside this Report.

Next steps

This Report has been endorsed by political representatives from both jurisdictions and seeks to **inform policy and provide a strategic vision** for the future development of the railways in the coming decades for the island. It aims to present an overview of the evidence seen by this Review and describe what appear to be the most promising **opportunities and interventions for rail** on the island of Ireland. These opportunities respond to the Goals and Objectives of the Review, which are based on an extensive evidence base which was further informed by public consultation.

Ultimately, it will be for the Irish Government and the Northern Ireland Executive to consider which of the recommendations described in this Report should be taken forward for further development. Each of the recommendations described in this Report would be subject to separate appraisal, environmental assessment and decision in line with applicable governance processes in each jurisdiction.

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Chapter 2 | The Railway Today

Introduction

This Chapter describes the island's rail network as it is configured today, outlines how the network has developed in recent decades, and summarises the current socioeconomic and environmental context on the island. The Chapter shows how rail can help support wider policy goals to improve connectivity, enhance accessibility, boost economic growth, enable regional development, and deliver each jurisdiction's climate change goals across the whole island – both for passengers and freight.

Today's railway

A map of the public railways in operation on the island today is provided in **Figure 1**. This map highlights currently electrified sections of the network, as well as areas where infrastructure investment is planned in the short term (e.g., Dublin's DART+ programme, the Foynes freight line, and line speed improvements planned for the Derry~Londonderry – Belfast railway).

The island of Ireland currently has around **2,300km (1,438 miles) of public rail lines**. Iarnród Éireann (Irish Rail), the state-owned railway company in Ireland, operates 1,944km (1,215 miles) of the rail network, and Translink (Northern Ireland Railways), the state-owned transport company in Northern Ireland, operates another 357km (223 miles) in Northern Ireland. Most **rail corridors** radiate from Dublin and Belfast, with several branches off the main routes to these cities. The route from Waterford to Athenry/Galway via Limerick is the only significant cross-country link that does not radiate from Dublin or Belfast. Apart from the mainlines from Dublin to Cork and Belfast and some short stretches of suburban lines around these cities, most of the rail network is a single-track railway, which severely limits service frequencies.

The only **electrified sections** of the railway are those used by the Dublin Area Rapid Transit service (DART) – a suburban service operating along the coast of the Dublin area from Greystones to Malahide and Howth. All other services are powered by diesel traction.

The **Irish Gauge** of 1,600mm (5'3") is used across the island, which is slightly wider than the gauges used in Great Britain and most of Europe.

The **maximum speed** permitted on the rail network is 160km/h (100mph) along the lines from Dublin to Cork, Kilkenny, and Athlone. The maximum speed on Northern Ireland's network is 145km/h (90mph) between Belfast and Dublin and on parts of the Belfast to Derry~Londonderry route. Numerous speeds restrictions apply on these routes and across the wider network.

At the time of writing there were 199 **passenger rail stations** on the island of Ireland. Each of the seven major cities serves as a terminus for rail services. Dublin, Belfast, and Cork each have a **suburban rail network**, although some only serves a limited number of areas within these cities, while the other cities (Limerick, Derry~Londonderry, Galway, and Waterford) have one station each.

Dublin has multiple terminus stations, the busiest of which are Connolly, Heuston, and Pearse. While it is possible to travel between Connolly and Pearse by rail, Heuston and Connolly are not currently connected by passenger rail services. For the latter, connections via the Luas tram are possible, and future DART services through the Phoenix Park Tunnel are planned. This presents wider challenges for the rail network as it makes it difficult to operate direct passenger services between towns and cities in northern and eastern parts of the island and those to the west of Dublin.

Service **frequencies** are currently relatively low, especially in regional and rural areas, where many routes are served by one train per two hours, and some only have two services per day. Service frequencies are significantly higher on the DART (e.g., Malahide – Greystones) and Dublin commuter network and on suburban services in the Belfast area.

Some rail lines in Ireland are also used for **freight**. These connect Ballina, Westport, and Navan to the ports of Waterford and Dublin. The freight lines from Mayo share track with passenger services between Mayo and Dublin, along with the corridor from Kildare to Waterford. Freight services to Navan share track with passenger services between Dublin and Drogheda before continuing to Navan on a freight only line. There are currently no rail freight operations in Northern Ireland.

Historic development

The island's rail network reached its peak around 1920, with approximately 5,540km (3,442 miles) of network. At that time, Ireland had one of the densest railway networks in the world. The railway network therefore once served almost every population centre across the island.

However, **between the 1930s and the 1970s the network shrank substantially**. These closures occurred for two main reasons. One was the perception, common at the time in many parts of the western world, that rail was a technology that would be surpassed by the perceived convenience of personal road-based transport, and this view was supported by evidence of declining demand for passenger rail. The other was the prevailing economic circumstances arising from the partition of Ireland.

The earliest rail closures were mainly on the most rural lines that struggled for viability as road transport improved, but from the 1950s onwards more substantial closures occurred. In Northern Ireland, the government developed extensive motorway building plans and planned to close many railways. While the motorway network plans were ultimately scaled back, the rail network within Northern Ireland shrunk considerably, leaving most areas west of the River Bann without a service. Closures across the rest of the island's network were more gradual but ended up removing almost all branch lines and cross-country routes not serving Dublin directly.

The emergence of the **two separate jurisdictions** in the 1920s also had a significant impact on the island's rail network. The introduction of customs controls on the new border disrupted rail services and impacted traditional patterns of trade and commerce. At that time, there was much less cooperation between the two new administrations than there is today. As such, almost all cross-border routes were closed in the 1950s and 1960s, initially on the Northern Ireland side. This left Cavan, Donegal, Fermanagh, Monaghan, and Tyrone without any rail services and just one cross-border line between Dublin and Belfast.

The railway network stabilised from the 1980s onwards, and, **since the 1990s, there has been something of a renaissance in rail**. In common with many other western countries, the growth and regeneration of cities, along with increasing congestion on roads, has stimulated significant growth in demand for rail services.

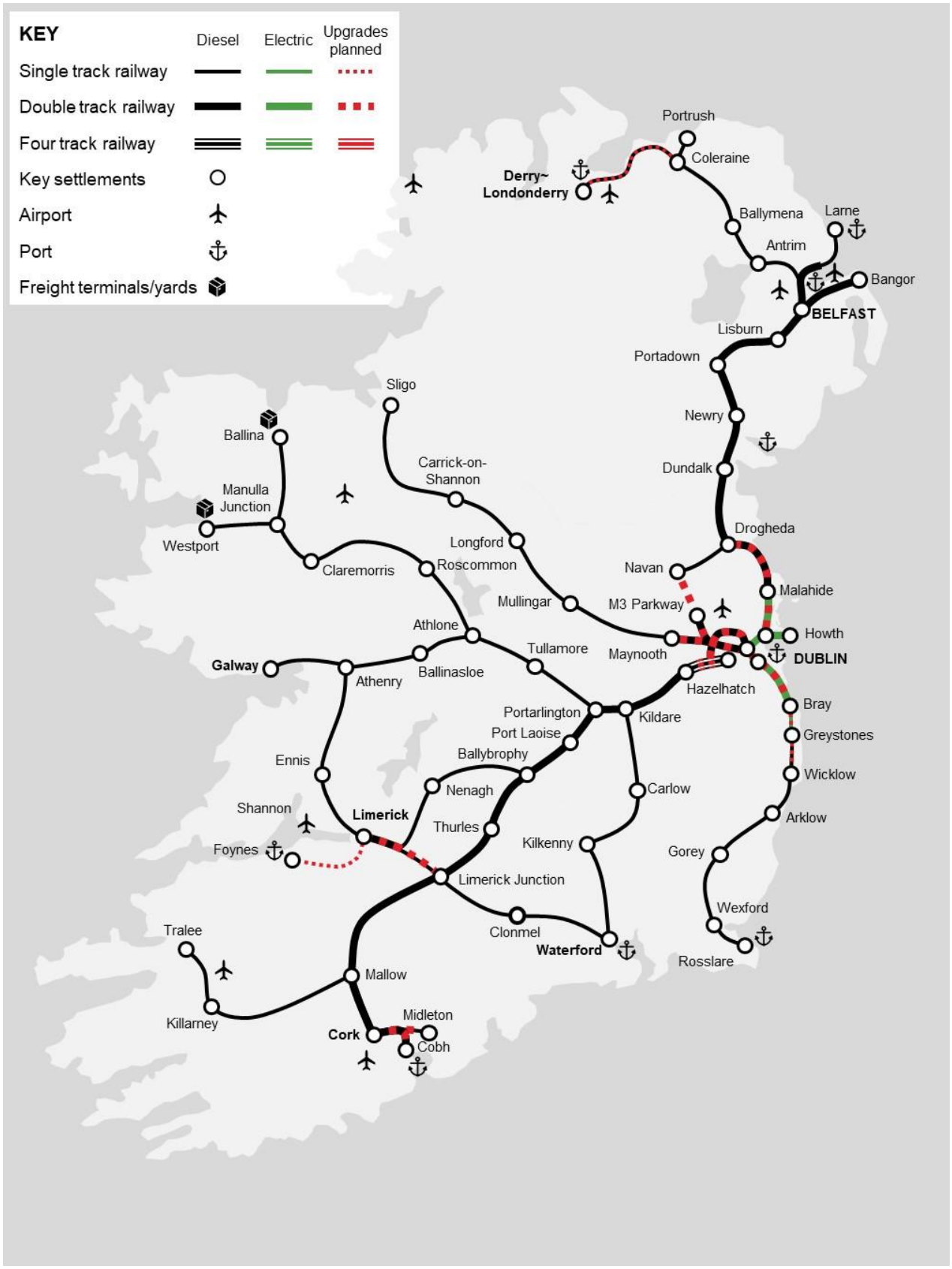


Figure 1

Baseline rail network

Upgrades marked in red in this map are planned short-term interventions that were agreed prior to the finalisation of the All-Island Strategic Rail Review such as Dublin's DART+ programme, the Foynes freight line, and line speed improvements planned for the existing Derry~Londonderry – Belfast railway.

The launch of the DART network in 1984, along with investment in the cross-border Enterprise service in the 1990s, highlighted the potential role the railways could play in supporting the island's economic growth. This gave both jurisdictions confidence to invest in enhancing and expanding rail services. In the 1990s passenger services were reinstated between Limerick and Ennis, and these were extended to Athenry in 2010. Since the turn of the millennium there have been additional reopening of railways between Whiteabbey and Antrim, between Clonsilla and M3 Parkway near Dublin, and between Glounthaune and Midleton.

Both jurisdictions have also invested in improving service frequencies on key intercity and commuter routes (e.g., Dublin – Cork), adding track capacity (notably to the west of Dublin), and investing in modern rolling stock (e.g., Ireland's intercity fleet and Northern Ireland's New Trains programme).

This recent investment has contributed to a **37%** growth in passengers across the whole island between 2011 and 2019 (**Figure 2**) – with the railway reaching a record of serving more than **65 million passengers** in 2019. While demand fell significantly during the COVID-19 pandemic, there are encouraging signs that demand is recovering fast. In 2022, both Iarnród Éireann and Translink recorded 70% of pre-pandemic demand. Despite this recent growth, however, passenger rail market (or mode) share remains low at around 1% of all trips or around 3% of passenger kilometres, which is lower than most European countries (the EU average for the latter figure is around 8%). Rail freight mode share is also at a historical low of less than 1% of total tonne kms.

Looking ahead, there are grounds to be optimistic. There are clear commitments to expand Dublin's DART network (DART+ programme), invest in the Belfast – Dublin enterprise service, expand and renew rolling stock, double-track short sections of the railway, and invest in a multi-billion Euro MetroLink line in Dublin.

Figure 2

Annual passenger rail journeys (millions)
Sources: Iarnród Éireann, Translink

Socioeconomic context

The **island's population** steadily declined in the aftermath of the Great Famine from a peak of approximately 8.5 million in the 1840s to just 4.2 million in the 1960s. This decline coincided with the period from the beginnings of the Irish railways to the last of the substantial closures in the mid-twentieth century. However, since the 1960s, this trend in population has reversed and in the last half century the island's population has grown to over 7 million at present.

The island's population is expected to grow significantly in the future. Ireland's National Planning Framework estimates the population will grow by a million people by 2040. It will also become more urbanised, as most of this growth is concentrated in the island's largest cities (**Figure 3**).

Increased urban populations make car ownership both less attractive and less necessary, making the role of rail for longer distance travel more important. As such, rail is in a strong position to serve the island's growing population. This will likely increase over the horizon of this Review, especially as planning policies are increasingly promoting demand management and transport orientated growth around rail stations.

The island has experienced **significant economic growth** in the last two decades, although the island's economy was severely affected by the 2008 Global Financial Crisis and COVID-19 pandemic. In recent years the island's economy has benefitted from significant Foreign Direct Investment, notably in Dublin, Cork, Limerick, Galway, and Belfast.

However, many regions of the island, including Derry~Londonderry and Waterford, have not benefitted from the same growth as the largest cities and have less access to key services and international gateways. Improved rail connections to the strongest performing urban areas, together with better regional connections and regeneration based around railway hubs, would improve access to economic opportunities in these places.

There are known challenges regarding the **affordability of housing** in Ireland with the highest rent increases recorded in Dublin, Cork, and Galway. A lack of affordable housing in the major cities means there is a potential threat to social cohesion and economic growth. With a lack of affordable housing in major cities, there is potential to enhance rail links to serve more affordable areas within the island's largest cities. Developing housing in compact, transport-oriented developments around stations can help promote sustainable travel outcomes.

In both jurisdictions legislation has been passed that commits to achieving **net-zero carbon emissions by 2050**. The Government of Ireland has also recently published a **Climate Action Plan**, which includes measures to reduce the number of car journeys taken, reduce on-street parking, and prioritise active travel and the use of public transport. This plan includes a key goal to **increase the public transport mode share by 130% by 2030**. Many regional and local authorities in both jurisdictions have made similar commitments and are pursuing similar plans. As one of the least carbon intensive forms of passenger transport, rail could help achieve this objective.

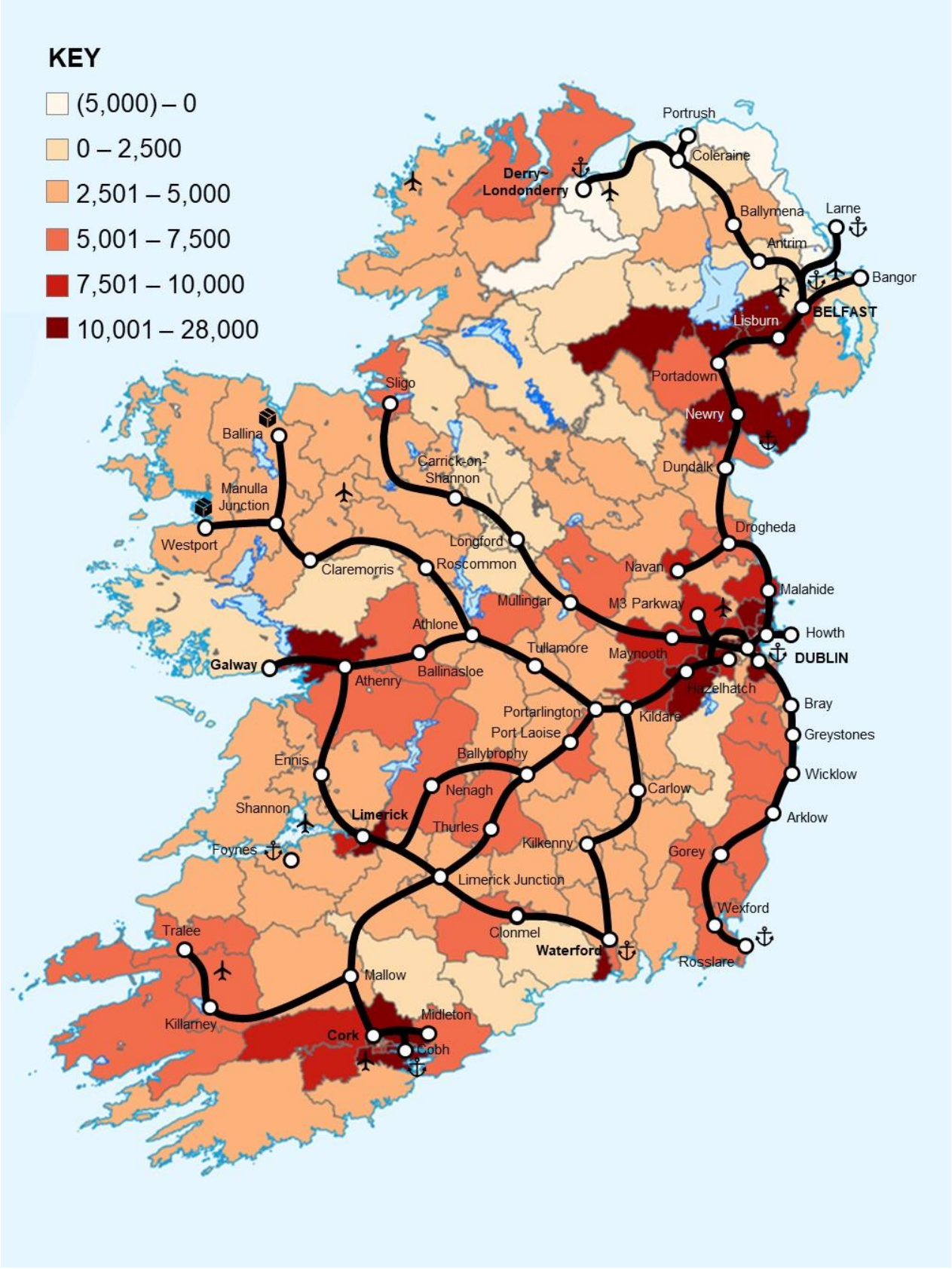


Figure 3

Forecast population growth (2019-40)

Sources: National Development Plan (Ireland), NISRA (Northern Ireland)

The role of rail

Rail has the potential to deliver on **accessibility, climate, connectivity, economic growth, environmental** and **regional development** goals across the whole island – both for passenger and freight flows. It can change the economic landscape of the island by unlocking regeneration and growth opportunities, attracting investment, and supporting sustainable development.

As part of an integrated transport solution, the rail system could evolve to be a stronger **'backbone' of the public transport system**, providing a core network of connectivity between urban areas and regions that is an attractive travel option to a range of customers and businesses.

A backbone is an integral but interdependent component to any system, which delivers value through integration with the other components. In a public transport system, this means enhanced regional connectivity into the main railway nodes, facilitating last mile connections, providing intermodal terminals for freight, and integrated ticketing and trip planning for a seamless public transport travel experience. Rail should not compete with other complementary elements of the system, but instead provide a vital pillar upon which the other elements can function.

To realise this role, **rail will need to grow its market (or mode) share of travel**. Research, such as the CSO National Travel Survey, shows there are several features of a passenger rail service that can be improved to boost ridership. These features are:

- Well-connected (i.e., enables passengers to complete most of their journey directly);
- Accessible and easy to use;
- Affordable;
- Frequent;
- Reliable;
- Fast; and
- Pleasant and comfortable to use.

While there are some examples on the island where the railway is competitive against other modes, in many cases it falls short. The Review has identified many opportunities for rail to significantly improve its competitiveness and grow its market share. Some opportunities can be delivered quickly while others will require longer-term intervention.

In general, rail is best suited to the corridors with highest demand between major cities and the largest towns. One of rail's key strengths is its spatial efficiency. As **Figure 4** shows, rail can carry very high volumes of passengers for a relatively small footprint – more efficient than any other form of land transport.

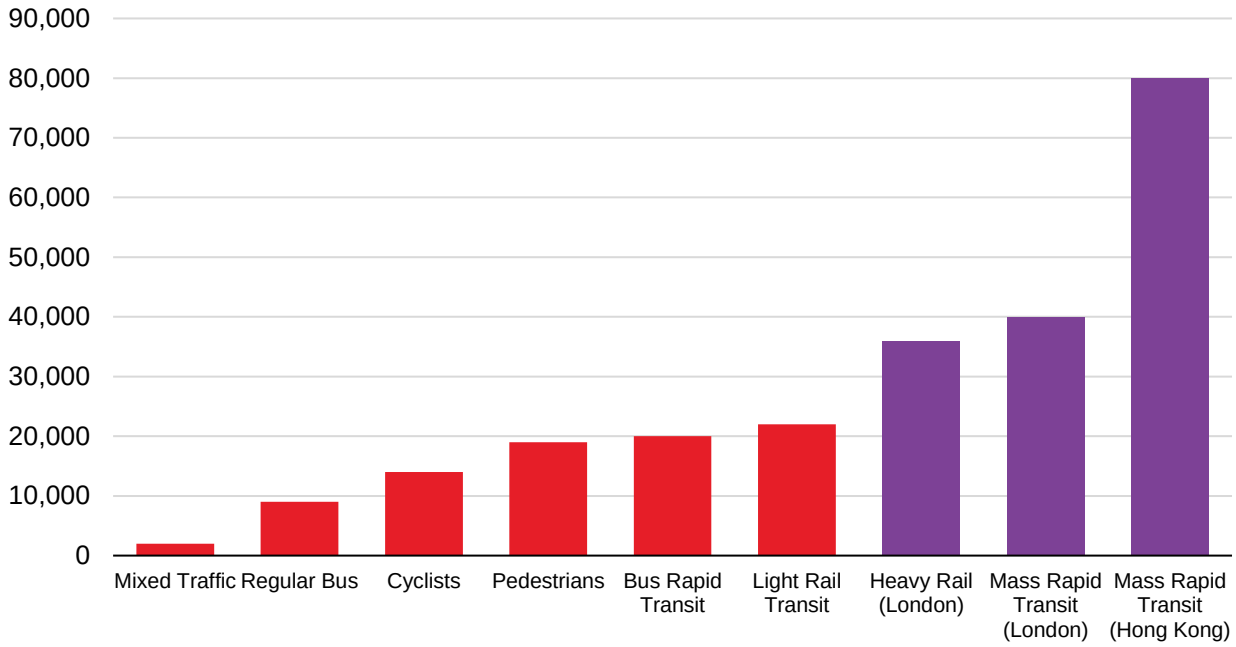


Figure 4

Capacity of transport modes (passengers per 3.5m lane/track) – rail is highlighted in purple

Sources: H. Botma and H. Papendrecht 1991. Traffic Operation and Bicycle Traffic. In Transportation Research Record 1320. TRB Washington DC: National Research Council and based on GTZ calculations 2009.

Tied to this efficiency, rail is one of the **lowest emitters of carbon** on a passenger km basis. As shown in **Figure 5**, the carbon footprint of electric railways – even those that operate at very high speed – is significantly lower than other land modes except active travel. Climate policies have been introduced in both Ireland and the UK that legally require large reductions in greenhouse gas emissions over the coming decades. The enhancement and expansion of rail services is a key component in meeting decarbonisation targets, particularly if combined with rail network electrification.

Rail is also ideally suited to forming the core of compact **transport-oriented development**. These communities have higher densities than the car-centric urban sprawl that has proliferated across the island in the last half century and have many social, economic, and environmental benefits. Higher densities support a larger number of services within walking distance, reducing the need for short distance car trips while rail provides for longer distance journeys. These types of development contribute to a more equitable society by reducing barriers to travel for non-drivers.

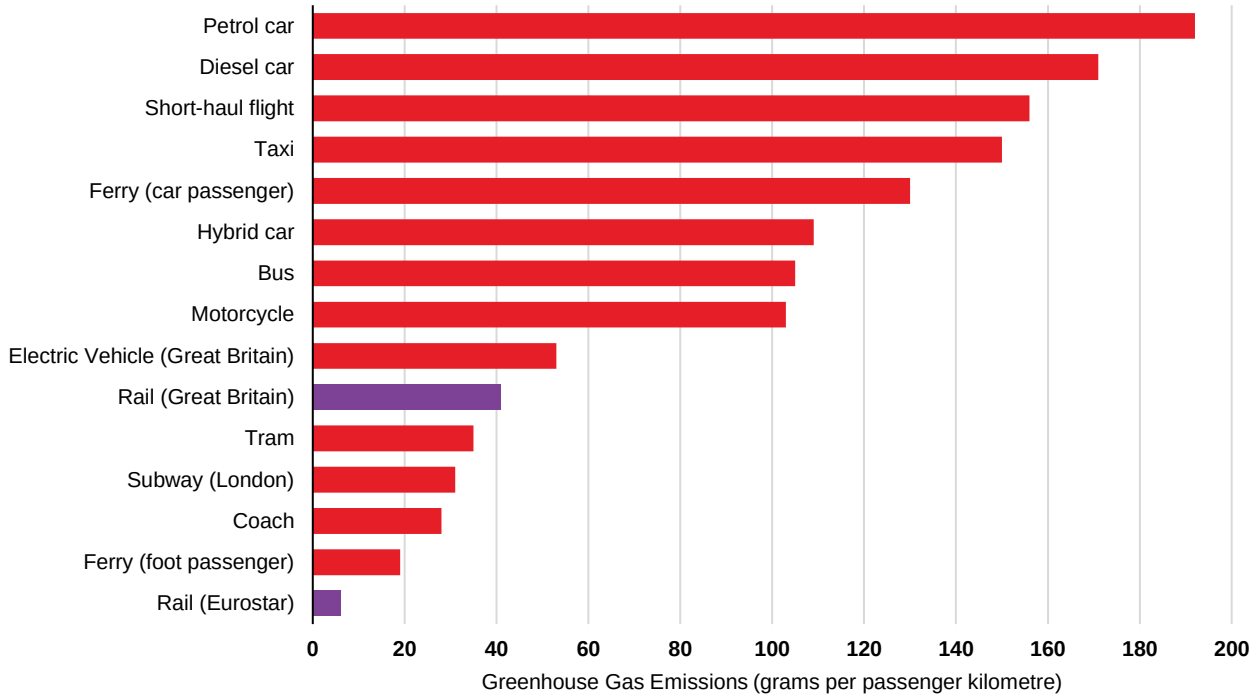


Figure 5

Greenhouse gas emissions by transport mode – rail in purple

Source: UK GHG conversion factors for company reporting

Heavy rail is less suited to supporting lower demand corridors and more isolated communities, but it can complement a regional bus service that could connect these communities to the wider public transport system. Rail can provide access to journeys for those with no access to car and can attract demand from more carbon intensive modes.

It is notable that areas of the island that are not served by the railway also have relatively high levels of deprivation. This underlines the potential wider role rail could play in supporting regional economic development and rebalancing the economy across the island of Ireland.

Heavy rail can also play a role in supporting a **sustainable freight logistics and transport system**. It is particularly suited to the traditional bulk freight market (which are generally non-time critical flows), as well as the growing market in intermodal goods and parcel services (which are more time critical).

As this Report will describe in Chapter 4, rail freight is generally considered to be most competitive over relatively long distances. In the island of Ireland, this means the potential role of rail freight will be focused on serving inter-regional journeys between the island's largest cities and busiest ports.


NIKE

ARUP

Chapter 3 | The Case for Change

Introduction

This Chapter describes the **key challenges and constraints** the current railway on the island of Ireland is facing and the undesirable outcomes the current railway is generating. It summarises the findings of the **public consultations** that were held to inform this Review, which demonstrated the significant public interest in improving rail services across the island. This is followed by a discussion of the **policy response** to current arrangements, and a summary of this Review's **Vision**, **Goals**, and **Objectives**.

Challenges and constraints

The key challenges and constraints identified by the Review (shown in **Figure 6**) are:

- **There are significant gaps in the rail network's coverage.** There is significant interest in this study from stakeholders in poorly served areas who wish to see their communities back on the rail map.
- **Service frequencies and speeds are relatively low compared to similar railways** (such as in Scotland and Denmark – see Chapter 4). The train is often slower than the car and bus between key cities.
- **Ireland has the lowest level of electrified railway in the European Union** and Northern Ireland has no electric railways. Electrification is a key enabler for achieving a net-zero carbon transport system.
- **The quality of service offered does not consistently meet customer expectations.** Many respondents to the initial public consultation highlighted concerns about service quality (e.g. lack of catering on services).
- **Station access is inconsistent and, in some places, poor.** Many stations are not fully accessible to users with mobility needs, and many stations are located some distance from the communities they serve.
- **No major airport on the island is currently served by passenger rail services.** Only Kerry and George Best Belfast City Airports are currently served by the rail network, and these do not have direct connections to terminal buildings. Dublin Airport is the busiest airport in Europe without a railway or metro station.
- **Integration across cities (notably Dublin), modes, and jurisdictions is inconsistent.** Allowing for interchange times with Luas it takes around 40 minutes to cross Dublin from Heuston to Connolly, which can make journeys from Belfast to towns and cities beyond Dublin very long.
- **Current infrastructure limits opportunities to deliver affordable, transformational improvements.** A map showing the key infrastructure constraints of the current rail network is provided in **Figure 6**.
- **Demographics on the island are not conducive to supporting high density, high frequency railway networks in many places.** There are some corridors and communities whose public transport needs are probably better served by bus.
- **The island's natural assets present some constraints to future rail development on some corridors.** Many of the island's coastal transport corridors pass through highly scenic (and designated/protected) areas.

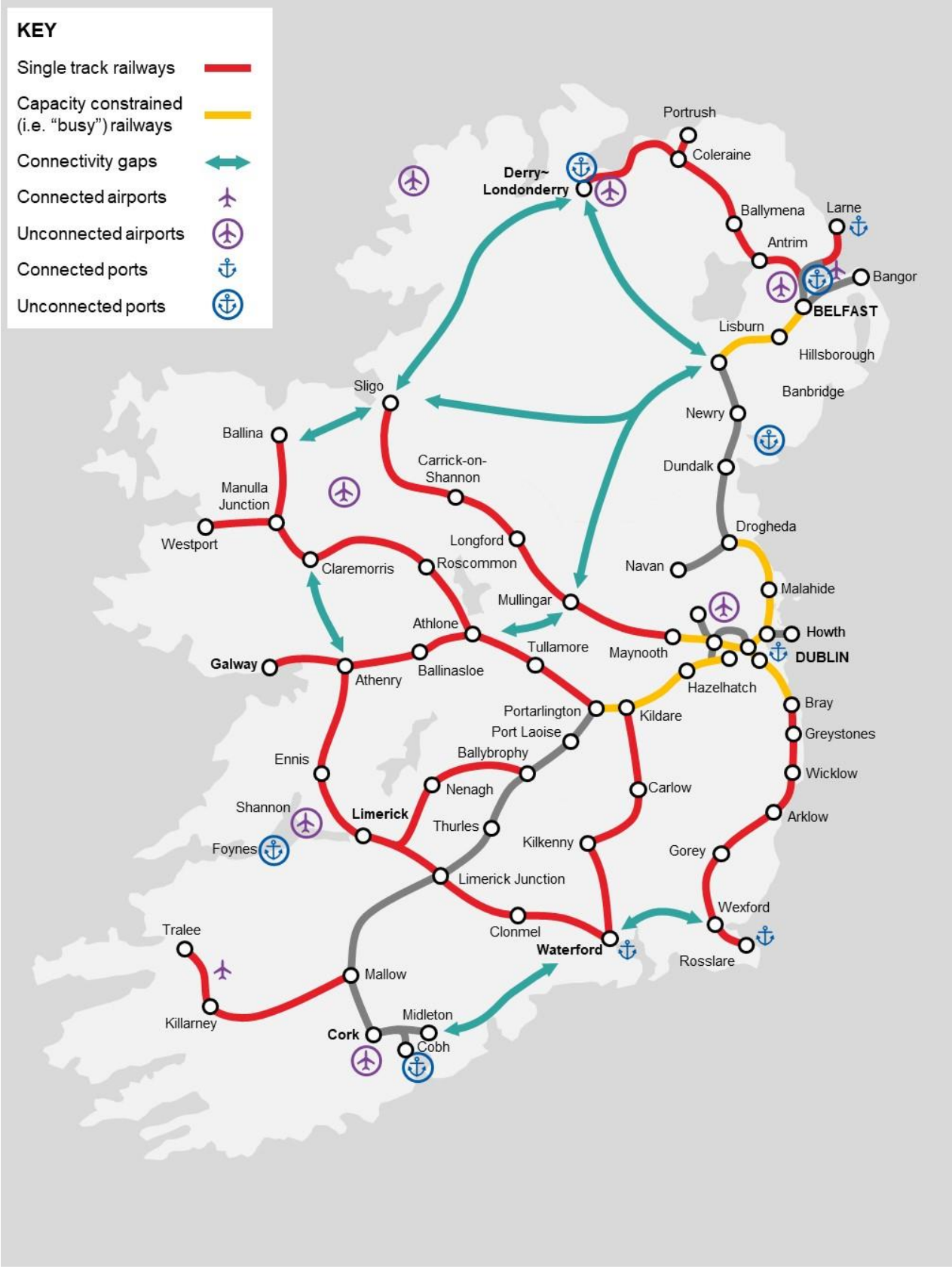


Figure 6

Key constraints and connectivity gaps

Undesired outcomes

The challenges and constraints described above are driving the following undesirable outcomes:

- **Low passenger rail mode share** and high private car mode share.
- **Low rail freight mode share** and high road freight mode share.
- Relatively high **carbon emissions** from the rail and the wider transport system.

These drive the following undesirable wider socioeconomic and environmental impacts:

- **Economic impacts:** High private car and road freight mode share means more congested roads, reduced productivity, and in some circumstances, missed opportunities for investment. Indirectly, high reliance on cars can promote low density development and inefficient land use. Improving rail services can enable businesses to access larger customer and labour markets and unlock agglomeration benefits (from pooling of resources/labour markets) across regions.
- **Social impacts:** Overreliance on cars and Heavy Good Vehicles (HGVs) risks isolating vulnerable communities and limiting equitable access to jobs and services. Heavy traffic is associated with poor air quality and reduced safety, which undermines health and wellbeing. Some policy responses to congestion, such as road expansion, can be costly and may only work in the short term (road building often induces more demand).
- **Environmental impacts:** Rail can play a significant role in the fight against climate change. The carbon footprint of rail is significantly lower than cars and HGVs and can be lower still if the rail network decarbonises. Rail is also space efficient, which means it can deliver high-capacity, transport corridors that require less land, and generate less noise/air pollution than roads.
- **Challenging rail industry finances:** Low passenger and freight use risks fuelling a vicious cycle. In the past, low demand has harmed the case for investment. Boosting demand would help put the rail industry's finances on a more sustainable footing.

Stakeholder aspirations

The Review held a **first public consultation** from November 2021 to January 2022 and asked the public and wider stakeholders in both jurisdictions about their aspirations for the railway. The "Work Package 1: Context and Policy" Report, which is published alongside this Report, provides details about the results of this consultation.

This exercise showed there is **significant interest** from stakeholders in both jurisdictions in improving rail services across the whole island. In total, 7,120 responses were received via the consultation website and email. Input was also sought from public bodies at all levels of government as well as voluntary and specialist interest groups.

There was a particularly strong response rate from the **North West of the island** where many respondents expressed interest in seeing the reinstatement and improvement of passenger railway services in these areas. There were slightly more responses from Northern Ireland (54%) as compared to the rest of the island (42% – other responses did not

declare a specific location), which reflected strong interest in this study in the North West. A map showing the distribution of responses to the initial public consultation alongside the current coverage of the rail network is provided in **Figure 7**. The key themes that emerged from the initial consultation were:

- There is significant interest in improving **intercity connectivity** (particularly from urban dwellers) and enhancing regional and rural connectivity.
- There is significant interest in **reinstating or building new railways**. 85% of public responses cited this aspiration (97% of responses in the North West of the island).
- Public responses also highlighted strong interest in **shortening journey times**, **increasing service frequencies**, and **decarbonising** the wider transport system.
- Responses from public stakeholders (e.g., local councils) placed significant emphasis on **decarbonisation and climate change**. These stakeholders also highlighted the role rail could play in supporting **local economic development**, enabling modal shift from road to **rail freight**, boosting connectivity to **global gateways**, and supporting **tourism**.
- Several respondents wished to see **better integration** between cycling and rail and with **Park and Ride** interchanges. More broadly, accessibility was raised as a concern from several respondents.
- Many public respondents said they felt the **quality of infrastructure** was behind comparable European countries, and that they wanted to feel pride in their infrastructure. This included several references to **airport and port connectivity,** which are seen to be better in comparable European counties.
- Respondents also cited **anti-social behaviour as a concern**, which reflects recent data showing a marked increase in policing interventions between 2019 and 2020 (which may reflect concern about COVID-19 pandemic offences).

The responses from this consultation have been used to develop and refine the Goals and Objectives of this study, which are set out later in this Chapter.

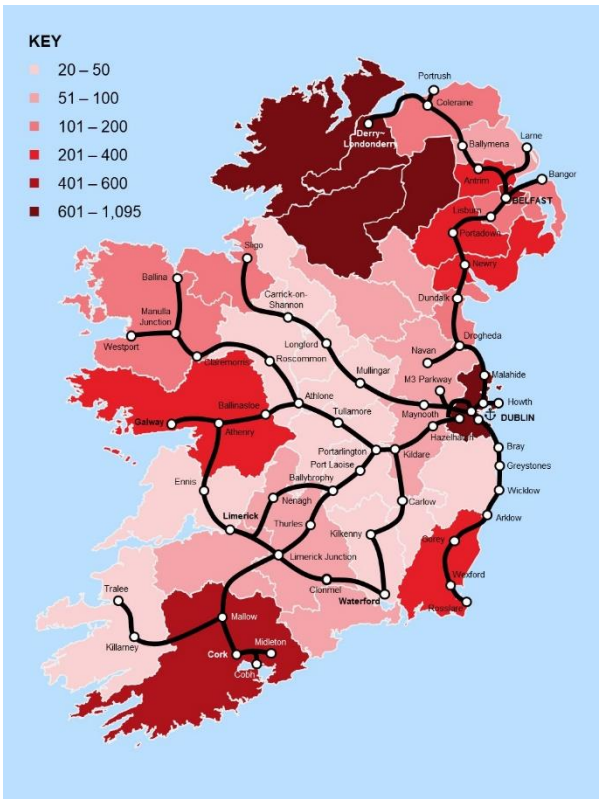


Figure 7

Consultation responses by area

SEA Public consultation

The Review held a **second public consultation** from July to September 2023. The technical remit of this consultation was to formally consult on a Draft Strategic Environmental Assessment (SEA), which was published alongside the Draft Final Report for the Review. However, a large majority of responses focused on non-SEA topics.

In total, 454 unique responses were received: 131 from stakeholders, including airports and ports, business groups, campaign groups, councils, elected officials, government, and other institutions; and 323 from the public. Of the responses that expressed a clear opinion of the Review and its recommendations, approximately 64% were favourable; 29% were unfavourable; and 7% expressed mixed sentiments. The most cited issue in the consultation, featuring in 32% of responses, was the absence of proposals to extend rail services to Enniskillen in Co. Fermanagh. Excluding responses relating to Fermanagh, approximately 74% of the remaining responses were favourable; 17% were unfavourable; and 9% were mixed. Only 2% of respondents were unsupportive of not investing more in rail. Additional feedback included requests for the Review to go further by proposing to reopen more railways and include more new stations in the recommendations. There were also requests to examine the role of tourism in boosting demand, and to make firmer commitments to delivering a more accessible railway.

The feedback from this consultation was carefully analysed and motivated the project team to commission further research – including into the potential role of tourism demand in strengthening the case for investment, as well as sensitivity tests relating to rail to Enniskillen.

The following amendments have been included in this final Report to take account of feedback from the public consultation exercise.

- A specific new recommendation to continue to invest in improving accessibility on the rail network, including rolling out step-free access more widely. The Review also commits to undertake Equality Impact Assessments when schemes are taken forward for future development.
- A new recommendation for both jurisdictions to undertake a refresh of this Review once a decade.
- The Report has been amended to clarify that the proposed new railway between Derry~Londonderry and Portadown should be designed to accommodate line speeds up to 200km/h, as was the intention in the Draft Final Report.
- The Report has been amended to reflect plans to improve connectivity to the South- East – as outlined in the latest Greater Dublin Area Transport Strategy – to include the extension of the DART network to Wicklow.
- The timeline for delivery has been adjusted to bring forward the reinstatement of the North Midlands railway between Portadown and Armagh from a long-term to a medium-term horizon.,
- Maps have been amended to include a proposed new station at Craigavon.
- Some technical wording has been adjusted to reflect the high-level nature of the Review (e.g. removing references to in-cab signalling).
- A reference has been added to the Executive Summary on safeguarding alignments identified for future railways and stations.

Further details about this public consultation are provided in **Appendix A.**

Policy context

There are strong commitments to reducing the carbon emissions associated with transport. Policies and plans at every level of government in both jurisdictions have clear aims to increase the share of passenger travel by sustainable modes: public transport, walking and cycling.

Public policy recognises that rail is well placed to address wider challenges and opportunities for the island of Ireland. As the stronger backbone of a sustainable transport system, rail can support a growing and aging population, enable housing growth and other transport orientated development, mitigate congestion in cities, and deliver more equitable outcomes for all regions and cities of the island.

Both jurisdictions are committed to investing in public transport to address the challenges the island faces. However, to unlock this investment, there needs to be a clearer route for delivery. The aim of the Review, therefore, is to provide a strategic vision for a clear route forward to policymakers in both jurisdictions.

Vision, Goals, and Objectives

This Review aims to present a coherent strategic vision for delivering a railway that meets the aspirations of the people it serves and supports the development of a prosperous, equitable, and sustainable future. The **Vision Statement** underpinning the Goals and Objectives of this Review is to deliver:

"An accessible, efficient, safe and sustainable transport system that supports communities, households and businesses."

To deliver this ambition, the Review developed six overarching Goals and 13 Objectives. These are set out in **Table 1**. The Goals and Objectives were published in November 2021 as part of the initial public consultation and were positively received by many respondents to this consultation. The Goals and Objectives have been endorsed by Steering Group members from both jurisdictions. In the following Chapter, this Report presents a set of recommendations that have been developed by the Review that, collectively, deliver the Vision, Goals, and Objectives of this Review.

Vision Statement		
To deliver an accessible, efficient, safe and sustainable transport system that supports communities, households and businesses.		
Goals		**Objectives**
Goal 1 Decarbonisation	**Contribute to decarbonisation**	• Reduce the carbon emissions associated with rail's construction, operation, and maintenance
		• Reduce the carbon emissions from motor vehicle travel
Goal 2 Intercity	**Improve connectivity between the Island's major cities**	• Provide an attractive public transport choice for travel between the seven cities of Dublin, Belfast, Cork, Limerick, Derry~Londonderry, Galway, and Waterford
Goal 3 Regional and Rural	**Enhance regional and rural accessibility**	• Give people in rural and regional areas better access to economic opportunities, and public services
		• Improve inter-regional accessibility
Goal 4 Sustainable Cities	**Encourage sustainable mobility**	• Manage demand through compact growth and better integration of public transport with land use
		• Enhance the integration of rail with other transport modes
		• Minimise negative impacts on the environment
Goal 5 Freight and Economy	**Foster economic activity**	• Contribute to balanced economic growth between urban and regional areas
		• Support the efficient movement of goods and people between economic centres and international gateways
Goal 6 Economic Feasibility	**Achieve economic and financial feasibility**	• Plan investment in rail that is financially feasible
		• Access potential funding
		• Ensure investment in rail is considered alongside meeting objectives

Table 1

Review Goals and Objectives

ARUP

Chapter 4 | Recommendations

Introduction

This Chapter presents **plausible choices** for policymakers that, together, provide a **route to achieving the Review's Goals and Objectives**. In doing so, this Chapter presents a set of **recommendations** and summarises the case for taking them forward to the next stage of development.

Consistent with the introduction to this Report, **the recommendations provided below do not represent official policy for either jurisdiction**, but aim to provide a constructive, evidence-based approach for delivering the Goals and Objectives of this Review. Furthermore, this Report does not make firm recommendations about the timing for delivering options, although a plausible Roadmap is presented in **Chapter 6**. Ultimately, it will be for policymakers in both jurisdictions to decide which of the plausible options presented in this Chapter should be taken forward at any time.

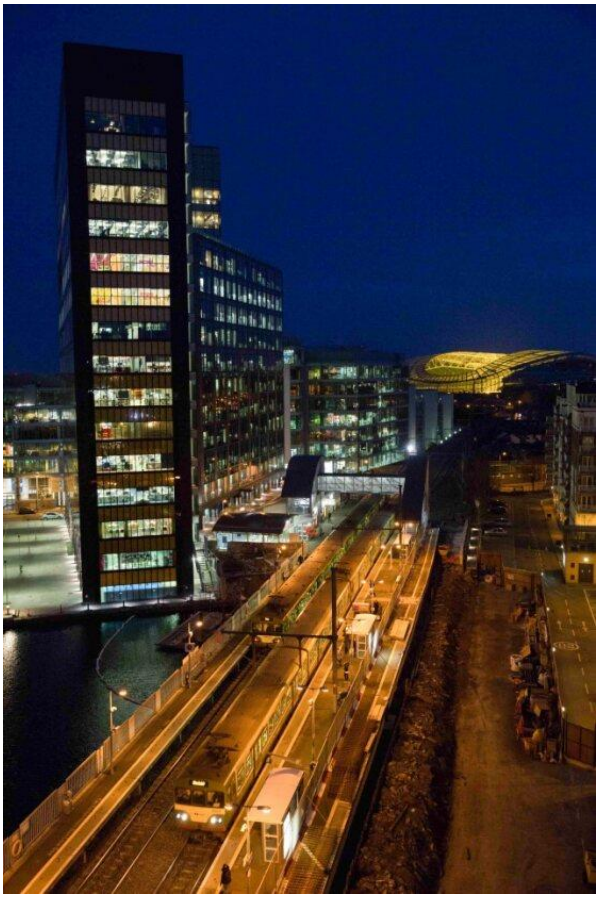
In total, the Review examined over 70 geographically specific options and assessed their feasibility, economic viability, and contribution to the Review's Goals and Objectives. Around half of these options were progressed and are presented in this Chapter.

Appendix B provides details about the process the Review followed to develop its recommendations and explains why some options were not progressed. Further details about the options that were considered but ruled out are also provided in this Appendix.

Recommendations

In this Chapter recommendations are presented by themes, which broadly align to the Review's Goals and Objectives. **Table 2** list the **32 recommendations** that are presented in this Chapter and **Figure 8** shows how a potential future railway would look in 2050 if all these recommendations were delivered.

The estimated capital, operating, and maintenance costs of the infrastructure interventions presented in this chapter are summarised in **Chapter 5.** These costs exclude recommendations relating to freight access charges and customer experience. Any option referenced in this chapter but not listed as a recommendation is not included in these cost estimates.



Statutory strategy alignment

The Review notes that the **Greater Dublin Area (GDA) Transport Strategy** has recently been adopted in accordance with Section 11 of the Dublin Transport Authority Act 2008. The Strategy sets out a statutory framework for the development of transport across the Dublin region up to 2042. The recommendations set out in this Chapter are intended, within the GDA, to represent potential additional complementary provision which could be considered for inclusion in future updates to the GDA Transport Strategy. It is acknowledged that this Strategy is the statutory plan for the development of transport within the GDA. It is intended that this Report will be an input for the next review of the GDA Transport Strategy within the next six years.

Strategic Environmental Assessment and Appropriate Assessment

A Strategic Environmental Assessment (SEA) and **Appropriate Assessment (AA)** of the All-Island Strategic Rail Review have been carried out to ensure environmental considerations have been incorporated into the Review. Any new projects or plans arising from the implementation of this Review shall be subject to appropriate feasibility, options and environmental assessments where required.

As required under Annex I of the SEA Directive (2001/42/EC), **mitigation measures** and **monitoring measures** are proposed to address potential negative effects arising from the implementation of the Review. The Directive has been transposed into Irish law under Statutory Instrument No. 436 of 2004 (the Planning and Development (Strategic Environmental Assessment) Regulations 2004), as amended; and Northern Irish law under the Environmental Assessment of Plans and Programmes Regulations (Northern Ireland) 2004.

Mitigation and monitoring measures are proposed by the SEA Environmental Report under the following environmental topics:

- Population and Human Health;
- Biodiversity;
- Land and Soils;
- Water;
- Air and Climate;
- Archaeological, Architectural and Cultural Heritage;
- Landscape and Visual;
- Material Assets; and
- Noise.

Mitigation and monitoring measures are also proposed by the Appropriate Assessment completed of the Review. All sets of measures shall be adhered to in full during the implementation of this Review.

All mitigation and monitoring measures are outlined in **Appendix C** of this Review, and in the SEA documents and Appropriate Assessment Report (Natura Impact Statement) which are published alongside this Review.

Decarbonisation recommendations

1. Develop and implement an All-Island Rail Decarbonisation Strategy that includes an electrified intercity network.
2. Develop plans to invest in the skills, supply chains, and rolling stock to deliver decarbonisation.
3. Procure hybrid and electric rolling stock in the medium term.

Intercity recommendations

4. Upgrade the cross-country rail network to a dual-track railway (and four-track in places) and increase service frequencies.
5. Upgrade the core intercity railway network to top speeds of 200km/h (125mph).
6. Develop short sections of new railways on congested corridors.
7. Develop a cross-Dublin solution.

Regional and rural recommendations

8. Provide more direct services between Ireland's West and South Coasts.
9. Ensure regional and rural lines have at least one train per two hours.
10. Increase line speeds to at least 120km/h (75mph).
11. Upgrade Limerick Junction and the Limerick Junction – Waterford line.
12. Reinstate the Western Rail Corridor railway between Claremorris and Athenry.
13. Extend the railway into Tyrone, Derry~Londonderry, and Donegal.
14. Reinstate the South Wexford Railway.
15. Develop the railway to boost connectivity in the North Midlands.
16. Integrate bus service and rail service timetables to connect communities where direct rail access proves to be unviable.

Sustainable cities recommendations

17. Connect Dublin, Belfast International, and Shannon Airport to the railway and improve existing rail-airport connections.
18. Extend double tracking in the Belfast area.
19. Segregate long-distance/fast services from stopping services.
20. Explore the case for developing new stations in the Belfast, Cork, Derry~Londonderry and Limerick – Shannon city regions.

Freight recommendations

21. Develop a sustainable solution for first-mile-last-mile rail access for Dublin Port.
22. Reduce Track Access Charges for freight.
23. Strengthen rail connectivity to the island's busiest ports.
24. Develop a network of inland terminals close to major cities on the rail network.

Customer experience recommendations

25. Continue to invest in initiatives that deliver a seamless customer journey.
26. Continue to benchmark and monitor service quality and deliver continuous improvement.
27. Ensure future rolling stock specifications are aligned to the infrastructure-led interventions outlined in this Review.
28. Invest in improving integration within rail and between rail and other transport options.
29. Deliver 'clock-face' timetable calling patterns.
30. Develop cross-border structures to improve the effectiveness of cross-border infrastructure and rail service planning.
31. Invest in a rolling programme of accessibility improvements, including step-free access.
32. Review and update the All-Island Strategic Rail Review once a decade, taking account of latest policies and developments.

Table 2

List of the Review's recommendations

Please note: This is an indicative artistic interpretation of the recommendations presented within this document. The pathways delineated on this illustration are conceptual in nature and should not be interpreted as a precise or literal depiction of potential routes or route corridors.

Figure 8

A potential future railway on the island of Ireland

Decarbonisation

Both jurisdictions on the island of Ireland are committed to achieving net-zero carbon emissions by 2050. Rail has the potential to play a major role in decarbonising the island's transport networks in two ways – by encouraging people to switch from carbon emitting modes to rail, and by reducing the emissions from the wider rail system. However, in contrast to many EU countries, the island's rail network is currently highly reliant on diesel traction. This is a challenge for both passenger and freight transport.

Decarbonising the railways will require action on construction, operations, maintenance, and renewals. The construction industry is leading on decarbonising construction, maintenance, and renewals. This Review has generally focused on decarbonising operations, although it has also considered and estimated the impact of embodied carbon arising from developing new railways.

The scope of this Review does not include developing a detailed decarbonisation strategy for the island's railways. That said, the Review has developed a plausible approach for decarbonising the island's railways by drawing on insights from Great Britain's Traction Decarbonisation Network Strategy and Denmark's Togfunden programme.

Strategic options

There is a wide range of emerging technologies under development that could, in the long term, play a significant role in delivering carbon neutral rail transport. However, if both jurisdictions are to achieve their commitments to fully decarbonise their economies by 2050, then it is imperative that action is taken now. The proposed approach to decarbonising the island's railway is therefore based on **proven, available solutions.** At the time of writing, the strategic options available for decarbonising the island's railways that appear to be most viable are:

- **Electrified railways:** Electric traction is proven, widely used, and supported by relatively strong supply chains. It can support passenger trains and freight trains over long distances, at high speed, and without refuelling. However, this option requires significant investment in infrastructure such as Over Head Line Equipment (OHLE). Ireland is currently investing heavily in expanding OHLE for the DART service in the Dublin area, which will increase the length of electrified railway from circa 50km to 150km (around 5% of the island's railway route length).
- **Battery electric trains:** Battery electric trains have been proven at a relatively small scale. These are suited to operating short distances but cannot currently support higher speed (i.e., 200km/h) passenger trains or freight trains over long distances.
- **Hydrogen powered trains**: This technology is earlier in its development cycle, but the signs are promising. Hydrogen trains have been shown to work in a live operating environment, although the economics of adopting this technology at scale are less clear. This technology could support passenger services over relatively long distances in areas with relatively easy access to hydrogen production and storage.

Based on the opportunities and limitations presented by the technological options outlined above, the Review has attempted to define which sections of the railway network are best suited to electrification, battery electric, hydrogen, and multiple options.

In general, it appears that OHLE is needed to deliver long-distance, high-speed passenger services, whereas alternative traction options may be more viable for slower and/or shorter journeys. This suggests OHLE should be considered the leading option for decarbonising corridors used by intercity services, while alternatives could be considered elsewhere. **Figure 9** shows how this approach might look if it were rolled out across the whole island.

Further considerations

There are further issues to consider, which will ultimately shape the island's approach to decarbonising the railway:

- **The island will need a green electricity grid to deliver a truly net-zero carbon railway.** The rail industry could support this process by investing in renewable power sources on their estates, switching to "green" energy providers, investing in low carbon vehicles (road, plant, and rail), and reducing the consumption of resources through moving to a circular economy.
- **Delivering electrification will take time and investment.** A rolling programme of electrification will require skills, capacity, robust supply chains, and certainty of long-term investment. Experience from overseas suggests a "stop-start" approach to electrification yields significantly higher unit costs than a steady, rolling programme.
- **Hybrid trains are likely to be needed while the network electrifies.** Hybrid trains can operate on electric and non-electric railways, whereas electric only vehicles can only operate when end-to-end routes are electrified. Most hybrid trains produced today run under diesel and electric traction, but future trains may include hydrogen traction. Ultimately, the goal should be to eliminate diesel altogether. Hybrid trains are in high demand globally, so the market should be able to provide these for the island.
- **OHLE Alternating Current (AC) voltage is desirable for high-speed operations.** The expanding DART network is powered by 1500V Direct Current (DC) OHLE and, while there are advantages in rolling out DART traction beyond Dublin, there are drawbacks to this approach. It is likely to cost more and may not deliver enough power to support 200km/h services, so it is likely that DART will operate to a different traction system to electric intercity services.

Recommendations

In summary, to achieve the decarbonisation Goals and Objectives of this Review, governments in both jurisdictions should:

1. **Develop and implement an All-Island Rail Decarbonisation Strategy that, as a minimum, includes an electrified intercity network.** This should determine which decarbonisation solutions should be adopted for each part of the railway, recommend a common set of standards to be applied across the whole island, and provide a roadmap for decarbonising the railway by 2050.
2. **Develop plans to invest in the skills, supply chains, and rolling stock to deliver decarbonisation**. This will help control the costs of what is likely to be a significant long-term investment in the island's railways.
3. **Procure hybrid and electric rolling stock in the medium term.** Given the long lead in times for the procurement and delivery of rolling stock, and its relatively long operational life, it is recommended that planning for electric and hybrid traction across the island should start soon.

The map provided in **Figure 9** provides a plausible outcome that might be delivered by this Strategy, which assumes core intercity routes would be electrified with OHLE, while regional lines could be served by hybrid solutions, such a battery and/or hydrogen operated trains.

Case Study | Hydrogen Trains

While electric and battery operated trains could play a major role in decarbonising the island of Ireland's railways, there also may be a role for hydrogen in some parts of the island, particularly on longer distance routes that serve rural areas, where the business case for investing in OHLE may be weak. There are examples of hydrogen trains in passenger use across Europe, including in Germany and Italy. An example of a hydrogen train in commercial operation – in this case Alstom's Concordia Stream Hydrogen model – is shown to the right.

A hydrogen powered passenger train (Credit: Alstom)

Figure 9

Decarbonisation interventions

Intercity Spine

The island of Ireland's current intercity passenger rail service falls significantly short of the level of service widely available in Western Europe.

- **Journey times** are often uncompetitive with car journey times on most intercity routes.
- **Service frequencies** are less than one train per hour between all seven key cities, except for Dublin – Cork.
- **Connectivity** limitations between the South/West and North/East sections of the rail network (focused on Heuston and Connolly stations) means it can be difficult to travel directly between Belfast and Derry ~ Londonderry on one side and Cork, Galway, Waterford, and Limerick on the other by rail.
- Feedback from the initial public consultation that there is an aspiration from the public to improve the **quality of service** provided by current intercity services. Some aspects of the railway that drive service quality are addressed in this section (e.g., speed and service frequency), while others are considered in the "**Customer Experience**" section below (e.g., on board experience).

Both Iarnród Éireann and Translink are investing in improving line speeds and increasing service frequencies. For example, in the relatively near future, it is envisaged that the Dublin – Belfast Enterprise service will operate hourly. However, if both jurisdictions wish to deliver a world-class passenger rail service between the largest cities on the island of Ireland, then significant interventions will be needed to improve journey times, service frequencies, and cross island connectivity.

Journey times

An attractive all-island intercity passenger rail service should deliver journey times between the island's major cities that are **materially faster than car journeys.** This suggests passenger rail intercity journeys should aim to achieve an average speed higher than average speeds achieved on the island's motorways, which have maximum speed limits between 100 – 120 km/h (62 – 75mph).

Evidence from Great Britain and Europe suggests that to achieve an average speed of 120 km/h, **intercity rail services need to operate at speeds of up to 200km/h (125mph)**. This ensures that, even when allowing for stops, waiting times, and interchange times, the railway delivers a faster journey than the car.

Significant upgrades to **signalling**, **track condition**, **level crossings**, and **rolling stock** will be needed across the island's rail network to achieve a 200km/h railway. It may be possible to deliver some of these enhancements through Iarnród Éireann and Translink's existing asset renewals programmes.

High Speed Rail

The Review has considered whether developing a new, fully segregated, 300 km/h (186mph) **high speed rail** network could be a viable proposition for the island of Ireland.

While this scenario could deliver transformational improvements in journey times between the island's largest population centres, analysis undertaken for this Review suggests the benefits of delivering this network would be significantly outweighed by the costs. Given the distance between key population centres, there are diminishing economic returns in targeting speeds above 200km/h.

Furthermore, developing a large new rail network would likely have a significant adverse impact on the natural environment and would risk generating more carbon through construction than would be offset through attracting more demand to the railways.

This is not to say new intercity railways should be ruled out – indeed, the evidence suggests a mix of online and offline improvements will be needed to deliver the Goals and Objectives of this Review.

Service frequencies

In the short term, some frequency enhancements can be delivered with existing infrastructure thanks to the planned procurement of additional rolling stock. However, to achieve a step change in frequencies and operating performance, it will be necessary to **add capacity** on sections of the rail network where there is a high level of conflict between intercity, freight and local commuter rail services. This is particularly relevant on busy sections of the railway on the approaches to Dublin and Belfast, and on single-tracked sections of the railway such as Portarlington – Athlone.

Most capacity can be delivered by building **additional track**, upgrading **junctions**, and adding **platform capacity** in some places. These improvements could be delivered in parallel with line speed improvements. In some cases, it may be easier to develop new lines rather than deliver dual or four-tracking upgrades on existing corridors, such as between Drogheda and Clongriffin.

Cross-island connectivity

In the longer term, and in line with the Review's goals of improving all-island connectivity between the major cities, consideration will be required as to the optimal solution for **cross-Dublin services**.

To better connect northern and eastern parts of the island to the South and West, the Review recommends a long-term intervention that **transforms east–west connectivity** between Heuston and the Dublin – Belfast corridor, with interchange stations in Dublin City Centre, should also be considered. The concept for an east-west tunnel in Dublin has been studied extensively in the past, largely in the context of an expanding DART or Dublin mass transit system. It has been cited in several strategic documents in the past by both the National Transport Authority and Iarnród Éireann.

The development of such a solution will obviously need to be aligned with the development of the rail network within the Greater Dublin Area generally. The Transport Strategy for the Greater Dublin Area 2022 to 2042 proposes to protect and preserve an alignment for a cross-Dublin tunnel for delivery post 2042, and it is recommended that any such proposal considers fully the implications of this Review for the tunnel's alignment, functionality, and delivery.

Considering this context, this Review encourages policymakers to consider whether this intervention could support longer distance services such as direct services between the island's largest cities (e.g., Belfast – Cork) and Dublin Airport (e.g., Cork – Dublin Airport), as well as medium distance commuter services (serving stations as far out as Athlone, Portlaoise, Kilkenny and Drogheda). A future east-west tunnel would almost certainly include interchange stations with the planned MetroLink underground line and DART network. In addition to boosting connectivity across Dublin, this intervention would help relieve pressure at terminus stations at Connolly and Heuston and stimulate development and regeneration in the areas served by new underground stations.

Recommendations

The Review has considered the costs and benefits of potential solutions to the alignment and capacity constraints outlined above, as well as their impact on the environment. This work has informed the recommendations set out below.

In summary, to deliver a world-class all-island intercity railway that meets the Goals and Objectives of this Review, governments in both jurisdictions should develop plans to:

4 **Upgrade the cross-country rail network to a dual-track railway (and four-tracks in places) and increase intercity service frequencies**.

This would involve dual-tracking the railway between Portarlington – Athlone, Kildare – Kilkenny, and Maynooth – Mullingar and four-tracking Connolly/Spencer Dock – Clongriffin.

In addition to enabling higher frequency intercity services on these corridors, these improvements would allow more commuter services to serve intermediate stations and thus enable intercity services to deliver faster city-to-city journey times.

5 **Upgrade the core intercity railway network to line speeds of up to 200km/h (125mph) by:**

- Upgrading the condition and strength of straight sections of track.
- Realigning some sections of the railway where steep curves and level crossings currently force trains to reduce speeds.
- Providing capacity to segregate intercity and regional services from other services on busier sections of the railway, which could include loops on busy sections to accommodate growth while longer term solutions are developed.
- Upgrading signalling and rolling stock – which could be delivered incrementally as part of a wider renewals programme.

Recommendations (Continued)

6 **Develop short sections of new railways on congested corridors.** There are three sections of the network that are likely to require a four-tracking or new rail alignment solution to accommodate conflicting demands for capacity and deliver a 200 km/h railway. These three sections are:

- **Belfast – Lisburn – Newry:** The existing railway between Newry and Belfast has significant constraints due to its alignment, level crossings, and limited space to add capacity between Lisburn and Belfast. A new railway could deliver significant journey time and capacity benefits for this corridor.
- **Dublin – Drogheda:** This railway is expected to become busier when the DART network is extended to Drogheda MacBride. While it is probably technically feasible to four-track this railway – notably between Connolly and Malahide – four-tracking some sections may result in a significant adverse effect on the integrity of several Special Protection Areas and potentially the waterfronts of Malahide and Balbriggan. An alternative approach could be to build a new railway from Drogheda to Clongriffin following the M1 corridor. This railway would be shorter than a four-tracked solution, deliver faster journey times, require fewer significant crossings, require less land and property acquisition, generate less disruption to existing services during construction, and would have a more limited impact on the environment.
- **Portarlington/Kildare – Hazelhatch:** This railway is also expected to become busy as the commuter market to the South West of Dublin grows. It should be feasible to four-track the corridor as far as Portarlington but doing so would have some impact on towns on the route and would involve building tracks through the Curragh. An alternative option could be to build a new alignment from Hazelhatch to Portarlington (with a spur to the Waterford line) that avoids the Curragh. This route would be shorter and could deliver faster journeys.

7 **Develop a cross-Dublin solution**. An east-west railway from Heuston to Spencer Dock could deliver transformational improvements in cross-island connectivity if combined with improvements north of Connolly.

A map illustrating the interventions that are likely needed to deliver a fast, frequent, and high-quality intercity railway service is shown in Figure 10.

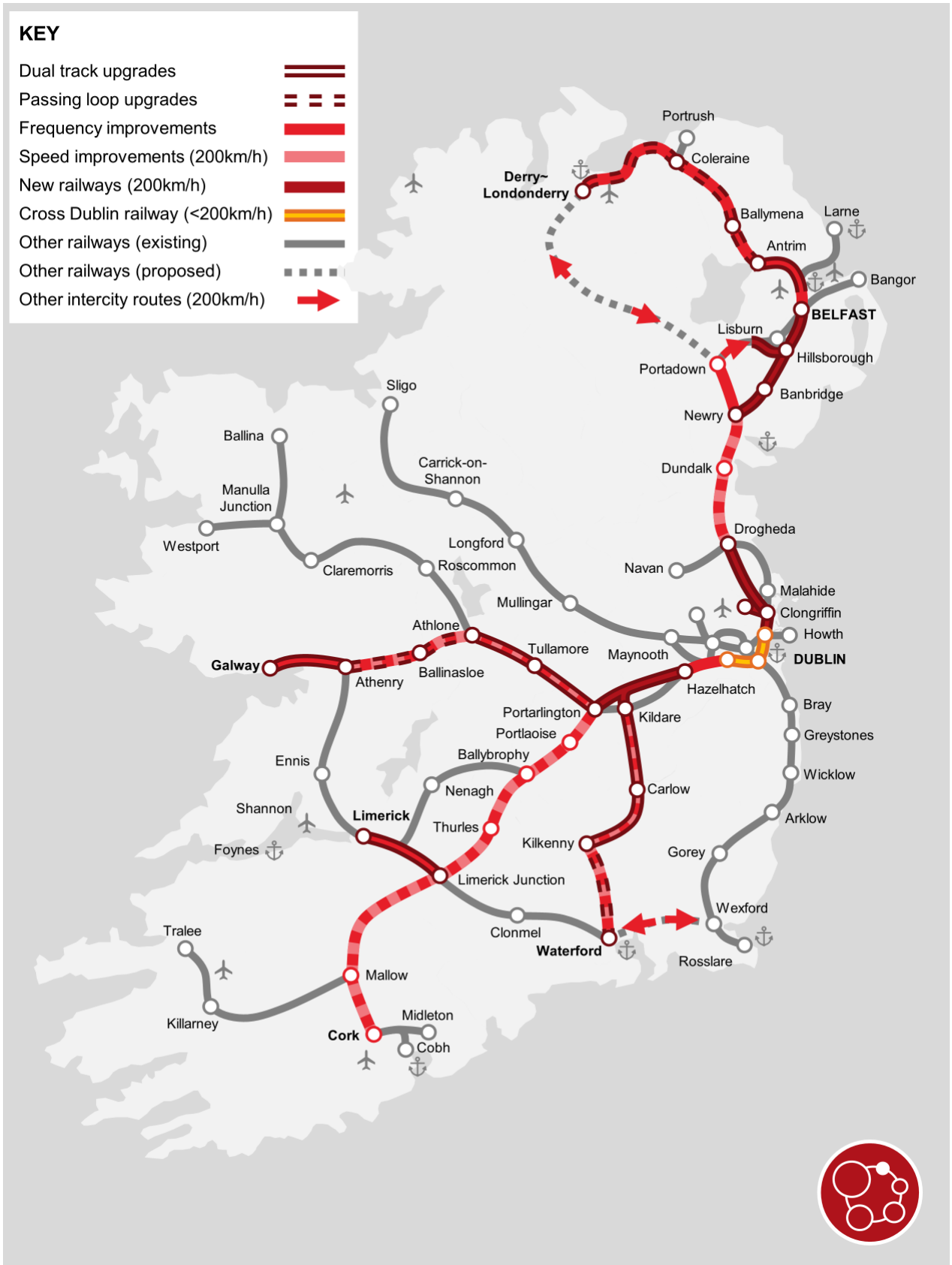


Figure 10

Intercity network interventions

Case Study | Denmark

Denmark shares many similarities with Ireland. It has a similar population size, and its economic geography is highly centred on a large metropolitan area on the eastern side of a large island. Denmark held a strategic review of its railway in 2006 and identified similar challenges that the island's railways face today, including:

- Low levels of electrification;
- Capacity constraints, especially on main lines into the capital city;
- Conflicts between intercity, regional, suburban, and freight services; and
- Speed restrictions and poor alignments, resulting in relatively slow journeys.

To achieve a modern railway, Denmark developed, and has started to implement, a new plan, Togfonden DK (Train Fund Denmark) since 2014.

Most of the funds in Togfonden DK are used for large investments in new and faster rail connections, including faster travel times on most regional lines, an upgrade to support transport of rail freight, and extensive electrification of the network.

Several upgrades to the railway network have since been planned and completed to reduce journey times between major cities in the country and the achievement of a concept called the Hour Model.

This aims to reduce travel time to under one hour between each major city pair, increase the accessibility of regional cities, and enable them to play a stronger role in the economy.

This programme of investment has included delivering Denmark's first high-speed railway line, which runs between Copenhagen and Ringsted on the route to Odense and was completed in 2018. This line relieves congestion on busy commuter routes on the key corridor from the west of the country to Copenhagen. Further investments in high speed railways from Odense to Aarhus to Aalborg are planned.

Today, Denmark's railway delivers average speeds between its major cities that, in some cases, are twice as fast as current speeds between major cities on the island of Ireland. Denmark has achieved these improvements largely through investing in the existing network, with one short section of new railway on a congested corridor.

Economic assessment indicates that – based on future projections – the "Hour Model" will be a profitable project. The investment in rail infrastructure improvements have been forecast to have a Net Present Value of between DKK 11bn and DKK 7.6bn (€1.5bn/£1.3bn - €1bn/£0.8bn) for New Construction Budgeting surcharges of 10% and 50% respectively. This project will also help improve agglomeration between Denmark's key cities, and boost productivity nationwide.

This case study illustrates the benefits that a faster, higher capacity intercity rail provides for a country with similar socioeconomic and geographical characteristics to the island of Ireland.

Regional and Rural

The island of Ireland's railway network today is approximately half of its size at its peak. The decommissioning of railways around the mid part of the 20th century cut some rural communities off from the rail network. Additionally, **interregional connectivity is poor** in many places, especially in border areas.

It is clear from responses to the initial public consultation that **there is significant stakeholder interest in restoring abandoned railways** and improving connectivity in poorly served areas of the island, particularly in the North West and South East. Public policy in both jurisdictions is increasingly recognising the need to rebalance the economy away from Dublin and Belfast to enable all parts of the island to prosper.

Approach

The Review has considered options to:

- **Connect as many towns with populations of 10,000 or more to the rail network as possible**. These towns (including some in city regions that are out of the scope of this Review) are shown in Figure 11. A threshold of towns with a population of 10,000 was chosen as this is the threshold used by Ireland's National Planning Framework as a definition of a "large town" and is the threshold used by Northern Ireland's Statistics and Research Agency as the definition of a "medium town".
- **Directly connect each of the regions of the island of Ireland**. These were defined in the "Work Package 1: Context and Policy" Report and are shown in **Figure 11**.
- **Improve intraregional connectivity**. There are several "missing links" within the regions that could support important inter and intra-regional journeys (also shown in **Figure 11**).

To achieve the aims outlined above, the Review examined options for reinstating former railways and building new railways across the whole island of Ireland. The Review sifted these options and grouped them into four geographical regions:

- **Northern Ireland**;
- **West Coast**;
- **South Coast**; and
- **North Midlands**.

Short listed options were then assessed (as “packages”), costed, and appraised against the Review’s Goals and Objectives. Some options were found to be unviable because:

- **They would not attract enough demand** (within the Review’s horizon up to 2050) to justify having a regular passenger rail service. In many cases, lower cost public transport options such as buses and coaches may provide a better service than a highly infrequent rail service.
- **They would be highly costly to deliver**. This is especially the case for potential rail routes that cut through challenging terrain (which is common in coastal areas around the island).
- Linked to the cost, **they would have a significant adverse impact on the natural environment**. As an example, the Review considered multiple opportunities for boosting connectivity in the North West of the island but ruled out options that would cut through the Sperrins Area of Outstanding Natural Beauty.
- The Review’s assessment of the carbon impact of some packages of interventions found that some options might generate **more carbon emissions** through their construction than would be offset through attracting more people to the railway from less sustainable travel options.
- **They do not align with local planning policy**. The Review has not taken forward options to develop new railways that contradict the National Transport Authority’s metropolitan strategies, Northern Ireland Executive policies, or on alignments that local authorities consider to be better suited to alternative modes.

A full list of the options that were considered, along with rationale for why some were taken forward and why others were not, is provided in **Appendix B**. The options recommended for further study are discussed in more detail below.

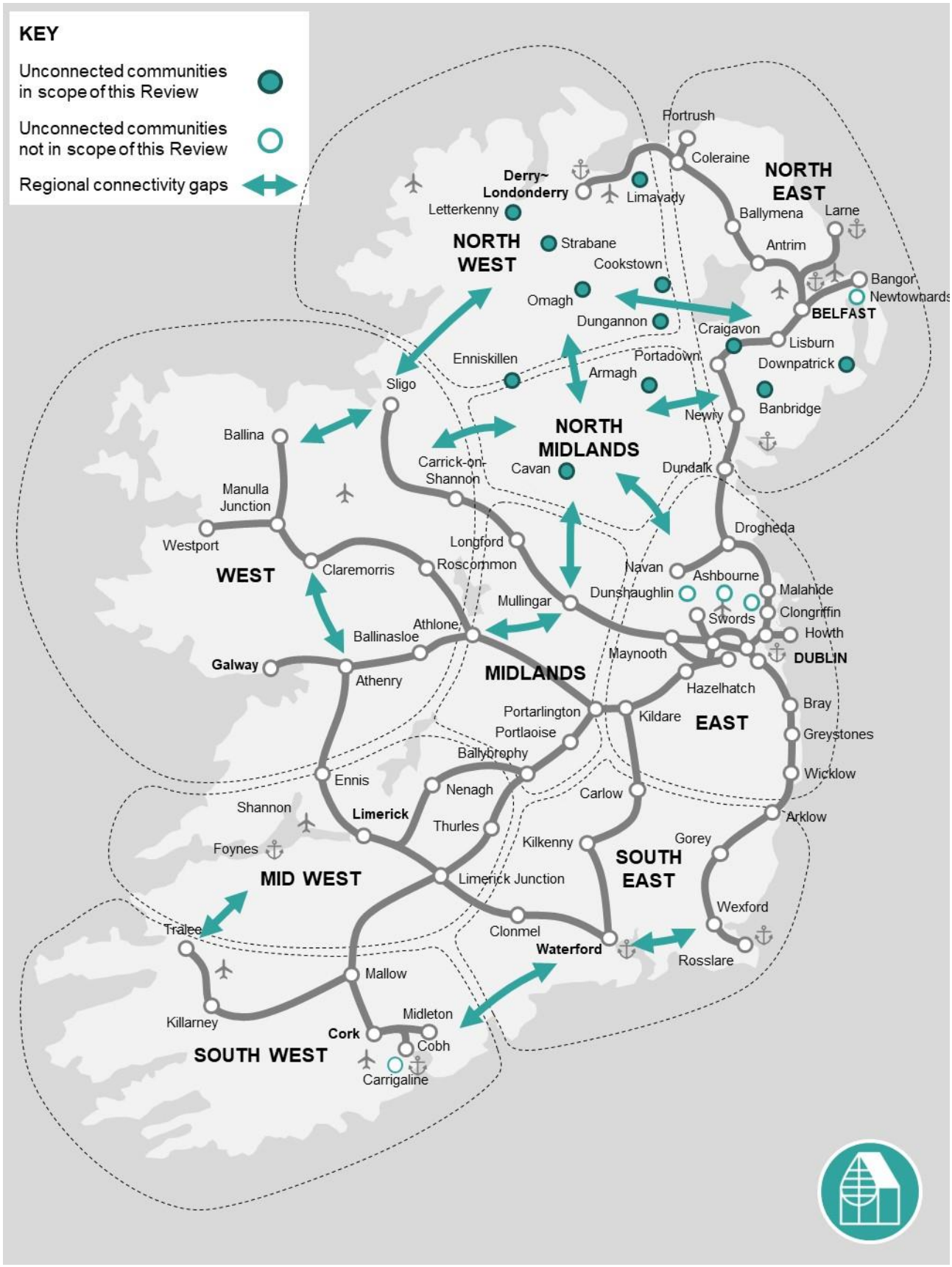


Figure 11

Regional and rural connectivity challenges

Northern Ireland

The railway network in Northern Ireland is centred on Belfast and is mostly confined to the area east of the River Bann. Service patterns are reasonably frequent in the core of the network, with half hourly services all day on lines connecting Belfast with Portadown, Bangor, and Whitehead and hourly services to Derry~Londonderry, Portrush, and Larne. Enterprise services between Belfast and Dublin run around once per two hours.

The existing network has several constraints, which reduce the quality of service. None of the network is electrified and large portions are single track, particularly the lines from Whiteabbey to Derry~Londonderry and Downshire to Larne along with the Dargan Bridge in Belfast. Level crossings in places such as Lurgan and poor alignments such as the line between Portadown and Newry limit speeds and capacity. Online upgrades are very challenging on some existing alignments, such as the coastal route between Derry~Londonderry and Coleraine. Congestion on routes into Belfast and Dublin also limits the speed and frequency of the Enterprise service between the island's two largest cities.

In addition to constraints on the existing network, its sparseness leaves many large settlements entirely unserved by rail. The west of Northern Ireland was one of the areas worst affected by rail closures in the mid-twentieth century, and large settlements such as Armagh, Cookstown, Dungannon, Enniskillen, Omagh, and Strabane have had no rail services for decades. There are also large towns further east with no rail access despite their proximity to Belfast, mostly in County Down including Banbridge, Downpatrick, and Newtownards.

Given the large gaps in the existing network, and the number of large settlements currently unserved, there are many opportunities to enhance and grow the rail network in Northern Ireland. The Review has considered improved intercity connections for Belfast and Derry~Londonderry, both between the two cities themselves and onwards to Dublin and Galway. Many regional and rural lines have also been considered that reconnect larger settlements and restore regional links to the Midlands and the West of Ireland.

Some of the options considered were found to have limited viability for rail services within the horizon of the review. Physical constraints ruled out some options, such as the Sperrin Mountains ruling out Cookstown as a stop on a service from Derry~Londonderry to either Belfast or Dublin. In other cases, remoteness from population centres was the major factor, particularly for routes serving Enniskillen where anticipated travel demand is unlikely to justify the cost of delivering rail services at this time.

Rail services to locations such as Newtownards would function as commuter links to Belfast and thus fell outside the scope of the Review. Future Local and Regional Transport Plans could consider how Belfast's public transport network can better serve these places.

The Review has identified several opportunities in Northern Ireland where rail is well-placed to improve connectivity.

These opportunities include:

- **Restoring the rail line between Derry ~ Londonderry and Portadown.** This would link the large towns of Strabane, Omagh, and Dungannon to the rail network and greatly improve intercity connectivity between Derry~Londonderry and both Dublin and Belfast.
- **Reinstating the railway from Portadown to Armagh, Cavan, and Mullingar.** This would reconnect many towns to the network and boost connectivity between Northern Ireland, the Midlands, and the West.
- **Building a new direct line between Lisburn and Newry,** together with a tunnel from Adelaide to the Lisburn area. This would improve journey times and deliver much needed capacity on the Belfast-Dublin route, while also providing rail services to Banbridge and Dromore.
- **Electrifying much of the network**, which would contribute to decarbonisation and improve journey times on existing lines.
- **Integrating bus and rail ticketing and timetabling.** This would enable people in areas without direct rail services, such as Enniskillen, to seamlessly connect with the rail network for longer journeys.

West Coast

While many of the larger settlements along the west coast of Ireland are served by the railway network, these are along three distinct lines linking Galway, Westport/Ballina, and Sligo to Dublin without direct services between the main settlements in the region. Links to other regions are also limited, with the line linking Athenry to Limerick the only one that does not run to Dublin. Service frequencies are fairly low, with only between five and nine services per weekday in each direction. The region is the source of much of the island's existing freight on the routes from Ballina and Westport to Waterford and Dublin.

Further to the north there have been no rail services in County Donegal since the mid-twentieth century, although the county once had an extensive network – albeit narrow gauge rather than Irish gauge. The Western Rail Corridor connecting Limerick to Sligo, which was closed to scheduled passenger services in the 1960s and 1970s, had been expected to reopen as far north as Claremorris in the 2007-2013 National Development Plan. However, with the onset of the 2008 financial crisis, only the section between Ennis and Athenry was completed.

The Review has considered several options to improve connectivity both within the region and to and from adjacent regions. These have included increasing frequencies to a minimum of once per two hours on all routes, and hourly or better on many lines. Targeted speed improvements and double tracking between Athenry and Galway have also been evaluated.

Many new lines have been assessed, including routes linking Derry~Londonderry to Sligo via Letterkenny, Sligo to Galway via Claremorris, and Sligo to Enniskillen and onwards to Portadown and Belfast via either Clones or Omagh.

Given the relatively low population density and lack of larger towns across the region, the Review has found that expansion of rail is difficult to justify in much of the region within the horizon of the Review. Furthermore, there is challenging terrain in many parts of the region – for instance, a line between Sligo and Derry-Londonderry would require complex crossings of the River Garavogue and River Erne and then a route through the Barnesmore Gap. The relatively low level of anticipated demand suggests that rail is not the appropriate solution to improve connectivity along many of the routes assessed.

While many options for developing new railways in the region are unlikely to be viable within the horizon of this Review, the Review has identified several interventions that could have potential.

These interventions include:

- **Improving services between Galway and Dublin, Limerick, Cork and Waterford** – together with double tracking between Athenry and Galway.
- **Improving service frequencies between key Mayo towns and Athlone** by building more passing loops on this corridor.
- **Restoring the rail line between Athenry and Claremorris**. This would be particularly beneficial for freight, allowing a direct route for freight from Ballina and Westport to ports on the South Coast that avoid the most congested part of the rail network around Dublin. This would also reconnect Tuam to the railway and enable direct services between Galway and Mayo.
- **Developing a new rail link from Letterkenny to Derry~Londonderry**. This would connect the major urban centres of the North West to each other and greatly improve access to Belfast and Dublin.

South Coast

While the South West of Ireland has relatively good connectivity to Dublin, the South East is more isolated, and connectivity between the South Coast cities of Cork and Waterford is poor.

The South East of Ireland is connected to the railway by a largely single-track railway that runs south of Dublin to Rosslare Europort via Wexford. The railway is intensely used by the DART service between Dublin and Greystones. Between Greystones and Rosslare Europort, however, the railway is lightly used by passenger services (around 4 – 5 trains per day each direction). The towns of Wicklow, Arklow, Gorey, Enniscorthy, and Wexford, as well as Rosslare Harbour, are therefore poorly served by rail. Journey times from Rosslare Europort to Dublin are currently around 3 hours.

Rail connectivity in the South East has declined in recent years with the closure of the South Wexford Railway in 2010. Furthermore, the line from Waterford to Limerick Junction has only two services per day per direction and has many speed restrictions, hampering connections to Limerick and Cork.

There are several constraints that make it challenging to improve passenger and freight access to the South East. Much of the railway is single track, limiting opportunities to increase service frequencies. Rail alignments are poor, limiting opportunities to increase speeds.

There are also significant conflicts with DART services, particularly between Dublin and Greystones, and there are significant geographical constraints limiting potential diversions (e.g., Bray Head).

Despite these challenges, there are opportunities for growing the role of rail in this region. Over 300,000 people live in County Wexford and County Wicklow, and Rosslare Europort is growing following changes to trading arrangements between Ireland, the UK, and the European Union.

The Review has considered interventions to enable faster and more frequent journeys between Rosslare Europort and Dublin, including adding passing loops, tunnelling through Bray Head, developing a new railway along the M11 corridor, and building a new line for DART services along the N11 corridor. A more direct route between Cork and Waterford was also considered but found to be impractical due to the geography of this corridor.

Many of these solutions would be very costly and are unlikely to be justifiable as most railways in this region would not be expected to support more than one or two trains per hour in each direction.

It appears that the best way forward for boosting connectivity in the South East of Ireland in the shorter term is to introduce an hourly shuttle service between Wexford and Greystones, with DART services to be extended to Wicklow.

Connectivity could be further improved by reinstating the railway between Waterford and Rosslare (including a chord/curve to the south of Wexford) and extending some Dublin – Waterford intercity services to a new station to the south of Wexford O'Hanrahan once the line between Heuston and Waterford has been upgraded. With improvements to the intercity corridors described above, this would reduce journey times between Dublin and Wexford by around an hour. This intervention would also support further development of freight services to and from Rosslare Europort.

A map of these proposals is shown in **Figure 12**.

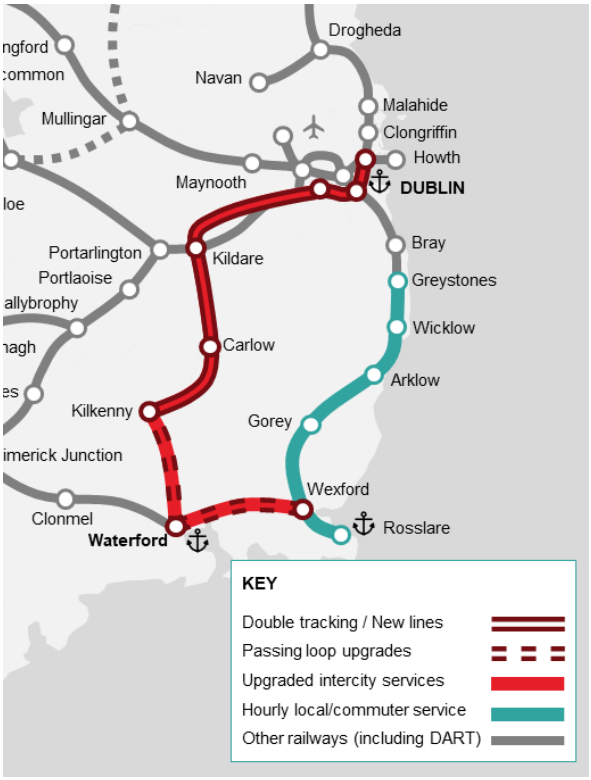


Figure 12

South East Ireland

Improving the Waterford to Limerick Junction line would also improve connectivity between the South East and cities to the South and West. This railway could deliver significant benefits for freight services, which could access the North West without needing to pass through Dublin or turn back at Kildare.

Furthermore, installing a curve at Limerick Junction would enable trains to leave the Cork – Dublin line and join the Limerick – Waterford line, which would boost passenger rail connectivity between Cork and Waterford.

North Midlands

Bisected by the border, the North Midlands region is centred on parts of counties Armagh, Cavan, Fermanagh, and Monaghan. It saw large scale closures to its rail network in the mid-twentieth century and today is entirely unserved by rail. This is despite the region containing several large towns that are relatively close to the two largest cities on the island – Dublin and Belfast.

The Review considered the potential of rail to serve several functions within the region. One of these would be to connect communities within the region to each other and to their nearest major cities of Belfast, Dublin, and Galway. Public transport and road connections within the region are often poor compared to other parts of the island which impacts on its economic competitiveness. Large settlements such as Armagh and Cavan are within the commuting catchment of Belfast and Dublin and restored rail links would have a beneficial impact on access to employment, third level education, healthcare, and international gateways.

Given its central location, restored rail links through the region would also help integrate other regions across the island. The Review considered direct services from Belfast to Galway that would link the West and North East to each other in addition to connecting the communities along the way. Lines through the region would also deliver alternative freight paths to Northern Ireland that avoid the most congested parts of the network around Dublin, improving the reliability of both passenger and freight services across the network.

The Review has found that while anticipated demand (within the Review's horizon) fell below the threshold for rail on some routes, such as from Clones to Sligo via Enniskillen, there is potential for rail in certain parts of the region. While through services from Belfast to Galway were not found to generate high demand, demand towards Dublin and between Armagh and Belfast was sufficient to support rail services. Combined with the restoration of rail services on the line between Mullingar and Athlone this line would greatly increase inter-regional accessibility across the northern half of the island.

Recommendations

To deliver the regional and rural Goals and Objectives of this Review, both governments should develop plans to develop the interventions shown in **Figure 13** and listed below:

8 **Provide more direct services between Ireland's West and South Coasts** – e.g., between Galway, Limerick, and Cork.

9 **Ensure regional and rural lines have at least one train per two hours** (at regular times) – and hourly services between Galway, Limerick, Cork, and Waterford.

10 **Increase line speeds to at least 120km/h (75mph)** – this would deliver significant benefits for communities across the island.

11 **Upgrade Limerick Junction and the Limerick Junction – Waterford line**. This will support freight services between the South Coast ports, Foynes, and the North West. With a chord at Limerick Junction, it will support direct Cork – Waterford services.

12 **Reinstate the Western Rail Corridor railway between Claremorris and Athenry**. This will support freight and regional connectivity objectives in the West of Ireland.

13 **Extend the railway into Tyrone, Derry~Londonderry, and Donegal**. Reinstating the railway between Portadown, Dungannon, Omagh, Strabane, Derry~Londonderry, and Letterkenny would connect the railway to many communities and support direct services between Dublin, Belfast, Derry~Londonderry, and Letterkenny.

14 **Reinstate the South Wexford Railway** to boost connectivity in the South East.

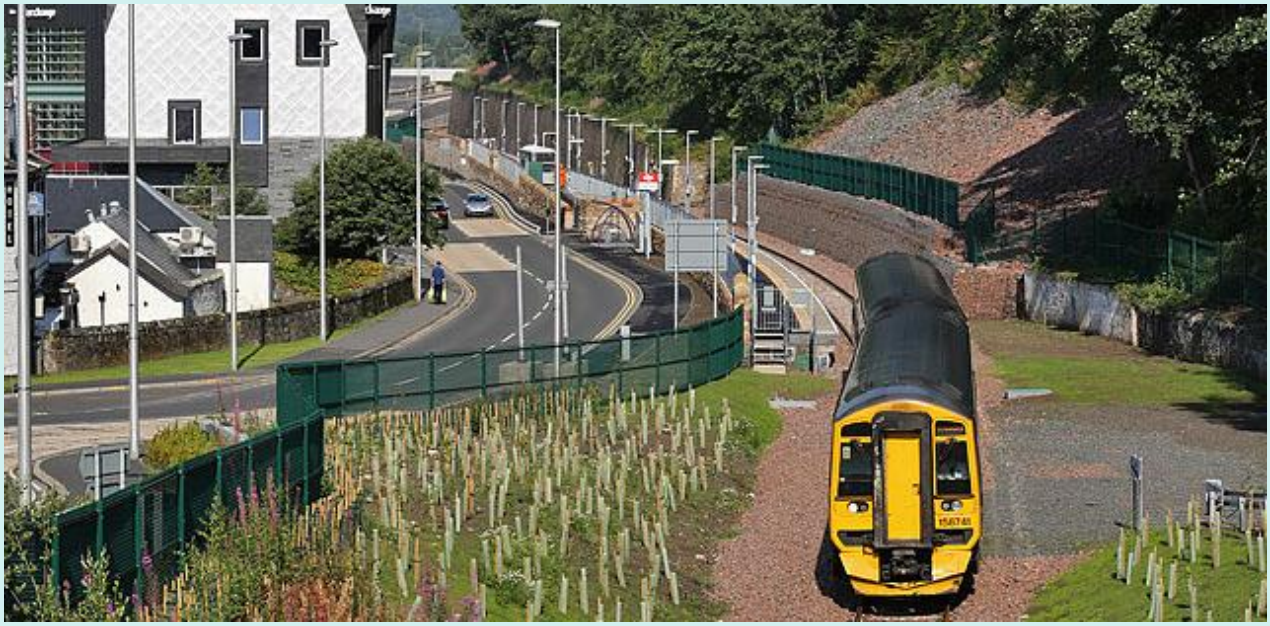
15 **Develop the railway to boost connectivity in the North Midlands**. Reinstating the railway between Portadown, Cavan, Mullingar, and Athlone would address several regional connectivity gaps. Building a new link between Maynooth and Adamstown and dualling the railway to Mullingar would also add capacity to support services to this region.

16 **Integrate bus service and rail service timetables to connect communities where direct rail access is unviable** – bus services can help new railways boost public transport connectivity to places like Donegal, Enniskillen, Cookstown, and Downpatrick.

Figure 13

Regional and rural interventions

Case study | Scottish Borders Railway



The Borders Railway at Galashiels (Photo: Walter Baxter, Creative Commons)

The Borders Railway serves a north-south corridor in the South East of Scotland connecting the city centre of Edinburgh with settlements to the South East of the city, Midlothian, and the Borders. The corridor runs c. 50km from Edinburgh City Centre to the village of Tweedbank in the Borders. This railway was closed in 1969 and partially reopened in September 2015.

The Business Case for reinstating this railway was borderline (at best), and the Final Business Case reported a Benefit to Cost Ratio of 0.5 – 0.7 in 2012. The railway specification was limited to an unelectrified, single-track railway, reflecting relatively cautious demand forecasts.

In reality, demand for the Borders Railway far exceeded expectations. It became so popular that the annual return journey demand in the first year alone was 75% greater than estimated in the Business Case, which assumed just under 650,000 passengers would use the railway in its first year of operation. This grew to 1.7 million journeys in 2018/19.

This demand has exposed the 'basic' infrastructure and caused overcrowding which would not have been an issue had actual demand mirrored the forecasted demand. While high demand should be seen as a success, the failure to anticipate this demand has meant that the Borders Railway has effectively capped its capacity. Some of the constraints built into the infrastructure also presents long-term challenges in decarbonising the railway.

The good news is that, despite some of the challenges presented by infrastructure capacity constraints, it has been possible to increase service frequencies to two trains per hour during peak hours. There are also long-standing plans to extend the railway across the border to Carlisle, which would enable the railway to take on a greater role as an inter-regional railway.

It is a difficult balance to strike between future proofing infrastructure and minimising exposure to perceived gold-plating. In this sense, the borders railway offers a cautionary tale for pessimists.

Sustainable Cities

Several cities across the island of Ireland are developing **significant improvements** to public transport services. These improvements cut across multiple modes of transport and are underpinned by city and regional strategies that take a holistic approach to journeys in their areas.

Plans for **multi-billion Euro improvements to public transport services** in the island's largest cities are taken as committed and are fully supported by the Review. While the scope of the Review does not include detailed proposals for commuter and urban rail services on the island, the Review indicates how the all-island interventions recommended by this Review can support plans to improve these services.

There is **significant alignment** between the Goals and Objectives of this Review and the ambitions of the island's largest cities – as set out in the National Transport Authority's Metropolitan Transport Strategies for the Greater Dublin Area, Cork, and Limerick-Shannon Area, as well as the Department for Infrastructure's Eastern Area Transport Plan. For example, the DART+ Programme in Dublin and planned new stations in the Belfast area should help grow the attractiveness of rail, which, in turn, should boost demand for intercity services. That said, there may be **competition for capacity** between intercity, freight, urban, and commuter rail services. This Review has therefore considered where conflicts might arise between different services and proposes plausible solutions to address these potential conflicts.

This section describes the key considerations and recommendations that have been developed to ensure this Review supports the ambitions of cities in both jurisdictions. In particular, it highlights how interventions developed in support of this Review's wider all-island Goals and Objectives can help the island's cities improve their urban and wider commuter rail networks.

Additionally, this section considers opportunities to better connect the island's railway to three of its **busiest international airports** (Dublin, Belfast International, and Shannon).

Dublin

As noted in the introduction to this Chapter, the **Greater Dublin Area (GDA) Transport Strategy** sets out a statutory framework for the development of transport across the Dublin region up to 2042. The recommendations set out below represent potential additional complementary provision which could be considered for inclusion in future updates to the GDA Transport Strategy.

In line with this Transport Strategy, the National Transport Authority and Iarnród Éireann are currently delivering an ambitious **DART+ Programme**, which will expand DART beyond its current coastal corridor to the North, West, and South West of the GDA. This will include increasing service frequencies on several lines, including Dublin Connolly – Maynooth, Connolly – Drogheda, and Heuston – Hazelhatch. To support the development of higher frequency DART services, there will likely be a need to segregate DART services from others – particularly intercity and freight. This is especially the case if the future heavy rail network of Ireland is driven by different OHLE traction than the 1.5kV DC DART system.

The recommendations included in this Review that would support this objective include:

- Developing a long-term solution to the bottleneck between **Connolly – Drogheda**.
- Providing a new link between **Adamstown – Maynooth** to enable Sligo services to be diverted away from the DART West route and to enable DART to eventually extend commuter services to **Navan**.
- **Routing longer-distance services** to the South East via an improved railway between Kildare and Waterford and a reinstated rail link between Waterford and Wexford.
- Delivering a **transformational, east-west, cross-Dublin rail link** between Heuston and the Northern Line.

Belfast

The Greater Belfast Area has benefitted from significant investment in public transport in recent years. A new major transport hub is being delivered at **Belfast Grand Central**, and there are plans to expand the city's successful Glider mass transit system.

In the relatively near future, Translink and the Department for Infrastructure are planning to deliver a new station to the west of Lisburn. Other potential interventions – some of which have been described above – that would boost the attractiveness of rail in Belfast include:

- Developing a new railway between **Adelaide and the Lisburn area** to deconflict intercity and local services.
- Reinstating the railway between **Lisburn – Antrim** with a station at **Belfast International Airport.**
- **Developing new stations** at Templepatrick/ Ballymartin, Lisburn West, Craigavon, and potentially elsewhere on the network.
- Improving connectivity between Sydenham station and **George Best Belfast City Airport**.

Derry~Londonderry

The development of a new railway between Portadown and Derry~Londonderry could free up additional capacity on the existing Coleraine route and enable **separate suburban and inter-city services** on these two corridors.

Improvements to suburban services could include building a spur to and station at **Limavady** and building new stations at places such as Ballykelly.

Cork

Cork is currently served by a commuter service that provides a two-train per hour service between Cork Kent, Midleton, and Cobh. There are **proposals to electrify and expand the Cork suburban network** to serve several new stations and improve frequencies on all branches. Phase 1 of Cork's commuter rail programme, which is ongoing, will deliver capacity improvements in the area. The **Cork Metropolitan Area Transport Strategy** includes proposals for a **tram route** between Mahon and Ballincollig, which in the longer term could extend south to Cork Airport and Carrigaline.

Limerick

Currently, there are limited local rail services in the Limerick area. However, the configuration of the railway here, as well as committed plans to **reinstate the railway to Foynes**, could open-up opportunities to develop a **suburban rail service** to serve local journeys. Options for developing local rail services in this area are set out in the **Limerick Shannon Metropolitan Area Transport Strategy** and include developing stations between Foynes – Limerick – Sixmilebridge and extending the railway to Mungret and **Shannon Airport**.

Galway and Waterford

While Galway and Waterford do not have specific urban rail services, many of the recommendations in this Review will support sustainable mobility in these cities and enable them to deliver their respective Metropolitan Area Transport Strategies.

Airports

Four of the five busiest airports on the island of Ireland (based on 2019, pre-pandemic patronage data**) are not connected to the rail network.** This includes the busiest airport in Ireland – Dublin – which is the busiest airport in Europe to lack a rail or metro/light rail connection. Several committed schemes and intervention options outlined in this Chapter identify opportunities to improve airport connectivity. Committed and proposed interventions include:

- Plans to connect **Dublin Airport to Dublin** via a new MetroLink line.
- As discussed above, proposals to connect **Belfast International Airport** through reinstating the Lisburn – Antrim railway.

Additionally, this Review has considered options to improve airport connectivity by:

- **Directly connecting Dublin Airport to the inter-urban rail network.** Several options have been considered for connecting the island's busiest airport to the inter-urban railway, including building a direct link from the Northern Line.

  A direct link could be combined with the proposed cross-Dublin tunnel to enable direct journeys between the Airport and places beyond Dublin, including Cork, Limerick, Galway (and potentially Northern Ireland with a change at Clongriffin). This aims to complement the MetroLink project, which will connect the Dublin Airport to Dublin City Centre.
- Building a spur from Limerick to **Shannon Airport**.
- Improving connectivity between Sydenham and **George Best Belfast City Airport**.

Recommendations

In support of wider policies and strategies for urban railways in the island's largest cities, both jurisdictions should develop plans shown in **Figure 14** and described below to:

17 Connect Dublin, Belfast, and Shannon airports to the railway by.

- **Building a spur from Clongriffin to Dublin Airport**. This intervention, which aims to complement the planned MetroLink project in Dublin, would enable intercity and other longer-distance services to directly access Ireland's busiest airport. With the proposed cross-Dublin tunnel outlined in the intercity section above, this intervention could connect places like Cork and Galway to Dublin Airport.
- **Reinstating the railway between Lisburn and Antrim**. This would enable Belfast International Airport to be connected to the railway network.
- Improving existing rail-airport connections at **George Best Belfast City Airport**.
- **Building a spur from Sixmilebridge or Cratloe to Shannon Airport**. This intervention could include developing new stations between the airport and Limerick to be served by a new urban rail service centred on Limerick.

18 **Extend double tracking in the Belfast area**. The section of railway between Antrim and Monkstown would need to be dualled to enable more frequent local services to the North and East of Belfast.

19 **Segregate long-distance/fast services from stopping services**. This can be achieved by delivering a four-track railway on the approaches to Dublin Heuston and Connolly, and potentially by diverting Sligo and Longford trains away from the Maynooth – Connolly corridor using a new link between Adamstown and Maynooth.

20 Explore the case for developing new stations in the Belfast, Cork, Derry~Londonderry (e.g., Limavady), and Limerick – Shannon city regions.

Figure 14

Sustainable cities heavy railway interventions

Case study | Exeter

The Avocet Line near Exeter (credit: Mark Lynam)

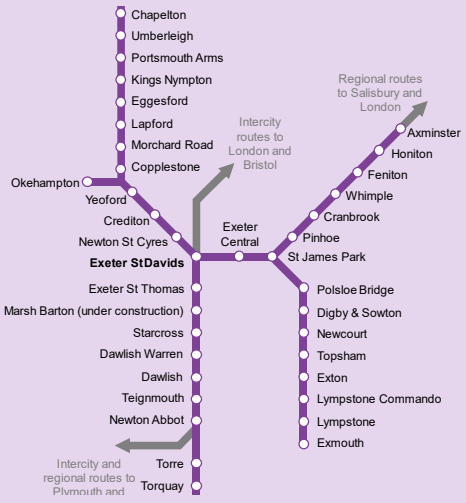
Exeter is the 2nd largest city in Devon and the 3rd largest in South West England. With a population of approximately 130,000, it is around the same size as the Limerick-Shannon metropolitan area. Like Limerick, Exeter is located on a wide estuary in a largely rural hinterland, around two hours from its capital city. The city's population is also growing at double the national average.

Exeter is served by three railways, two of which are single-tracked, and all of which are unelectrified. Despite these constraints, Exeter benefits from a suburban rail network that delivers a two train per hour service to eight stations in the city and around a dozen more outside the city boundaries. This service is popular and growing thanks to growth in the urban fringe of the city towards the airport, and this has helped build the case for investing in new stations in the City's boundaries. A map of the local rail service network pin Exeter is shown to the right.

Exeter's regional network has also recently expanded with the reopening of a previously decommissioned line to Okehampton, a community in Dartmoor with a population of around 7,500.

This service has proven to be so popular the operator has increased services to Okehampton to an hourly service pattern.

Although the service currently provided in Exeter is relatively unsophisticated, it provides an example for how local railways can serve smaller cities (i.e., with fewer than 200,000 residents) and make a significant contribution to delivering a sustainable public transport system.



The map above shows the core routes served by the "Devon Metro". At the time of writing, the network was served by 2 trains per hour (or more) between Exmouth and Paignton, 1 train per hour between Bideford and Exeter St Davids, 1 train per hour between Okehampton and Exeter St Davids, and a combination of services delivering 1 – 2 trains per hour between Axminster and Exeter St Davids. A new station is being developed at Marsh Barton.

Freight

Rail freight is something of a “niche” activity on Ireland’s railways today. The railway supports some outbound freight flows from Mayo to Waterford and mining products from Tara Mines to Dublin, as well as inbound intermodal freight from Dublin and Waterford to the North West. However, the competitiveness of rail freight has been significantly eroded in recent decades and volumes have fallen from c.4 million tonnes in 1981 to c.0.3 million today (which is less than 1% of modal share).

As **Figure 15** below shows, in 2019 Ireland recorded the lowest level of rail freight mode share in the European Union (excluding Member States that have no railways). Northern Ireland (which is in the UK figure below) currently has no regular rail freight operations. There are several factors driving this trend, including changes in freight and logistics patterns, the development of Ireland’s motorway network, and many of the railway’s infrastructure constraints outlined in Chapters 2 and 3. The cost of rail freight versus road freight, including relatively high track access charges levied on operators, is also an issue.

Despite recent challenges, the **Iarnród Éireann Rail Freight 2040 Strategy** aims to grow rail freight towards levels seen in Europe and provides a framework to achieve this goal.

This Review has explored opportunities for increasing rail freight’s market share so that it is broadly comparable to similar countries and recognises that future rail freight growth will come from **modal shift** (rather than organic growth). This will help reduce carbon emissions, improve air quality, reduce road noise and congestion, and support regional economic development.

There are also opportunities to develop **inland rail freight terminals** to serve the largest urban and industrial areas across the island – including areas in Northern Ireland. These large multi-purpose rail freight interchange and distribution centres would be ideally linked to both the rail and strategic road networks. They could play a role in helping reverse rail freight’s recent decline on the island.

There are also opportunities to improve the efficiency of **transferring freight between rail and sea transport**. Currently, the rail network can only accommodate Load-on/Load-off (“LoLo”) cargo movements, but some European railways can also accommodate Roll-On/Roll-Off (“RoRo”).

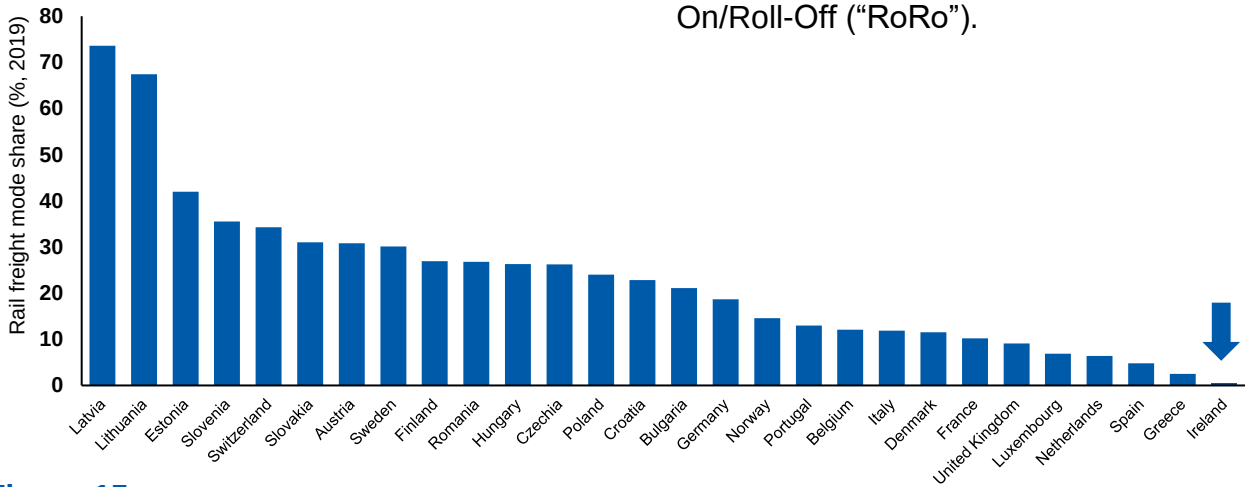


Figure 15

European countries’ rail freight mode share (source: Eurostat, 2019)

Approach

The **Iarnród Éireann 2040 rail freight strategy** proposes to increase Ireland's rail freight's mode share "in line with other European countries". Given Ireland's geographical context as an island situated some distance from the core rail freight corridors of Europe, it seems reasonable to target the level of mode share that is currently achieved by other island and/or peninsula railways in Europe. This ranges from 3% in Greece to 30% in Sweden, but most countries in this category appear to lie in the 5 – 10% range. This Review has therefore considered how the railway could support a **level of rail freight mode comparable to western European countries – around 10%**, which reflects an ambition to use rail freight to decarbonise the island's transport system. This will likely require interventions to support higher outbound flows, which tend to focus on the South Coast ports, and higher inbound intermodal flows, which are likely to target the island's largest cities. There are also opportunities to leverage recent adjustments to trade patterns between Ireland, the UK mainland, and Europe to support rail freight flows between the island's South Coast ports and the European mainland.

Future rail freight services within the island of Ireland are likely to be most viable where there is a **sufficient critical mass** of cargo movements (in terms of tonnes-lifted). In general, this means rail freight is likely to be competitive on corridors that support at least one million tonnes per annum of road freight covering distances above 100km. This suggests the greatest potential for intermodal rail freight will focus on routes between Dublin and the largest cities on the island of Ireland, while the greatest potential for outbound flows is from the North West to the South Coast ports.

Dublin Port will play a key role in helping grow rail freight in Ireland. The 2040 Dublin Port Masterplan plans for growth through consolidating the existing estate and expanding on the Poolbeg peninsula. Rail connectivity to the current port area is poor – part of the railway runs on and across busy roads, creating significant conflicts with road traffic – and there is currently no rail connectivity to Poolbeg. These challenges will need to be addressed to realise the objective of growing rail freight in Ireland to reduce road congestion and decarbonise the transport system.

Strategic options

To grow rail freight in the island of Ireland, the Review has considered the following:

- Rail freight needs be **price competitive** with road freight, and it needs to **connect major freight producers and customers** together in a reasonable time. This means the railway needs to **connect seamlessly to Ireland's busiest ports and** connect with **inland rail freight terminals** that serve the island's largest population and industrial areas. This also means **ports connected with the railway should enable the LoLo cargo movements**, although it is noted that in some European countries increased levels of RoRo cargo movements are being handled via rail also, which warrants consideration in Ireland.
- Rail freight must enable **seamless movements** between ports and inland terminals. This means key freight corridors must have the capacity to accommodate freight services and minimise conflicts with other rail users.
- Rail freight should be provided with access to **decarbonised forms of railway traction**.

Many of the interventions outlined earlier in this Chapter will support rail freight. These include:

- Developing a new railway to link between **Limerick – Foynes**.
- Reinstating the railway between **Claremorris – Athenry** to enable rail freight from the North West to access the South and Mid West while avoiding the busy Dublin – Cork line (and the need to reverse at Kildare).
- Reinstating the railway between **Rosslare – Waterford**. While there is currently no rail freight traffic from Rosslare Europort, in the longer term this port could be developed to accommodate LoLo movements.
- Reinstating the railways between **Athlone – Mullingar – Portadown** and adding capacity between **Dublin – Mullingar**. This will provide alternative routes between Dublin and the North and West (avoiding intercity routes).
- Adding capacity on corridors used by rail freight today, and that could be used in the future, including **Dublin – Athlone**, **Dublin – Drogheda**, and **Limerick – Waterford**.
- Considering opportunities to **better connect other ports** to the railway where it runs close to ports such as Marino Point near Cobh.

Additionally, there will need to be **enhancements to current ports and inland terminals**, and the development of new **inland terminals** to serve the island's largest industrial areas. While it is not the role of this Review to recommend specific locations for these terminals, it is considered that at least one terminal should be developed for the largest cities on the island of Ireland – ideally at locations with good road access, and where the railway is well suited to accommodating freight traffic. Further assessment will be needed to establish ideal locations for these terminals. To serve these terminals, there would need to be an increase in **freight rolling stock capacity** (both locomotives and wagons).

The Review has considered options for improving connections to the Port of **Belfast** and **Ringaskiddy**. In these cases, it was found that developing new rail links would be very costly and disruptive and would encourage freight traffic to use parts of the railway that are already quite congested. Alternative options for Belfast include developing an inland terminal to the South West of the city and alternative options for Ringaskiddy include connecting to Marino Point near Cobh.

The Review has also analysed the economics of rail freight in Ireland and established that **track access charges** – which are reportedly among the highest in Europe – **present a major barrier to growth**. Analysis undertaken for this Review suggests bringing these charges closer to the levels that are typically levied in the EU should help stimulate growth in rail freight in the short term.

Recommendations

To grow the island's rail freight industry and support the freight Objectives of this Review, both jurisdictions should develop plans to:

21 Develop a sustainable solution for first-mile-last-mile rail freight access for **Dublin Port**. Without this connection, there are limited options for growing rail freight.

22 **Reduce Track Access Charges for freight services.** These charges are high compared to other European railways but could be reduced through support/government subsidy to stimulate demand for rail freight.

23 **Strengthen rail connectivity to the island's busiest ports** where links are feasible and improve access to ports that currently are underserved by rail freight, including Foynes for Limerick, Waterford, Marino Point for Cork, and Rosslare Europort (in the longer term, when LoLo operations are feasible here, or, in the shorter term following analysis of the feasibility of RoRo rail freight).

24 **Develop a network of inland terminals close to major cities on the rail network**, especially where there is good access to major roads/motorways, limited impact on communities and passenger traffic, and good access to industrial clusters. Potential locations for new terminals include the Upper Bann area for Northern Ireland, Limerick Junction, a location north of Cork, Athenry for Galway, Sligo, and west of Dublin.

These interventions will enable freight services to operate on routes that avoid many busy intercity routes, as shown in light blue in Figure 16.

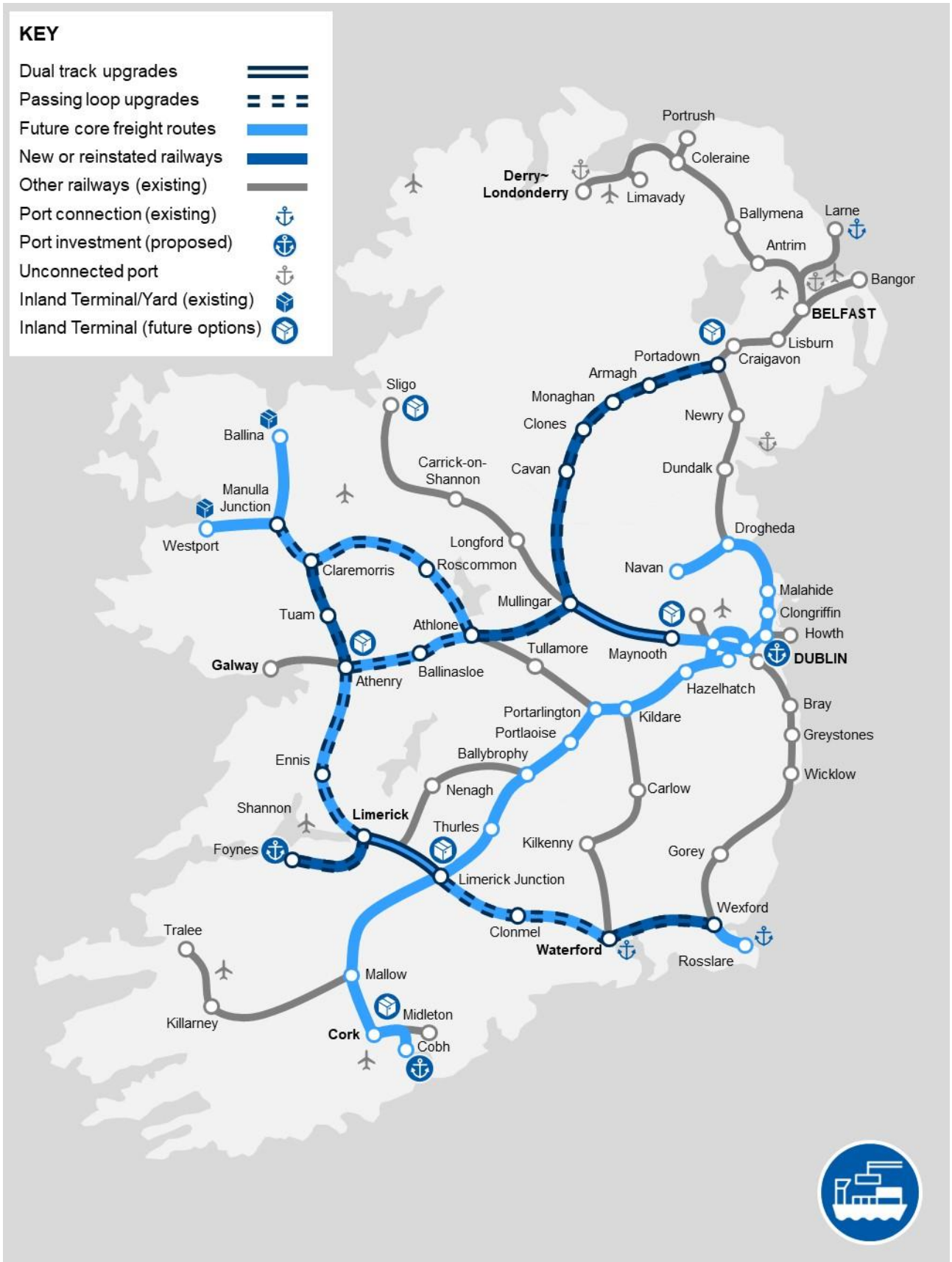
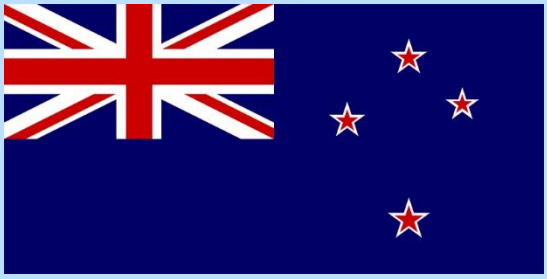


Figure 16

Rail freight interventions

Case Study | New Zealand



New Zealand is an island nation with a similar population to Ireland but is more isolated from its nearest neighbours. As in Ireland, rail freight in New Zealand is used for moving imports and exports to and from major ports as well as carrying bulk commodities such as logging.

KiwiRail (a state owned enterprise) manages the 4,000km rail network and operates both freight and passenger services. The network is split into two parts, one on the North Island and the other on the South Island. Both islands are connected by the Interislander ferry service, which can carry rail vehicles. The rail network outside of cities is largely dedicated to freight (see map to the right).

Rail freight's mode share in New Zealand is much higher than in Ireland. In 2017/18, rail freight's mode share was 11.5% for all goods and much higher in coal, paper, dairy, and meat products. KiwiRail operates more than 900 freight trains per week, or around 130 a day. While rail's freight share has remained steady in recent years, there are concerns the industry will stagnate without intervention.

The Government considers rail an essential part of the freight industry, providing resilience through offering an alternative transport option for importers and exporters. Investing in restoring the rail freight network is one of two strategic investment priorities in the recently published 2021 Rail New Zealand Plan, which sets a framework for delivering a resilient and reliable rail network.

The New Zealand Rail Plan identifies several challenges that could hold back growth of rail freight. While some of these are external to the industry (e.g., COVID-19), there are many operational restrictions and gaps in electrification across the network. To address these challenges plan, the government has committed to invest in:

- A longer-term sustainable programme of maintenance and renewals; and
- A programme of intergenerational replacement of locomotives, Interislander ferries, wagons and shunts, and modernisation of facilities reaching end of life.

Funding for these investments will come through the National Land Transport Programme under the new planning and funding framework, with support from the Crown and track users. The first tranches of funding have already been committed to a range of projects, including core asset maintenance, intergenerational asset replacement of rolling stock and Interislander ferries.

Thanks to recent investment, some ports have experienced significant growth in rail freight demand. For example, the Lyttelton Port Company saw significant growth in demand and subsequent rail freight services, with weekly services increasing from 2-3 per week in 2016 to 16 per week by 2020. The port estimates that this takes 120 heavy vehicles off the road each day. The port also notes that customers see rail freight as a key component of reducing the carbon emissions associated with their products. A new weekday rail service between Auckland and Christchurch is also being launched to help New Zealand businesses recover from the pandemic.

New Zealand shows it is possible for rail freight to compete and succeed on an island network.

Customer Experience

Customer experience cuts across all aspects of the railways across the island. Customer satisfaction is driven by a wide range of factors that can affect all stages of a typical journey. This journey includes **multiple stages**, which are: journey planning; ticket purchase (and affordability); the journey to the station; experience at the station; experience on the train; interchange and egress; the journey to destination; and post journey customer care (lost property, compensation, etc.). To deliver a good customer experience it is therefore important to consider **each part of a customer's journey** and work to ensure this journey is as seamless as possible.

While customer satisfaction with passenger rail services is generally high in both jurisdictions, international benchmarking suggests the current customer offer is behind comparative European operators. At the time of writing, for example, on-board catering is quite limited, and many stations lack adequate amenities for the size of the communities they serve (e.g., Lurgan).

Many topics considered in this section were highlighted in hundreds of responses to the first public consultation that supported this Review. In particular, respondents highlighted concerns about **accessibility**, **integration**, **affordability, cleanliness** and **anti-social behaviour.** Some of the concerns highlighted in the public consultation could and should be addressed in the short term. Indeed, there are already many initiatives underway in both jurisdictions to improve customer experience, such as investments in integrated ticketing systems, step-free access, and new rolling stock.

Many of the interventions outlined in this section will be seen as '**Business as Usual'** as the railway continuously improves its customer offer. One example of this is the railway's continuous programme to improve accessibility by investing in stations and rolling stock that provide a seamless experience for all passengers – regardless of their needs.

As fully integrated, vertically aligned operators, Iarnród Éireann and Translink are well placed to deliver a seamless customer experience. Many of the factors that drive customer satisfaction are monitored by **Public Service Contracts** in both jurisdictions. The contract in place in Ireland imposes penalties on Iarnród Éireann if they consistently fail to deliver good customer service.

Strategic options

Many of the infrastructure-led interventions described earlier in this chapter will help improve several key elements of service quality: including the speed, frequency, and reliability of services.

In addition, there are opportunities to improve the passenger experience by:

- Improving the availability of **information** in advance, during, and after each journey – especially during periods of planned and unplanned disruption, particularly for those with disabilities which make it harder to access information and services.
- Targeting investments that add capacity to **reduce overcrowding**, such as longer trains and more frequent passenger services.
- Using cascaded rolling stock to deliver more frequent, **'clock-face' timetable** services.

- Maintaining a consistently high-quality **cleaning and maintenance regime** across the whole railway estate.
- Ensuring **stations** and **rolling stock** are attractive, clean, accessible, warm, well lit, and equipped to enable customers, regardless of their mobility needs, to undertake their journeys.
- Providing a wider range of hot and cold **catering** at larger stations and on longer distance services.
- Providing, maintaining, and cleaning high-quality **facilities** (e.g., washrooms) at stations and on longer distance services.
- Providing **wi-fi** and **charging facilities** at stations and onboard trains to enable passengers to work and enjoy online activities on board services.
- Providing **car parking**, secure **bike storage** (at stations and on trains), and **high-quality interchanges** with public transport and walking and cycling networks at stations.
- Ensuring the railway estate is **accessible** for passengers with mobility needs.

Many of the interventions listed above are being pursued by multiple agencies in the rail and wider transport industry, and there have been significant improvements delivered in recent years (notably contactless and integrated payment systems).

Planning and information

The quality, timeliness, and accuracy of **information** provided to customers (and potential customers) is a key driver of customer satisfaction. This issue is especially important during periods of disruption, when customer anxiety is often at its highest and when information is often at its scarcest.

Both jurisdictions should continue to invest in online, in-station, and on-board information systems and leverage opportunities presented by the latest technology. For example, many on-board **customer information systems** also provide information about crowding in different carriages, toilet occupancy, the status of connecting services, and notices about events. Additionally, both jurisdictions should work with operators to enable them to provide real-time timetables and performance data through **Advanced Programming Interfaces** (APIs). This will enable developers to build applications that provide customers with better information to enable them to plan their end-to-end journeys.

Stations

While many stations on the island of Ireland provide a welcoming environment for customers, the station experience varies significantly across the island. Not all stations provide the ticketing, waiting, alighting, and interchanging services that most customers have come to expect from modern public transport. Research shows that the **station experience** is a particularly important driver for longer distance passengers who tend to spend more time at stations. The **accessibility** of stations is also critically important to passengers with mobility needs, and **wayfinding** is important for passengers unfamiliar with the railway.

Each jurisdiction has a rolling programme of **station enhancements and renewals**. It is common for enhancements (and new stations) to be tied to local investment in growth and development, which can help raise the quality of the built environment to the benefit of all parties. Stations also offer opportunities to generate **revenue** from customers by providing retail and hospitality services – these services not only increase customer choice but also help build the case for further investment.

Rolling stock

One of the most significant drivers of customer satisfaction is the quality, accessibility, maintenance, and cleanliness of **rolling stock**. In addition to the quality of the on-board experience that is provided by rolling stock, the size of the fleet often drives the regularity and frequency of timetables, which is another key driver of customer satisfaction.

Many of the infrastructure-led interventions described earlier in this chapter will only deliver their full benefits if they are supported by high-quality, low-carbon, high-performance, accessible rolling stock. This presents some challenges in timing the delivery of interventions. For example, much of the Iarnród Éireann intercity fleet (which is entirely driven by diesel traction) is relatively new and will not need to be replaced for at least a decade. This suggests the near-term focus of electrification should be on DART and Enterprise services, as rolling stock for these services is due for renewal earlier.

In the longer term, both jurisdictions should ensure their future rolling stock fleets are:

- As **standardised** and consistent as possible (as they generally are today).
- Capable of electric and non-electric (but otherwise decarbonised) **traction**.
- Capable of reaching up to **160km/h** on regional and rural routes and up to **200km/h** on intercity routes – if the infrastructure-led interventions described above are delivered.
- Configured to provide **high levels of comfort, accessibility** and high-quality **amenities** (e.g., information, wi-fi, charging points, good quality catering, washrooms, etc.).

Fares and ticketing

One of the most popular topics of political discourse about the railways – and public transport in general – is the **affordability and simplicity of fares**. There will always be a challenge in balancing the needs of passengers (and the benefits to society arising from their decision to travel by rail and not by car) with the needs of taxpayers, who ultimately fund the gap between the cost of running the railway and the revenues generated from operations. At the time of writing, each EU Member State that has a railway (as well as the UK) provides some form of subsidy to passenger rail services. In some cases, governments are covering more than half the total cost of operating passenger rail services in their jurisdictions. Some subsidy is therefore likely to be needed for years to come.

The Irish government has recently reduced fares for some journeys and aspires to generally **improve the affordability of public transport**. There may be opportunities to further reduce fares where capacity is in high supply, for example in counter peak directions travelling out of Dublin in the morning. Varying fares on longer distance services could help match demand to supply for services that offer reservations systems.

There are opportunities to **further improve ticketing systems**. Digital ticketing and contactless payment systems should continue to roll out across the whole island, and these should integrate well with other payment systems.

Accessibility and integration

The Review recognises that inaccessibility in transport means more than just not being able to gain access to physical infrastructure. It presents a real obstacle for autonomy, personal development and participation in a wide range of activities in the community. Many of the interventions outlined in this Review – including proposed expansion of the rail network and increases in service frequency – provide a way of addressing wider challenges and opportunities for the island of Ireland, including in terms of supporting an aging population and supporting more equitable outcomes for all. The Review also recognises the commitment of both jurisdictions to invest in rolling programmes to improve accessibility across the public transport network.

That said, there are opportunities to further improve the accessibility and integration by:

- Improving the **physical integration** of rail stations with other public transport and active travel options.
- Improving the **accessibility** of the railway, particularly for those with mobility needs. This should include step-free access to and within stations and, where future interventions allow, step-free rolling stock.
- Providing better **information about accessibility** on on-line platforms and using a**udio-visual announcements** on trains and at stations.
- Aligning **fare structures** and **concessions**, between both rail operators and/or with other public transport providers.
- Integrating modern **customer information** and **payment systems**.
- Aligning **service calling patterns** to enable seamless transfer to other rail and other public transport services.

There are examples of the initiatives listed above being delivered in both jurisdictions. For example, Translink provides free bus services between some stations and their respective city centres (e.g., Newry), and Dublin's terminus stations have good connectivity to other public transport services (e.g., Luas and bus). An integrated Next Generation Ticketing plan is being developed by the National Transport Authority in Ireland. Delivering further improvements will rely on the co-operation of parties outside the rail industry. There may be a role for government to enable these parties to work seamlessly together.

Cross-border partnership working

As the railway grows and develops potentially more cross-border opportunities, there could be a case for **strengthening cross-border working** in the planning of cross-border infrastructure and rail services. This is likely to be needed if the number of cross-border passenger rail services grows from a few dozen today to potentially over a hundred in the future.

Finally, the Department of Transport and Department for Infrastructure, along with other key stakeholders who have been engaged in this Review, wish to highlight the benefits of undertaking this exercise across both jurisdictions, and express the hope that such an exercise can be repeated. The final recommendation of this Review is, therefore, to encourage political leaders to commit to a **re-evaluation of this Review** over its timeframe to reflect on progress to date, refresh objectives, and – where appropriate – amend recommendations to deliver the railway the island of Ireland needs to thrive as a prosperous, sustainable community in the long-term.

Recommendations

Both jurisdictions are recommended to:

25 **Continue to invest in initiatives that deliver a seamless customer journey** such as improving information provision and catering.

26 **Continue to benchmark and monitor service quality and deliver continuous improvement.** The Public Service Contracts provide a framework for holding operators to account for delivering high levels of service.

27 **Ensure future rolling stock specifications are aligned to the infrastructure-led interventions outlined in this Review.** This includes increasing the size and/or speed of the rolling stock fleet to deliver higher frequency service patterns and new services.

28 **Invest in improving integration within rail and between rail and other transport options** – and put in place appropriate forums to co-ordinate work across institutions.

29 **Deliver clock-face timetable calling patterns** that integrate with other services.

30 **Develop cross-border structures to improve the effectiveness of cross-border infrastructure and rail service planning.**

31 **Continue to invest in a rolling programme of accessibility improvements, including step-free access,** to ensure that all people have equal access to the railways.

32 **Update the All-Island Strategic Rail Review once a decade**, taking account of latest policies and developments.

The costs of these interventions are not included in the capital costs presented in **Chapter 5** but would be expected to be included in “business as usual” costs.

Case Study | Leap Card

In 2011, the Railway Procurement Agency (now part of Transport Infrastructure Ireland) developed a contactless smart card for automated fare collection for the Greater Dublin Area. This enabled users to pay for Luas, DART, Iarnród Éireann and Dublin Bus services with a single card. This card was branded the “Leap Card” and has since been rolled out across many urban areas in Ireland.

Today, Leap Cards are widely accepted in the Greater Dublin Area, the Cork Metropolitan Area, the Limerick and Shannon Metropolitan Area, Galway, Waterford, Westmeath, Drogheda, Sligo, and Kilkenny. There are plans to expand further to other towns and communities in Ireland.

Initially, Leap Cards offered only a pre-paid electronic wallet system for single-trip fares, but it has since developed to enable weekly, monthly, and annual subscriptions. It also enables concessions (such as student discounts) and can be purchased tax-free through employers.

Tickets purchased using the Leap Card are generally discounted compared to cash prices, and integrated ticketing is offered in the Dublin area via a flat fare system across all modes of transport.

Leap Cards can be purchased at convenience stores offering Payzone services and topped up at any Luas or Irish Rail ticketing machines, using iPhone/ Android Apps, and in convenience stores. The minimum top-up for the card is currently €5.00/£4.20. Users who opt to register their card can also view their purchase history on line.

Today, the Leap Card is accepted nationwide on numerous private bus operators’ services all over the country as well as on many services managed by the National Transport Authority. Leap Cards are accepted across more than 13,000 devices from more than 13 different equipment suppliers.

To date over 6.3 million Leap Cards have been issued of all types. The card has been used for more than 1.2 billion journeys, and the payment system underpinning the card has handled over €1.6bn/£1.3bn in top-ups. 2022 was the busiest year ever for sales of Leap Cards, with over 950,000 cards issued across Ireland.

Looking ahead, there are opportunities to expand contactless and integrated ticketing beyond current metropolitan areas to spread the benefits of integration to the rest of the island of Ireland.

This case study shows the benefits of delivering integrated public transport services across the island of Ireland and showcases the improvements that are being delivered today, thanks to cross-agency working and partnerships.

ARUP

Chapter 5 | Benefits and Costs

Introduction

This Chapter summarises the benefits, costs, and other impacts that would likely be delivered by the key recommendations outlined in **Chapter 4**. It also shows how they support the Review's Goals and Objectives.

The development of the recommendations presented in **Chapter 4** was informed by capital cost, operational cost, demand, revenue, and carbon assessment. It was supported by an objective environmental assessment. **Appendix B** sets out all the interventions that were considered by this Review. It also outlines the process that was followed to determine which interventions should be taken forward for more detailed analysis and, ultimately, be included as recommendations in this Report. **Further assessment, analysis, approval, and funding would be required to take any recommendation presented in Chapter 4 forward**, and it is for the governments in both jurisdictions to decide which interventions should be pursued.

Benefits for railway users

Perhaps the most visible benefits to railway users that would be realised if the recommendations of this Review were delivered would be **transformational improvements** in the **quality, speed, and frequency of rail services** across the island of Ireland. These benefits would be unlocked as each intervention is implemented, incrementally building a combined all-island impact when all recommendations are delivered.

Rail journey times between the largest cities would be significantly reduced – in some cases halved – and would be materially quicker than car. (**Figure 17**).

There would also be **more direct services** between the island's largest cities, significantly improved connectivity for journeys across the island that transit through Dublin, and on some routes (such as Dublin – Belfast) potentially a quadrupling in service frequencies between key cities.

The benefits of more frequent services would be particularly felt in areas that are currently served by fewer than half a dozen services in each direction per day.

The operations of the railway will also be more **reliable** and **resilient**, as there will be more capacity to absorb shocks and more physical segregation between different types of passenger and freight services.

The recommendations of this Review would **significantly increase access to the railway network** – especially in western parts of Northern Ireland, as well as the North West, Midlands, and South East of Ireland.

If all recommendations were delivered, then the **number of people living within 5km of a railway station could grow by over 700,000** - representing a 25% growth from today's population catchment. Additionally, every county in Ireland and Local Government District in Northern Ireland would have at least one rail station served by a regular passenger rail service. Furthermore, integrated bus-rail tickets and timetables could enable the benefits of rail extensions to reach communities served by rural bus routes that interchange with rail hubs.

If all the recommendations were delivered, then **passenger journeys** undertaken on the island's rail network **could double**. Similarly, the market share of rail would also double from around 3% of passenger kms today to more than 6% (before any demand management measures are considered, which could increase mode share further). It could also increase the revenues of the rail industry, depending on the fares policy adopted.

The Review's recommendations would also enable the island's largest cities to boost their multi-modal public transport offer. A new east-west railway in Dublin would deliver transformational improvements in **cross-city connectivity for the Greater Dublin Area** and benefit journeys across the island that transit through Dublin. Additional capacity around Dublin and Belfast would enable Iarnród Éireann and Translink to **boost local services**. Dublin, Belfast, and Shannon would benefit from **airport rail links** that would enable 90% of commercial aviation passengers to access their airports by rail.

The recommendations would also enable the **rail freight industry** to rebound by providing better routes between the island's ports and its major economic centres, delivering inland multi-modal interchange facilities between freight operators, and lowering the costs of rail freight in general terms. Improvements to the Western Corridor and in the South East would ensure there are minimal conflicts between freight and other traffic.

A summary of the key outcomes and benefits that could be delivered is presented later in **Table 4**.

Benefits for non-railway users

In addition to the benefits highlighted above, the recommendations of this Review would contribute to several wider socioeconomic and environmental goals.

Analysis for this Review indicates it would: **reduce congestion** on the island's road networks, **reduce accidents**, **improve air quality**, **reduce noise**, and **reduce the carbon footprint** of the transport sector. There would also be reduced carbon emissions from railway operations, and mode shift would add further carbon benefits.

The recommendations could deliver a significant boost to the **productivity** of the economy in both jurisdictions through promoting agglomeration – that is, productivity arising from pooling and sharing of resources and knowledge across labour markets and between cities and major economic hubs.

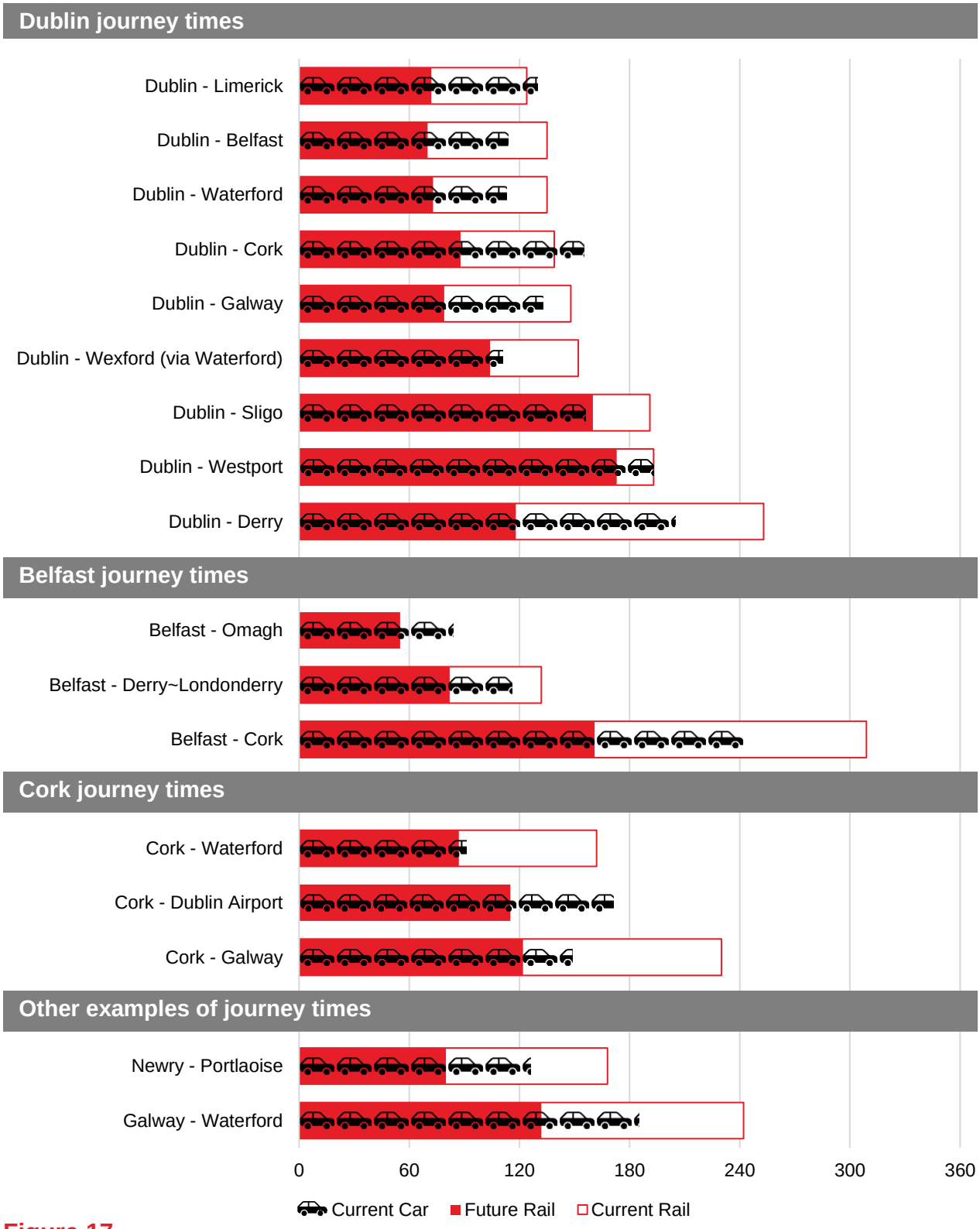


Figure 17

Indicative journey times by rail and car

This shows indicative in-vehicle passenger journey times between selected stations for the current rail and car journeys and for future rail journeys that would benefit from the recommendations in this Review. This assumes maximum speeds of 200km/h would be achieved on most intercity lines. For the existing journey times, the fastest scheduled services on a weekday are shown. The modelling used to generate these estimates assumes the interventions would take effect in 2040 and would therefore reflect the projected population and economy of the island in this year. The comparison car journey times shown in the same chart present the average in vehicle journey car journey times between the same stations in 2021.

Costs

The Review has undertaken a high-level, top-down assessment of the **capital**, **maintenance**, and **operating costs** of delivering the recommendations of this Review. These costs were informed by benchmarking exercises of Ireland and other European railways and benefitted from insights from Iarnród Éireann and Translink.

In 2021 prices, the **capital cost** of the Review's recommendations is estimated to be in the order of **€32bn/£27bn**. This excludes VAT and costs of existing proposals such as the DART+ programme and Dublin MetroLink. A high level of allowance for **Optimism Bias** has been included in this estimate. Updated cost estimates in 2023 prices are provided in **Appendix D**.

The **additional operating and maintenance costs** for maintaining a larger rail network on the island are estimated to be circa **€600m/£500m** in 2021 prices, which could be met by additional revenue and/or government support (depending on fare levels).

This investment would take around **25 years to deliver**, which suggests an annual capital spend of the order of **€1.3/£1.1bn** would be required above existing commitments. A breakdown of these costs is provided in **Table 3** and more details about on how they were derived is set out in **Appendix B**.

While these additional costs are significant, and will increase with inflation, they are similar in scale to the funding Ireland invested in the 2000s to expand its motorway network and would be shared across both jurisdictions.

Other trade-offs considered

In addition to the monetised costs outlined above, there would be **other trade-offs and impacts** arising from the delivery of the interventions described in **Chapter 4**, particularly during their construction. This includes **potential disruption to communities**, **townscapes**, **severance**, **biodiversity**, **landscapes**, **noise,** and **carbon emissions** driven by the construction of new railways. These impacts and trade-offs have been carefully considered by this Review and have shaped many of the recommendations.

In general, most of this Review's recommendations focus on existing railways and corridors, which minimises their impact, though some new lines/re-opening of old lines is proposed. The Review also recommends tunnelled interventions in urban areas to reduce their impact.

The Review does not recommend constructing new railways through the North West coastal region, partly because of concerns about the impact of this on the environment, as well as value for money considerations. Similarly, the Review has also ruled out developing a large high speed rail system, related to concerns that the carbon generated from its construction would not be offset by downstream carbon emission reductions, and value for money issues.

Going forward, each major intervention described in this report would be subject to **rigorous economic, equality, and environmental impact assessments**, which will help to further strengthen benefits, control costs, and mitigate potential environmental impacts.

Assessment and appraisal

The Review assessed and appraised several interventions in different combinations (referred to as “Packages” and “Scenarios” in **Appendix B**). A qualitative Multi Criteria Assessment of these Packages and Scenarios is presented in **Table A.5** in **Appendix B**. Some interventions (largely freight and customer service interventions) were not quantitatively assessed but were qualitatively assessed. An economic appraisal of the recommendations of this Review suggests that – altogether – they have the potential to generate a **Benefit to Cost Ratio broadly equal to one** under the Department of Transport’s Common Appraisal Framework (the approach used for Northern Ireland generated lower BCRs). A breakdown of the monetised benefits and costs generated by this appraisal is shown in **Figure 18**.

Personas and stories

Customer personas are fictional profiles which represent characteristics of both existing and potential customers of the rail network. The purpose of developing personas is to help understand and empathise with a diverse range of customer needs and help to embed a customer mindset in the decision-making process. Understanding the customer and their end-to-end journey helps ensure that services can stay resilient to changing needs and trends.

Several personas were created during the first stages of the Review to enable the project team to form an understanding of the challenges people face today. The personas were informed by a desktop study of current literature, news articles, and data analysis as well as feedback from the public consultation. **Table 5** below presents some of the tangible benefits a future transformed railway could deliver for these customer personas.

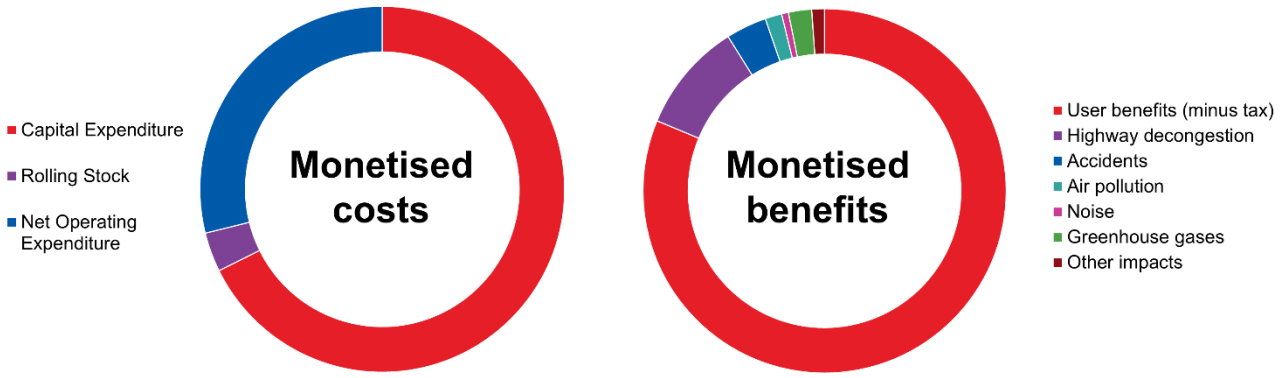


Figure 18

Breakdown of monetised costs and benefits of the recommendations of this Review (approximately €20bn/£16.7bn in 2011 discounted prices).

Intervention	Capital Cost Estimates Range, 2021 prices	
	In Euros (€), millions	In Sterling (£), millions
Electrification and/or dual tracking	**4,600 – 7,100**	**3,800 – 6,000**
Belfast – Drogheda electrification	700 – 1,000	600 – 900
Dublin – Portarlington electrification	300 – 400	200 – 400
Kildare – Waterford electrification/dual-tracking	500 – 900	500 – 700
Portarlington – Galway electrification/dual-tracking	800 – 1,300	700 – 1,000
Portarlington - Limerick Junction electrification	300 – 500	300 – 400
Limerick Junction – Limerick electrification	100 – 200	100 – 200
Limerick Junction – Cork electrification	500 – 700	400 – 600
Maynooth – Mullingar electrification/dual-tracking	700 – 1,200	600 – 1,000
Sixmilebridge – Limerick – Foynes electrification	600 – 900	500 – 800
Speed improvements and/or realignments	**1,500 – 2,400**	**1,300 – 2,000**
Dublin – Cork	500 – 800	400 – 700
Kildare – Waterford	100 – 200	100 – 200
Portarlington – Galway	500 – 800	400 – 700
Athenry – Limerick – Waterford	400 – 600	300 – 500
New, reinstated, and/or four-tracked railways	**13,500 – 21,000**	**11,200 – 17,500**
Intercity (Dublin – Clongriffin four-tracking)	700 – 1,000	500 – 800
Intercity (Clongriffin – Drogheda)	600 – 1,000	500 – 800
Intercity (Hazelhatch – Portarlington)	1,100 – 1,800	1,000 – 1,500
Intercity (Maynooth – Adamstown)	100 – 200	100 – 200
Intercity (Belfast – Newry)	1,800 – 2,800	1,500 – 2,300
Northern Ireland (Portadown – Derry~Londonderry)	2,200 – 3,400	1,800 – 2,800
Northern Ireland (Lisburn – Antrim)	300 – 400	200 – 300
Northern Ireland (Limavady and new stations)	100 – 200	100 – 200
Dublin (East – West Tunnel)	3,400 – 5,300	2,900 – 4,400
Dublin (Dublin Airport Link)	700 – 1,100	600 – 900
Cross-border (Portadown – Mullingar)	1,100 – 1,600	800 – 1,200
Cross-border (Letterkenny Spur)	200 – 300	200 – 300
North Midlands (Mullingar – Athlone)	300 – 400	200 – 400
West Coast (Shannon Airport Link)	100 – 200	100 – 200
West Coast (Claremorris – Athenry)	400 – 600	300 – 500
South Coast (Waterford – Rosslare/Wexford)	400 – 600	300 – 500
Rolling stock	**800 – 1,300**	**700 – 1,000**
Total (capital and rolling stock)	**20,400 – 31,800**	**17,000 – 26,500**
Additional annual operating and maintenance costs	600 – 900	500 – 800

Table 3

Capital cost estimates of recommended interventions

Based on broad assumptions on route and service specifications and includes 56% optimism bias. Some estimates in this table may differ to other estimates prepared by other parties for some interventions. This is because a 'top-down' approach to cost estimating (based on unit costs applied to items such as 1km of new track and/or stations) was necessary to provide estimates for a large number of interventions, which is by its nature likely to yield different results.

In summary, the qualitative and quantitative assessments and appraisals undertaken for this review suggest that, as a whole, the recommendations of this Review could deliver net economic benefits for the island of Ireland while meeting all the Review's Goals and Objectives (see Table 4).

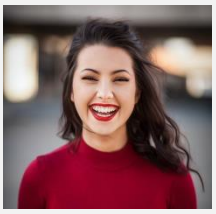
Goal	Objective	Potential Outcomes
Goal 1 | Decarbonisation	✓ Reduces the carbon emissions associated with rail's construction, operation, and maintenance ✓ Reduces the carbon emissions from motor vehicle travel by doubling rail's mode share	80% of train kms would be delivered by electric trains, and the remaining could be delivered by battery electric and hydrogen traction.
Goal 2 | Intercity	✓ Provides an attractive public transport choice for travel between the seven major cities of Dublin, Belfast, Cork, Limerick, Derry~Londonderry, Galway, and Waterford	Rail journey times between the island's major cities would be significantly reduced, by 50% in some cases. There would be hourly services between key cities, increasing to half-hourly on busiest routes.
Goal 3 | Regional and Rural	✓ Gives people in rural and regional areas better access to economic opportunities, and public services ✓ Significantly improves inter-regional accessibility	700,000 more people would live within 5km of a railway station – representing an increase of 25% on today's catchment.
Goal 4 | Sustainable Cities	✓ Supports compact growth & integration of public transport with land use ✓ Enhances the integration of rail with other transport modes ✓ Minimises negative impacts on the environment	90% of the island's commercial aviation passengers would be able to access their airports by rail.
Goal 5 | Freight and Economy	✓ Contributes to balanced growth between urban and regional areas ✓ Supports the efficient movement of people between economic centres and international gateways	66% of the island's freight tonnage would pass through ports served by the island's railway.
Goal 6 | Economic Feasibility	✓ Plans investment in rail that is financially feasible ✓ Identifies potential funding ✓ Ensures investment is considered alongside objectives	There would be a €20bn/£17bn boost to the island's economy, based on 2011 prices.

Table 4

How the recommendations of this Review deliver its Goals and Objectives

Lauren

The student



Lauren is a 19-year-old student who commutes from Strathfoyle in Derry~Londonderry to the University of Ulster campus in Coleraine.

Today's railway

- Lauren lives far from Derry~Londonderry station and often needs a lift from her parents.
- A lack of secure cycle parking at the station and on board the train for bikes dissuades Lauren from cycling to and from the station.
- With just one train service per hour, long waits to interchange at Coleraine station, and the last service departing shortly after 22:00, Lauren has to plan her schedule around the timetable.

A potential future railway

- A new station at Strathfoyle would provide much more convenient access to the network.
- Improved cycle parking facilities at stations and new carriages with more space for bikes will make it much more convenient to combine rail and cycling for end-to-end journeys.
- Increases in frequency to two trains per hour, extended schedules, and more coordinated timetabling for the interchange at Coleraine will give more freedom to rail passengers.

Marta

The commuter

Marta is a 35-year-old who travels from her home in Newry to work in Dublin two days per week.

Today's railway

- Marta now works on a hybrid schedule, so season tickets no longer represent good value for money and day return tickets are expensive.
- Neither her home nor her workplace are immediately adjacent to stations so her first and last mile connections can be inconvenient.
- The rail journey to Dublin is relatively slow due to old alignments and conflict with DART services. It is often delayed between Drogheda and Connolly.

A potential future railway

- More flexible ticketing options will make rail more accessible to more people.
- Integrated ticketing across travel modes, including rail, bus, and cycling, together with coordination of rail and bus timetables will greatly expand the effective catchment of rail services.
- Separation of DART and intercity rail with a new line from Drogheda to Clongriffin and four tracking onwards to Dublin City Centre will greatly speed up rail travel times.

Darren

The business traveller

Darren is a 42-year-old based in Cork who regularly travels for business to Dublin, Belfast, and Galway.

Today's railway

- Poor interchange and slow services make rail travel between Cork and both Galway and Belfast less attractive, so Darren often opts to drive for those journeys.
- Wi-Fi on board is sometimes unreliable, so he often has to download files in advance to ensure he can get work done on the move.
- Infrequent services are very inconvenient for him when business meetings overrun, requiring a lot of waiting around for the next service.
- Car parking at Cork station encourages Darren to drive to the station even though he lives in the city.

A potential future railway

- Major enhancements to intercity connectivity, such as cross-Dublin routes, and timetable integration will make journeys between Cork, Belfast, and Galway much faster.
- High-quality Wi-Fi could be provided on board all services to ensure that rail is an attractive option.
- Much more frequent services mean that passengers will not need to plan their schedules around timetables, making rail more appealing.
- Improved onward public transport connections from rail stations will encourage users to carry out their entire journey by sustainable modes.

Holly

The wheelchair user

Holly is a 29-year-old living in Ballymote who plans to visit Kilkenny for a weekend away with friends.

Today's railway

- Holly has reduced mobility and needs to call ahead to arrange assistance at stations. Phone lines are often not open during evenings or at weekends. She also has to check if lifts are in working at each station on her journey.
- Her journey requires her to take the Luas to travel between Connolly and Heuston, increasing journey time and making the experience less pleasant.
- Her perceptions of the inconvenience of having to arrange assistance in advance cause her to only consider rail travel a handful of times per year.

A potential future railway

- Upgrades to carriages, platforms, and station layouts will increase accessibility and provide step-free access for all users. Alternative contact methods will make arranging assistance more convenient.
- The integration of the network in Dublin through a link between Kilcock and Adamstown will make the journey much more convenient with a single interchange at Adamstown or Heuston.
- More seamless service offerings for users with limited mobility and more affordable fares will create good experiences that encourage people to travel more by rail.

Jim

The retired traveller

Jim is a 73-year-old retiree living in Westport who often visits his children and grandchildren in Galway. With a free travel pass, he likes to take public transport as much as he can.

Today's railway

- There is currently no direct passenger rail service between Westport and Galway, so Jim has to drive or rely on a bus that can take more than two hours to complete this journey.
- There are no lifts at Westport station, which is not an issue at the moment as only one platform is regularly in use. However, it would be an issue if the second platform were brought into use to accommodate more services.
- Jim would enjoy tea and a bun on his journey, but the lack of catering options means that his journey is not as pleasant as it could be.

A potential future railway

- A direct and regular passenger rail service between Westport and Galway would be significantly faster and more convenient for passengers like Jim, enabling him to make this journey more often and spend more time with his family in Galway.
- Investment in more accessible stations will ensure that facilities such lifts are available to serve an expanding railway.
- Incorporating catering requirements into a service quality regime will help ensure that these services are provided and improve customer experience.

Table 5

Personas and stories for a future transformed railway in the island of Ireland

ARUP

Chapter 6 | Roadmap for Delivery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DAVE

Introduction

The Review has developed the recommendations outlined in Chapter 4 to create a **plausible roadmap** for achieving the Goals and Objectives of this Study. This Roadmap is structured to represent the key themes presented in the previous Chapter. It has been designed to balance feasible delivery timelines, stakeholder priorities, and spending profiles to deliver each intervention by 2050. It presents a timeline for the possible future development and delivery of key interventions, broadly broken down as follows:

- **Short** term: from today to circa 2030.
- **Medium term**: 2030 – 2040.
- **Long term**: 2040 – 2050.

Details about the potential phasing of interventions are provided below.

Interventions

Short term interventions

The interventions that could be delivered by circa 2030, subject to funding and appropriate analysis and appraisal, are:

- Safeguard corridors, routes, and key stations (new lines, potential stations, and major hubs e.g., Portadown) to ensure key corridors identified in the Review are protected to accommodate new railways and stations in the medium to longer term.
- Develop and start to implement a Rail Decarbonisation Strategy.
- Increase intercity service frequencies to at least hourly between Dublin and Belfast, Cork/Limerick, Galway, and Waterford.
- Increase other service frequencies to at least one train per two hours between Galway-Limerick, Limerick-Cork, Limerick-Ballybrophy, Dublin-Sligo, Dublin-Mayo, and Greystones-Rosslare Europort.
- Through services between Cork and Galway via Limerick with modifications to track and platforms at Limerick Junction to allow more through movements Cork-Limerick.
- Join regional services up to deliver more direct services between Galway – Limerick – Cork and Waterford.
- Improve online capacity and line speeds on various parts of the rail network, such as between Limerick and Limerick Junction.
- Build the Limerick – Foynes railway and develop concept for local passenger services between Foynes and Shannon Airport.
- Reduce freight Track Access Charges.
- Start to reinstate Claremorris – Athenry.
- Start to reinstate Antrim – Lisburn with a station at Belfast International Airport.
- Examine feasibility of RoRo rail freight with a view to reinstating the South Wexford railway between Waterford and Rosslare Europort.
- Identify and deliver a solution for first-mile-last-mile rail freight access for Dublin Port.
- Continue to invest in initiatives that improve customer experience, improve integration, and improve accessibility – including wider roll out of step-free access.

Medium term interventions

Interventions that are likely to take longer than six or seven years to deliver, but could still be delivered (or at least developed) by the end of the next decade, are:

- Invest in developing the skills, supply chains, and rolling stock to deliver the Rail Decarbonisation Strategy.
- Deliver capacity and speed improvements to existing core intercity corridors.
- Start rolling out overhead electrification on intercity routes.
- Procure hybrid and electric rolling stock as fleets come to their end of life.
- Upgrade intercity routes to 160 – 200km/h / 100 – 125mph and increase other line speeds to 120 – 160km/h / 75 – 100mph.
- Upgrade the core network to a dual-track railway and increase commuter and intercity service frequencies.
- Develop new stations in the Belfast, Cork, Derry~Londonderry (including Limavady), and Limerick – Shannon city regions and boost service frequencies in these areas (including Belfast – Coleraine – Portrush).
- Develop a network of inland rail freight terminals on the rail network.
- Improve on-board experience through rolling stock procurement and renewal.
- Improve station experience through investment and expansion.
- Develop appropriate arrangements for planning cross-border services.
- Develop a cross-Dublin proposal.
- Start extending the railway from Portadown to Derry~Londonderry.
- Reinstate the railway between Portadown to Armagh.

Long term interventions

The interventions that will likely take longer to deliver in full, probably into the 2040 – 2050 period, are listed below. However, to reach these timescales, planning for these interventions will need to start soon, and some corridors may need to be safeguarded in the planning system to enable their future development.

- Build new higher speed railways (or four-track existing railways) on busy corridors between Belfast – Newry, Drogheda – Dublin, and Portarlington/Kildare – Hazelhatch. This might be phased with some medium term elements.
- Deliver a cross-Dublin solution and connect the heavy rail network to Dublin Airport.
- Maximise segregation of intercity/regional services from local services.
- Complete the new railway from Portadown to Derry~Londonderry and Letterkenny.
- Reinstate the North Midlands railway between Armagh, Cavan, Mullingar, and Athlone.
- Build a new link between Maynooth and the Dublin – Cork railway.
- Complete the electrification and decarbonisation of the railways.

Phasing

As a programme of multiple interventions, the roadmap can be implemented incrementally, in accordance with policy priorities, demand growth and funding availability. The phasing of the implementation of these interventions would need to be determined in detail by each jurisdiction – some interventions may require distinct phasing themselves. That said, the Review has taken the following considerations into account to develop an indicative timeline for delivery:

- **Electrification** and **decarbonisation** interventions are likely to be seen as a priority. This will enable rail to make a greater contribution to the decarbonisation of the wider transport system as soon as possible, while also delivering material improvements in journey times on existing railways.
- Many electrification interventions could be delivered alongside online **speed** and **capacity** enhancements, and so these are also prioritised in the early part of the programme.
- Due to the condition of existing corridors, the **Foynes** and **Lisburn – Antrim** railways can be delivered in the relatively near future.
- Iarnród Eireann's plans to expand rolling stock fleets should enable **regional frequency enhancements** and **direct regional services** to be introduced in the relatively near future.
- Due to the current condition and alignment of the track, the **Claremorris – Athenry** railway can be reinstated relatively soon.
- **Four tracking Dublin – Clongriffin** is essential to enable the intercity network to grow, followed by the **Dublin tunnel**.
- The timing of the reinstatement of the **South Wexford Railway** should be informed by a general examination of the feasibility of Roll-on/Roll-off rail freight across the network.
- **New railways** are expected to take longer to plan and construct. To ensure a relatively even distribution of annual capital spend, it is recommended that new railways are built sequentially (by each jurisdiction).
- The roadmap prioritises the **Portadown – Derry~Londonderry** route over other new railways as it delivers key intercity and regional objectives for this Review, and it serves a relatively large population.

Conclusions and next steps

This Review has examined the strategic role rail could play in delivering a prosperous economy for the island of Ireland as the stronger backbone of a high-quality and sustainable transport system. It has identified opportunities and interventions that, collectively, could transform transport connectivity and access, as well as accelerate the island's transition to a net zero carbon economy. The future development of railways in both jurisdictions will be, of course, directed by their respective governments and legislatures.

More work is needed to test the economic feasibility, equality impact, and environmental impact of many recommendations included in this Report, as well as to secure necessary funding to take projects forward.

This Review does, however, provide an evidence base along with rationale underpinning recommendations for policymakers to consider as they develop their long-term investment plans for the island's railway.

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Appendix A | Public Consultation

Introduction

This Appendix summaries the analysis of responses received as part of the second public consultation for the All-Island Strategic Rail Review, which was held from 25th July to 29th September 2023.

Previously, a public consultation for the Review was held from November 2021 to January 2022 to understand the aspirations of stakeholders and the public for the island's railway, to gain insight into perceptions of the relative importance of the goals of the project, and to inform the development process of the Review's recommendations. The second consultation presented the first opportunity to test the response of stakeholders and the public to the subsequent recommendations of the Review.

The technical remit of the second consultation was to formally consult on a Draft Strategic Environmental Assessment (SEA), which was published alongside the Draft Final Report for the Review. However, the large majority of responses to the consultation focused on non-SEA topics.

The rest of this Appendix summarises the key comments that emerged from the second consultation and outlines how the Review has utilised feedback from this consultation to develop the final version of this Report.

When reviewing any figures presented in this Appendix, it should be noted that these were derived from consultation responses, which may not be representative of wider public opinion.

Summary of responses

In total, 474 responses were received as part of the public consultation. Of these:

- 454 were assessed to be unique and material responses (i.e. not duplicates, not queries about process, etc.);
- 131 were from stakeholders, including airports and ports, business groups, campaign groups, councils, elected officials, government, and other institutions; and
- 323 were from the general public.

Of the 454 unique and material responses, 351 expressed a clear opinion of the Review and its recommendations. Of these:

- Approximately 64% were favourable;
- Approximately 29% were unfavourable; and
- The remaining 7% expressed mixed sentiments.

One of the most cited issues in the consultation, featuring in approximately 32% of responses, was the absence of proposals to extend rail services to Enniskillen in Co. Fermanagh within the Review's recommendations. Of these:

- Approximately 30% were from respondents who stated that they live in or are based in Fermanagh;
- Approximately 16% were from respondents who stated they live or are based outside Fermanagh; and
- Approximately 53% were from respondents who did not identify their location.

Excluding responses relating to Fermanagh, approximately 74% of the remaining responses were favourable, 17% were unfavourable, and 9% were mixed.

Categorises of responses

Jurisdiction

A total of 151 responses were from respondents based in Ireland, 109 in Northern Ireland, 8 from respondents spanning the border or based outside the island, and 186 did not explicitly state a location. While more respondents were based in Ireland, when weighted by population a higher proportion of responses came from respondents based in Northern Ireland. The proportions of respondents per category were broadly similar in each jurisdiction.

Role

Business groups, councils, and government bodies made up a slightly greater proportion of respondents in Ireland while elected officials and the general public made up a slightly greater proportion among Northern Ireland respondents.

Location

The largest number of respondents were from Co. Fermanagh, and given the county's small population, its proportion of responses dwarfed any other. This reflects that Fermanagh was the only county not to be served by rail in the recommendations of the Review. Other counties with high numbers of responses were the North West counties of Derry~Londonderry and Donegal, counties containing major cities such as Dublin, Antrim, Limerick, and Cork, and Louth on the Dublin-Belfast corridor. By contrast, very few responses were received from Midland counties.

It is noted that a location has only been assigned to a respondent when explicitly stated within their response. Respondents who highlighted specific local issues but did not expressly identify that they are from the location in question have not had their location assumed.

Sentiment of responses

The sentiment of responses was analysed and categorised into one of the following categories:

- Support for the recommendations of the Review;
- General support for the recommendations of the Review, but feeling that the recommendations must go further with additional routes, stations, higher speeds, etc;
- Mixed/nuanced responses that supported some aspects of the recommendations while critiquing others;
- Responses that do not support the recommendations of the Review in general because they were not considered to be ambitious enough for rail, and suggested significant review of the recommendations;
- Responses that do not support the recommendations of the Review because they were more critical of rail investment in general; and
- Responses that were neutral or did not contain enough information to be categorised.

This analysis found the majority of respondents were broadly in favour of the recommendations, including those who felt the recommendations should go further. There was a higher proportion of support in Ireland than in Northern Ireland, reflecting the large number of respondents in Co. Fermanagh who felt the recommendations did not go far enough. More than half of respondents felt that the recommendations should go further when those who are broadly in favour of the review and those who are

generally critical of the review are considered together. Only 2% of respondents were unsupportive of investing more in rail.

Location specific comments

A significant number of the responses received mentioned specific rail routes that respondents wished to see included in the final Report.

Enniskillen (and in particular, a route from Enniskillen to Omagh) was the most mentioned by a significant margin, with other routes in the North West and West making up the top of the list.

Approximately half of the specific lines mentioned were included within the recommendations of the Review, with some of the comments highlighting the need for higher specifications such as 200km/h on the proposed Portadown to Derry~Londonderry line.

There were also several references to existing routes – albeit fewer than references to proposed new routes. The most commonly mentioned were the cross-country lines from Galway to Limerick and from Limerick to Waterford. Some concerns were raised about the draft Report's proposals for the Wicklow area, and these have been taken on-board in this refined final Report.

The main themes of comments relating to existing routes were a desire to see higher speeds, more frequent services, better connections between rail services and with other modes of transport, and considering direct services rather than a requirement for interchange on certain routes such as Limerick-Cork.

There were also many requests for new stations, particularly in the North West, and specifically in counties Fermanagh, Donegal, and Sligo. Other places that were mentioned more frequently included various airports, in particular City of Derry Airport, Ireland West Airport, and Shannon Airport, along with new station proposals between Wicklow and Wexford such as Avoca and Ferns.

Key themes

While the responses received in the consultation covered a wide range of topics, six key themes were identified in the analysis.

North West connectivity

The most cited theme in responses by a considerable distance was a sentiment that the recommendations of the Review did not go far enough to provide rail connectivity for the North West. While the exclusion of routes serving Co. Fermanagh from the recommendations was the most commonly cited specific issue, a broader range of concerns were also presented. Respondents also suggested delivering other routes in the North West, such as continuing the recommended route from Derry~Londonderry to Letterkenny southwards to Sligo, connecting Enniskillen to Omagh, Sligo, and Clones, and reopening part of the Western Rail Corridor from Collooney to Claremorris.

Respondents highlighting connectivity in the North West often cited that the recommendations did not go far enough to addressing gaps in interregional connectivity. While many welcomed the introduction of lines from Derry~Londonderry to Portadown and Letterkenny, from Portadown to Mullingar, and from Claremorris to Athenry, some felt that these were not sufficient to enhance connectivity between the North West, the West, and other regions.

A common sentiment was that the North West is more deprived than other regions, and, as such, it should receive 'positive discrimination' with a lower economic

viability threshold for schemes than in other regions. Several respondents felt that delivering comprehensive rail services in the region was critical to enable the region to economically catch up with other parts of the island.

South east connectivity

The other region where many respondents felt the recommendations of the Review were not aligned to local aspirations was the South East, and, in particular, Wicklow. The line from Rosslare to Dublin has particular challenges – it is generally single track, runs close to the coast, runs through residential neighbourhoods in South Dublin, and is constrained by frequent DART services north of Greystones. The Review recommended the restoration of the Waterford to Wexford line to improve service quality for Wexford and to enable Dublin-Wexford services to be rerouted through Waterford to Dublin. Under this plan, communities between Wexford and Greystones would be served by a (more frequent) shuttle service, which would require passengers to transfer to DART at Greystones throughout most of the day. Some respondents in Wicklow were critical of this approach, stating that it would represent no improvement in service quality over the existing offering.

The small number of respondents from Wexford were generally more positive towards the recommendations of the Review although they emphasised that services to Dublin should continue to serve central areas of the city rather than terminating at Heuston.

While urban rail services did not fall within the scope of the Review, and the recommendations aimed to segregate longer distance services from urban ones, the interaction between the two is complex on the Dublin to Rosslare line. Improvements to rail services in Wicklow and Wexford beyond those recommended in the Review would require more comprehensive assessment of these interactions.

The influence of tourism on demand

Some respondents highlighted the importance of tourism for rail demand in many of the regions where the population of residents and access to employment is lower. While the demand projections for the Review were based on the Passenger Demand Forecasting Handbook (PDFH) approach commonly used in the UK, which focuses on residential and employment populations and does not directly consider demand from tourism, non-commuting trip purposes such as leisure and tourism account for around half of intercity rail journeys in Ireland (according to passenger surveys in each jurisdiction). In response, preliminary analysis was carried out to compare demand at adjacent stations where one is a renowned tourist destination, and the other is less so. This indicated that tourism may contribute significantly to demand in some locations. For instance, Portrush station has over twice as many passengers per annum as Ballymoney despite having half its population. As such, further research was carried out to investigate into whether tourism is a significant factor behind higher demand at specific stations across the island's rail network.

Technical considerations

Some respondents went into some detail on specific technical aspects of the recommendations. These included aspects such as line speeds and the details of a cross-Dublin link between the Northern line and the Kildare line. However, these comments were not always in agreement with each other. For example, some suggested that 200km/h /

125mph speeds would be too ambitious while others said they were insufficient.

Equality and inclusion

While the recommendations of the Review included the accessibility of stations and services for disabled people, some feedback from organisations supporting disabled people felt the proposals were not explicit enough. The National Disability Agency in Ireland was broadly supportive of the Review, however, they asked for explicit consultation with advocacy groups and the inclusion of a disability impact assessment for the recommendations. The Inclusive Mobility and Transport Advisory Committee (IMTAC) in Northern Ireland was more critical, requesting engagement with the Departments to address their concerns of insufficiently definitive measures to support accessibility within the recommendations.

Affordability and deliverability

Some stakeholders, while broadly supportive of the Review, raised concerns about the deliverability and affordability of the recommendations. Some, such as IBEC and the CBI, suggested that prioritisation would be critical to ensure that impactful recommendations such as upgrades to the Dublin-Belfast line were delivered promptly. Other stakeholders highlighted the risks to delivering the project posed by the length of the proposed timeline, the complex range of stakeholders, and potential budgetary challenges with competing priorities. Some, such as the Irish Academy of Engineering, highlighted the need to consider rail in the context of transport more broadly when developing proposals.

Further research

In response to feedback from the public consultation, the technical advisor team:

- Undertook research into the potential for tourism demand to be captured in the Review's analysis.
- Undertook three additional scenario sensitivity tests to explore alternative options for improving connectivity in Co. Fermanagh (further details are provided below under the heading "Enniskillen").
- Consulted with key stakeholders to agree appropriate changes to the Report, in particular with respect to the approach for the South East, the Report's narrative on equality and accessibility, and the response to some technical comments received from specialists and experts. There were also recommended changes to include references to more stations and adjust the timing of some proposed initiatives.

This additional work provided the following insights and outcomes:

- Tourist demand specifically does not appear to be a large source of trips when compared to leisure trips more generally. The analysis does not suggest that tourist demand has been underestimated in the trip rate model, and as such the demand estimates for new stations are reasonable – assuming that future rail travel behaviours are broadly in line with those on the existing network.
- Including an additional railway between Omagh and Enniskillen would likely represent poor value for money – see below for details.

Focus on Enniskillen

In response to feedback from the public consultation, further analysis was undertaken to investigate the viability of including a rail link to Enniskillen in the final Report.

This exercise found:

- Enniskillen is located in a relatively sparsely populated part of the island. The area of Fermanagh to the west of the town and Lough Erne is has a similar population density to West Donegal and Leitrim, and the area to the east has similar population density to West Tyrone and Cavan.
- That said, Enniskillen itself is a relatively large settlement in the context of Northern Ireland, and if the town were located on an existing rail corridor, then there would be a very strong case for building a station for the town.
- However, Enniskillen is relatively isolated from major population centres and is not located on an obvious corridor between major cities – indeed, the corridor on the former railway between Sligo and Enniskillen has been formally earmarked to be developed as a greenway.
- Several demographic indicators – including population, employment, and jobs – indicate relatively weak growth in Co. Fermanagh compared to areas further east such as South Tyrone, Co. Armagh, and Greater Belfast.
- A branch line between Omagh and Enniskillen would deliver journey times to Belfast that are comparable to car journey times and would be faster than current bus journey times. Service frequencies would likely be hourly for both rail and bus options. The relative competitiveness of the public transport options between Belfast and Enniskillen would therefore strengthen if a railway were developed – but not substantially.
- Demand forecasts undertaken for the Review (and elsewhere) indicate demand for passenger rail services in Enniskillen would be relatively low. They would likely pass the threshold for developing a new station on an existing railway, but they appear to fall short of the levels of demand needed to justify building a new railway.
- Under the CAF and TAG appraisal frameworks, the Benefit Cost Ratio for building a new railway between Omagh and Enniskillen is significantly below 1. The incremental BCR range for scenarios assessed for this option in the Review is approximately 0.04 – 0.17 (depending on scenario and appraisal framework). This proposal would therefore represent poor value for money.

Given these findings, a rail link to Enniskillen has not been included in the recommendations in the final Report.

Amendments to the final Report

The following amendments have been included in this final Report to take account of feedback from responses received from the public consultation.

- A specific new recommendation to continue to invest in improving accessibility on the rail network, including rolling out step-free access more widely. The Review also commits to undertake Equality Impact Assessments when schemes are taken forward for future development.
- A new recommendation for both jurisdictions to undertake a refresh of this Review once a decade.
- The report has been amended to clarify that the proposed new railway between Derry~Londonderry and Portadown should be designed to accommodate line speeds up to 200km/h / 125mph, where this is found in further study to be beneficial, as was intended in the Draft Final Report.
- The Report has been amended to reflect plans to improve connectivity to the South East – as outlined in the latest Greater Dublin Area Transport Strategy – to include the extension of the DART network to Wicklow.
- The timeline for delivery has been adjusted to bring forward the reinstatement of the North Midlands railway between Portadown and Armagh from a long-term to a medium-term horizon.
- Maps have been amended to include a proposed new station at Craigavon.
- Some technical wording has been adjusted to ensure it reflects the “high-level” nature of the Review (for example, by removing references to in-cab signalling).
- A reference has been added to the Executive Summary to emphasise the need to safeguard alignments for future railways and stations.

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Appendix B | Review Methodology

Approach and methodology

The technical work underpinning the All-Island Strategic Rail Review was delivered through eight stages. A diagram illustrating the stages is provided in **Figure B.1**. The key activities undertaken at each stage of the study were:

- **Stage A**: Understand the context of the Review and identify connectivity opportunities.
- **Stage B**: Identify connectivity opportunities suitable for rail interventions.
- **Stage C**: Define the function of each corridor in the context of the wider rail network.
- **Stage D**: Develop a long list of potential interventions (options).
- **Stage E**: Form island-wide packages (joining together multiple corridors).
- **Stage F**: Undertake an initial multi criteria assessment of the packages against this Review's Goals and Objectives.
- **Stage G**: Refine final packages for appraisal.
- **Stage H**: Appraise the final packages.

There were two iterations of Stage H – the first iteration appraised seven packages of interventions, and the second assessed a **Final Package of Recommendations** based on the best performing elements of the other packages. The recommendations in this Review align with those interventions included in this Package.

The outputs of this work are published alongside this Final Report as the following documents:

- **Work Package 1**: Context and Policy – covering Stages A, B, and C.
- **Work Package 2**: Package Development and Sifting – covering Stages D, E and F.
- **Work Package 3**: Appraisal and Definition – covering stages G and H.

The rest of this Appendix describes the key activities that were undertaken at each stage of this Review. In particular, it explains how a long list of options was sifted, assessed, appraised, and used to develop the recommendations outlined in **Chapter 4** of this Report.

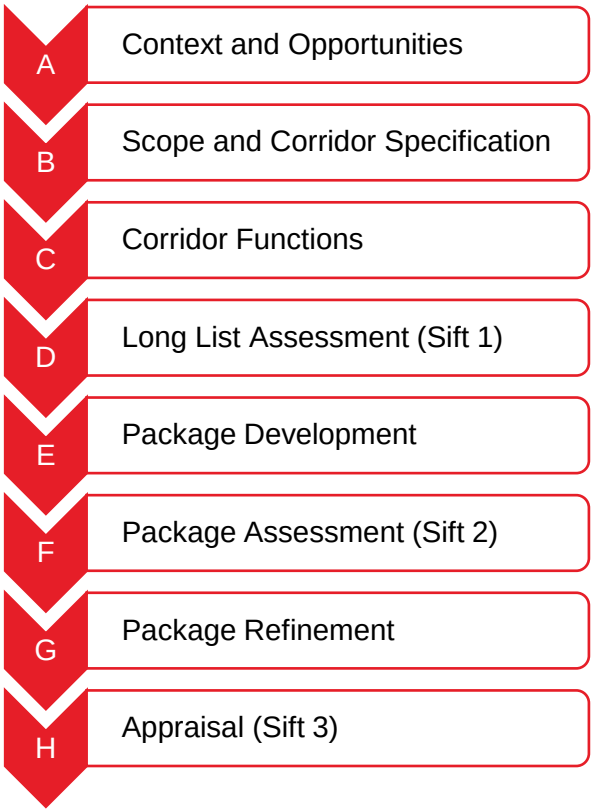

Figure B.1

Stages in the Review

Stage A | Context

In **Stage A** the project team undertook an extensive review of the policy, socioeconomic, and environmental context of the island of Ireland and its railways. The evidence collated by this review enabled the team to identify the key strategic corridors and connectivity opportunities to be included in the scope of the Review. A public consultation was also held at this Stage, and the insights from this consultation informed all subsequent stages of the Review. One of the key outputs from Stage A was the development of **Goals** and **Objectives** for this Review.

Stages B&C | Corridor definition

In **Stage B** the evidence collated in Stage A was used to identify where rail could play a role in supporting passenger and freight connectivity on the island of Ireland. In **Stage C**, concepts (or typologies) were developed for strategic movement corridors to highlight the type of movements rail could support across the island of Ireland. This further enabled the team to tighten the scope of the Review. The key corridors (and their roles) identified and analysed in these stages are presented in **Figure A.2**.

Stage D | Sift 1

In **Stage D** the project team collated a long list of options for interventions on the strategic movement corridors identified in Stages B and C and undertook an initial sift of these options. Options for interventions were sourced from the project team, client team, High Level Steering Group members, and feedback gathered from the public consultation exercise. The options were carefully tabulated in a central database and updated throughout the sifting process. They included proposals for enhancements to existing railways and the development of new (or reinstatement of former) rail corridors. They were generally restricted to infrastructure interventions – complementary measures were considered at a broader, qualitative level. The long list of options was then passed through the first of three sifts. This sift focused on ruling out options due to unambiguous, strategic constraints, including those that were:

- **Not aligned with policy.** This ruled out options that were not aligned to strategies such as the Greater Dublin Area Transport Strategy and Cork Metropolitan Area Transport Strategy, as identified in Stage A.
- **Out of the scope of the study.** This ruled out options that did not serve the strategic movement corridors and connectivity opportunities identified in Stages B and C.
- **Targeting corridors or towns with very low demand potential.** Interventions that aimed to connect towns with populations of 10,000 or more that passed through sparsely populated areas (e.g., Letterkenny – Sligo) were considered, whereas interventions that did not extend to towns of a similar population and only served sparsely populated areas (e.g., West Cork) were deemed to be unviable for rail.
- **Likely to generate an adverse impact on protected areas where better alternative corridors exist.** For example, the Review considered multiple options for a new railway between Portadown and Derry~Londonderry but ruled out options that ran through the Sperrins Area of Outstanding Natural Beauty.

The results of Sift 1 (**Stage D**) are presented in **Table B.1**.

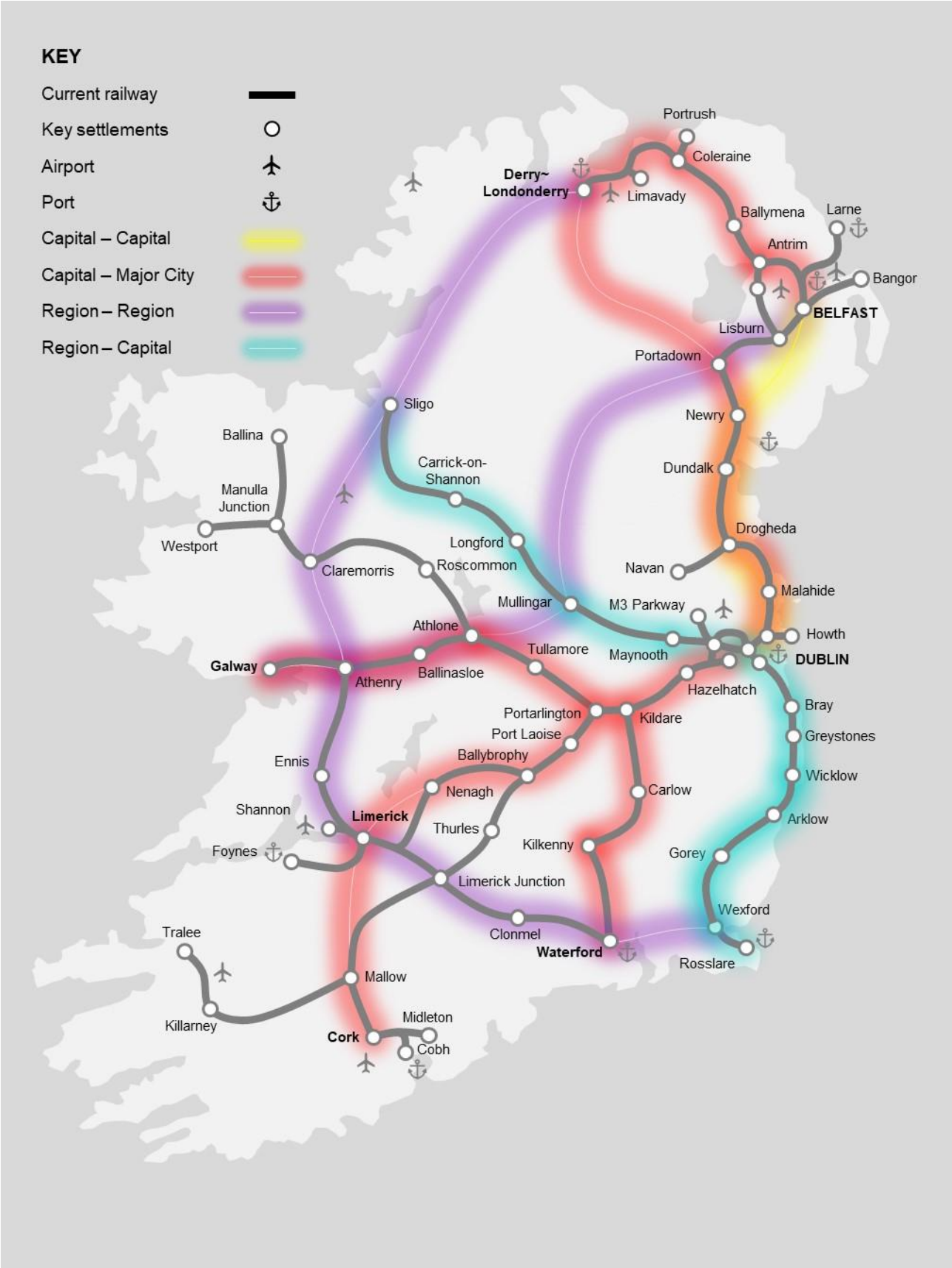

Figure A.2

Strategic movement corridors on the island of Ireland

Stage E | Package development

In **Stage E** the project team combined options into groups of interventions called **packages**. These packages were developed to enable functionally similar interventions to be qualitatively assessed against the Review's Goals and Objectives in Stage F. The packages were defined as follows:

- **Package 1 – Do Minimum:** This package focused on committed interventions and options that required minimal investment in new infrastructure (e.g., some regional service frequency enhancements).
- **Package 2 – Transformational Intercity Connectivity:** This package included variants of possible future segregated high-speed railways that would deliver top speeds of 300km/h / 186mph between major cities.
- **Package 3 – Enhanced Regional Connectivity:** This package included upgrades to the existing rail network to improve journey times and service frequencies on longer distance routes.
- **Package 4 – Enhanced Rural Connectivity:** This package included the reinstatement of old and creation of new railways to fill strategic gaps and expand rail access to rural areas.

Stage F | Sift 2

In **Stage F** the project team undertook a qualitative assessment of the packages developed in Stage E. Almost all the options that passed Sift 1 were found to support many of the Review's key Goals and Objectives. However, it was recognised at this stage that some of the regional and rural packages may need to be disaggregated as they progressed to the next stage.

Sift 2 established that a "spider" high speed rail network (based on multiple lines radiating from Dublin) would be much more costly to deliver than a "linear" high speed network (based on a single line from Cork to Belfast via Dublin), while both options would largely meet the same Goals and Objectives. The latter option was therefore taken forward to the next Stage, while alternative high speed rail options were "parked".

The results of Sift 1 (**Stage D**) and Sift 2 (**Stage F**) are presented in **Table B.1**.

Ref	Intervention / Option	Sift 1				Sift 2	Result
		Policy	Scope	Demand	Impact		
1.01a	Belfast – Antrim – Derry~LD (online improvements)						Proceed
1.01b	Limavady (new spur)						Proceed
1.01c	Belfast – Derry~Londonderry (new High Speed Line)					X	Park
1.02a	Drogheda – Newry (online improvements)						Proceed
1.02b	Belfast – Newry (new line)						Proceed
1.02c	Belfast – Newry (four-tracking)						Proceed
1.02d	Clongriffin – Drogheda (four-tracking)						Proceed
1.02e	Clongriffin – Drogheda (new line)						Proceed
1.02f	Clongriffin – Connolly (four-tracking)						Proceed
1.03a	Dublin – Portarlington (online improvements)						Proceed
1.03b	Hazelhatch - Portarlington (full 4-tracking)						Proceed
1.03c	Hazelhatch - Portarlington (part 4-tracking)						Proceed
1.03d	Hazelhatch - Portarlington (new line)						Proceed
1.03e	Dublin – Cork (new direct High Speed Line)					X	Park
1.03f	Dublin – Cork (new High Speed Line via Waterford)					X	Park
1.03g	Dublin – Cork (new High Speed Line via Limerick)						Proceed
1.03h	Portarlington – Cork (online improvements)						Proceed
1.03i	Dublin – Limerick (new High Speed Line)					X	Park
1.03j	Dublin – Galway (new High Speed Line)					X	Park
1.04	Dublin – Sligo (online improvements)						Proceed
1.05	Galway – Portarlington (online improvements)						Proceed
1.06	Limerick – Athenry (online improvements)						Proceed
1.07	Limerick – Limerick Junction (online improvements)						Proceed
1.08	Waterford – Limerick Junction (online improvements)						Proceed
1.09	Waterford – Kildare (online improvements)						Proceed
1.10a	DART Coastal Loops	X			X		Park
1.10b	Bray Head					X	Park
1.10c	Wicklow - Arklow					X	Park
1.10d	Wexford Waterfront						Proceed
2.01a	Heuston – Dublin Airport – Drogheda (new line)						Proceed
2.01b	Heuston – Tara St – Northern Line (new line)						Proceed
2.02	Lisburn – Belfast Int'l – Antrim (reinstated/new line)						Proceed
2.03a	Derry~Londonderry – Omagh – Portadown (new)						Proceed
2.03b	Derry~Londonderry – Cookstown – Portadown (new)				X		Park
2.03c	Derry~Londonderry – Magherafelt – Antrim (new)				X		Park
2.03d	Derry~Londonderry – Navan (new line)			X			Park
2.04a	Waterford – New Ross – Wexford (new line)						Proceed

Ref	Intervention / Option	Sift 1				Sift 2	Result
		Policy	Scope	Demand	Impact		
2.04b	Waterford – Wellingtonbridge – Wexford (reinstated line)						Proceed
3.02a	Letterkenny – Sligo (new line)						Proceed
3.02b	Derry~Londonderry – Letterkenny (new line)						Proceed
3.02c	Enniskillen – Omagh (new line)						Proceed
3.03a	Claremorris – Athenry (reinstated line)						Proceed
3.03b	Claremorris – Collooney (new line)						Proceed
3.03c	Sligo – Ballina – Westport – Galway (new line)			X	X		Park
3.04a	Portadown – Clones (new line)						Proceed
3.04b	Clones – Sligo (new line)						Proceed
3.04c	Clones – Mullingar (new line)						Proceed
3.05	Midleton – Waterford (new line)						Proceed
3.06	Athlone – Ballina/Westport (online improvements)						Proceed
3.07	Tralee – Mallow (online improvements)						Proceed
3.08	Athlone – Mullingar (reinstated line)						Proceed
3.09	Limerick – Ballybrophy (online improvements)						Proceed
4.01a	Belfast – Portadown (online improvements)						Proceed
4.01b	Belfast Suburban (online improvements)						Proceed
4.02a	Cork Suburban (online improvements)						Proceed
4.02b	Cork Suburban (port access)						Proceed
4.02c	Cork – City Centre – Airport – West Cork (new line)			X	X		Park
4.03	Derry~Londonderry Suburban (online improvements)						Proceed
4.04	Dublin Suburban (DART programme)		X				Park
4.05a	Sixmilebridge/Cratloe – Shannon Airport (new spur)						Proceed
4.05b	Limerick Commuter service (using Foynes link)						Proceed
4.06	Galway Suburban (online improvements)		X				Park
4.07	South Dublin relief line (new line)			X	X		Park
4.08	Ballycastle Branch (new line)			X	X		Park
4.09	West Donegal Branches (new line)			X	X		Park
4.11	Foynes – Tralee (new line)			X			Park
4.12	Kilkenny – Portlaoise (new line)			X			Park
4.13	Donegal – Enniskillen (new line)			X			Park
4.14	Mullingar – Navan (new line)			X			Park
4.15	Adamstown – Maynooth (new line)						Proceed
4.16	Enfield – Edenderry			X	X		Park

Table B.1

Sift 1 and 2 Results (Stages D and F)

Stage G | Package refinement

In **Stage G** the packages that performed well in Sift 2 were revised and re-defined. This reflected the outcomes of Sift 2, which showed only one (segregated) high speed rail option needed to be taken forward for future assessment, while a greater number of disaggregated regional and rural packages were needed to enable the project team to better understand their regional impacts.

The packages defined in Stage E were therefore refined to create the following seven packages:

Package 1 | Short term and decarbonisation

Package 1 focused on service improvements along existing rail lines to improve frequencies, enhance interchange, directly connect more destinations, increase electrification, and provide some new services on relatively short sections of disused or new rail routes. The main features of this package are:

- Electrification of intercity and commuter services between Belfast-Bangor, Belfast-Drogheda, Dublin-Cork, Portarlington-Galway, Limerick Junction-Limerick, and Kildare-Waterford.
- Speed upgrades to maximum of 160km/h on core and some regional intercity lines, improving journey times across the island.
- One train per hour on intercity routes between Dublin and Belfast, Cork, Limerick, Galway, and Waterford.
- One train per two hours on regional routes including Galway-Limerick, Limerick-Cork, Limerick-Ballybrophy, Dublin-Sligo, Dublin-Westport/Ballina, and Greystones-Rosslare Europort.
- Through services between Cork and Galway via Limerick with modifications to track and platforms at Limerick Junction to allow more through movements Cork-Limerick and Limerick-Waterford.
- Direct services between Belfast and Portrush.
- New passenger services on the Limerick-Foynes line together with a new line to Shannon Airport.
- Restored passenger services on the Lisburn-Antrim line and a new station at Belfast International Airport.

Package 2 | Intercity

Package 2 focused on improving connections between the seven major cities. There are two packages within this, with the first of these (Package 2a) centred on a higher-speed network with maximum speeds of 200km/h / 125mph, and the second (Package 2b) centred on a high speed network with maximum speeds of 300km/h / 186mph. These packages include the interventions in Package 1. The features of each package are described below.

Package 2a | Higher Speed

- Upgraded track, including realignments, to deliver up to 200km/h / 125mph line speed on intercity routes between Dublin and Belfast, Galway, Limerick, Cork, and Waterford.
- A new rail route between Drogheda and Inchicore, partially in tunnels, to allow for direct trains between Belfast and the major cities in the South and West via Dublin. This includes new stations at Drogheda East, Dublin Airport, and Glasnevin to connect with MetroLink, DART, and the airport.
- New stations on lines to/from Dublin.

- Dual tracking between Galway and Athenry.

Package 2b | High Speed

- A new 300km/h / 186mph electrified rail alignment between Belfast and Cork via Dublin and Limerick, acting as a spine for the island's rail network.
- Upgrades to the Portarlington-Galway and Kildare-Waterford lines to 200km/h / 125mph, with both lines having through connections to the Belfast-Dublin-Cork spine.
- Electrification of the Maynooth-Longford line including a realignment bypassing Enfield for express services.
- A new link between Hazelhatch and Kilcock, allowing trains from Sligo to travel directly to Heuston. This both separates longer distance trains from the DART network and enables trains from Sligo to travel directly to Dublin Airport and onwards towards Belfast.
- A restored Mullingar-Athlone link, allowing services between Dublin and Galway and Mayo to alternate between routing via Portarlington and via Mullingar.

Package 3 | Regional and rural

Package 3 focused on improving the connections of different regions both to each other and to the major cities and international gateways. It addresses gaps in the existing railway network, particularly in the North West but also in the West and the South East. There are four packages within this, each focused on a particular geographic region of the island. These packages also incorporate the interventions in Package 1 and Package 2a. The main features of each package are described below.

Package 3a | Northern Ireland

- A new 200km/h / 125mph electrified double-tracked line between Portadown and Derry~Londonderry via Omagh, providing direct connections between Derry~Londonderry and both Belfast and Dublin on an hourly basis.
- A new 120km/h / 75mph single-track unelectrified line between Omagh and Enniskillen with an hourly service.
- Enhanced suburban rail around Derry~Londonderry, with extra track capacity, new stations on the line to Coleraine, and a new spur to Limavady.
- Additional stations and capacity enhancements (e.g., passing loops) on the existing Derry~Londonderry-Belfast line including new stations on this corridor, all with at least hourly service.

Package 3b | West Coast

- A new 120km/h / 75mph electrified line between Derry~Londonderry and Sligo, double-tracked between Derry~Londonderry and Letterkenny and single-track between Letterkenny and Sligo. Hourly services along the whole line and two trains per hour between Letterkenny and Derry~Londonderry.
- A new 120km/h / 75mph electrified single-track line between and Sligo and Athenry, with hourly Sligo-Galway services.
- Electrification and speed upgrades, including limited realignment, between Athenry and Sixmilebridge to enable hourly services between Limerick and Galway.

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Package 3c | South Coast

- Electrification and speed and capacity enhancements along the Limerick Junction-Waterford line to enable 120km/h / 75mph running.
- A new 120km/h electrified double-tracked line between Waterford and Wexford via New Ross, with interventions to deconflict rail movements in Wexford Town.
- A new 120km/h / 75mph electrified single-track line between Midleton and Waterford along the South Coast with an hourly service.
- Direct services between Rosslare Europort and both Limerick and Cork. Intercity trains to/from Waterford (with origin/destination in Belfast/Derry~Londonderry via Dublin) which continue to Rosslare Europort.
- Existing Dublin-Rosslare Europort service is replaced with hourly Greystones-Wexford service, connecting with the DART at Greystones and Wicklow.

Package 3d | North Midlands

- A new 120km/h / 75mph electrified double-tracked line between Portadown and Clones via Armagh and Monaghan.
- A new 120km/h / 75mph electrified single-track line between Clones, Enniskillen, and Collooney.
- A new 120km/h / 75mph electrified single-track line between Clones and Mullingar via Cavan, Ballyjamesduff, and Oldcastle (later amended to follow the alignment for the former railway, which avoids these towns).
- Restoring the Mullingar-Athlone link, allowing direct services between Belfast and Galway via Cavan.
- Hourly services between Belfast and Sligo via Enniskillen, one train per two hours between Belfast and Dublin via Cavan, and one train per two hours between Belfast and Galway via Cavan.
- One train per two hours between Dublin and Galway via Mullingar and Athlone.

Stage H | Appraisal and Sift 3

In **Stage H** the project team undertook a qualitative assessment and economic appraisal of the packages that were developed in Stage G. The core economic appraisal undertaken at this stage was based on the following guidance sources:

- UK Department for Transport's Transport Analysis Guidance (TAG);
- Irish Department of Transport's Common Appraisal Framework (CAF);
- Better Business Cases Northern Ireland Supplementary Guidance;
- Ireland Public Spending Code;
- UK Treasury Green Book; and
- National Transport Authority and Transport Infrastructure Ireland Guidance.

Some interventions (largely freight and customer service interventions) were not quantitively assessed but were qualitatively assessed.

Initially, the project team assessed each of the seven packages developed in Stage G. This showed that while some packages performed well, others had shortcomings. The project team then combined the best performing elements of each package into an eighth package and appraised this using the same approach.

The economic appraisal was based on demand estimates that were delivered using an elasticity-based model (for routes on the existing network) and a gravity-based trip-end model (for new stations and routes). This high-level, indicative approach gives broad indications of the potential scale of demand, at an appropriate level of detail for this Review.

Further information about the assessment and appraisal undertaken for this Review is provided in the **Work Package 3: Appraisal and Definition Report** that is published alongside this Report. A breakdown of benefits and costs in present values (discounted and presented in 2010/11 prices), are presented in **Table B.3** (for CAF) and **Table B.4** (for TAG).

Benefits

As part of the economic appraisal of the packages, the following benefits were considered and, where possible, monetised for each package:

- Journey time benefits for business, commuter, and leisure travellers;
- Highway/road decongestion;
- Accidents;
- Local air quality;
- Noise;
- Greenhouse gases;
- Other external effects (CAF only), which includes impacts on nature, landscapes, and the urban environment; and
- Marginal External Costs (TAG only), which accounts for indirect taxation.

Benefits were calculated using journey times from a modelling suite that applied assumptions on alignments, calling patterns, and line speeds.

Costs

The following costs were considered and, where possible, monetised.

- Capital costs;
- Rolling stock costs; and
- Additional operating and maintenance costs.

Cost estimates were drawn from recent relevant projects, studies, and experience, including insights from Iarnród Éireann and Translink. They were based on assumptions for unit costs for items such as kilometres of new railway, rolling stock units, or train kilometres operated. The estimates presented for some interventions in this report may differ to other estimates prepared by other parties for similar interventions. This is because a 'top-down' approach to cost estimating was necessary to provide estimates for a large number of interventions, which is by its nature likely to yield different results to more detailed 'bottom-up' estimates.

Optimism Bias was applied to all these costs to reflect uncertainty, risk, and contingency. The level of Optimism Bias varies between CAF and TAG. Further details about the assumptions underpinning the cost estimates are provided in the **Work Package 3 Report.**

Appraisal

The investment frameworks listed above were applied to prepare present value estimates for the benefits, costs, net present value, and benefit to cost ratios of each package. Results based on the TAG framework are presented in 2010 values, and results based on CAF guidance are presented in 2011 values. Both frameworks applied a 60-year appraisal period for the packages. The appraisal results, along with a breakdown of benefits and costs in present values (discounted and presented in 2010/11 prices), are presented in **Table B.3** (for CAF) and **Table B.4** (for TAG).

It should be noted that the packages were assessed as combinations and not in isolation. This reflects the Review's assumption that the additional regional and rural interventions included in packages 3a, 3b, 3c and 3d would not be delivered in isolation but would likely be delivered alongside interventions included in Package 1, Package 2a, and Package 2b. **Table B.2** shows which interventions were included in each package for qualitative assessment and appraisal.

Development of recommendations

The first iteration of the appraisal undertaken in Stage H showed that:

- While many combinations and permutations of the packages supported the Review's Goals and Objectives, many delivered a **poor Benefit to Cost Ratio (BCR)** – in some cases, significantly below one.
- Several of the **regional and rural** packages were judged to be unviable as they generated too little demand to justify their cost. The carbon assessment also found that some routes would not generate enough modal shift to offset the carbon generated by the construction of the new railways.
- A **new segregated high-speed railway** from Cork to Belfast via Dublin would represent very poor value for money – but some sections of the route that was appraised appeared to stimulate high demand.

The results from this appraisal were used to develop a **final package of recommendations, (Package 3e)**, which combined the best performing elements of the other seven packages.

Table B.2 presents interventions that were included in the final package of recommendations and explains why some options were not taken forward.

Recommendations appraisal

An appraisal of the recommendations was then undertaken, and the results of this appraisal are presented alongside the results of the other packages in **Table B.3 (€)** and **Table B.4 (£)**. The assessment results for all eight packages are presented in a Multi Criteria Assessment Framework in **Table B.5**.The project team also estimated the scale of **wider impacts,** which account for agglomeration and imperfect competition, that Scenario 3e could deliver.

Tables B.3 and **B.4** show the economic appraisal of the recommendations delivered a BCR above one under the Common Appraisal Framework approach (increasing to 1.1 with wider impacts) and **Table B.5** shows the Final Scenario strongly supports the Review's Goals and Objectives. Indeed, the final package of recommendations performs as well as or better than the other packages against all but three of the criteria used to assess their performance.

This does not mean that each recommendation is guaranteed to produce a BCR above one when assessed individually in future appraisals, but the evidence suggests that when taken together, **the benefits of delivering the recommendations in this Review – including non-monetised benefits – more than outweigh their costs**.

Ref	Intervention / Option	Package								Result	Comment
		1	2a	2b	3a	3b	3c	3d	3e		
1.01a	Belfast – Antrim – Derry~LD (online improvements)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
1.01b	Limavady (new spur)				✓				✓	Included	
1.02a	Drogheda – Newry (online improvements)		✓		✓	✓	✓	✓	✓	Included	See note 1
1.02b	Belfast – Newry (new line)			✓					✓	Included	
1.02c	Belfast – Newry (four-tracking)		✓		✓	✓	✓	✓		Parked	
1.02d	Clongriffin – Drogheda (four-tracking)									Parked	
1.02e	Clongriffin – Drogheda (new line)								✓	Included	
1.02f	Clongriffin – Connolly (four-tracking)								✓	Included	
1.03a	Dublin – Portarlington (online improvements)		✓		✓	✓	✓	✓	✓	Included	See note 2
1.03b	Hazelhatch - Portarlington (4-tracking)		✓		✓	✓	✓	✓		Parked	
1.03d	Hazelhatch - Portarlington (new line)			✓					✓	Included	
1.03g	Dublin – Cork (new high speed line via Limerick)			✓						Parked	
1.03h	Portarlington – Cork (online improvements)		✓		✓	✓	✓	✓	✓	Included	

Ref	Intervention / Option	Package								Result	Comment
		1	2a	2b	3a	3b	3c	3d	3e		
1.04	Dublin – Sligo (online improvements)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
1.05	Galway – Portarlington (online improvements)		✓	✓	✓	✓	✓	✓	✓	Included	
1.06	Limerick – Athenry (online improvements)					✓			✓	Included	
1.07	Limerick – Limerick Junction (online improvements)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
1.08	Waterford – Limerick J. (online improvements)						✓		✓	Included	
1.09	Waterford – Kildare (online improvements)		✓	✓	✓	✓	✓	✓	✓	Included	
2.01a	Heuston – Dublin Airport – Drogheda (new line)		✓	✓	✓	✓	✓	✓		Parked	See note 3
2.01b	Heuston – Tara St – Northern Line (new line)								✓	Included	
2.02	Lisburn – Belfast Int'l – Antrim (reinstated/new line)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
2.03a	Derry~Londonderry – Omagh – Portadown (new)				✓				✓	Included	
2.04b	Waterford – Wellingtonbridge – Wexford (reinstated)						✓		✓	Included	See note 4
3.02a	Letterkenny – Sligo (new line)					✓				Parked	See note 5
3.02b	Derry~Londonderry – Letterkenny (new line)					✓			✓	Included	
3.02c	Enniskillen – Omagh (new line)				✓					Parked	See note 6
3.03a	Claremorris – Athenry (reinstated line)					✓			✓	Included	See note 5
3.03b	Claremorris – Collooney (new line)					✓				Parked	See note 5
3.04a	Portadown – Clones (new line)							✓	✓	Included	See note 6
3.04b	Clones – Sligo (new line)							✓		Parked	
3.04c	Clones – Mullingar (new line)							✓	✓	Included	
3.05	Midleton – Waterford (new line)						✓			Parked	See note 4
3.06	Athlone – Ballina/Westport (online improvements)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
3.07	Tralee – Mallow (online improvements)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
3.08	Athlone – Mullingar (reinstated line)			✓				✓	✓	Included	
3.09	Limerick – Ballybrophy (online improvements)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
4.01a	Belfast – Portadown (online improvements)		✓	✓	✓	✓	✓	✓	✓	Included	
4.01b	Belfast Suburban (online improvements)				✓				✓	Included	
4.02a	Cork Suburban (online improvements)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
4.02b	Cork Suburban (port access)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
4.03	Derry~Londonderry Suburban (online improvements)				✓				✓	Included	
4.05a	Sixmilebridge/Cratloe – Shannon Airport (new spur)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
4.05b	Limerick Commuter service (using Foynes link)	✓	✓	✓	✓	✓	✓	✓	✓	Included	
4.15	Adamstown – Maynooth (new line)			✓					✓	Included	See note 7

Table B.2

Composition of packages and development of Final Scenario (Package 3e)

Notes on the Final Scenario

1. **Dublin – Belfast corridor**: Several options were considered for delivering faster and more frequent intercity services on this corridor. Detailed consultation with Iarnród Éireann and Translink helped establish the following:
   - **Belfast – Newry**: It would be very expensive to four-track the railway on this part of the corridor due to built-up areas, the constrained configuration of Portadown station, challenging alignments, and a significant number of level crossings. A shorter, direct line is likely to be a more viable solution for at this part of this corridor, but both options should be considered in developing this intervention.
   - **Drogheda – Clongriffin**: This corridor is likely to become constrained when the DART is extended north. The Review examined options to provide additional loops, fully four-track the line, and develop a new (shorter and faster) line in parallel. From a qualitative standpoint, the new line appears to offer more advantages than disadvantages, but all options would need to be considered for this corridor.
   - **Clongriffin – Connolly**: Several studies in the past have concluded that it would be technically viable to deliver a four-tracked solution on this corridor. This Review has considered developing a tunnel from Clongriffin to Connolly (or Spencer Dock if it were part of a cross-Dublin Tunnel scheme) and concluded this would be extremely costly to deliver. However, to realise the benefits of interventions north of Clongriffin, it will be necessary to add capacity on this corridor.
2. **Hazelhatch – Portarlington**: The Review has examined several options for adding capacity on this corridor, which is needed if the objectives of a higher frequency intercity service (and more frequent and regular commuter service) are to be realised. The options considered include four tracking part or all this section and/or building a new line to the north of the existing alignment. Qualitatively, the latter option appears to have a lower impact on the environment as the current alignment runs through built up areas and the Curragh. As with the interventions discussed above, the business case process should consider all three options.
3. **Cross-Dublin Link**: The Review has considered two broad approaches for linking the North East of the rail network to the South West, enabling transformational improvements in cross-island and cross-Dublin connectivity. This is seen as a critically important intervention to deliver the Review's Goals and Objectives for the intercity network. Two options have been considered: one that links Heuston to Drogheda via Dublin Airport (north-south), and one that broadly follows the DART+ Tunnel / Interconnector scheme (east-west). Following consultation with senior stakeholders in industry and government, it has been concluded that the east-west option aligns better with wider aspirations for the Greater Dublin Area. This option also has the benefit of being carefully studied in the recent past, which has enabled

planners to identify a technically feasible and deliverable route.

4. **South Coast**: Modelling undertaken for interventions in this corridor generally showed they would attract a reasonable level of patronage. They would also support rail freight between the South Coast Ports and the rest of the island. However, it would likely be more cost effective to route longer distance services between Cork and Waterford via improved railways between both cities and Limerick Junction rather than on a new line, so a new railway between Cork and Waterford was not included in the Final Scenario (package 3e).
5. **West Coast**: Modelling undertaken for interventions on this corridor showed there would be very low demand for passenger rail services on this route and that building a railway on this corridor would have a significant adverse impact on the environment. There are also no obvious opportunities for developing significant rail freight demand between Claremorris and Derry~Londonderry. That said, the modelling showed there would some demand between Letterkenny and Derry~Londonderry. It was also assessed that a connection to Letterkenny was essential for achieving the Review's goals of reaching as many large (population >10,000) towns as possible within reasonable economic constraints. This link was therefore retained in the Final Scenario. It was also noted that the link between Claremorris and Athenry provided an important link for the Island's rail freight network, and that the town of Tuam would probably generate demand for a passenger service. This link was also retained, but all other proposed links in Package 3b were dropped form the Final Scenario.
6. **North Midlands**: Modelling undertaken for interventions in this Package showed demand would be skewed to the corridor between Portadown, Armagh, Clones, Cavan, and Mullingar. The same modelling showed that demand between Clones, Enniskillen and Sligo would be much lower – and therefore would be unlikely to represent good value for money. Similarly, the modelling showed that providing a railway for this corridor via Enniskillen and Omagh would probably not stimulate enough demand to justify developing a new railway on this corridor. In response to the public consultation held July – September 2023, the economic feasibility of a link to Enniskillen was further tested and confirmed the initial assessment. This suggests a higher frequency, integrated bus link between Enniskillen and rail stations such as Omagh, Dungannon, and Cavan would offer a better public transport offer at this time.
7. **Sligo – Dublin:** The Final Scenario includes a link between Adamstown and Maynooth/Kilcock to enable Sligo trains to access Heuston (and potentially a new cross-Dublin tunnel) as an alternative to Connolly. This may be needed if (as is planned) the frequency of DART services increases on the route between Maynooth and Connolly, which would likely limit the speed of longer distance services as well as limit opportunities to increase the frequencies of these services.

Package	1: Short Term	2a: Higher Speed	2b: High Speed	3a: Northern Ireland	3b: West Coast	3c: South Coast	3d: North Mids.	3e: Final Scenario
Costs								
Capital Costs	(3,000)	(9,400)	(25,600)	(11,600)	(12,700)	(11,100)	(12,400)	(13,600)
Rolling Stock Costs	(400)	(700)	(1,600)	(800)	(800)	(800)	(800)	(700)
Operating and maintenance expenditure	(2,900)	(8,300)	(12,000)	(10,000)	(9,700)	(9,400)	(10,200)	(9,400)
Revenue	1,200	2,600	3,100	2,900	2,600	2,700	2,800	3,600
Present Value Costs	(5,200)	(15,700)	(36,200)	(19,500)	(20,600)	(18,500)	(20,500)	(20,100)
Benefits								
Business users	700	1,800	2,200	2,100	1,900	2,000	1,900	2,500
Commuter users	1,600	3,400	3,700	3,700	3,500	3,600	3,700	5,000
Leisure users	3,200	7,100	8,900	7,900	7,400	8,000	7,700	9,900
Highway decongestion	500	1,300	1,600	1,500	1,400	1,400	1,500	1,800
Accidents *	196	492	613	552	507	529	544	689
Local air quality *	81	202	252	227	208	217	224	283
Noise *	33	83	103	93	85	89	92	116
Greenhouse gases *	112	280	349	314	289	301	310	392
Other external effects *	62	155	192	173	159	166	171	216
Indirect taxation	(300)	(600)	(700)	(700)	(600)	(600)	(700)	(800)
Present Value Benefits	6,300	14,200	17,400	15,900	14,700	15,800	15,500	20,100
Net Present Value	1,100	(1,500)	(18,800)	(3,500)	(5,900)	(2,700)	(5,100)	6 *
Benefit to Cost Ratio	**1.2**	**0.9**	**0.5**	**0.8**	**0.7**	**0.9**	**0.8**	**1.0**

Table B.3

Economic appraisal results, Common Appraisal Framework approach

2011 Prices, €m, discounted, rounded to nearest €100m (except where a figure has an asterisk *)

Package	1: Short Term	2a: Higher Speed	2b: High Speed	3a: Northern Ireland	3b: West Coast	3c: South Coast	3d: North Mids.	3e: Final Scenario
Costs								
Capital Costs	(2,800)	(8,500)	(23,300)	(10,500)	(11,600)	(10,100)	(11,300)	(12,400)
Rolling Stock Costs	(400)	(700)	(1,600)	(700)	(800)	(800)	(800)	(700)
Operating and maintenance expenditure	(3,000)	(8,500)	(12,500)	(10,300)	(10,000)	(9,700)	(10,500)	(9,700)
Revenue	1,200	2,800	3,400	3,100	2,800	2,900	3,000	3,900
Present Value Costs	(4,900)	(15,000)	(34,100)	(18,600)	(19,600)	(17,700)	(19,600)	(19,000)
Benefits								
Business users	500	1,200	1,500	1,400	1,200	1,400	1,300	1,700
Commuter users	1,100	2,400	2,700	2,700	2,500	2,600	2,700	3,600
Leisure users	1,200	2,600	3,300	2,900	2,700	3,000	2,800	3,600
Highway decongestion	500	1,100	1,400	1,300	1,200	1,200	1,300	1,600
Accidents *	71	177	220	198	182	190	196	248
Local air quality *	10	24	30	27	25	26	27	34
Noise *	4	11	13	12	11	12	12	15
Greenhouse gases *	68	171	213	192	177	184	190	240
Indirect taxation (MECs) *	38	96	120	108	99	103	106	134
Indirect taxation (Rail fares)	(200)	(500)	(600)	(600)	(500)	(600)	(600)	(700)
Present Value Benefits	**3,200**	**7,400**	**8,900**	**8,200**	**7,600**	**8,100**	**8,000**	**10,500**
Net Present Value	**(1,700)**	**(7,700)**	**(25,200)**	**(10,300)**	**(12,000)**	**(9,500)**	**(11,600)**	**(8,500)**
Benefit to Cost Ratio	**0.7**	**0.5**	**0.3**	**0.4**	**0.4**	**0.5**	**0.4**	**0.6**

Table B.4

Economic appraisal results, Transport Analysis Guidance approach

2010 Prices, £100m, discounted, rounded to nearest £m (except where a figure has an asterisk *)

The Final Package of Recommendations

In summary, the interventions identified as recommendations for this Review are:

Short term and decarbonisation:

- Electrification of intercity and commuter services between Belfast-Bangor, Belfast-Drogheda, Dublin-Cork, Portarlington-Galway, Limerick Junction-Limerick, and Kildare-Waterford.
- Speed upgrades to 160km/h / 100mph on core and some regional intercity lines.
- One train per hour on intercity routes between Dublin and Belfast, Cork, Limerick, Galway, and Waterford.
- One train per two hours on regional routes including Galway-Limerick, Limerick-Cork, Limerick-Ballybrophy, Dublin-Sligo, Dublin-Westport/Ballina, and Greystones-Rosslare Europort.
- Through services between Cork and Galway via Limerick with modifications to track and platforms at Limerick Junction to allow more through movements Cork-Limerick.
- Direct services between Belfast and Portrush.
- New passenger services to the Limerick-Foynes line and a spur to Shannon Airport.
- Reinstatement of the Lisburn-Antrim line with a station at Belfast International Airport.

Intercity

- A new 200km/h / 125mph line from Belfast to Newry via Hillsborough, Dromore, and Banbridge, with connections to the Lisburn-Antrim line and towards Portadown.
- A new 200km/h / 125mph line linking Drogheda to Clongriffin with four-tracking from Clongriffin to Connolly/Spencer Dock.
- A spur to Dublin Airport from Clongriffin.
- A cross-Dublin tunnel from the north of Spencer Dock to Heuston, with connections for DART and MetroLink at several stations in Dublin City Centre.
- A new 200km/h / 125mph double-tracked electrified alignment between Hazelhatch and Portarlington and a link to the Kildare-Waterford line.
- A short link between Maynooth and Adamstown to separate longer-distance trains from the DART services.
- Double tracking from Dublin as far as Mullingar, Athlone, and Kilkenny, as well as between Galway and Athenry.

Regional and rural

- A new 200km/h / 125mph dual-tracked electrified line between Portadown and Derry~Londonderry.
- A new single-track line between Derry~Londonderry and Letterkenny.
- New stations between Derry~Londonderry and Coleraine, including a spur to Limavady.
- Dual-tracking and new stations between Belfast and Antrim (on the Belfast – Derry~Londonderry line).
- A new single-track line between Portadown and Mullingar via Armagh, Monaghan, Clones, and Cavan.
- A reinstated single-track line between Mullingar and Athlone.
- A reinstated single-track line between Claremorris and Athenry via Tuam.
- A reinstated single-track line between Waterford and south of Wexford.
- A curve at Limerick Junction to facilitate through services between Cork-Waterford.
- Enhancements to capacity and alignment along the Limerick Junction-Waterford line.

Other interventions including enhanced port connectivity, inland freight terminals, reduced freight access charges, and customer experience initiatives were not quantitively assessed but have been qualitatively assessed and are included in the Review's recommendations.

Goal	Objective	Criteria	1	2a	2b	3a	3b	3c	3d	3e
Decarbonisation	Reduces emissions from construction, operation, and maintenance	Reduction in rail carbon emissions over study period.								
	Reduces carbon emissions from motor vehicle travel.	Reduction in road carbon emissions over study period (modal shift).								
Intercity	Provides an attractive public transport choice for travel between cities.	Journey time benefits on intercity flows.								
		Frequency benefits on intercity flows.								
Regional and Rural	Gives rural and regional areas better access opportunities and services	Access to jobs and expansion of catchment areas.								
	Improves inter-regional accessibility	Journey time benefits on inter-regional flows.								
		Frequency benefits on inter-regional flows.								
Sustainability	Promotes compact growth and integration of public transport with land use	Stations with transport-oriented development potential.								
	Enhances integration of rail with other modes	Stations as multimodal transport hubs offering convenient interchange between modes.								
	Minimises the negative impact on the environment	Impact on noise, air quality, landscape, townscape, biodiversity, historic environment, and water environment.								
Freight and Economy	Helps balance economic growth between urban and regional areas	Wider economic impacts on productivity and distribution of jobs								
	Supports efficient movement of goods	Matrix of freight paths between centres and gateways								
	Supports access to international gateways	Matrix of GJTs between centres and gateways								
Economic Feasibility	Financially feasible	Overall funding requirement.								
	Access to potential funding	Source, certainty, and scale of funding required.								
	Benefit to Cost Ratio	Value for money assessment								

Table B.5

Results of a qualitative multi-criteria assessment of the performance of the eight packages against the Review's Goals and Objectives. Key to shading is provided to the right.

Show stopper	Strong negative	Slight negative	Neutral	Slight positive	Strong positive

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Appendix C | Mitigation and Monitoring Measures

Mitigation Measures

Environmental Aspect	Mitigation Measure
Population and Human Health	Any developments resulting from the implementation of the Review which would be likely to have a significant negative effect on amenities in the plan area through air emissions, noise emissions, odours, water emissions or visual disturbance should be mitigated in order to eliminate significant negative impacts or reduce them to relevant limit levels.
Biodiversity	**Protection of Biodiversity including Natura 2000 Network** Protect designated sites including Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), Natural Heritage Areas (NHAs), proposed Natural Heritage Areas, United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage and UNESCO biosphere sites, Ramsar Sites, Salmonid Waters, Shellfish Waters, Freshwater Pearl Mussel catchments, Flora Protection Orders and Species, Wildlife sites (including Nature Reserves); the Water Framework Directive (WFD) Register of Protected Areas; Wildfowl Sanctuaries and Tree Preservation Orders. Any developments arising from the implementation of the Review shall comply with relevant EU Environmental Directives and applicable National Legislation, Policies, Plans and Guidelines, including the following: European Union (EU) Directives, including the Habitats Directive (92/43/EEC, as amended), the Birds Directive (2009/147/EC), the Environmental Liability Directive (2004/35/EC), the Environmental Impact Assessment Directive (2011/92/EU, as amended by 2014/52/EC), the Water Framework Directive (2000/60/EC) and the Strategic Environmental Assessment Directive (2001/42/EC); National legislation, including the Wildlife Acts 1976 and 2010 (as amended), the Planning and Development Act 2000 (as amended) and associated regulations, Environmental Impact Assessment Regulations, the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended), the Flora Protection Order 2015, the Wildlife (NI) Order 1985 (as amended), the Wildlife and Natural Environment Act (NI) 2011, The Conservation (Natural Habitats, etc) Regulations (Northern Ireland) 2017 and the Strategic Planning Policy Statement (SPPS) for Northern Ireland; National policy guidelines; Catchment and water resource management plans; and Biodiversity plans and guidelines including National Biodiversity Action Plan 2017-2021 and Ireland's 4th National Biodiversity Action Plan (Ireland), All-Island Pollinator Plan; Biodiversity Strategy for Northern Ireland to 2020 (Northern Ireland), Draft Environment Strategy (NI), the Draft NI Peatland policy, the Draft Green Growth Strategy (Northern Ireland) and Northern Ireland Energy Strategy 2050; the Draft Green Growth Strategy for Northern Ireland, Draft Environment Strategy for Northern Ireland. (and any updated/superseding documents).

Environmental Aspect	Mitigation Measure
	Biodiversity and Ecological Networks Any developments arising from the implementation of the Review should aim to protect, restore and enhance biodiversity and ecological connectivity, including woodlands, trees, hedgerows, semi-natural grasslands, rivers, streams, natural springs, wetlands, geological and geo-morphological systems, other landscape features, natural lighting conditions, and associated wildlife where these form part of the ecological network and/or may be considered as ecological corridors or stepping-stones in the context of Article 10 of the Habitats Directive. The design of any developments arising from the implementation of the Review should aim to achieve no net biodiversity loss where practicable. The design of any developments arising from the implementation of the Review should aim to incorporate Biodiversity Net Gain where practicable.
	Invasive Species Appropriate invasive species surveys shall be carried out in advance of any construction/reinstatement works. Invasive Species Management Plans shall be prepared and implemented where required, following the assessment of invasive species surveys.
	Direct Land Take The design of any developments arising from the implementation of the Review will ensure that measures are explored to avoid unnecessary land-take, in line with the ecological mitigation hierarchy which prioritises avoidance, and seeks to reduce, mitigate and then compensate and offset for adverse effects on biodiversity, in that order of preference. If land-take cannot be avoided, an assessment of the type (and use) of habitat present is required to determine suitable mitigation and/or compensation measures.
	Hydrological Change Where proposed work has the potential to result in hydrological change, and there is a European Site within the zone of influence, then design level modelling will be undertaken to determine any potential hydrological change as a result of any proposed construction works which may impact on the hydrology of sites within the zone of influence of the implementation of the Review, including European Sites designated for their international nature conservation importance. This will also help to inform the overall design of any infrastructure requirements.

Environmental Aspect	Mitigation Measure
	Water Pollution Where proposed work has the potential to result in water pollution, and there is hydrological connectivity to a European Site, Surface Water Management Plans (SWMPs) will be prepared for planning submission of development proposals and implemented during construction where impacts on sensitive waterbodies are likely to arise. SWMPs will include appropriate measures such as temporary silt fencing, cut off ditches, settlement ponds and bunds set up early in construction to capture runoff and prevent ingress of sediments and contaminants into existing drainage infrastructure where necessary. Integrated and innovative solutions require a partnering approach best managed through a SWMP. Where implementation of the Recommendations presents a challenge to existing drainage systems, and/or the operation of a local drainage system is known to be complicated by interactions between river, groundwater and sewer systems or river and canal systems, submission of a Water Protection Plan and detailed site drainage plans will be required with planning applications associated with developments arising from the implementation of the Review, if a European Site falls within the zone of influence..
	Air Quality Where there is potential for implementation of the Review to result in significant increases in air pollution, and a European Site falls within the zone of influence of such implementation, then air quality modelling should be undertaken to determine potential air quality impacts of the implementation of the Review on sites, including European Sites within the zone of influence. Where increased air pollution may result in adverse effects on habitats, potential solutions to mitigate air pollution and resulting dust and nitrogen deposition may include: tree planting to reduce deposition of pollutants on a site (this is site and habitat dependent); preparation and implementation of dust management plans, screening and the provision of compensatory habitat (where practicable).
	Noise, vibration and visual disturbance Development proposals arising as a result of implementation of the Review will have regard to the requirements of the Noise Directive 2002/49/EC and associated Environmental Noise Regulations 2006 ES 45 and European Communities (Environmental Noise) Regulations 2018 S.I. No. 549/2018 (Ireland) (and any updated/superseding documents). Development proposals will provide evidence that the design does not result in increased noise, vibration or visual disturbance to important ecological receptors within the zone of influence, in particular those that are Qualifying Interests (QIs) / Species of Conservation Interest (SCIs) of European Sites, to the degree that the noise/vibration/visual disturbance affects the integrity of the ecological receptor. In constructing development proposals arising as a result of the Review regard shall also be given to BS 5228 Part 1 (2014) and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001 ’Code of Practice for Noise and Vibration Control on Construction and Open Sites’ (and any updated/superseding documents).

Environmental Aspect	Mitigation Measure
	Lighting Proposals arising from the implementation of the Review will demonstrate that the design of lighting minimises the incidence of light spillage or pollution into the surrounding environment and that there is no unacceptable adverse effect on the integrity of European Sites (i.e. no unacceptable adverse effect on QIs/SCIs of European Sites). It should be demonstrated that the design and implementation of a hierarchy of light intensity zones has been factored into designs to ensure that environmental impact is minimised as far as possible particularly in areas proximate to ecological corridors and European Sites. It is encouraged that that any developments arising from the implementation of the Review maintain dark skies in rural areas and limit light pollution in urban and rural areas.
	Additional Recreational Pressure Improving the transport network across the Island of Ireland increases accessibility to protected areas, which places pressure on habitats and species within the protected areas, and can have adverse effects on the integrity of such sites. Mitigation requirements would be dependent on the level of potential recreational pressure and the actual site in question, but mitigation needs to ensure that there are no adverse effects on the integrity of European Sites resulting from implementation of the Review Recommendations. Examples of alleviation include guided paths to less sensitive areas of Protected Sites, or reduced access at certain times of year when important features of a site are at their most sensitive e.g. breeding bird season.
Land and Soils	**Land Take** Development proposals arising from the implementation of the Review should be cognisant of the target of the National Planning Framework's (2018) Strategic Environmental Assessment (SEA) to "Maintain built surface cover nationally to below the EU average of 4%".
	Geological Heritage Sites and Areas of Special Scientific Interest Development proposals arising from the implementation of the Review should contribute towards the appropriate protection and maintenance of the character, integrity and conservation value of features or areas of geological interest. GSI datasets should be taken into account as appropriate during the design or development of projects and plans arising from the implementation of the Review, including those relating to geoheritage, groundwater, geohazards, natural resources and coastal vulnerability.
	Contamination Ensure that adequate soil protection measures are undertaken where appropriate on any developments arising from the implementation of the Review. Adequate and appropriate investigations shall be carried out into the nature and extent of any soil and groundwater contamination and the risks associated with site development work, particularly where brownfield development is proposed.
Water	**Flood Risk Management Guidelines** Any developments resulting from the implementation of the Review shall be subject to plan/project level flood risk assessments.

Environmental Aspect	Mitigation Measure
	Legislation Where appropriate, any developments arising from the implementation of the Review should contribute towards the protection of existing and potential water resources, and their use by humans and biodiversity. This should be carried out in accordance with the requirements and guidance in the EU Water Framework Directive 2000 (2000/60/EU), the European Union (Water Policy) Regulations 2003 (as amended), the European Communities Environmental Objectives (Surface Water) Regulations 2009 (SI No. 272 of 2009), the Groundwater Directive 2006/118/EC and the European Communities Environmental Objectives (groundwater) Regulations, 2010 (S.I. No. 9 of 2010) and other relevant EU Directives, including associated national legislation and policy guidance (including any superseding versions of same).
	Sustainable Drainage Systems (SuDS) Any new developments associated with the implementation of the Review should implement SuDS where possible.
Air and Climate	**Air** Any developments arising from the implementation of the Review should comply with air quality legislation and contribute to achieving greenhouse gas emission targets. Management plans shall be formulated based on the following best practice guidance from Ireland, the UK (Institute of Air Quality Management (IAQM) (2014), The Scottish Office (1996), UK Office of Deputy Prime Minster (2002) and Building Research Establishment (BRE) (2003) (and any updated/superseding documents). Dust management plans shall be prepared and implemented for any major construction/reinstatement/upgrade works associated with the implementation of the Review.
	Climate adaptation and resilience Improve resilience and adaptation to climate change by taking into account issues including the following in the location and design of any developments/plans arising from the implementation of the Review; • Flood risk; • Susceptibility to major accidents/disasters; • Extreme temperature and associated implications including those relating to the operation of transport and ancillary infrastructure and services.

Environmental Aspect	Mitigation Measure
Archaeological, architectural and cultural heritage	**Archaeological Heritage** Where practicable, developments arising from the implementation of the Review should protect archaeological heritage by implementing the relevant provisions of the Planning and Development Act 2000 (as amended), the National Monuments Act, 1930 (as amended) (Ireland), The Planning Act (NI) 2011,The Northern Irish Historic Monuments, Archaeological Objects Order 1995 (Northern Ireland) and the Planning Act (NI) 2011, The Valetta Principles for the Safeguarding and Management of Historic Cities, Towns and Urban Areas, the Convention for the Protection of the Architectural Heritage of Europe (hereafter referred to as the Granada Convention) (Council of Europe 1985), the Framework and Principles for the Protection of the Archaeological Heritage (Government of Ireland 1999) and the Code of Practice between the Department of Arts, Heritage and the Gaeltacht and Iarnród Éireann. Any plans or projects arising from the implementation of the Review will adhere to the existing Code of Practice between the Department of Arts, Heritage and the Gaeltacht and Iarnród Éireann (2012) and any future iterations. Any changes to archaeological heritage resulting from any new developments, reinstatement works or alterations to existing infrastructure arising from the implementation of the Review, shall be in accordance with the relevant legislation. Consultation with the National Monuments Service (NMS) of the Department of Housing, Local Government and Heritage (Ireland) and the Historic Environment Division of the Department of Communities (Northern Ireland) should be carried out for any plans/projects resulting from the implementation of the Review where impacts on protected sites are likely to arise. All assets as recorded in the Historic Environment Record of Northern Ireland will be considered at project / development level. Any developments associated with the implementation of the Review should contribute, where relevant, towards the protection and preservation of underwater archaeological sites in riverine, intertidal and sub-tidal locations.

Environmental Aspect	Mitigation Measure
	Architectural Heritage Where possible developments arising from the implementation of the Review should contribute towards the protection of architectural heritage by adhering to the relevant legislative provisions of the Planning and Development Act 2000 (as amended) and The Planning Act (NI) 2011, in relation to architectural heritage and the policy guidance contained in the Architectural Heritage Protection Guidelines 2011 (Ireland) and The Northern Irish Historic Monuments and Archaeological Objects Order 1995 (Northern Ireland) (and any updated/superseding documents). Any changes to architectural heritage or it's curtilage, resulting from any new developments, reinstatement works or alterations to existing infrastructure resulting from the implementation of the Review, shall be in compliance with relevant legislation. Any plans/projects arising from the implementation of the Review will have regard to the Historic Environment Division's Record of assets which have protections under the regional and local planning policies in Northern Ireland, including Historic (and Listed Buildings), designated Areas of Significant Archaeological Interest (ASAI), Historic Parks, Gardens and Demesnes, Defence and Industrial Heritage and shipwrecks and maritime heritage where relevant. All assets as recorded in the Historic Environment Record of Northern Ireland will be considered at project / development level. In addition, any plans/projects arising from the implementation of the Review will have regard to aspects of heritage not fully covered by those held on formal records - e.g. the wealth of vernacular heritage, particularly across the rural landscape, historic routeways, boundaries, and townland and parish boundaries.
Landscape and Visual	Developments and plans arising from the implementation of the Review should contribute, where possible, towards the protection of county and local level landscape designations from incompatible developments. Any developments which may arise from the implementation of the Review that have the potential to result in negative effects on these designations shall be accompanied by an assessment of the potential landscape and visual impacts of any such development. This will demonstrate that potential landscape effects have been anticipated and avoided to a level consistent with the sensitivity of the landscape and the nature of the designation. Protect amenity value and minimise negative effects on amenity value resulting from any new developments, reinstatement works or alterations to existing infrastructure arising from the implementation of the Review. Any developments arising from the implementation of the Review should protect the landscape character and visual potential of the coast and conserve the character and quality of seascapes. Cognisance shall be given to the information and recommendations contained in the Landscape Strategy for Ireland 2015-2025, the Northern Ireland Regional Landscape Character assessment and the Shared Horizons Statement of Policy on Protected Landscapes in Northern Ireland during the development of any projects and plans arising from the implementation of the Review. Any future plans/programmes arising from the implementation of the Review will have regard to existing and new landscape guidance documents.

Environmental Aspect	Mitigation Measure
Material Assets	**Resources and Waste** All waste arising during any construction or reinstatement works arising from the implementation of the Review shall be managed and disposed of in accordance with relevant legislation. Waste management plans shall be implemented to minimise waste and ensure correct handling and disposal of construction wastes streams. Where possible ensure that the principles of reduce, reuse and recycle are implemented on any developments arising from the implementation of the Review. **Land-Use and Infrastructure** Any developments arising from the implementation of the Review should protect public assets and infrastructure including public open spaces, parks and recreational areas, public buildings and services and utility infrastructure (electricity, gas, telecommunications, water supply, wastewater infrastructure etc).
Noise	Consideration of existing noise policy in Ireland and Northern Ireland, for example noise mapping and noise action plans produced by Local Authorities. Consideration of likely noise impacts / effects associated with new developments. This includes being cognisant of proximity to sensitive receptors when siting new developments and the noise levels associated with the construction plant and operation of the rail network. Any developments arising from the implementation of the Review should comply with the Environmental Noise Directive (2002/49/EC) and any noise-related planning requirements. Consideration of updated Environmental Protection Agency (EPA) and Department of Agriculture, Environment and Rural Affairs (DAERA) noise maps in Ireland and Northern Ireland. Consideration of 2030 zero-pollution objectives to reduce noise, such as retrofitting rail with quiet brakes and pads, where appropriate.

Environmental Aspect	Mitigation Measure
All	**Preparation of a Construction Environmental Management Plan** Construction Environmental Management Plans (CEMP) shall be prepared for any major construction/reinstatement works associated with the implementation of the Review. The CEMP shall include, but not limited to, the following information: Description of the project; Description of the construction works required (including duration and phasing, location, sensitive receptors etc); Details of any environmental assessments carried out to inform the CEMP; Roles and responsibilities (including training and competencies); Details on environmental management, including details of any environmental management systems, identification of the relevant regulations and requirements, environmental awareness and commitments; Identification of potential negative environmental effects and mitigation measures to reduce or avoid said impacts (including mitigation measures relating to population and human health, biodiversity, land and soils, water, air and climate, archaeological, architectural and cultural heritage, landscape and visual, material assets (including infrastructure, waste and resources). Procedures for audits, monitoring and inspections.
All	Operational Phase Maintenance Plans should be developed where relevant for any major developments arising from the implementation of the Review.
All	Any new railway lines shall be subject to feasibility, constraints and route options selections assessments.
All	Any developments arising from the implementation of the Review shall be subject to the relevant environmental assessments, as required (i.e. Environmental Impact Assessment, Environmental Impact Assessment Screening, Appropriate Assessment, Habitats Regulations Assessment).

Table C.1

Strategic Environmental Assessment and Appropriate Assessment Mitigation Measures

Monitoring Measures

Environmental Component	Indicators	Monitoring Sources	Frequency/Responsibility
Population and Human Health	Improved accessibility/proximity to rail transport Mode share of rail transport (passenger and freight) Improvement in air quality due to modal shift Reduction in Greenhouse Gas (GHG) emissions from rail transport and due to modal shift Status and quality of waterbodies near railway infrastructure	Central Statistics Office (CSO) Census Reports (Ireland) and Northern Ireland Statistics and Research Agency Census Reports (Northern Ireland)	Central Statistics Office (every 6 years) and Northern Ireland Statistics and Research Agency (every 10 years)
		Environmental Protection Agency (EPA)'s annual air quality reports (Ireland) and the Department of Agriculture, Environment and Rural Affairs (DAERA) data on air quality (Northern Ireland).	EPA (annual air quality reports) and DAERA (annual air quality reports)
		Irish Water and Northern Ireland Water's water quality reports.	EPA (continuously) and DAERA (continuously)
		Monitoring of the effects of projects developments required under separate processes (Environmental Impact Assessment (EIA); Appropriate Assessment (AA))	In accordance with the monitoring provisions of EIA/ AA In accordance with the monitoring provisions of the lower-level plans.
Biodiversity	Conservation status/habitat quality for all sites and species located near railway infrastructure. Conservation status/habitat quality for all sites and species positively impacted by an improvement in air quality due to modal shift and/or decarbonisation of rail. Level of biodiversity gain achieved as a result of the	The Status of European Union (EU) Protected Habitats and Species in Ireland Article 17 Report (Department of Housing, Local Government and Heritage (DHLGH))	DHLGH (every 6 years)
		DHLGH report of the implementation of the measures contained in the Habitats Directive - as required by Article 17 of the Directive.	In accordance with the monitoring provisions of EIA/ AA.

Environmental Component	Indicators	Monitoring Sources	Frequency/Responsibility
	implementation of the Review. Level of biodiversity lost as a result of the implementation of the Review.	Monitoring of the effects of railway related project development required under separate processes (EIA, AA).	National Parks and Wildlife Service (NPWS) (varies)
		Monitoring of the results of any ecological surveys carried out for any developments arising from the implementation of the Review.	Local Authority Waters Programme (LAWPRO) Catchment Scientists (varies)
		Updates to National Red List Check List (Ireland)	In accordance with the monitoring provisions of the lower-level plans.
		Targeted Local Catchment Assessments	European Economic Area (EEA) and EPA (continuously)
		Monitoring related to relevant Local Area Plans and County/City Development Plans.	EPA (every 4 years)
		Corine and Táilte mapping.	EPA and DAERA (continuously)
		EPA State of the Environment Report 2020.	EPA (yearly)
		Ireland's National Water Framework Directive Monitoring Programme, 2019-2021.	Inland Fisheries Ireland (IFI) (varies)
		EPA Water Quality of Ireland Report.	Birdwatch Ireland (every 6 years)
		Inland Fisheries Ireland (IFI) – Protected Freshwater Species – Atlantic Salmon etc – trends in protected freshwater species, population, distribution, health etc.	DAERA (annually)

Environmental Component	Indicators	Monitoring Sources	Frequency/Responsibility
		Birds of Conservation Concern Ireland – Monitoring by Birdwatch Ireland on status, distribution, population etc.	In accordance with the monitoring provisions of EIA/ AA.
Land and Soils	Incidences of soil contamination near railway infrastructure Rates of re-use/recycling of construction waste related to implementation of the Review Rates of brownfield site and contaminated land re-use and development near railway infrastructure Rates of greenfield development near railway infrastructure	Monitoring of the effects of project developments required under separate processes (EIA, AA)	In accordance with the monitoring of provisions of EIA/AA
		EPA State of the Environment Report 2020	EPA (every 4 years)
		CSO Census Reports (Ireland) and Northern Ireland Statistics and Research Agency Census Reports (Northern Ireland)	Central Statistics Office (every 6 years) and Northern Ireland Statistics and Research Agency (every 10 years)
		Monitoring for Geological Survey Irelands (GSI) (Ireland) and Geological Survey of Northern Ireland (GSNI) Database.	GSI and GSNI (varies)
		Corine and Táilte mapping.	EEA and EPA (continuously)
		Northern Ireland Environmental Statistics Report	DAERA (annually)
Water	Status and quality of waterbodies near railway infrastructure. Number of significant pollution events recorded as a result of the implementation of the Review.	Ireland's National Water Framework Directive Monitoring Programme, 2019-2021. River Basin Management Plan for Ireland 2018 -2021 (2022 – 2027).	EPA, continuously.
		Draft 3rd cycle River Basin Management Plan (RBMP) 2021-2027 for Northern Ireland	EPA (continuously) and DAERA (continuously)

Environmental Component	Indicators	Monitoring Sources	Frequency/Responsibility
		Irish Water and Northern Ireland Water's water quality reports.	DHLGH (every 6 years)
		The Status of EU Protected Habitats and Species in Ireland Report (Department of Housing, Local Government and Heritage)	EPA (every 4 years)
		EPA State of the Environment Report 2020.	EPA (continuous)
		Ireland's National Water Framework Directive Monitoring Programme	Office of Public Works (OPW) (every 3 years)
		Monitoring in the Review of Flood Risk Management Plans 2021.	EPA Catchment Unit, DHLGH and relevant local authorities (varies)
		Monitoring for the EPA Catchments Unit and Local Authority Waters Programme.	DAERA (annually)
		Northern Ireland Environmental Statistics Report	EPA (continuously) and DAERA (continuously)
Air Quality and Climate	General air quality results in Ireland and Northern Ireland. The level of GHG emission from rail transport changes over the plan period. Mode share of rail transport (passenger and freight) Nitrogen deposition	Environmental Protection Agency's annual air quality reports (Ireland) and the Department of Agriculture, Environment and Rural Affairs data on air quality (Northern Ireland).	EPA (annual air quality reports) and DAERA (annual air quality reports)
		Air Quality Monitoring Stations around Ireland.	EPA (continuous)
		EPA State of the Environment Report 2020.	EPA (every 4 years)

Environmental Component	Indicators	Monitoring Sources	Frequency/Responsibility
		EPA Greenhouse Gas Emissions Report.	EPA (annually)
		EPA Climate Change Projections.	EPA (varies)
		Climate Change Committee in Northern Ireland reports	Climate Change Committee Northern Ireland (continually)
		Monitoring of the effects of project development required under separate processes (EIA, AA)	In accordance with the monitoring provisions of EIA/ AA
		Monitoring related to relevant Local Area Plans and County/City Development Plans or Regional Spatial and Economic Strategy (RSES)	Various regional, county and local area development plans (varies)
		Northern Ireland Environmental Statistics Report	DAERA (annually)
Archaeological, Architectural and Cultural Heritage	Avoidance of significant adverse effects to sites and features of archaeological/architectural/cultural heritage as a result of the implementation of the Review. Condition of heritage assets near or associated with railway infrastructure. Projects progressed under the Review comply with the Code of Practice between the Department of Arts, Heritage and the Gaeltacht and Iarnród Éireann (2012) or any future revisions to that Code of Practice.	Registers of nationally protected sites and structures.	NMS (National Monuments Service) and ABHU (Architectural and Built Heritage Unit) of the Department of Housing, Local Government and Housing, UNESCO and Department for Communities Historic Environment Division (continually).
		Monitoring related to relevant regional, Local Area Plans and County/City Development Plans.	Various regional, county and local area development plans (varies)
		Monitoring of the effects of rail projects and or development required under separate processes (EIA, SEA AA)	In accordance with the monitoring provisions of EIA/AA

Environmental Component	Indicators	Monitoring Sources	Frequency/Responsibility
		Northern Ireland Environmental Statistics Report	DAERA (annually)
Landscape and Visual	No deterioration of landscape or areas with scenic value e.g. Areas of High Amenity, Areas of Outstanding Natural Beauty and Protected Views as a result of the implementation of the Review	Monitoring related to relevant Local Area Plans and County/City Development Plans or RSES's e.g., Landscape Character Assessments	Various regional, county and local area development plans (varies)
		National Landscape Strategy for Ireland 2015-2025	Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media (every 10 years)
		Landscape Character Assessments of Northern Ireland	Northern Ireland Environment Agency (varies)
		Corine and Táilte mapping.	EEA and EPA (continuously)
		Monitoring of the effects of project development required under separate processes (EIA, AA)	In accordance with the monitoring provisions of EIA/AA
		Northern Ireland Environmental Statistics Report	DAERA (annually)
Material Assets	Statistics relating to rail usage (including number of passengers and journey times). Economic growth statistics – particularly those relating to transport (rail). Mode share of rail transport (passenger and freight)	CSO Census Reports (Ireland) and Northern Ireland Statistics and Research Agency Census Reports (Northern Ireland)	Central Statistics Office (every 6 years) and Northern Ireland Statistics and Research Agency (every 10 years)
		Monitoring related to relevant regional, Local Area Plans and County/City Development Plans.	Various regional, county and local area development plans (varies)
		Monitoring of the effects of project development required under separate processes (EIA, AA)	In accordance with the monitoring provisions of EIA/AA
		Northern Ireland Environmental Statistics Report	DAERA (annually)

Environmental Component	Indicators	Monitoring Sources	Frequency/Responsibility
Noise	Changes and level of noise associated with construction and operation of the rail network over the plan period.	EPA Noise Mapping for Ireland	EPA
		Strategic Noise Maps	Irish Rail (Ireland); Translink NI Railways (Northern Ireland)
		Noise Action Plans	Local Authorities, every 5 years (Ireland) and Air and Environmental Quality Unit (AEQ) & DAERA, every 5 years (Northern Ireland)
		Northern Ireland Environmental Statistics Report	DAERA (annually)

Table C.2

Strategic Environmental Assessment and Appropriate Assessment Monitoring Measures

ARUP

Appendix D | Inflation

Introduction

This note presents a summary of analysis of the potential impact of inflation on capital cost estimates for interventions included in this Report of the All-Island Strategic Rail Review.

The estimates presented in this note are based on an assumed exchange rate between the Euro (€) and Pound Sterling (£) of €1.2/£1. While the current exchange rate differs to this ratio, this was the exchange agreed at the start of the Review, and so has been maintained throughout the study to ensure consistency.

The sources used to inform this analysis are provided at the end of this note.

Background

The capital costs for the interventions outlined in the Review are estimated to be in the order of €32bn/£27bn in 2021 prices. This includes an allowance of 56% for optimism bias, which reflects UK guidance on the presentation of capital cost estimates for early stage schemes. Further details about how these costs were estimated are provided in Chapter 5 of this Report ("Benefits and Costs"), as well as in the accompanying Technical Note "Work Package 3: Appraisal and Definition".

The estimates for the capital costs of the interventions included in this Report of the Review were developed in the first half of 2022 using prices from 2021. In March 2022, interest rates in Ireland were 0.25%, Consumer Price Index (CPI) inflation was 6.7%, and Tender Price Index inflation estimate published by the Society of Chartered Surveyor Ireland (SCIS) was 7%. At the same time, in the United Kingdom (UK) interest rates were 0.75%, CPI was 1%, and construction inflation (across all forms of construction) was estimated to be 1.9%.

Since the capital costs for these interventions were estimated, there were significant changes to interest rates and inflation in both jurisdictions. Furthermore, there is value in examining what impact recent changes in inflation may have on the Review's capital cost estimates.

Revisions

The Review's technical adviser team has reviewed seven published indicators from the UK and Ireland, which are summarised **Table D.1.**

If these inflation indicators were applied to the cost estimates for the interventions presented in this Report, then the estimated total capital costs of all interventions would rise from circa **€32bn/£27bn** in 2021 prices to **€35bn/£29bn – €37bn/£31bn** in 2023 prices (reflecting the range of the lowest and highest estimates considered).

Qualifications and caveats

- These estimates are based on recently published public data sets – data has not been sourced from procurement sources.
- At the time of analysis, some datasets had only recently been published, and therefore could change in later revisions.
- Some indicators reflect the whole economy, while others are more specific to construction.
- The total cost estimate applies to all interventions in the Review, covering both jurisdictions on the island. At the time of writing, inflation estimates for the UK were different (in most cases, slightly higher) than for Ireland.
- This analysis has not estimated potential changes in benefits due to the significant amount of uncertainty on the impact of inflation on these elements at the time of writing.
- The project team has not examined the potential impact of inflation on operations, maintenance, and renewals costs.
- We have not amended any appraisal models to reflect these changes.

Furthermore, as stated earlier in this Report, the future development of all interventions cited in the Review will be directed by their respective governments and legislatures and would be subject to separate appraisal and decision in line with applicable governance processes.

Approximate split by jurisdiction

In broad terms, the split of capital costs between Ireland and Northern Ireland is estimated to be around 75% for Ireland and 25% for Northern Ireland. There is some uncertainty to the precise split as this will depend on the ultimate routes agreed for new/reinstated cross-border railways that serve both jurisdictions. For the highest estimate identified in this analysis (€36.8bn/£30.7bn), the capital cost estimate for the interventions included in the Review that broadly apply to Ireland would total €27.6bn/£23.0bn.

If this investment were split evenly across 25 years in 2023 prices, then it would amount to €1.00bn/£0.92bn per annum (rounded to the nearest 10m). Similarly, for Northern Ireland the capital cost estimate would be €9.2bn/£7.7bn, which approximates to €0.37bn/£0.31bn per annum in 2023 prices (rounded to the nearest 10m) over a 25 year period.

Indicator	Start Period	Start Index	End Period	End Index	Change
UK CPIH	Mar-21	109.7	Mar-23	126.8	15.6%
UK CPI	Mar-21	109.4	Mar-23	128.9	17.8%
UK All Construction	Mar-21	113.3	Mar-23	131.9	16.4%
UK All New Work	Mar-21	115.9	Mar-23	138.6	19.6%
UK New Infrastructure	Mar-21	114.1	Mar-23	137.6	20.6%
Ireland CPI	Mar-21	102.7	Mar-23	118.0	14.9%
Ireland Tender Price	2021 (H1)	171.7	2022 (H2)	202.9	18.2%

Table D.1

Inflation indicator analysis (2021 – 23)

Sources

Ireland

- Interest Rates
  https://www.centralbank.ie/statistics/interest-rates-exchange-rates/ecb-interest-rates#:~:text=Fixed%20Rate%20Tender%3A%203.75%25
- Consumer Price Index (CPI)
  https://www.cso.ie/en/statistics/prices/consumerpriceindex/
- Tender Price Index
  https://scsi.ie/tender-price-index-february-2023-2/

United Kingdom

- Interest Rates
  https://www.bankofengland.co.uk/monetary-policy/the-interest-rate-bank-rate
- Consumer Price Index Households (CPIH):
  https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/l55o/mm23 and
  https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/l522/mm23
- Consumer Price Index (CPI):
  https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/april2021 and
  https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/april2023
- Construction output price indices
  https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/interimconstructionoutputpriceindices