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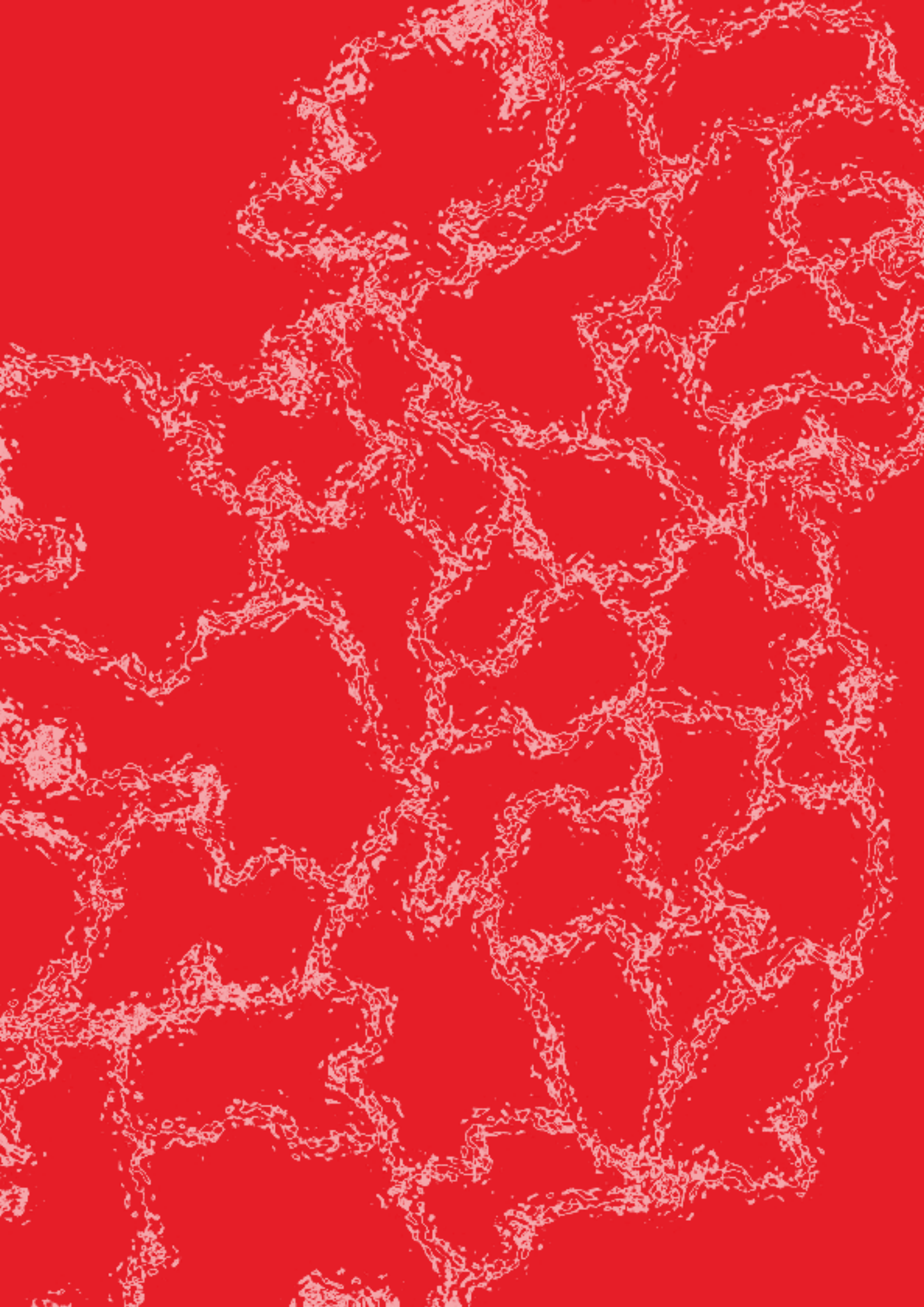
Department of Transport and Department for Infrastructure

All-Island Strategic Rail Review

Draft Report for Strategic Environmental Assessment Consultation

25 July 2023



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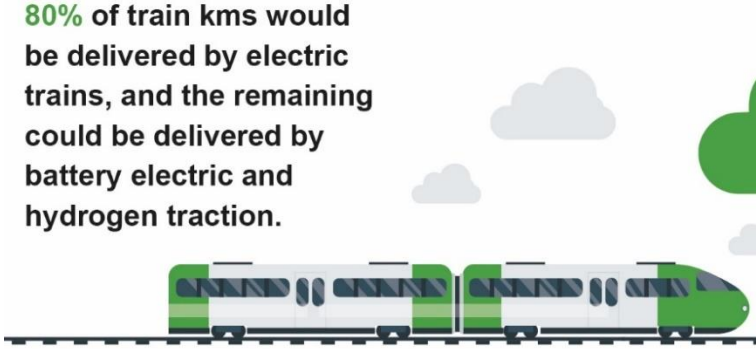
25 July 2023

Job number 283571

Ove Arup & Partners Limited
50 Ringsend Rd
Dublin
D04 T6X0
Ireland
arup.com

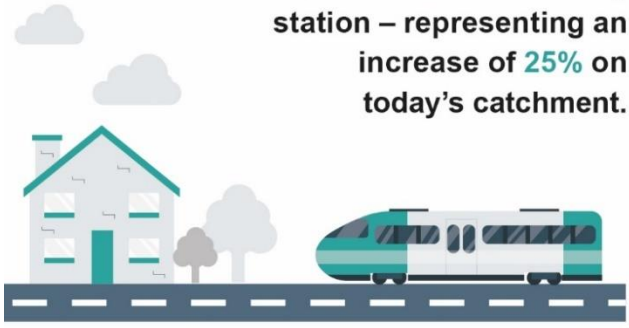
If the recommendations in this review were delivered…

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



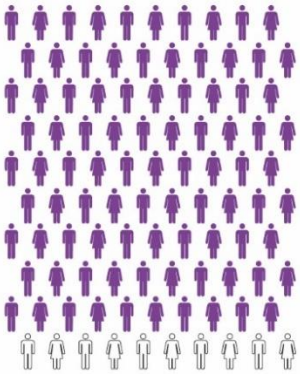
The carbon footprint of a passenger rail journey could be 80% lower than an equivalent journey by an electric vehicle.

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



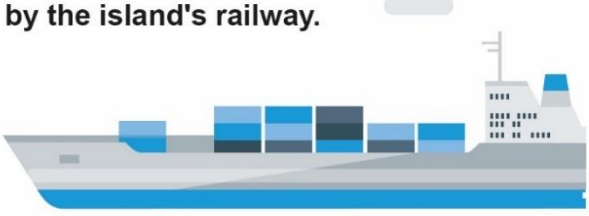
Rail journey times between the island's major cities would be significantly reduced, by 50% in some cases. There would be hourly services between key cities, increasing to half-hourly on busiest routes.

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.

The Review aims to inform policy and future strategy 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** aims 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-zero transport system and economy. As both jurisdictions plan to decarbonise while the island's population continues to grow, rail can play a stronger 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 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 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 a **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 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 **coherent framework** 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 **page 11** along with some key outcomes that the Review's recommendations could deliver.

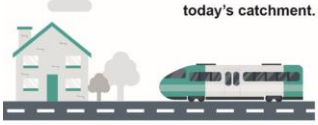
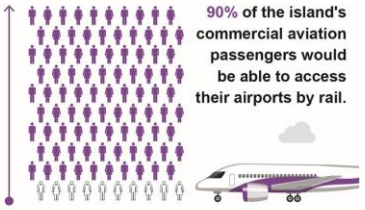
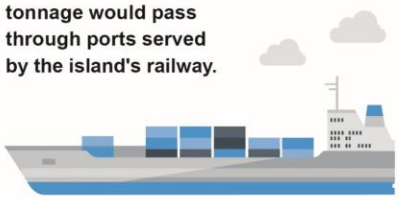
Recommendations

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 **30 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 presented on **page 12** and listed on **page 13**.

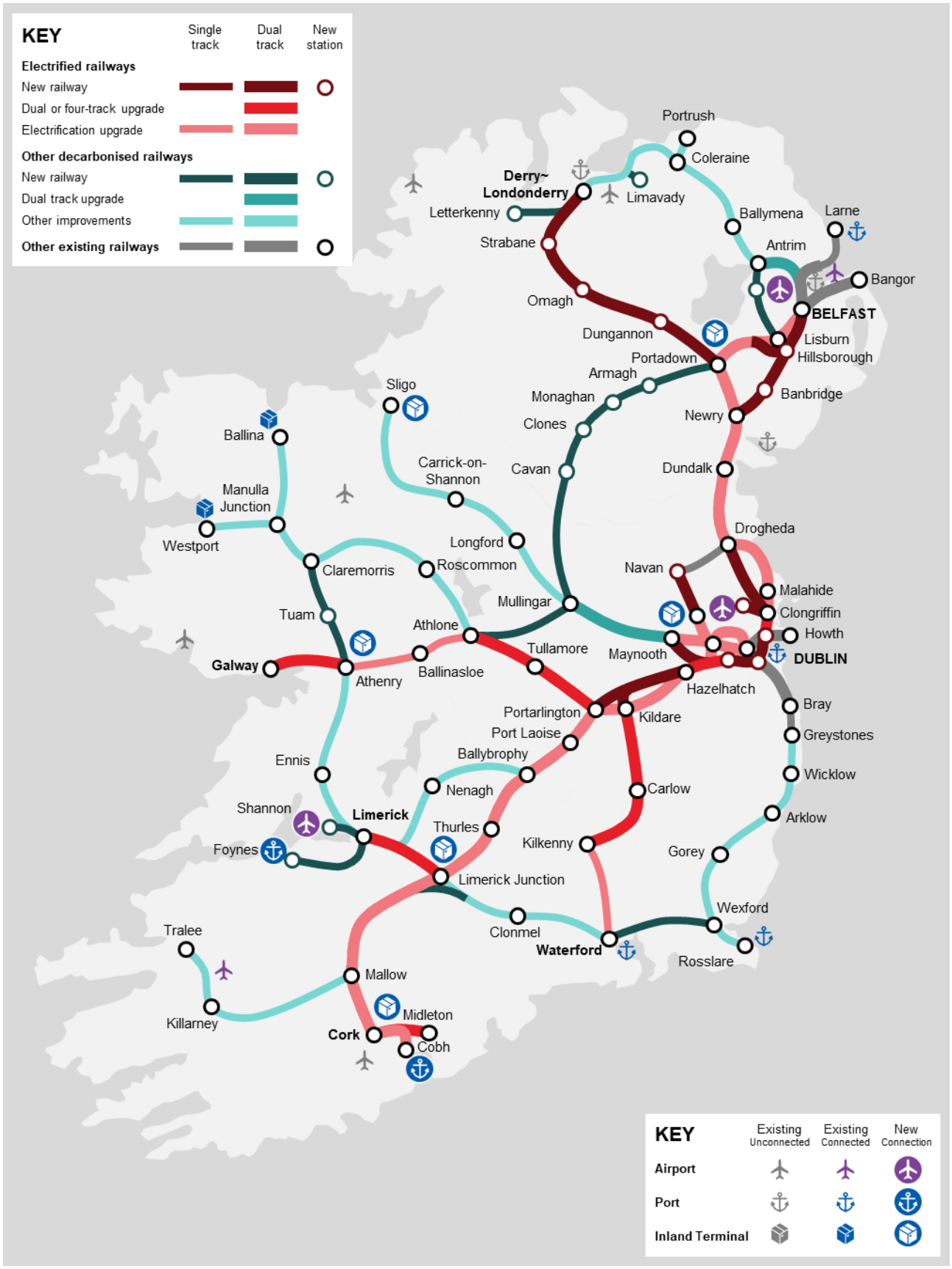
Benefits

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 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.

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.

Vision, Goals, Objectives, and potential outcomes of this Review



A potential 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 (including a spur for Limavady), 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 services.
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.

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 **€31.8bn/£26.5bn.** Additional annual costs for operating and maintaining a larger rail network on the island are estimated to be **€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 **€1.27/£1.06bn** would be required in addition to existing commitments (2021 prices, excl. VAT). Updated cost estimates in 2023 prices are provided in **Appendix B**. 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. More specifically, 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. The Review has also recommended tunnelled interventions in urban areas to reduce their impact and has ruled out developing a large high speed rail system partly due to concerns that the carbon generated from its construction would not be offset by downstream carbon emission reductions. Going forward, each intervention would be subject to **rigorous economic 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. 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 key interventions between the near future and 2050.

Conclusion

This Review has examined the 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 Ireland's transition to a net-zero economy**. It also provides an evidence base along with rationale underpinning recommendations for policymakers to consider as they develop their 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.

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 of Ireland.

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 **population 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 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.

The work was also 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 greatly benefitted from evidence provided by stakeholders and the wider public through a public consultation held from November 2021 to January 2022. A summary of the approach used to deliver this Review is provided in the **Appendix**.

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 in 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 plausible route for delivering the recommendations is provided in **Chapter 6**. This report has been endorsed by political representatives from both jurisdictions and seeks to **inform policy and strategy** 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 the 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 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 years, and summarises the current socioeconomic and environmental context on the island.

This Chapter will show 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) only 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 on the intercity network and 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 networks and on suburban services in the Belfast area (e.g., Bangor – Lisburn).

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.

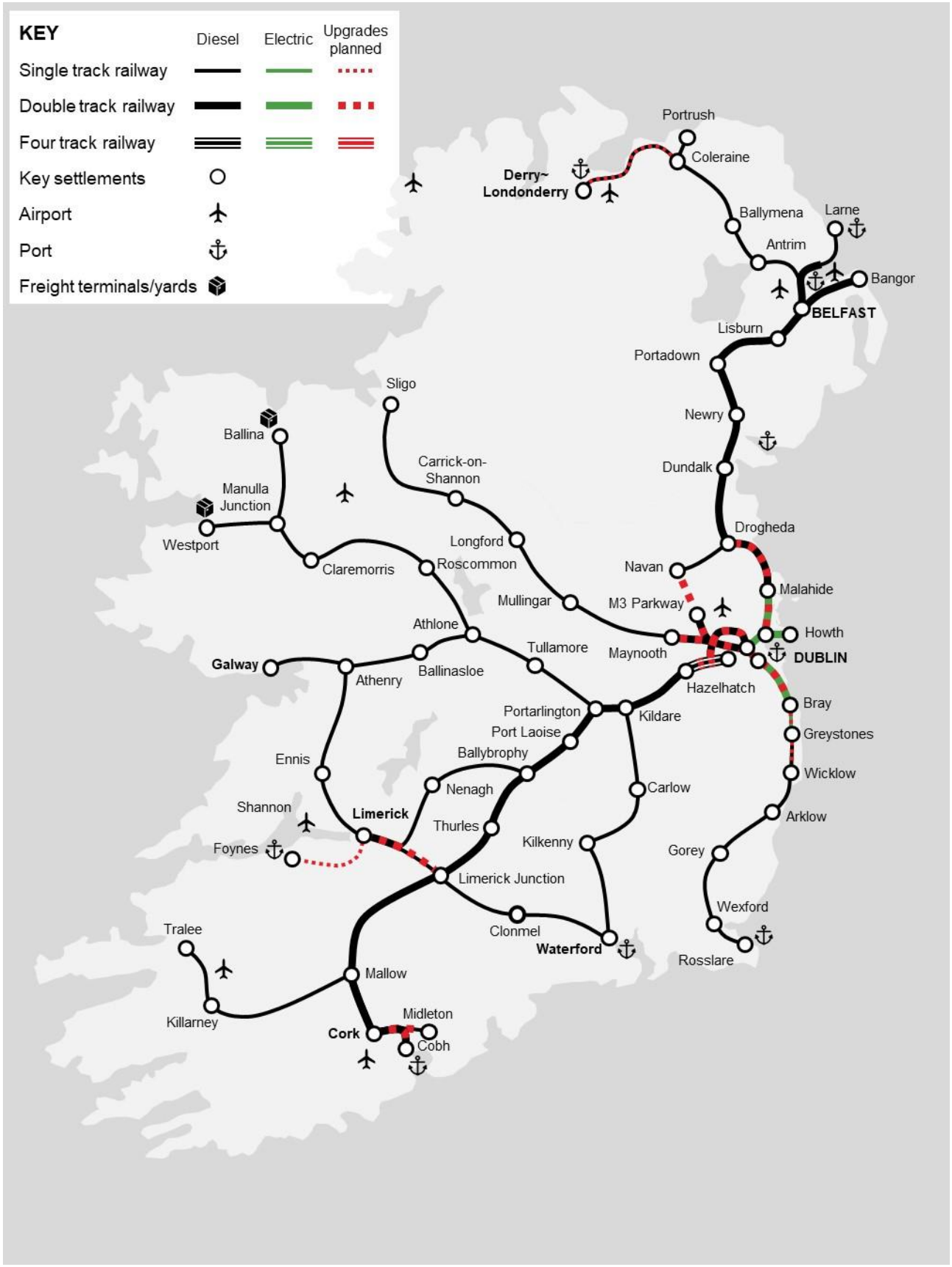

Figure 1
Today's railway

Historic Development of the Railway

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 in the 1920s.

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 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 a single 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.

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 Ireland'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 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 fleets, double-track short sections of the railway, and invest in a multi-billion Euro MetroLink subway line in Dublin.

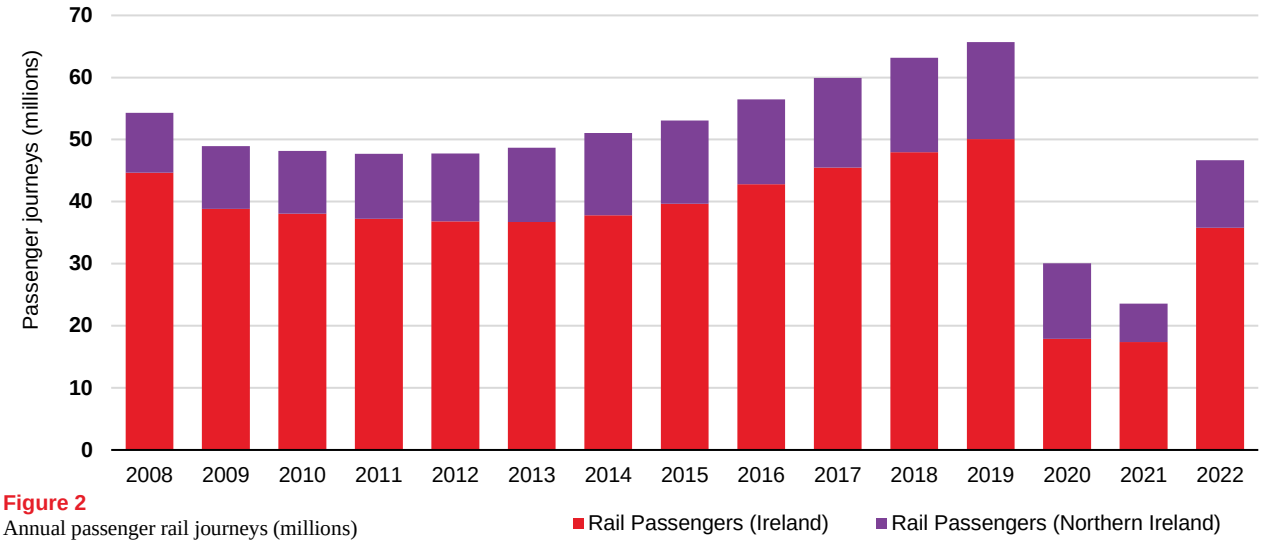

Figure 2
Annual passenger rail journeys (millions)

Socioeconomic and Political Context

The **island's population** steadily declined in the aftermath of the Great Famine from a peak of approximately 8.5 million in the1840s 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 grew 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 – with most of this growth concentrated in cities (**Figure 3**).

The island has become much **more urbanised** in that time, and the island's population is projected to grow by a further 20-30% by the early 2040s. 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, with growth focused on 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 rail stations can help promote more 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 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 play a key role in achieving this objective.

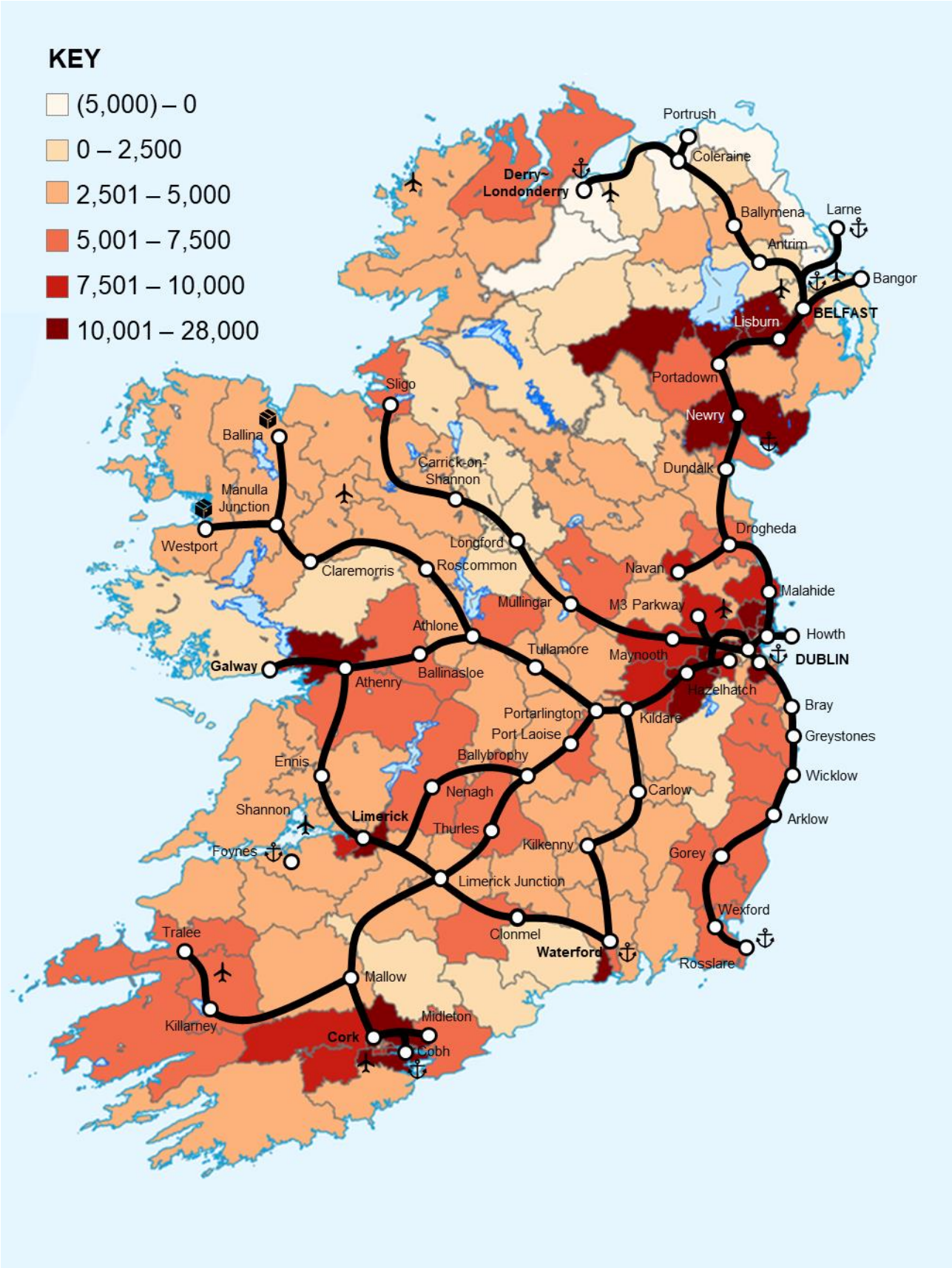

Figure 3
Forecast population growth (2019-40)

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** aims 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 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.

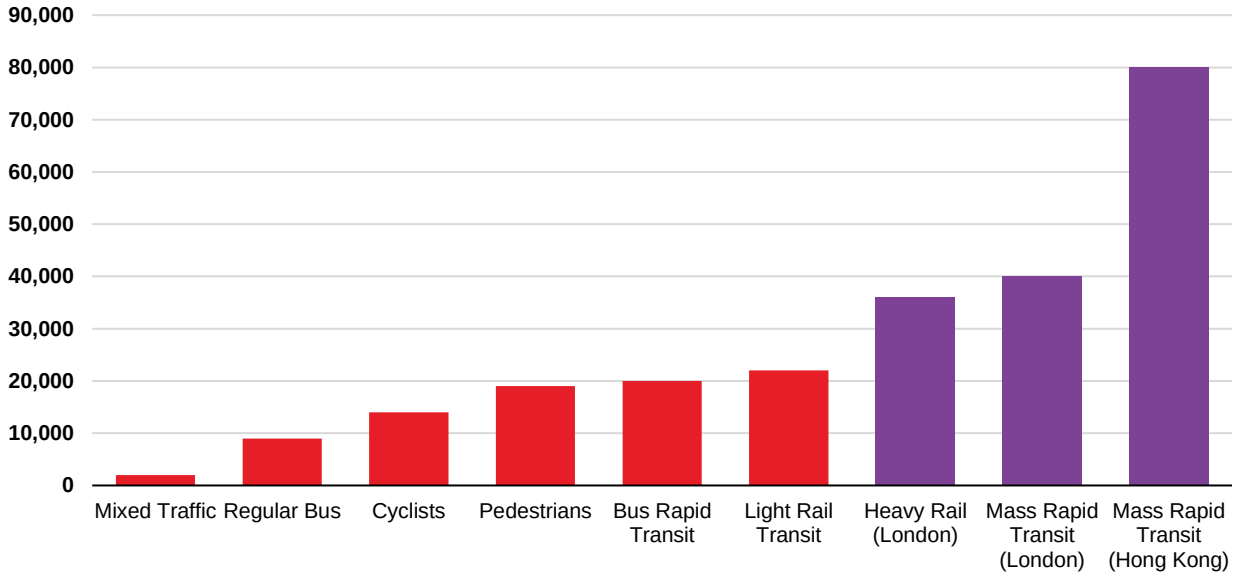

Figure 4
Capacity of different transport modes (passengers per 3.5m lane/track) – rail is shown in purple and other modes in red.

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 electrification of the rail network.

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 forced car ownership and barriers to travel for non-drivers.

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 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.

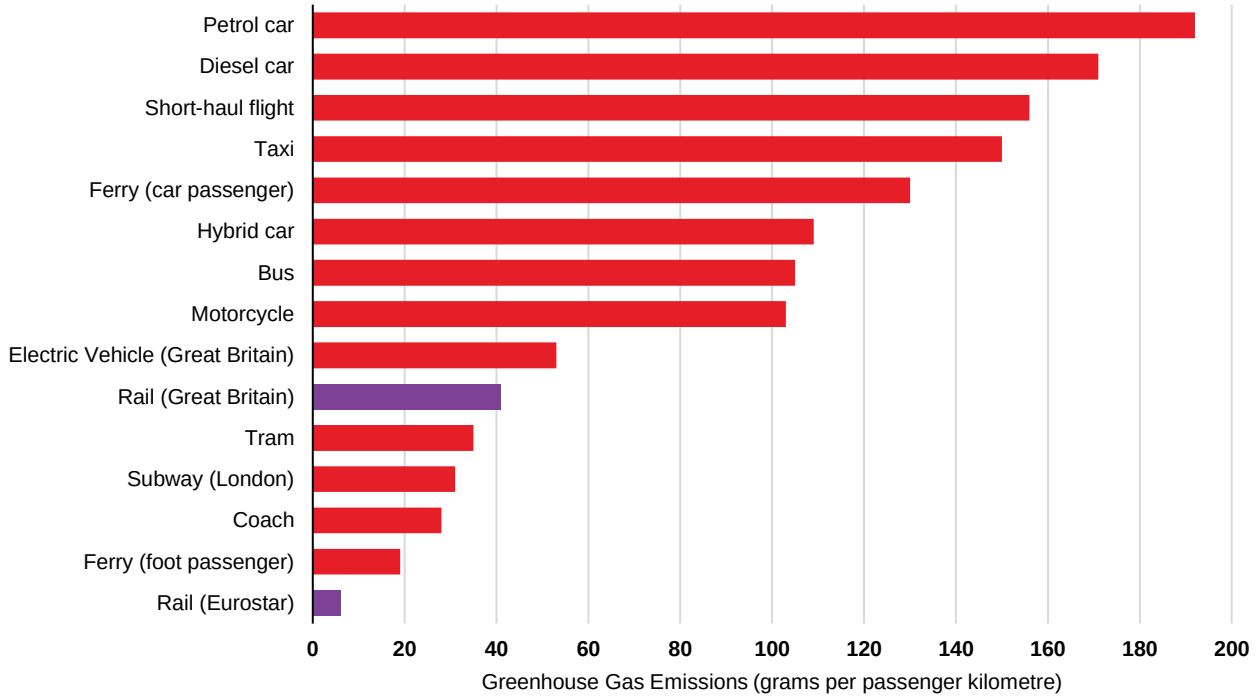

Figure 5
Greenhouse gas emissions by transport mode – rail in purple

Source: UK GHG conversion factors for company reporting


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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 consultation** that was 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** and **7**) 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 public consultation highlighted concerns about service quality.
- **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 Belfast George Best 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 7**.
- **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.

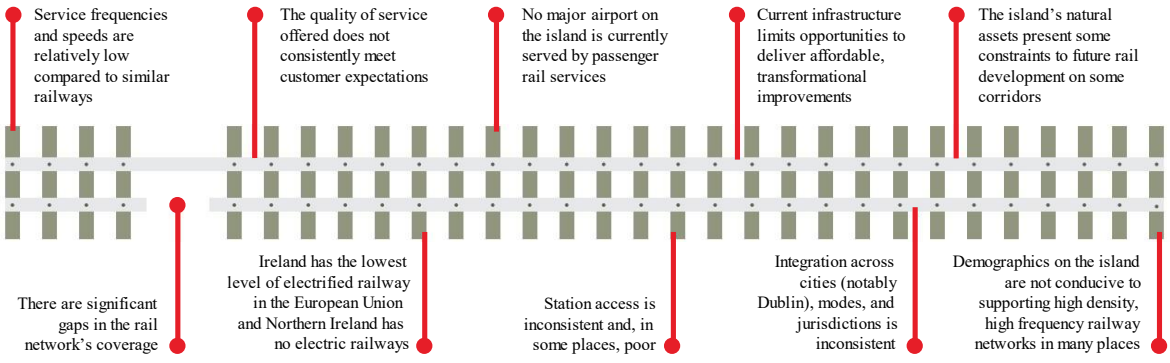


Figure 6
Key challenges and constraints

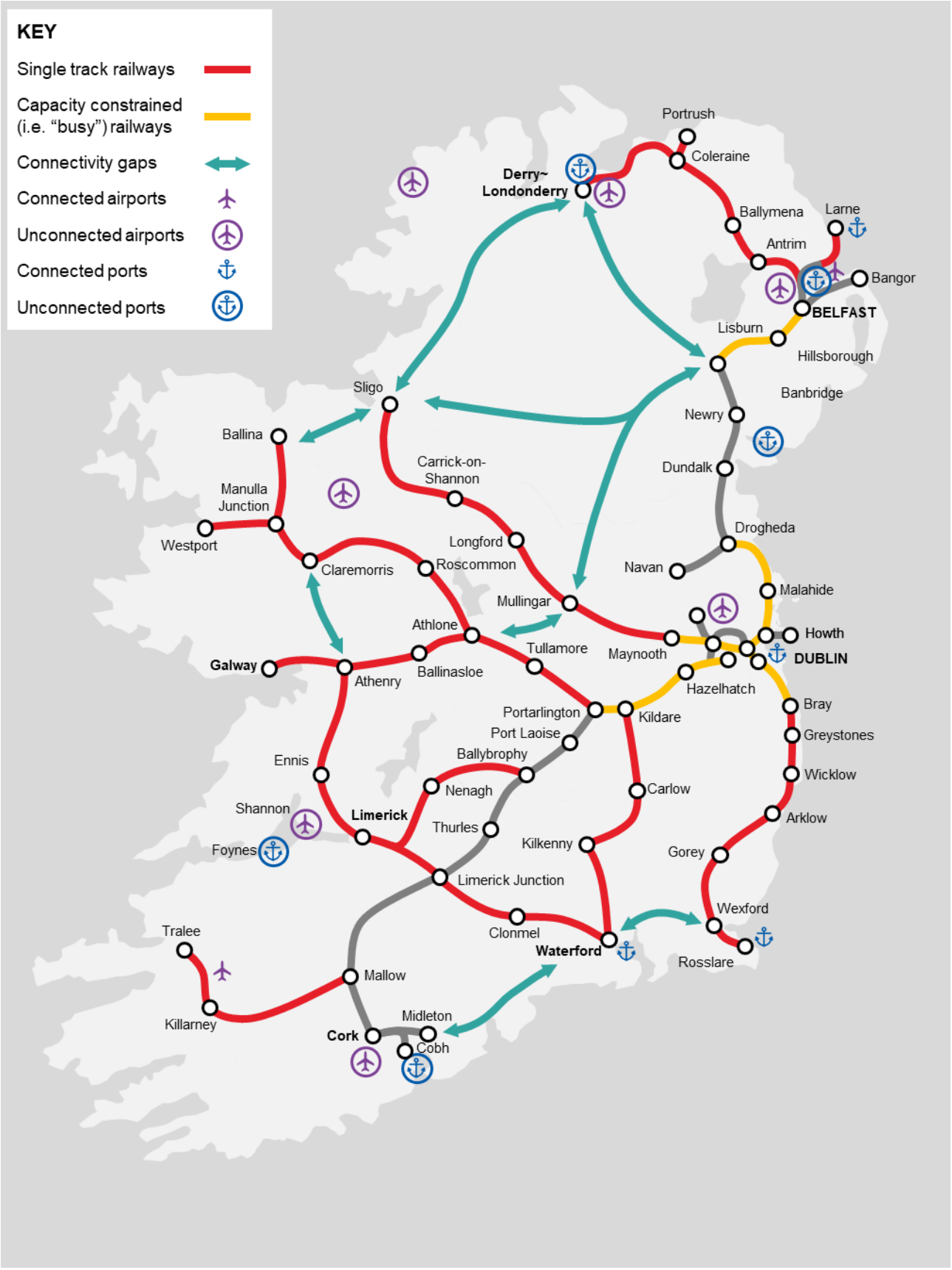


Figure 7
Key constraints and connectivity gaps

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 HGVs risks isolating vulnerable communities and limiting equitable access to jobs and services. Heavy traffic is associated with poor air quality, reduced safety, and severance, 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 **public consultation** from November 2021 to January 2022 and 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. 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 public consultation alongside the current coverage of the rail network is provided in **Figure 8**.

The key themes that emerged from the 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 below.

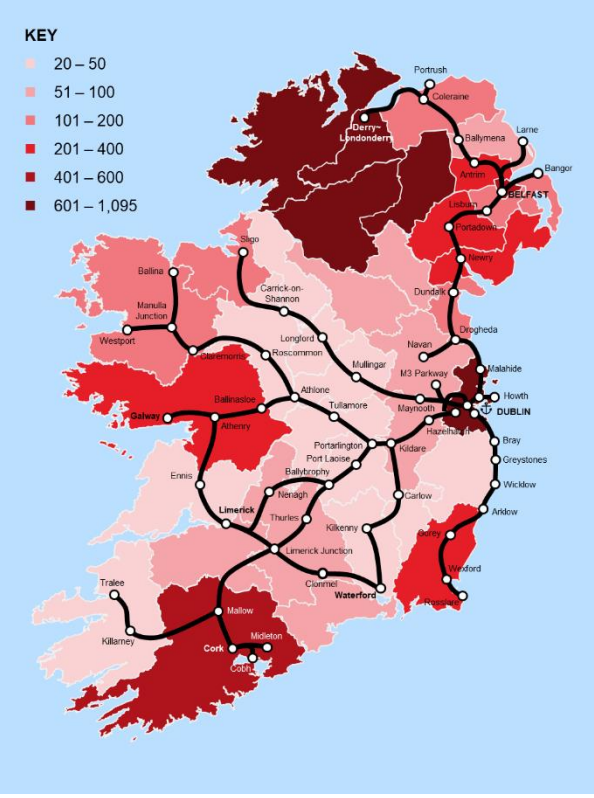


Figure 8
Consultation responses and current rail network coverage

Policy Response

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 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 will need to be a clearer route for delivery. This Review aims to provide a clearer route forward for policymakers in both jurisdictions.

Vision, Goals, and Objectives

This Review aims to present a coherent framework 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 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.

As stated in 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. The **Appendix** 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 as options are also provided in the Appendix.

Presentation of Recommendations

In this Chapter recommendations are presented by themes, which broadly align to the Review's Goals and Objectives. **Table 2** list the **30 recommendations** that are presented in this Chapter and **Figure 9** 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 costs.

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. All **mitigation measures** outlined in the accompanying SEA Environmental Report and Appropriate Assessment Report. The relevant mitigation measures should be adhered to in full during the implementation of 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.
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 (e.g., Limavady), 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 services.
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.

Table 2
List of the recommendations included in this Review

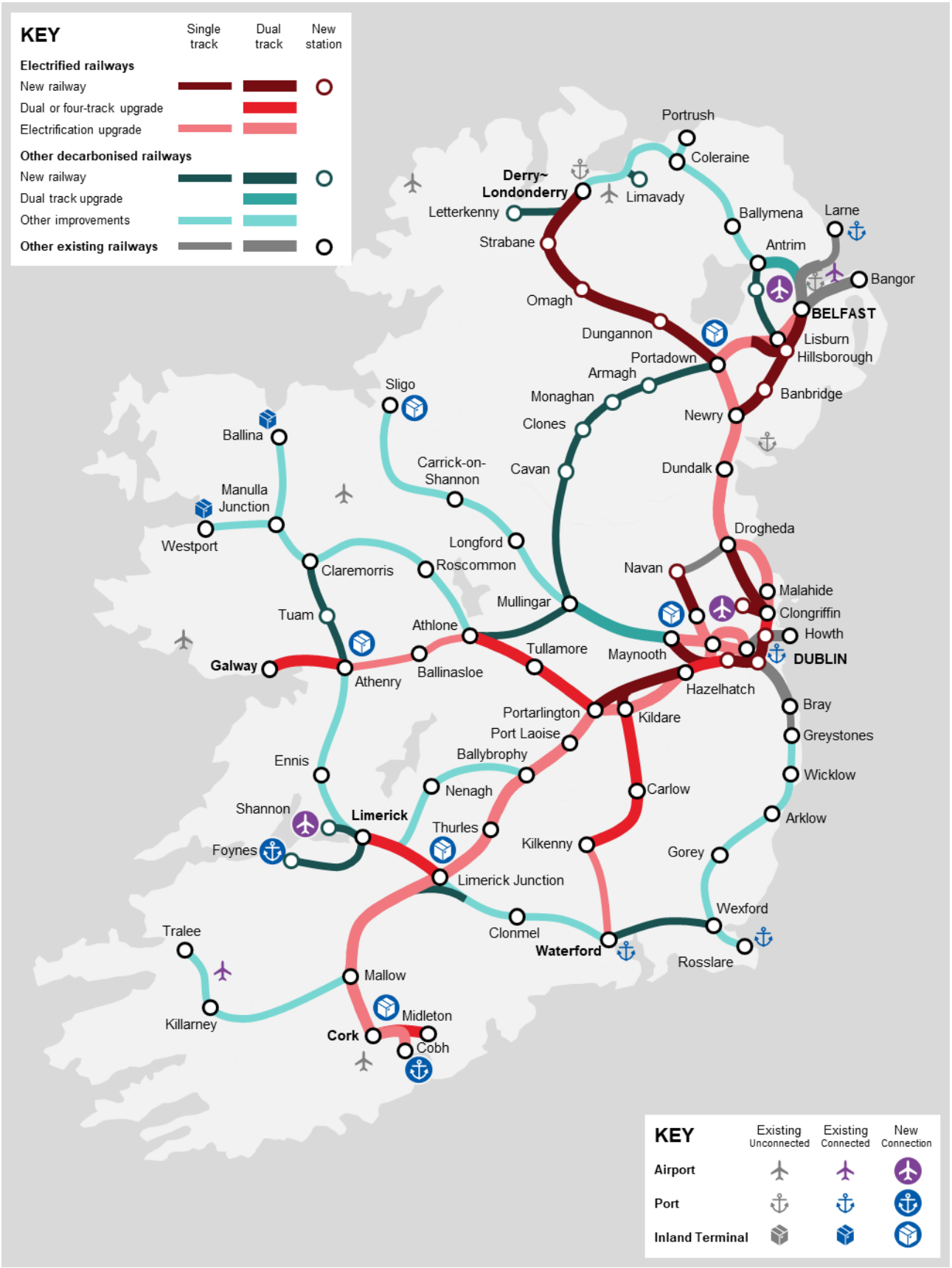


Figure 9
A potential future railway on the island of Ireland

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 Ireland'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 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 10** 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 Ireland's approach to decarbonising its 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 Ireland.
- **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.

   The map provided in **Figure 10** 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.

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.

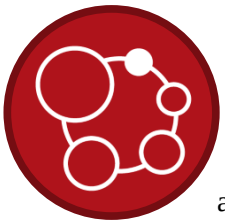
3. **Procure hybrid and electric rolling stock in the medium term.** Given the long lead in times for the procurement and delivery of rolling stock, and its relatively long operational life, it is recommended that planning for electric and hybrid traction across the island should start soon.

Case Study | Hydrogen Trains

While electric and battery operated trains could play a major role in decarbonising 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 in the image to the right.

A hydrogen powered passenger train (Credit: Alstom)

Figure 10
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.
- It is clear from the 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 private car. 200km/h is generally considered to be the highest speed a conventional train can reach before requiring in-cab signalling and has therefore been used as a target speed for intercity services in this Review. 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 considers 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 (subject to periodic review) 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 longer 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 potential impact on the environment. This work has informed the recommendations set out below. A map illustrating the interventions that are likely needed to deliver a fast, frequent, and high-quality all-island intercity railway service is shown in **Figure 11**.

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 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.

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, doing so may have 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 altogether. 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.

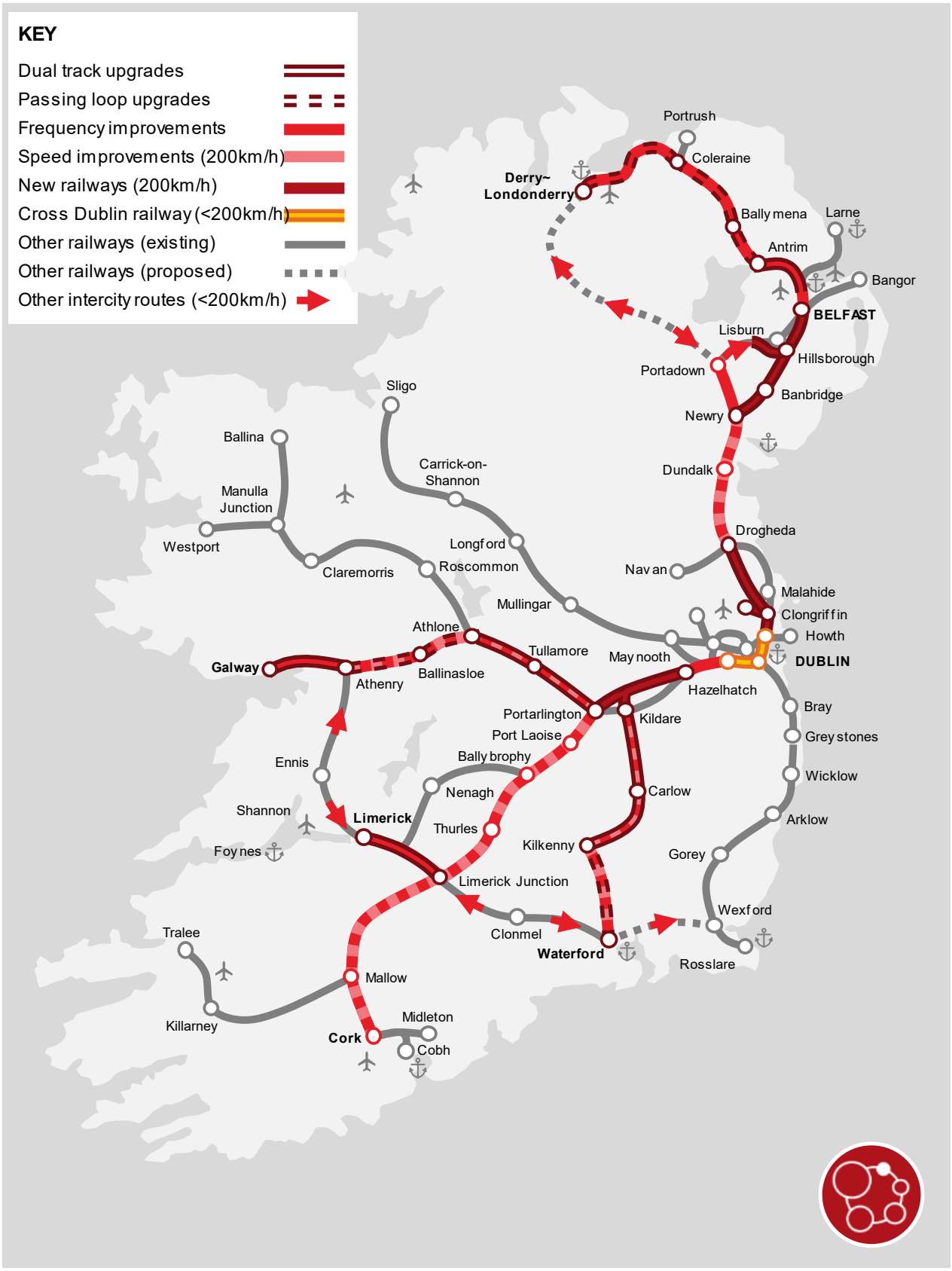


Figure 11
Intercity network interventions

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 Ireland's railways face today, including:

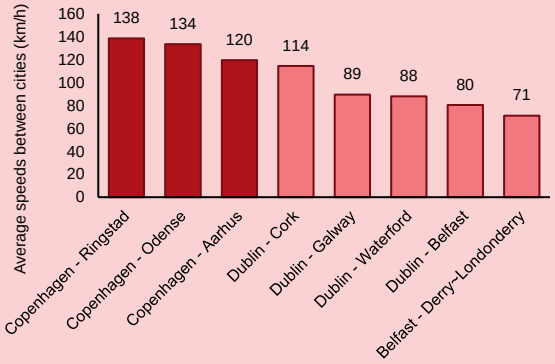
- Low levels of electrification;
- Significant capacity constraints, especially on main lines into the capital city;
- Conflicts between intercity, regional, suburban, and freight services; and
- Speed restrictions and poor alignments, resulting in relatively slow journeys.

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 electrification of most of the railway network.

In the past decade, several upgrades to the existing railway network have been planned and completed to support the reduction of travel times between major cities in the country (Copenhagen, Odense, Aarhus, Aalborg) 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 (metropolitan area population 1.4 million / 470,000 jobs) and Ringsted (population 23,000) on the route to Odense (population 205,000) and was completed in 2018. Other line speed upgrades are currently in the planning phase across the country. This line relieves congestion on busy commuter routes on the key corridor from the west of the country to Central Copenhagen. Further investments in high speed railways from Odense to Aarhus and 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 (see chart below). 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

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 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 that aim 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 12**. This threshold reflects the level of population that this Review considers necessary to generate sufficient demand for a viable passenger rail service (10,000 is the threshold used by Ireland's National Planning Framework as a definition of a "large town", and it 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 regions were defined in an earlier report prepared by the Review and are shown in **Figure 12**.
- **Improve intraregional connectivity**. There are several "missing links" within the regions that could support important inter and intra-regional journeys. These are also represented in **Figure 12**.

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) **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 whole 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. Furthermore, 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 the **Appendix**. The options included as recommendations for further study are discussed in more detail below.

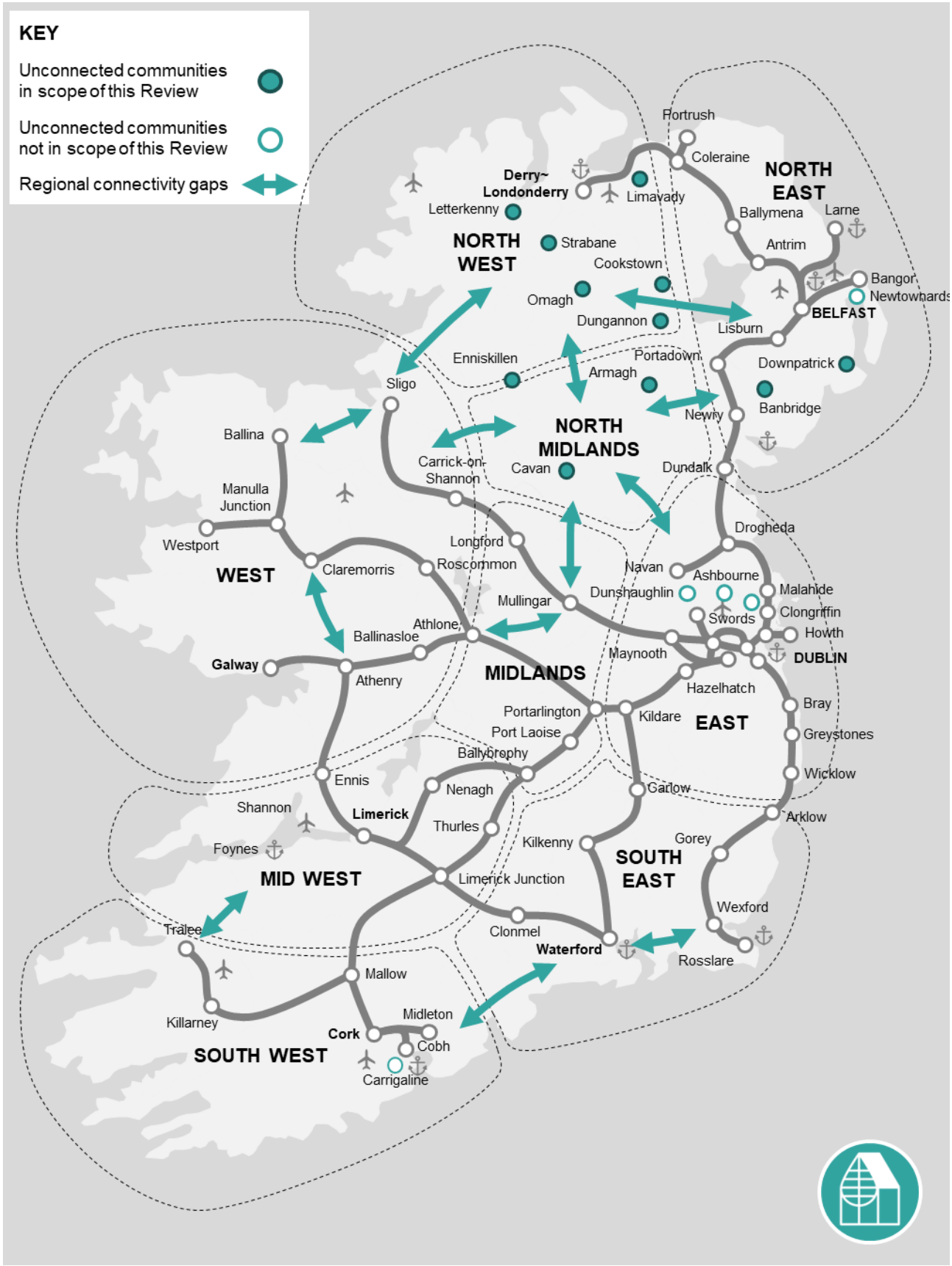


Figure 12
Regional and rural connectivity challenges

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 approximately 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 the wider Belfast 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 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 (as an alternative to the indirect and constrained existing route).
- **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 short 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 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, only the section between Ennis and Athenry was completed with the onset of the 2008 financial crisis.

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 in that appear to 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 network up to Greystones. Between Greystones and Rosslare Europort, however, the railway is very lightly used by passenger rail 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 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 EU.

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 the end of the DART route at Greystones**, while maintaining today's direct Dublin commuter services.

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 13**.

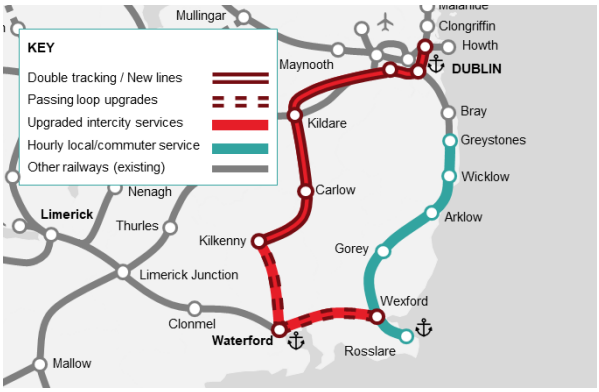


Figure 13
South East Ireland

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 and being located relatively close to both Dublin and Belfast, the island's largest cities.

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 14** 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 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 14
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, however, 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 demand continued to grow 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 respective areas.

Plans for **multi-billion Euro improvements to metro and commuter 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 Belfast Metropolitan 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 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 will deliver electrification, signalling improvements, and double tracking to Midleton. 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 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 subway line.
- As discussed above, proposals to connect **Belfast International Airport** through reinstating the Lisburn – Antrim railway.

Additionally, this Review has considered options to improve connectivity to airports 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**.
- Improving connectivity between Sydenham and **George Best 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 15** 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 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.**

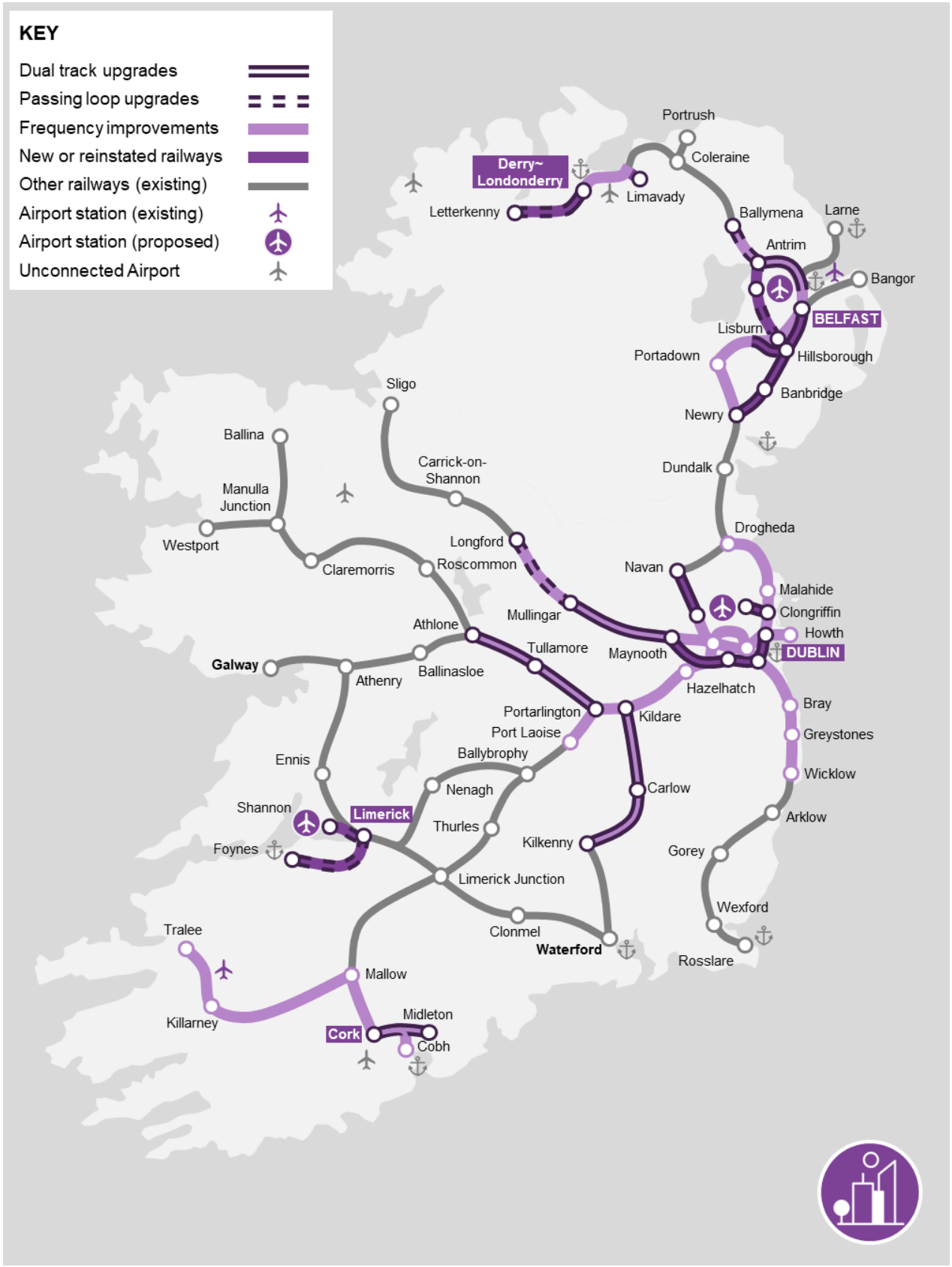


Figure 15
Sustainable cities heavy railway interventions

Case Study | Exeter and Devon Metro

The Avocet Line near Exeter (credit: Mark Lynam)

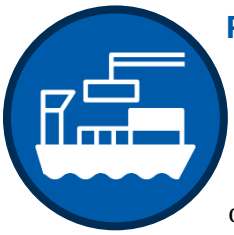
Exeter is the 2nd largest city in Devon and the 3rd largest in South West England. With a population of approximately 130,000, it is around the same size as the Limerick-Shannon metropolitan area. Like Limerick, Exeter is located on a wide estuary in a largely rural hinterland, around two hours from its capital city. The city's population is also growing at around 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 provided in 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, multi-modal 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 currently 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 16** 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 accounted for 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 levelled on freight operators, is also an issue.

Despite the decline and challenges, the **Iarnród Éireann Rail Freight 2040 Strategy** aims to grow the market of rail freight towards levels seen in Europe and provides a framework for achieving this ambition while also helping Ireland meet its environment and sustainability goals.

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 of Ireland.

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").

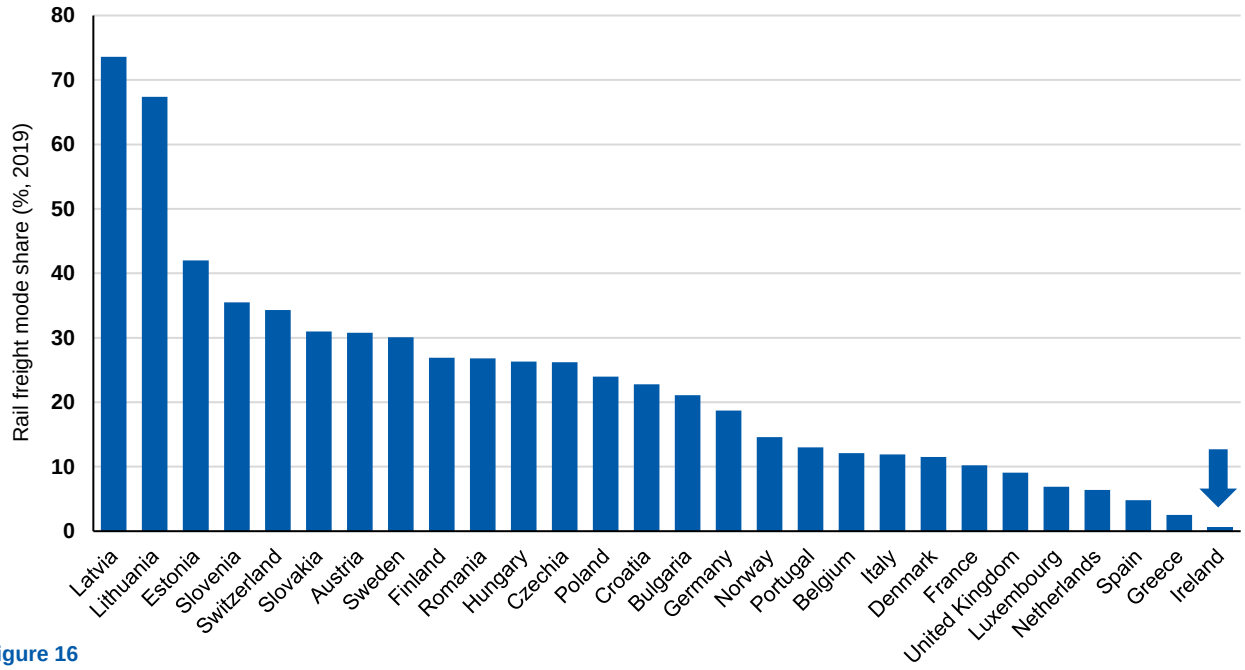


Figure 16
European countries' rail freight mode share (source: Eurostat, 2019)

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 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 fright 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 to **Foynes**.
- Reinstating the railway between **Claremorris – Athenry** to enable rail freight from the North West to access the South East/West 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 relatively 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 very 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 17**.

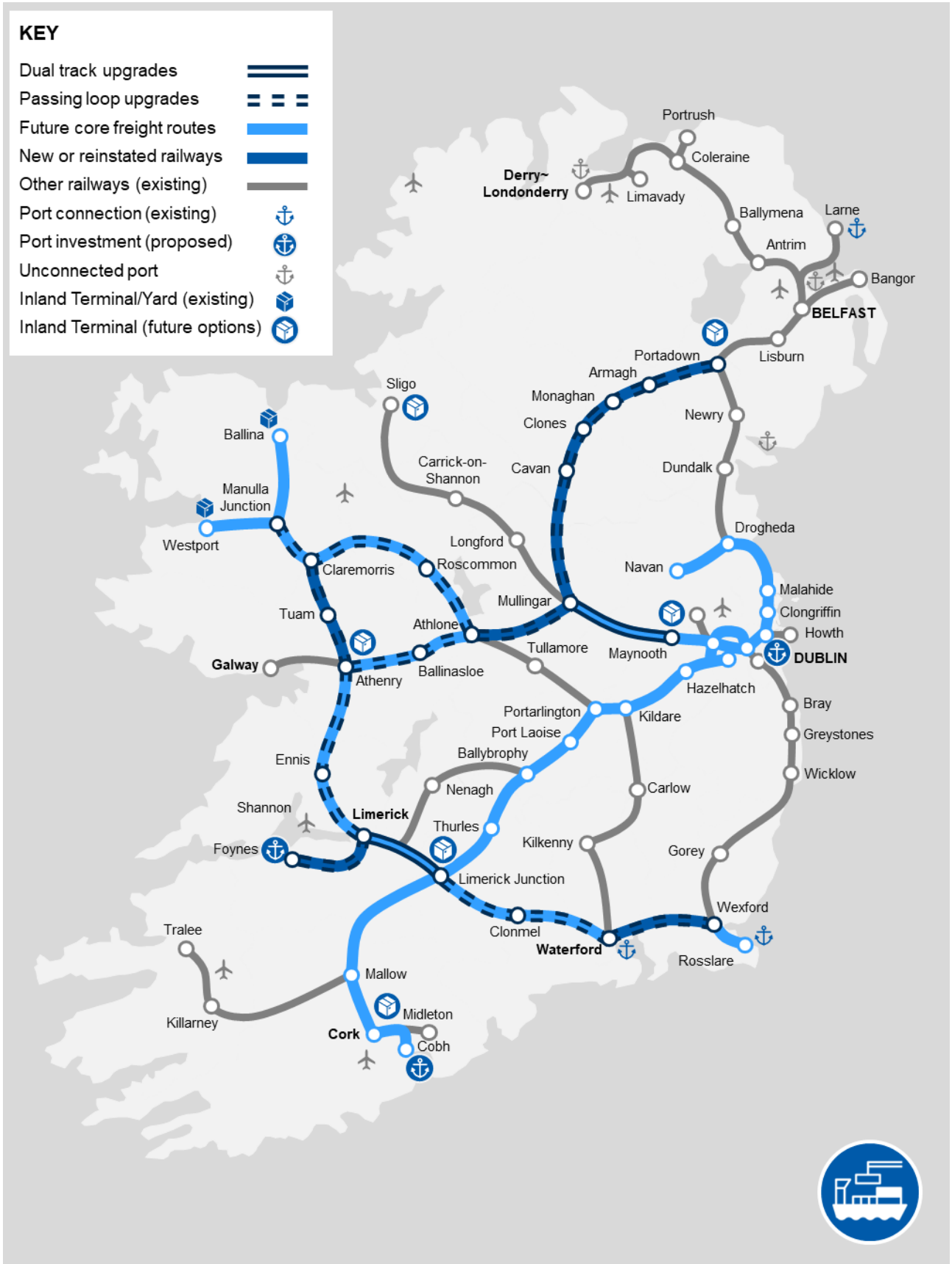


Figure 17
Rail freight interventions

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 for export.

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 maintenance 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 COVID-19 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 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 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.

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 wider 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, accessible, warm, well lit, and equipped with facilities to enable customers 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 leisure 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 who are 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 in station renewals.

Rolling Stock

One of the most significant drivers of customer satisfaction is the quality, 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 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 **200km/h** on intercity routes – if the infrastructure-led interventions described above are delivered.
- Configured to provide **high levels of comfort** 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 level of 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

There are opportunities to **improve the accessibility and integration of the railway** 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.
- Aligning **fare structures** and **concessions**, between both rail operators and/or with other public transport providers.
- Integrating modern **customer information** and **contactless/digital 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 Partnerships

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 over a hundred in the future.

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.**

*The costs of these interventions are not included in the costs presented in **Chapter 5**.*

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.

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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. The **Appendix** 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 railways 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 18**). 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 minimise conflicts between freight and other traffic.

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

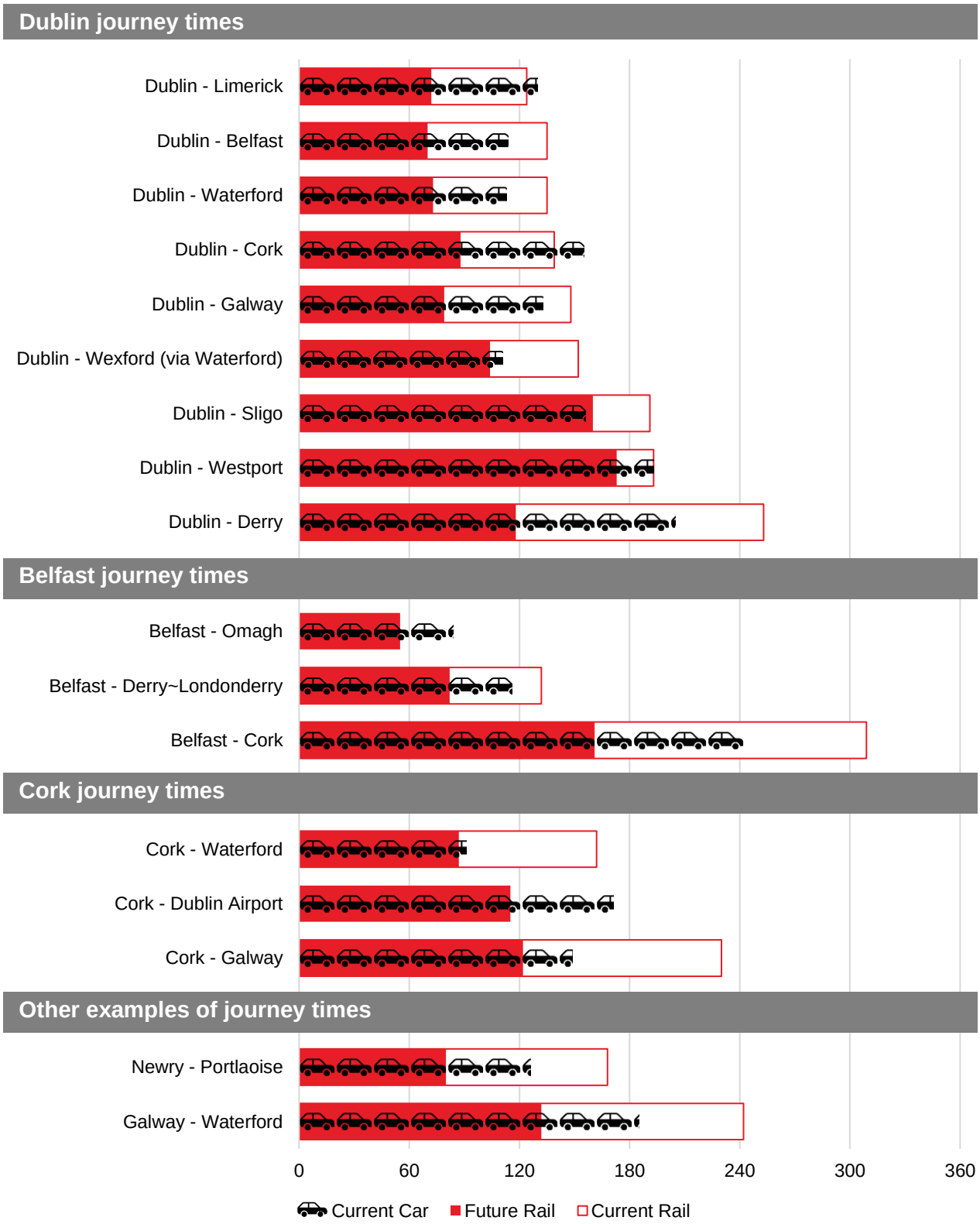


Figure 18
Indicative journey times by rail and car

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.

Benefits for Non-railway Users

In addition to the more visible 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.

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 based on 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 **€31.8bn/£26.5bn**. 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 B**. The **additional operating and maintenance costs** for maintaining a larger rail network on the island are estimated to be **€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 **€1.27/£1.06bn** 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 the **Appendix**. 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. More specifically, the Review is not recommending the construction of new railways through the North West coastal region, partly because of concerns about the impact of this intervention on the natural environment, as well as value for money considerations. The Review has also recommended several tunnelled interventions in urban areas to reduce their impact on residents and the built environment, and it has ruled out developing a large high speed rail system partly due to concerns that the carbon generated from its construction would not be offset by downstream carbon emission reductions. Going forward, each major intervention described in this report would be subject to **rigorous economic 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 the **Appendix**). A qualitative Multi Criteria Assessment of these Packages and Scenarios is presented in **Table A.5** in the **Appendix**. 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 19**.

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 – Portalington 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 operating and maintenance costs (per annum)	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). *The estimates presented for some interventions in this table may differ to other estimates prepared by other parties for similar 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 to more detailed 'bottom-up' estimates.*

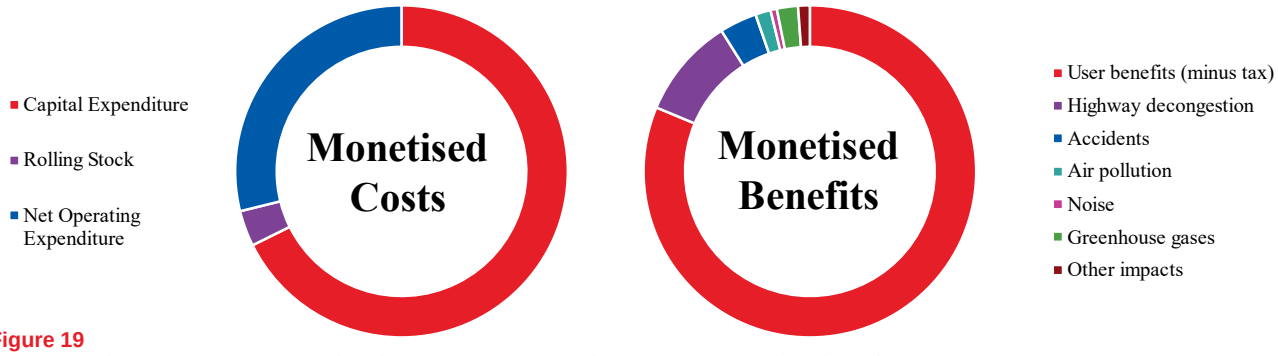


Figure 19
Breakdown of monetised costs and benefits of the recommendations of this Review (approximately €20bn/£16.7bn in 2011 discounted prices).

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).

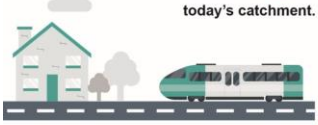
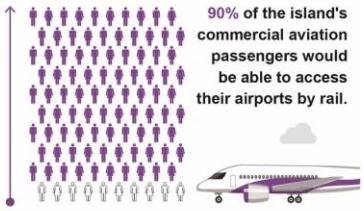
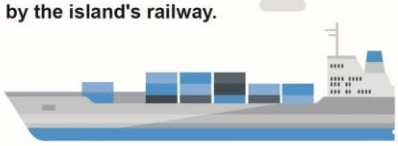
Goal	Objective	Potential Outcomes
Goal 1 | Decarbonisation	✓ Reduces the carbon emissions associated with rail's construction, operation, and maintenance ✓ Reduces the carbon emissions from motor vehicle travel by doubling rail's mode share	80% of train kms would be delivered by electric trains, and 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

Personas and Stories

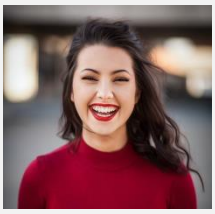
Customer personas are fictional profiles which represent characteristics of both existing and potential customers of the rail network. The purpose of developing personas is to help understand and empathise with a diverse range of customer needs and help to embed a customer mindset in the decision-making 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 at the start of the Review to enable the project team to form an understanding of the challenges people face today. The personas were informed by 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.

Lauren

The student

Lauren is a 19-year-old student who regularly 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 research if lifts are in operation at each station on her journey.
- Her journey requires her to take the Luas to travel between Connolly and Heuston, increasing the journey time and making the travel experience more unpleasant.
- Her perceptions of the expense of rail travel and 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 for all users. Alternative contact methods will make arranging assistance more convenient for passengers.
- 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 by rail more often.

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.

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Chapter 6 | Roadmap for Delivery


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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 c. 2030.
- **Medium term**: 2030 – 2040.
- **Long term**: 2040 – 2050.

Further details about the potential phasing of interventions are provided below.

Interventions

Short Term Interventions

The interventions that could be delivered within the next seven years 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 and Portarlington).
- 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/integration.

Medium Term Interventions

Interventions that are likely to take longer than seven years to deliver, but could still be delivered (or have made significant progress) 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 and start rolling out overhead electrification on intercity routes.
- Procure hybrid and electric rolling stock as each fleet comes to their end of life.
- Upgrade intercity routes to 160 – 200km/h.
- Increase other line speeds to 120 – 160km/h.
- Upgrade the cross-country rail 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 and services.
- Start to develop a cross-Dublin solution.
- Start extending the railway from Portadown to Derry~Londonderry and Letterkenny.

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.
- Extend the railway in the North Midlands (Portadown – Mullingar – 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 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 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 Ireland's transition to a net-zero 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 feasibility 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

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 A.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**: Solutions Development – 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.

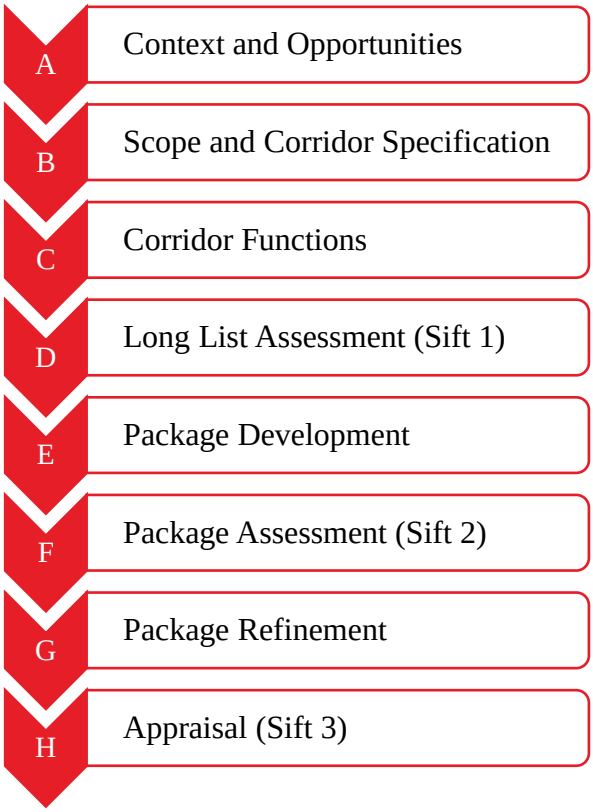

Figure A.1
Stages in the All-Island Strategic Rail Review

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 and 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**.

Figure A.2
Strategic movement corridors on the island of Ireland

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.

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 three variants of possible future segregated high-speed railways that would deliver top speeds of 300km/h between the island's 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 significantly 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 A.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 line)						Proceed
2.03b	Derry~Londonderry – Cookstown – Portadown (new line)				X		Park
2.03c	Derry~Londonderry – Magherafelt – Antrim (new line)				X		Park
2.03d	Derry~Londonderry – Navan (new line)			X			Park

Ref	Intervention / Option	Sift 1				Sift 2	Result
		Policy	Scope	Demand	Impact		
2.04a	Waterford – New Ross – Wexford (new line)						Proceed
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)			X			Park
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 A.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, and the second (Package 2b) centred on a high speed network with maximum speeds of 300km/h. These packages also included the interventions in Package 1. The main features of each package are described below.

Package 2a – Higher Speed

- Upgraded track, including realignments, to deliver up to 200km/h 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. Includes new stations at Drogheda East, Dublin Airport, and Glasnevin to connect with MetroLink, DART, and the airport.
- New stations on mainlines to/from Dublin.
- Dual tracking between Galway and Athenry.

Package 2b – High Speed

- A new 300km/h 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, 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 the 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 160km/h 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 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 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 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.

Package 3c – South Coast

- Electrification and speed and capacity enhancements along the Limerick Junction-Waterford line to enable 120km/h 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 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) continue to Rosslare Europort.
- Existing Dublin-Rosslare Europort service is replaced with hourly Greystones-Wexford service, connecting with the DART at Greystones.

Package 3d – North Midlands

- A new 120km/h electrified double-tracked line between Portadown and Clones via Armagh and Monaghan.
- A new 120km/h electrified single-track line between Clones, Enniskillen, and Collooney.
- A new 120km/h 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 Report** that is published alongside this Report.

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 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 A.3** (for CAF) and **Table A.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 and Package 2. **Table A.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 A.2 presents interventions that were included in the final package of recommendations and explains why some options were not taken forward.

Final Package of 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 A.3 (€)** and **Table A.4 (£)**. The assessment results for all eight packages are presented in a Multi Criteria Assessment Framework in **Table A.5**. The project team also estimated the scale of **wider impacts,** which account for agglomeration and imperfect competition, that Scenario 3e could deliver.

Tables A.3 and **A.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 A.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	
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 line)				✓				✓	Included	
2.04b	Waterford – Wellingtonbridge – Wexford (reinstated line)						✓		✓	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	

Ref	Intervention / Option	Package								Result	Comment
		1	2a	2b	3a	3b	3c	3d	3e		
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 A.3
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, providing a railway for this corridor via Enniskillen and Omagh did not appear to stimulate significant demand, which is probably because the journey times delivered by this infrastructure would not be competitive with car. 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 A.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 A.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 key interventions included 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 short link between Maynooth and Adamstown to separate longer-distance trains from the DART services.

Intercity continued:

- A new 200km/h (125mph) double-tracked electrified alignment between Hazelhatch and Portarlington and a link to the Kildare-Waterford line.
- Double tracking from Dublin as far as Mullingar, Athlone, and Kilkenny, as well as between Galway and Athenry.

Regional and Rural Packages:

- A new 160km/h (100mph) 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 existing 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 A.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 B

Introduction

This note presents a summary of analysis of the potential impact of inflation on capital cost estimates for interventions included in the Final 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 All-Island Strategic Rail Review, and so has been maintained throughout the study to ensure consistency.

Sources for data 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 €31.8bn/£26.5bn 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 the Final Report of the Review ("Benefits and Costs"), as well as in the accompanying Technical Note "Work Package 3 – Final Appraisal and Definition".

The estimates for the capital costs of the interventions included in the Final 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 have been significant changes to interest rates and inflation in both jurisdictions. Furthermore, as the Final Report of the Review is expected to be published in 2023, 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 B.1.**

If these inflation indicators were applied to the cost estimates for the interventions presented in the Final Report of the Review, then the estimated total capital costs of all interventions would rise from **€31.8bn/£26.5bn** in 2021 prices to **€35.0bn/£29.2bn – €36.8bn/£30.7bn** 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 writing, 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 in the Final Report of the Review, 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.

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

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 B.1
Analysis of inflation indicators (2021 – 2023)

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