

Luas Finglas

Preliminary Design & Statutory Process
Preliminary Business Case

June 2024

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Luas Finglas key facts

Environment

+1.3 million

low carbon
public transport trips in 2035


reduction in
CO₂ emissions per annum


440,000
reduction

in road network vehicle trips
along the corridor in 2035

Sustainability by Design


**Biodiversity
Net Gain
(BNG)**
Delivery of habitat creation
during design and construction

Replanting of more trees than
have been removed

Grass track design to
integrate surrounding areas

Modular innovative
track design

**Circular
economy**
Nature based
drainage solutions
Earthworks
design

Accessibility & Social Inclusion

+50%
Increase in
transport
capacity


to city centre from the
north-west of the city
(*when compared to a scenario without Luas Finglas)

10,000
'disadvantaged' people

live within 10-minute
catchment of Luas Finglas


New connections to schools,
Universities (TU Dublin & TCD),
hospitals and essential services

Economy

30
mins

47
mins

17 minute reduction in journey time
during peak hours on Luas when
compared to car


Almost
5,000
new homes
Supporting Jamestown
land redevelopment near to
Luas Finglas stops


Journey time reliability
from the M50/Finglas to
north city centre


Integration


350

Park and
Ride spaces

1.4

Benefit to
cost ratio

Luas BusConnects Iarnród Éireann

Integration with the wider
public transport system


St. Margaret's
Road
Catchment area extended by
inclusion of a Park and Ride

Safety & Physical Activity


Delivery of walking and cycling
along the Luas Finglas route


Cycle parking at each new station
to support cycle-tram trips


Active travel connection to schools,
parks, pitches and greenways

Executive summary

The Greater Dublin Area (GDA) must meet growing demand for public transport derived from population growth and to meet policy goals for sustainable mobility and climate action. Public transport is a key consideration in supporting the planning and supply of residential development required to meet Dublin’s housing challenge. To avoid unsustainable urban sprawl associated with car dependency, improved public transport is required within the footprint of existing urban areas for the benefit of existing and future communities.

The GDA Transport Strategy 2022-2042, devised to meet the future transport needs of the region, is the framework for the development of an integrated transport network that aligns with spatial planning policies. In developing the Strategy, the National Transport Authority (NTA) tested and appraised several options for high-capacity bus, on-street tram and underground metro in several locations in the GDA. The need for intervention to improve public transport capacity in the Finglas area has been the subject of extensive analysis including the North West Corridor Study that supported the previous iteration of the GDA Transport Strategy. The study concluded that Light Rail Transit (LRT) was required in addition to the bus network to support the sustainable growth of the area.

Luas Finglas has consistently emerged as the preferred public transport option for the corridor and is identified within the current Strategy as a component of the future development of the Luas network. Luas Cross City, which opened in 2017 bringing Luas from St Stephen’s Green to Broombridge, was planned as a phase in the development of Dublin’s light rail network and built to facilitate a northern extension through Finglas at a future date. This PBC is an important step in the delivery of this long planned extension.

“Luas Broombridge is just one phase in the creation of a light rail network for Dublin. Future phases, which will impact on Luas Broombridge, include possible extensions to Lucan (Line F) and northwest from Broombridge via Finglas”

1 Source: Luas Broombridge (i.e. Luas Cross City) Updated Detailed Business Case 9th November 2012
https://www.nationaltransport.ie/wp-content/uploads/2012/03/Updated_Detailed_BusCase-Issued_Final201311.pdf

Luas Finglas

Luas Finglas is a 3.9km extension of the Luas Green Line from Broombridge to Charlestown via Finglas, with a 350-space Park & Ride facility located just off the M50 at St Margaret's Road. The alignment is primarily off-road and segregated from traffic providing a high quality public transport service. In the year of opening, Luas Finglas will provide for a tram in each direction every 7.5 minutes during peak times with an approximate journey time of 30 minutes from Charlestown to Trinity College.

Luas Finglas preferred route



The proposals for Luas Finglas that are the subject of this Preliminary Business Case (PBC) have evolved following comprehensive route options analysis and two periods of non-statutory public consultation. The work to date has led to the identification of a Preferred Route which is shown in the previous figure illustrating the location of the proposed new Luas stations at St Helena’s, Finglas Village, St Margaret’s Road and Charlestown.

The scheme includes improvements to the walking and cycling network to enable access to Luas and deliver local connectivity benefits supporting active travel’s position at the top of the transport hierarchy. During the two non-statutory public consultations on Luas Finglas, the opportunity to construct parallel walking and cycling paths along the proposed route received strong support.

The Luas Finglas landscape strategy will result in the planting of many more trees than are required to be removed during construction. The design will seek to manage the impact on local ecology and wildlife where the route runs through undeveloped open land and parkland, seeking appropriate improvements to the local environment. Luas Finglas will in part be operated on grass track that, along with the proposed tree planting, will integrate the scheme with the surrounding areas and improve the resulting visual impact.

As an extension to the Luas network, Luas Finglas services will, to a significant extent, utilise existing infrastructure. Together with the current Luas infrastructure between Boombridge and the City Centre, Luas Finglas will operate within a 7.5km corridor between Charlestown and and City Centre that is largely segregated from traffic. Luas Finglas will result in more balanced passenger flows on the Green Luas Line north and south of the City Centre increasing the utilisation of available capacity on the network and leading to greater efficiency and productivity.

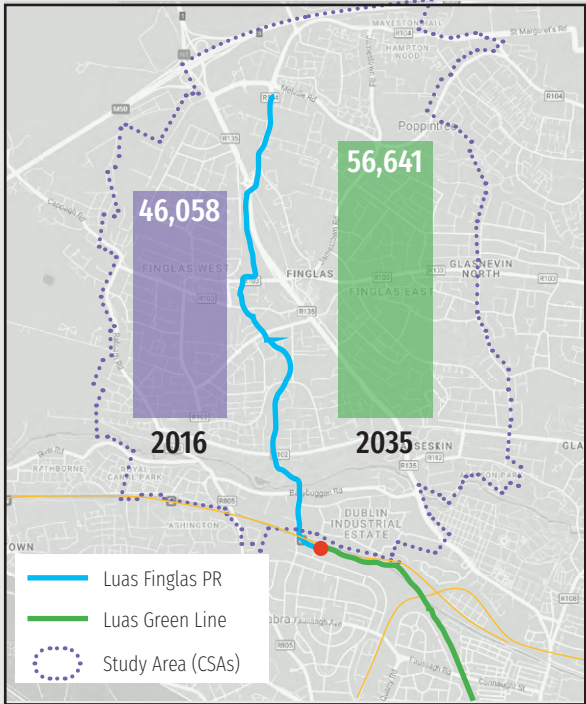


The Overarching Objectives for Luas Finglas, informed by policy and the need for the project, comprise:

- Serve existing and future transport demand
- Provide a safe, frequent, reliable, efficient and sustainable public transport connection from Charlestown and St Margaret’s Road (where it also serves a strategic Park & Ride) to the city centre, via Finglas
- Reduce public transport journey times between Charlestown, Finglas and the city centre compared to private car trips
- Contribute to the Climate Action Plan targets for the decarbonisation of transport
- Promote economic growth for the residents and businesses of Charlestown, Finglas and the surrounding areas

Luas Finglas will serve the population of the Finglas study area, which is forecasted to grow by over 10,500 people to over 56,500 by 2035, a 23% increase on the population in 2016. Through the substantial increase in public transport capacity and improvements to journey times and reliability, Luas Finglas will have a significant economic impact, improving the attractiveness of the area it serves supporting the delivery of regeneration and development investment, and providing capacity to enable medium and long-term compact and sustainable growth. Analysis shows that 73% of the new population expected in the Finglas area by 2035 will be within a 10-minute walk of one of the new Luas Finglas stops.

Population estimate



Luas Finglas will deliver a reliable public transport service offering 17-minute savings in journey time in the AM peak from Charlestown to Dublin city centre, compared to the longer and much less reliable expected car travel-time. By 2035, Luas Finglas will drive an annual increase of 46% in public transport boardings within its 1km catchment, thereby supporting modal shift.

Parts of Finglas are classified as disadvantaged by the Pobal HP deprivation index with approximately 10,200 people, equating to over one in five, currently living in deprived and disadvantaged areas within the catchment of Luas Finglas. Light rail is a proven driver of economic and social regeneration in previously under-served communities. The improved connectivity offered by the extension will widen employment opportunities and improve access to education and health facilities, leading to improved economic, health and social outcomes, reducing social exclusion and supporting improvement in the levels of affluence for residents in the area.

The proposed BusConnects and DART+ programmes will improve the capacity and attractiveness of public transport in the area and have been taken into consideration within this PBC. The attractiveness of walking and cycling will also increase due to ongoing investment in improved active mode infrastructure. However, further interventions are required to provide an integrated sustainable transport network of sufficient scale and capacity to adequately meet the future needs of the Finglas area and wider region. This is demonstrated by transport modelling analysis which, compared to the estimated population increase of around 10,500 persons, forecasts only an additional 400 person trips crossing the Royal Canal from the north-west in the 2035 Do Minimum scenario AM peak (i.e., without the delivery of Luas Finglas) compared to a 2020 base scenario. An additional 400 trips

AM peak hour persons crossing the Royal Canal



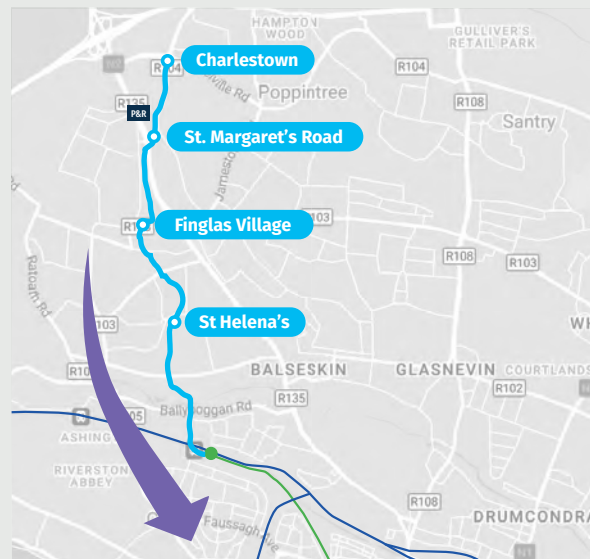
represents a relatively low growth in trips to the city centre given the estimated population increase of around 10,500 persons within the same time period reflecting the transport capacity constraints.

The delivery of Luas Finglas will help unlock potential capacity for people movements to and from the north-west corridor. Modelling analysis indicates that in the opening year 2035, Luas Finglas will lead to a 50% increase in transport capacity utilisation for trips travelling south towards the city centre in the AM peak. With the delivery of Luas Finglas, an additional 2,655 person trips are expected to cross the Royal Canal in the AM peak in 2035.

It is important that the transport network supports rather than constrains development. For example, Charlestown has planning permission for an additional 967 homes, and the Jamestown Industrial Park, recently rezoned as a Strategic Development and Regeneration Area (SDRA), has 52 hectares of land for redevelopment and indicative targets for an additional 3,500 – 3,800 residential units. If the additional transport demand arising from population growth is not met by a comparable increase in transport capacity, the developments will be less attractive to both developers and those wanting to live in the area. Ongoing planning is being progressed by Dublin City Council and Fingal County Council to better integrate transport and land use development, with the aim of capitalising on investment in major transport infrastructure to support sustainable development and deliver housing.

Transport demand in Finglas is also impacted by car trips from further afield passing through the area to reach Dublin city centre and other key destinations. The benefit of Luas Finglas will be extended beyond its immediate catchment through the provision of a Park & Ride facility and integration with the existing and planned public transport network, including BusConnects and DART+.

Transport modelling indicates that the level of demand at Charlestown Place and St Margaret’s Road will exceed 800 passengers in the morning peak hour when the service is available in 2035. This level of demand rivals some of the highest demand Green Line stations at Stillorgan, Balally and Dundrum as recorded in the 2019 Luas Census. Even the station with the lowest boardings along the planned extension, St Helena’s (568 passengers), will attract higher boarding numbers than many of the stations along the existing Green Line. Luas Finglas will generate an additional 1.3 million low carbon public transport trips in 2035, increasing to 1.8 million in 2050.



AM Person Trips 2035



Policy Alignment

Luas Finglas aligns with important national and local policy, specifically:

- Climate Action Plan 2023:** acknowledges the need for investment in public transport to support mode shift and contribute to reaching the target to halve carbon emissions from transport by 2030 and reach net zero no later than 2050.
- National Sustainable Mobility Policy:** is structured around three principles: safe and green mobility; people focused mobility; and better integrated mobility. The associated Action Plan 2022-2025 includes continued appraisal and planning of new light rail in Dublin as a core action.
- Project Ireland 2040:** Identifies ten National Strategic Outcomes including NSO 1: Compact Growth; NSO 4: Sustainable mobility; NSO 5: A strong economy, supported by enterprise, innovation and skills; NSO8: Transition to climate-neutral and climate resilient society.
- National Investment Framework for Transport in Ireland:** Four investment priorities including Decarbonisation; Mobility of people and goods in urban areas; and Enhanced regional and rural connectivity.
- Regional Spatial & Economic Strategy 2019-2031:** Sixteen Regional Strategic Outcomes including: Healthy Placemaking; Climate Action and Economic Opportunity.
- Transport Strategy for the Greater Dublin Area 2022-2042:** Luas Finglas is identified in the Strategy as one of four schemes to expand the reach of Luas across Dublin. The Cycle Network Plan is a core component of the Strategy and both Primary Radial and Secondary routes are identified within the Luas Finglas corridor.
- Dublin City Development Plan 2022-2028:** recognises that Finglas is one of twelve Key Urban Villages in Dublin with identified areas for development and regeneration that would be supported by Luas Finglas.

Project Costs

The overall delivery cost range of Luas Finglas is outlined in the following table. This includes a comprehensive project risk assessment and contingency allowance to ensure a robust representation of the economic impact of the scheme at this stage.

Forecast Range	Risk P-Value	Without Inflation (Q1/Q2 2022)	With Inflation	With VAT
Management Stretch Target	OBC RCF P30 Low	€270 million	€364 million	€421 million
Management Base Target	OBC RCF P50 Medium	€334 million	€496 million	€574 million
Prudent Client Appraisal Value	OBC RCF P80 High	€401 million	€656 million	€759 million

Scheme Appraisal

In line with CAF and the Public Spending Code (PSC) 2019, Luas Finglas has been subject to a detailed Financial and Economic Appraisal to ensure it provides a positive return on investment. This includes a comprehensive Multi-Criteria Analysis (MCA) to capture the important wider benefits of the scheme that are not easily monetised.

Economically, Luas Finglas will provide a positive Benefit-Cost Ratio (BCR) of 1.4 in the expected core scenario and between 1.0 to 2.0 over a range of scenarios comprising variations in costs, demand and changes in the wider transport network. As a sensitivity test, cost, demand and transport network scenarios that individually have lower benefit to cost ratios have been combined. In the unlikely event that the conditions underpinning this sensitivity test arise, the resulting BCR will reduce to 0.8.

Scenario	Summary Description	Cost Scenario	BCR
Core	Assumes that all committed projects are implemented along with the delivery of DART+ West and the BusConnects Core Bus Corridor infrastructure that have planning applications submitted and directly serve Broombridge and the Finglas corridor. MetroLink, located to the east of Finglas, has not been included in this scenario.	'Reference Class Forecasting' P80	1.4
		'Management Base Target' P50	1.7
		'High Risk' P90	1.1
		'Management Stretch Target' P30	2.0
Alternative Growth Future	Assumes delivery of the 'Core' scenario projects and demand patterns aligned with the NTA's 'Alternative Future Scenario for Travel Demand'. This aims to reflect changes in transport demand e.g. increased working from home.	'Reference Class Forecasting' P80	1.1
		'Management Base Target' P50	1.3
Core + MetroLink	Assumes that all the projects of the 'Core' scenario are delivered along with MetroLink.	'Reference Class Forecasting' P80	1.0
		'Management Base Target' P50	1.1
Core + MetroLink + Alternative Growth Future	Assumes that all the projects of the 'Core + MetroLink' scenario are delivered, along with demand patterns aligned with the NTA's 'Alternative Future Scenario for Travel Demand'.	'Reference Class Forecasting' P80	0.8
		'Management Base Target' P50	1.0

The BCR is informed by strategic transport modelling undertaken in the NTA's East Regional Model (ERM). The modelling analysis indicates that the introduction of MetroLink leads to a reduction in patronage on Luas Finglas and associated user benefits. A detailed technical note has been produced (Appendix E) which investigates the sensitivity test with MetroLink in further detail. From GIS analysis prepared, there is very limited overlap in areas served by both Luas Finglas and MetroLink, meaning that for the most part these lines serve two different catchment areas. MetroLink will provide a very high quality public transport option and, as the model reflects, some passengers will be willing to walk longer distances to use MetroLink instead of Luas Finglas. However, personal preferences that impact people's

willingness to walk long distances cannot be fully reflected in the model, which might affect the outcome. Therefore, MetroLink might not reduce the number of people using Luas Finglas as much as the model predicts.

Overall, it is expected that Luas Finglas will deliver a positive BCR and will deliver good value for money. The scheme will deliver many other important non-monetised economic and social benefits, especially focused around accessibility, social inclusion and integration. These are captured in a detailed Multi-Criteria Analysis presented in this PBC. Luas Finglas performs extremely well in achieving the overall scheme objectives and will deliver positive impacts for the north-west of the city.

Delivery

Transport Infrastructure Ireland (TII) has proven experience in delivering Luas projects in Dublin since 2004. This includes Luas Cross City, a project of considerably higher complexity and challenge than Luas Finglas, which was delivered on time and within 4% of budget.

From governance to stakeholder engagement to construction timelines and cost forecasting, TII's institutional experience in light rail provides confidence the timelines and estimates forecasted in this PBC can be delivered.

Opportunities for Earlier Delivery of Luas Finglas

The National Development Plan (NDP) seeks to deliver a range of projects within the period up to 2031 and also create a pipeline of projects that are ready for delivery in the period beyond 2031. Within the current NDP, Luas Finglas is a pipeline project with funding available to bring the project to the point of delivery. The current programme will seek to deliver the necessary planning approval for the project in Q2 2025, however the procurement and award of main construction contracts will not commence until funding for the implementation of the project is committed within the NDP. Should the funding envelope be available, opportunity exists to deliver the project earlier than scheduled, which will result in cost savings and delivery efficiencies. This scenario could see advance works commencing in 2026, with main infrastructure and power and systems works to follow. Operation of Luas Finglas by the end of 2031 completion date is achievable under this scenario.

Recommendation / Next Steps

The Preliminary Business Case for Luas Finglas presents the appraisal undertaken which has identified strong alignment with policy alongside significant quantified benefits that are in excess of the project costs. Luas Finglas will deliver additional benefits that cannot be monetised and wider benefits that are not included in the core scenario. On the basis of this PBC, it is proposed that approval in principle is given to proceed to the next Approval Gate in line with the Public Spending Code.

1 | Introduction

1.1 Background

The North West Corridor Study (NWCS) (2015) analysed the demand for transport in the north-west of Dublin. It concluded that Light Rail Transit (LRT) was required in addition to the bus network to support the sustainable growth of the area. The subsequent Transport Strategy for the Greater Dublin Area (GDA) 2016 – 2035 (and its recent review 2022-2042) identified an extension to Luas from Broombridge into Finglas and on to Charlestown as a key measure to improve public transport connections in the area. Luas Cross City, which brought Luas from St Stephen's Green to Broombridge was planned as a phase in the development of Dublin's light rail network and built to facilitate a northern extension through Finglas at a future date.

The proposed scheme is to be delivered by Transport Infrastructure Ireland (TII) in collaboration with the National Transport Authority (NTA). The scheme has progressed through several stages of development and assessment, in line with the NTA's Project Approval Guidelines and the Public Spending Code (2019) including:

Phase 1: Scope and Purpose

- Strategic Assessment Report (SAR) (2019)

Phase 2: Concept Development and Option Selection

- Stage 1 Options Selection Report (2019)
- Stage 2 Options Selection Report (2020)
- Definition of the Emerging Preferred Route (EPR) (2020)

- First round of non-statutory public consultation (NSPC) on EPR (2020)
- Definition of the Preferred Route following the first NSPC (2021)
- Second round of non-statutory public consultation (2021)
- Project Appraisal Report (PAR) (2021)

The scheme is currently at **Phase 3: Preliminary Design** of the NTA's Project Approval Guidelines with the Preliminary Business Case (PBC) forming one of the key deliverables required for approval through Gateway 3. The Guidelines are aligned with the Public Spending Code under which approval in principle for the PBC is required prior to proceeding with an associated planning application. This approval in principle will represent Approval Gate 1 in the project lifecycle as set out in the PSC.

1.2 Purpose

The purpose of this PBC is to describe the process followed in order to appraise the Luas Finglas scheme, and confirm it is a good use of public money. It explains the strategic fit of the scheme; how it aligns with Government policy; the options considered and the investment required. The benefits, impacts and affordability of the proposed intervention are appraised, along with identifying a plan for implementation.

This PBC has been prepared in compliance with the latest appraisal and project delivery guidance, specifically:

- The Department of Public Expenditure and Reforms (DEPR) Public Spending Code (PSC) (2019)
- The Department of Transport (DoT) Common Appraisal Framework (CAF) (March 2016, updated October 2021)²
- National Transport Authority Project Approval Guidelines (2020)
- Transport Infrastructure Ireland Project Appraisal Guidelines (PAG) (2016 plus various updates)

In following relevant guidance, this PBC builds upon previous reports and ongoing work in the design and planning of Luas Finglas. It presents the appraisal of the scheme in an objective manner within a common basis consistent with other projects. All appropriate information for the approvals process is provided.

1.3 Preliminary Business Case Report Structure

The structure for this Preliminary Business Case (PBC) is as follows:

- **Chapter 2** identifies the case for change and the need for the scheme.
- **Chapter 3** provides an overview of the assessment of alternative modes and the process followed to reach a preferred route for the Finglas corridor.
- **Chapter 4** details the chosen scheme, the demand for Luas Finglas, the scheme costs and its impacts.
- **Chapter 5** contains the economic and financial appraisal of the scheme. The costs and expected benefits are assessed quantitatively and qualitatively.
- **Chapter 6** outlines the emerging contracting and procurement strategy for Luas Finglas, project implementation considerations, the current project risk assessment, and the proposed governance arrangements.
- **Chapter 7** concludes this PBC and outlines the next steps of in the delivery of the scheme.

This PBC contains several appendices, compiled to allow more comprehensive consideration of various topics.

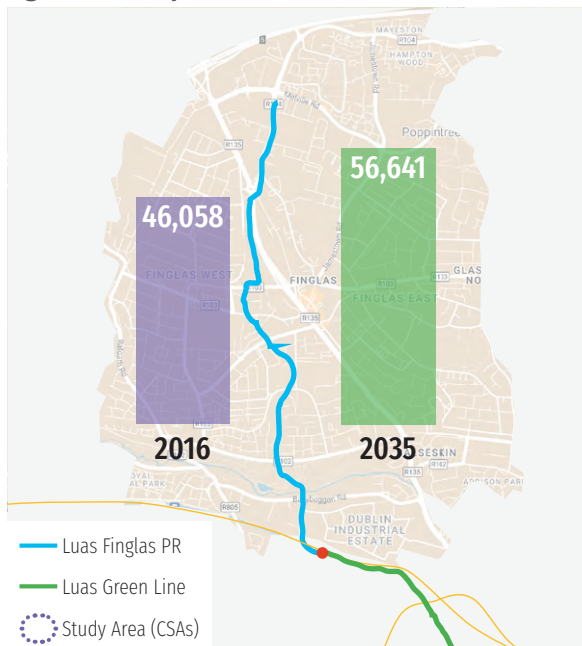
² CAF remains the applicable appraisal guidance at the time of PBC preparation

2 | Case for Change

2.1 Challenge Overview

The case for change is underpinned by the challenges that impact the need for transport in the Finglas area both now and in the future. Analysis was undertaken of available data relevant to the performance of the existing transport network in the study area and the expected future performance without Luas Finglas. The main data sources used were the 2016 Census and data extracted from the NTA's East Regional Model (ERM).

Figure 2.1 Population estimate



Project Ireland 2040 outlines how the population of Ireland is forecasted to grow to 5.7 million people by 2040. This represents a 20% increase on the population recorded in the 2016 Census and will give rise to a need for at least an additional half a million new homes. In keeping with policy objectives for compact growth, the

population within the footprint of Ireland's Cities is planned to increase above the national average. Within the Finglas study area, the population is forecasted to grow by over 10,500 people (23%) by 2035³.

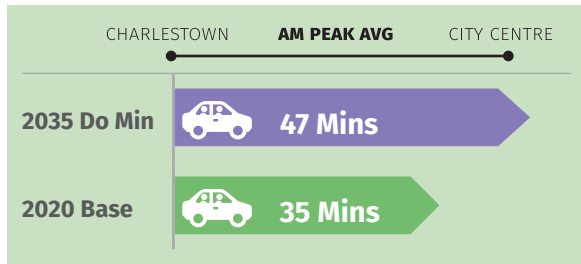
Around 15,000 work-related trips and 8,000 school/college trips take place on an average weekday from the Finglas area⁴. This number will likely rise as the population grows.

Access to Dublin city centre from the north-west corridor is constrained to a small number of bridge crossings over the Royal Canal at Phibsborough, Broombridge and Ratoath Road. These areas are currently over capacity during peak periods. If current rates of car use continue, traffic congestion is likely to increase in the future due to increased demand for transport arising from general population growth and proposed developments in the Finglas area and wider region.

³ Taken from analysis of NTA Planning Sheets developed based on Project Ireland 2040 National Planning Framework targets

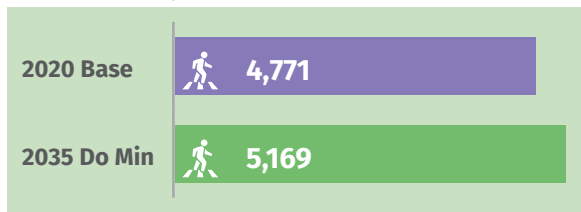
⁴ 2016 Census Figures

Figure 2.2 Journey time comparison



Modelling in the NTA’s ERM suggests that journey times on average by car from Charlestown to the city centre⁵ will increase by around 12 minutes by 2035, adding nearly 35% to the journey time.

Figure 2.3 AM peak hour persons crossing the Royal Canal



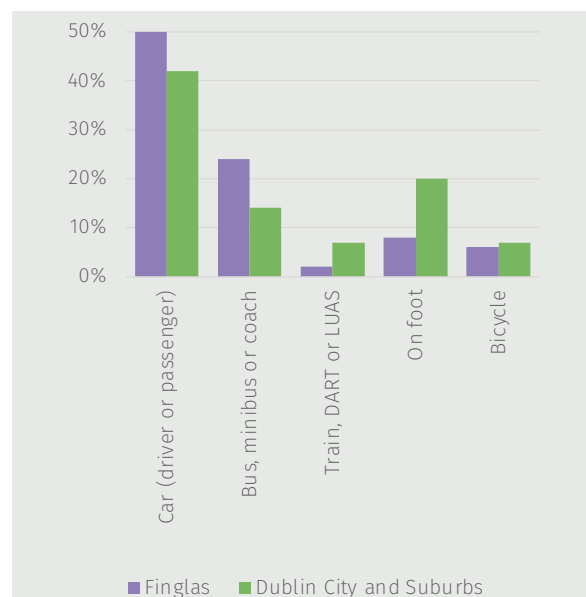
Given the constraints, there is little scope for the capacity of the existing road based transport network to grow to meet future needs. Transport modelling analysis forecasts an additional 400 person trips crossing the Royal Canal from the north-west in the 2035 Do Minimum scenario AM peak hour (i.e., without the delivery of Luas Finglas) compared to a 2020 base scenario. This is including the proposed upgrades to the bus network and infrastructure to be delivered by BusConnects. An additional 400 trips represents a relatively low growth in trips to the city centre given the estimated population increase of around 10,500 persons within the same time period reflecting the transport capacity constraints. This analysis from the transport modelling indicates the need for a high-capacity public transport solution that can act independently of the existing road network

to support the development of the Finglas area. Without this, congestion and journey times are likely to continue to grow into the future.

Accommodating an increase in demand for transport across the city while achieving net-zero emissions by 2050, will require significant changes in travel behaviours and the availability of attractive alternatives to the private car. Compared to the wider Dublin City and suburbs, Finglas has a high proportion of car users for travel to work, and relatively low proportions of walking and cycling. According to Census 2016 data, around 50% of Finglas residents travelling to work and education commute by car. Just 1% of trips for work or education in the Finglas area are made by rail-based modes with the nearest station located at Broombridge.

In the absence of additional sustainable transport capacity, the road-based transport network will be more unreliable, threatening local economic vitality, development and regeneration.

Figure 2.4 Summarised Comparative Modal Share



(SAPs, Travel to work, census 2016)

5 Taken to be Trinity College for the purpose of this analysis

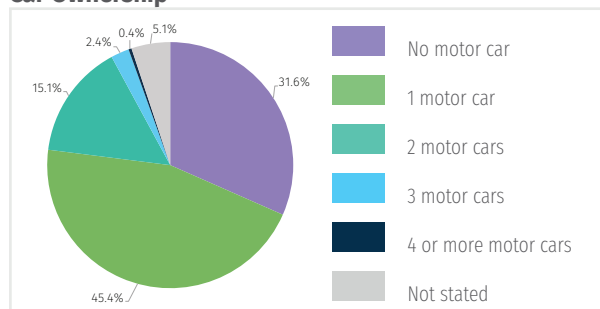
Finglas has experienced substantial development in the recent past and is expected to develop significantly in the years to come. It is important that the transport network supports rather than constrains development. For example, Charlestown has planning permission for an additional 967 homes, and the Jamestown Industrial Park, recently rezoned as a Strategic Development and Regeneration

Area (SDRA), has 52 hectares of land for redevelopment and indicative targets for an additional 3,500 – 3,800 residential units. If the additional transport demand arising from population growth is not met by a comparable increase in transport capacity, the developments will be less attractive to both developers and those wanting to live in the area.

Figure 2.5 Pobal Deprivation Index (Census Small Area, 2016)



Car Ownership



The Pobal Deprivation Indices 2016⁶ highlight a number of areas in Finglas classified as disadvantaged or very disadvantaged (illustrated in Figure 2.5).

6 <https://maps.pobal.ie/WebApps/DeprivationIndices/index.html>

Analysis of census data indicates that around one third of households within the Finglas area do not have access to a private car. There is a need to support households without access to a car to avoid increased car ownership. However, poor levels of accessibility to employment areas and educational facilities by public transport are a significant barrier to employment for residents who don't own or have access to a car.

To support the regeneration of Finglas, and improve accessibility for residents, investment in a high-quality public transport solution is required to connect more people to a wider range of employment, education and recreational services. The benefits of Luas in accessing jobs and services will be particularly apparent for those with some form of mobility impairment who find existing bus-based public transport difficult to access. Light rail in general is a proven driver of economic and social regeneration in previously under-served communities, as illustrated later in this business case.

A well-developed integrated transport network is required to support accessibility and bring about economic benefits. Without further developing an integrated transport network for Dublin, issues such as congestion may impact the attractiveness of the City. This would directly impact on the cost of doing business due to time lost, increased operating costs and reduced accessibility to the labour market resulting in damaging impacts on the broader economy. Within the Finglas corridor, an underdeveloped integrated transport network will impact on the attractiveness of Finglas as a place to live and do business

hindering the sustainable economic growth of the area.

It is widely recognised in national and regional policy that an integrated public transport solution is required to encourage a shift to sustainable modes. Luas Cross City, an extension of the Green Line from St Stephen's Green to Broombridge opened to passengers in 2017. It was designed and built to accommodate a future extension of the Luas network to Finglas.

“Luas Broombridge is just one phase in the creation of a light rail network for Dublin. Future phases, which will impact on Luas Broombridge, include possible extensions to Lucan (Line F) and northwest from Broombridge via Finglas”

There are a number of other future public transport schemes in the north and north-west corridor of Dublin advancing through the planning process, including:

- **BusConnects:** The Preliminary Business Case for BusConnects has been approved by Government and planning applications for the individual corridors are currently being submitted to An Bord Pleanála. The BusConnects Network Redesign implementation is ongoing, bringing about the phased introduction of enhanced bus services across the city. The F-Spine serving Finglas is to be launched as an upcoming phase of the network redesign.

7 Source: Luas Broombridge (i.e. Luas Cross City) Updated Detailed Business Case 9th November 2012
https://www.nationaltransport.ie/wp-content/uploads/2012/03/Updated_Detailed_BusCase-Issued_Final201311.pdf

- DART+:** The DART+ Programme will significantly increase the frequency and capacity of the suburban rail network within the Greater Dublin Area. The DART+ West Railway Order application, which will see the electrification of the DART line to Maynooth and increased service frequency, has been submitted to An Bord Pleanála for approval. Broombridge station is located within the DART+ west corridor and provides an existing interchange with Luas Cross City, and a future interchange with Luas Finglas.
- MetroLink:** MetroLink is the proposed high-capacity, high-frequency rail line running from Swords to Charlemont,

linking Dublin Airport, Irish Rail, DART, bus and Luas services. The Preliminary Business Case for MetroLink has been approved by Government and a Railway Order application was lodged in September 2022.

The Luas Finglas extension to the Luas Green Line will complement the BusConnects, DART+ and MetroLink proposals, with improvements throughout the corridor providing greater connectivity between the north-west corridor to the city centre and beyond, driving transport demand increases and maximising the value of previous investments in public transport.

2.2 Alignment with Government Policy

Luas Finglas aligns with important national and local policy as summarised below.

Climate Action Plan 2023

Climate Action Plan 2023 (CAP23) is the second annual update to Ireland's Climate Action Plan 2019. The plan implements the carbon budgets and sectoral emissions ceilings required to halve our emissions by 2030 and reach net zero no later than 2050.

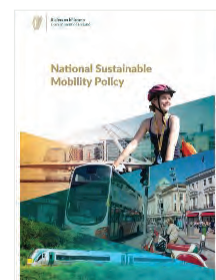
CAP23 sets out necessarily ambitious targets for the decarbonisation of transport which Luas Finglas will support, including a "20% reduction in total vehicle kilometres, a reduction in fuel usage, and significant increases to sustainable transport trips and modal share". CAP23 acknowledges the need for investment in public transport to significantly improve the attractiveness, capacity and frequency of public transport to achieve the level of modal shift and associated reduction in fossil-fuelled vehicle kilometres travelled.



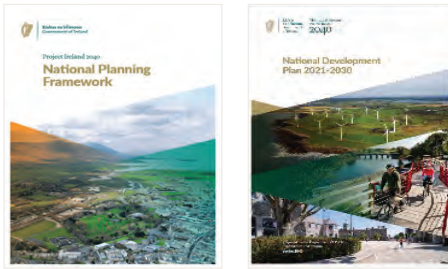
National Sustainable Mobility Policy

The policy, published in 2022, has three principles: safe and green mobility; people focused mobility; and better integrated mobility. These priorities are underscored by a series of goals, many of

which are applicable to the opportunity to improve transport in the Finglas area. The associated Action Plan 2022-2025 includes continued appraisal and planning of new light rail in Dublin as a core action. The timeline and output envisages planning documentation for Luas Finglas being completed by 2023.



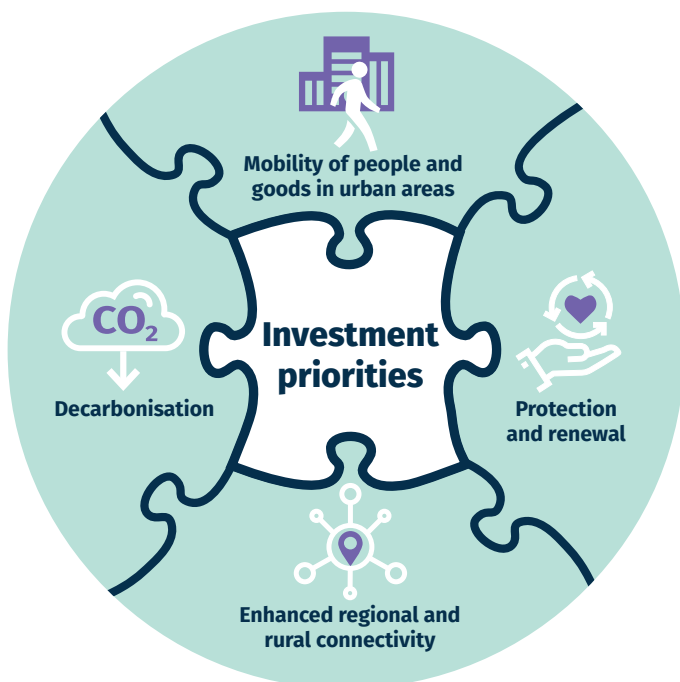
Project Ireland 2040: National Planning Framework and National Development Plan (2021-2030)



Project Ireland 2040 comprises the National Planning Framework (NPF) and the National Development Plan (NDP). Luas Finglas directly supports four of the ten Project Ireland 2040 NSOs:

- **NSO 1: Compact growth**
- **NSO 4: Sustainable mobility**
- **NSO 5: A strong economy, supported by enterprise, innovation and skills**
- **NSO 8: Transition to a climate-neutral and climate resilient society**

Light rail is one of the strategic investment priorities identified under the NSO4 of Sustainable Mobility. The NDP explicitly references Luas Finglas stating that “the NDP will permit the project continue to progress.”



National Investment Framework for Transport in Ireland (NIFTI)

Luas Finglas is very well aligned to three of the four investment priorities outlined in NIFTI:

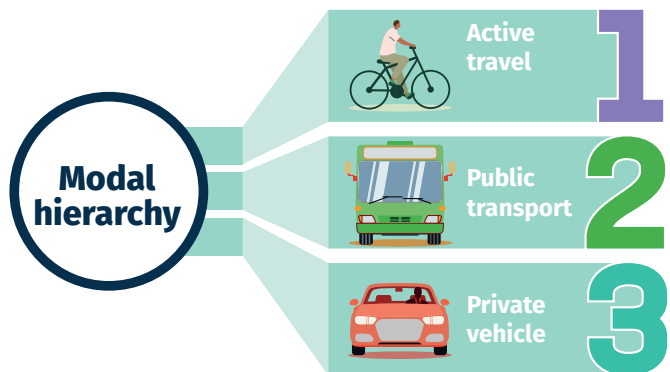


- **Decarbonisation**
- **Mobility of people and goods in urban areas**
- **Enhanced regional and rural connectivity.**

Luas will be extended through the inclusion of a strategic Park & Ride facility linked to the national road network, thereby delivering enhanced regional and rural connectivity.

Through the provision of walking, cycling and public transport, Luas Finglas aligns strongly with the modal hierarchy set out in NIFTI.

As Luas Finglas is an extension of Luas Cross City it also aligns with the NIFTI investment hierarchy which seeks to prioritise optimisation and improvements to existing infrastructure ahead of the construction of new.



Regional Spatial & Economic Strategy 2019-2031

The Regional Spatial & Economic Strategy (RSES) from the Eastern & Midland Regional Assembly outlines 16 Regional Strategic Outcomes (RSOs). The RSOs that most closely relate to meeting the transport needs of Finglas, and which will be supported by Luas Finglas, are:



- **Healthy Placemaking:** Sustainable settlement patterns; Compact growth and urban regeneration; Healthy communities
- **Climate Action:** Integrated transport and land use
- **Economic Opportunity:** Improve education, skills and social inclusion; Enhance regional connectivity

The Dublin Area Strategic Masterplan is part of the RSES. It recognises a number of key future transport infrastructure schemes, including the Luas Green Line extension to Finglas from Broombridge.

Transport Strategy for the Greater Dublin Area 2022-2042

The recently published review of the Greater Dublin Area Transport Strategy acknowledges the success of Luas from when it first arrived in Dublin in 2004, and that light rail remains a valuable tool in the transport solution for the city. The strategy proposes an expansion of the Luas network up until 2042 and beyond. Luas Finglas is identified in the Strategy as a scheme to be delivered in the medium term (2031-2036) to expand the reach of Luas across Dublin.



The Cycle Network Plan is a core component of the Strategy. Sections of the GDA Cycle Network Plan that align with the Luas Finglas alignment are included in the project for delivery.



Dublin City Development Plan 2022-2028

The Dublin City Development Plan, adopted in November 2022, recognises that Finglas is one of twelve Key Urban Villages in Dublin, as it is a focal point for jobs, services, shopping and other activities. The development plan looks ahead and takes into account future infrastructure, including the delivery of the Luas Green Line extension to Finglas.



The Plan has identified areas across the city that have land available for development. This includes 52 hectares located in and around Finglas Village and Jamestown earmarked as a Strategic Development and Regeneration Area (SDRA), and the Dublin Industrial Estate site adjacent to the Broombridge Luas interchange. The Plan relies on Luas Finglas and bus improvements, once delivered, to serve these regeneration areas.

Well-being Framework

In 2022 the Department of the Taoiseach published the Well-being Framework for Ireland, a cross-government initiative to help improve our understanding of quality of life and to measure how we are progressing overall as a country. This can help us better align policy decisions with people's experiences. There are 11 dimensions alongside two important cross-cutting issues of equality and sustainability. The key dimensions identified and incorporated into the appraisal are: Physical Health; Income and Wealth; Knowledge, Skills and Innovation; Housing and the Built Environment; Environment, Climate and Biodiversity; Safety and Security; Work and Job Quality; Time Use; and Connections, Community and Participation



2.3 Logic Map & Objectives

A set of overall objectives have been developed to ensure Luas Finglas addresses the transport related challenges facing the wider Finglas area and aligns with government policy as discussed.

The Overarching Objectives for Luas Finglas are:

- Serve existing and future transport demand
- Provide a safe, frequent, reliable, efficient and sustainable public transport connection from Charlestown and St Margaret's Road (where it also serves a strategic Park & Ride) to the city centre, via Finglas
- Reduce public transport journey times between Charlestown, Finglas and the city centre compared to private car trips
- Contribute to the Climate Action Plan targets for the decarbonisation of transport
- Promote economic growth for the residents and businesses of Charlestown, Finglas and the surrounding areas

As shown in the table below, the Overarching Objectives have been devised to be SMART: specific, measurable, attributable, realistic and time-bound as set out in the Public Spending Code.

Serve existing and future transport demand					
Measurable	Patronage – defined as the number of people using Luas Finglas. Transport capacity in the Finglas corridor at a fixed cordon point.				
Attributable	<table border="1"> <tr> <td>Pre-Operation</td> <td>During Operation</td> </tr> <tr> <td> <ul style="list-style-type: none"> Transport Modelling </td> <td> <ul style="list-style-type: none"> Monitoring and Evaluation Plan to identify suitable data sources and allocate responsible owners⁸ </td> </tr> </table>	Pre-Operation	During Operation	<ul style="list-style-type: none"> Transport Modelling 	<ul style="list-style-type: none"> Monitoring and Evaluation Plan to identify suitable data sources and allocate responsible owners⁸
Pre-Operation	During Operation				
<ul style="list-style-type: none"> Transport Modelling 	<ul style="list-style-type: none"> Monitoring and Evaluation Plan to identify suitable data sources and allocate responsible owners⁸ 				
Realistic	Luas Finglas will provide additional transport capacity within the Finglas Corridor				
Time-Bound	Transport Modelling has been undertaken for two future years: Opening Year (2035); Design Year (2050)				

Provide a safe, frequent, reliable, efficient and sustainable public transport connection from Charlestown to the city centre, via Finglas					
Measurable	KPI performance monitoring for frequency and reliability; accident data;				
Attributable	<table border="1"> <tr> <td>Pre-Operation</td> <td>During Operation</td> </tr> <tr> <td> <ul style="list-style-type: none"> Design standards and transport modelling </td> <td> <ul style="list-style-type: none"> Operational frequency and reliability performance indicators Road safety data Energy efficiency for vehicles and facilities </td> </tr> </table>	Pre-Operation	During Operation	<ul style="list-style-type: none"> Design standards and transport modelling 	<ul style="list-style-type: none"> Operational frequency and reliability performance indicators Road safety data Energy efficiency for vehicles and facilities
Pre-Operation	During Operation				
<ul style="list-style-type: none"> Design standards and transport modelling 	<ul style="list-style-type: none"> Operational frequency and reliability performance indicators Road safety data Energy efficiency for vehicles and facilities 				
Realistic	Luas Operation contracts will set performance targets for frequency and reliability, safety requirements / measures and energy efficiency				
Time-Bound	Contract performance timelines				

Reduce public transport journey times between Charlestown, Finglas and the city centre compared to private car trips					
Measurable	Average journey time comparisons between Charlestown, Finglas and the City Centre for Luas Finglas and private car				
Attributable	<table border="1"> <tr> <td>Pre-Operation</td> <td>During Operation</td> </tr> <tr> <td> <ul style="list-style-type: none"> Transport Modelling </td> <td> <ul style="list-style-type: none"> Monitoring and Evaluation Plan to identify suitable data sources and allocate responsible owners⁸ </td> </tr> </table>	Pre-Operation	During Operation	<ul style="list-style-type: none"> Transport Modelling 	<ul style="list-style-type: none"> Monitoring and Evaluation Plan to identify suitable data sources and allocate responsible owners⁸
Pre-Operation	During Operation				
<ul style="list-style-type: none"> Transport Modelling 	<ul style="list-style-type: none"> Monitoring and Evaluation Plan to identify suitable data sources and allocate responsible owners⁸ 				
Realistic	Luas Finglas will be operated within a dedicated corridor largely isolated from traffic congestion providing an advantage over travelling by private car.				
Time-Bound	Transport Modelling has been undertaken for two future years: Opening Year (2035); Design Year (2050)				

8 Further details on the Monitoring and Evaluation Plan including potential measurable indicators is provided in Section 6.5.

Contribute to the Climate Action Plan targets for the decarbonisation of transport

Measurable	Reduction in carbon emissions from transport related to travel in the Finglas corridor; Carbon emissions related to Luas Finglas	
Attributable	Pre-Operation <ul style="list-style-type: none"> ● Transport Modelling During Construction <ul style="list-style-type: none"> ● Emission reductions defined by the Project Sustainability Plan 	During Operation <ul style="list-style-type: none"> ● Energy efficiency for Luas vehicles and facilities ● Procurement ● Mode share by sustainable transport
Realistic	The need to increase public transport use to reduce carbon emissions is set out in the Climate Action Plan 2023 Potential to set CO2 levels targets in contract documents	
Time-Bound	Contract performance timelines for Luas operation Transport Modelling has been undertaken for two future years: Opening Year (2035); Design Year (2050)	

Promote economic growth for the residents and businesses of Charlestown, Finglas and the surrounding areas

Measurable	Uplift in population and employment in area of influence of the scheme available from Census data
Attributable	Review of population and employment statistics within the study area
Realistic	Identified areas of social deprivation within the study area
Time-Bound	National Planning Framework and Regional Spatial and Economic Strategy timeframes

The appraisal as presented in this PBC is structured under criteria which align with the Department of Transport’s Common Appraisal Framework (CAF) headings of Economy, Safety, Environment, Accessibility and Social Inclusion, Integration and Physical Activity. The Appraisal Criteria have been developed to comprehensively cover the CAF criteria and align with the overarching scheme objectives.

A Logic Map, illustrated in [Figure 2.6](#) below, has been developed to explore the link between policy, the overarching objectives, identified appraisal criteria, the anticipated outputs and desired outcomes from the scheme delivery.

The Appraisal Criteria are:

Economy

- Efficiently provide capacity for transport demand within the study area, supporting existing and future development
- Improve journey time reliability and reduce public transport journey times within the study area.

Safety

- Improve safety for transport users by providing additional alternatives to the private car.

Environment

- Reduce the impact of the delivery of transport infrastructure on the natural environment
- Encourage the use of sustainable transport to reduce the levels of harmful transport emissions.

Accessibility & Social Inclusion

- Improve accessibility to socially deprived areas within the study area by providing enhanced opportunities to access education and employment facilities
- Enhance the quality of transport to encourage and support regeneration, investment and employment opportunities in the identified development areas of Jamestown and Charlestown and elsewhere along the transport corridor

Integration

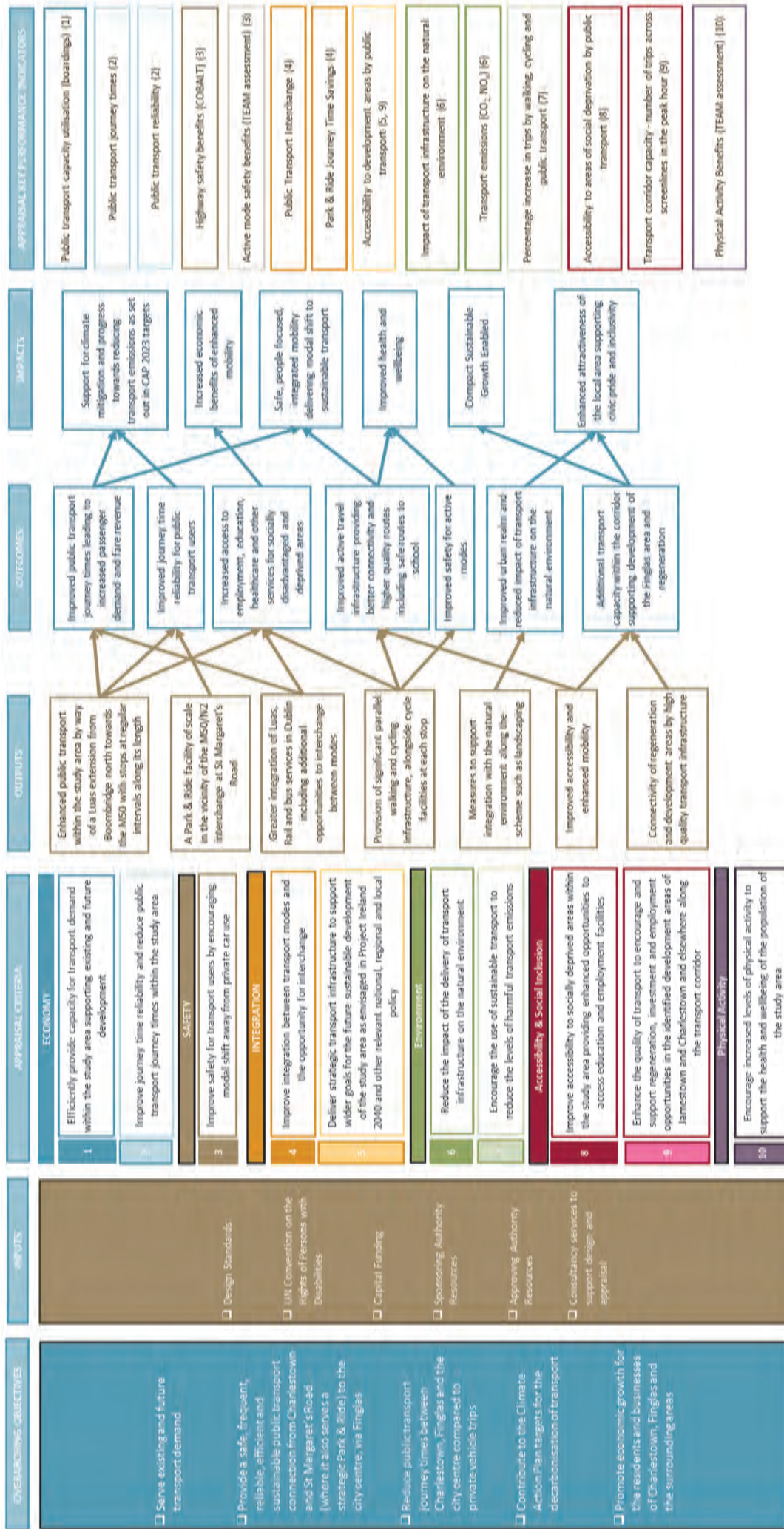
- Improve integration between transport modes and the opportunity for interchange
- Deliver strategic transport infrastructure to support wider goals for the future sustainable development of the study area as envisaged in Project Ireland 2040 and other relevant national, regional and local policy.

Physical Activity

- Encourage increased levels of physical activity to support the health and wellbeing of the population of the study area

A series of Key Performance Indicators (KPIs) are linked to the Appraisal Criteria to assess the options available to deliver upon the objectives and need for the intervention. Further details on the Multi-Criteria Scheme Appraisal is provided in Chapter 4 of this Preliminary Business Case.

Figure 2.6 Luas Finglas Preliminary Business Case Appraisal Logic Map



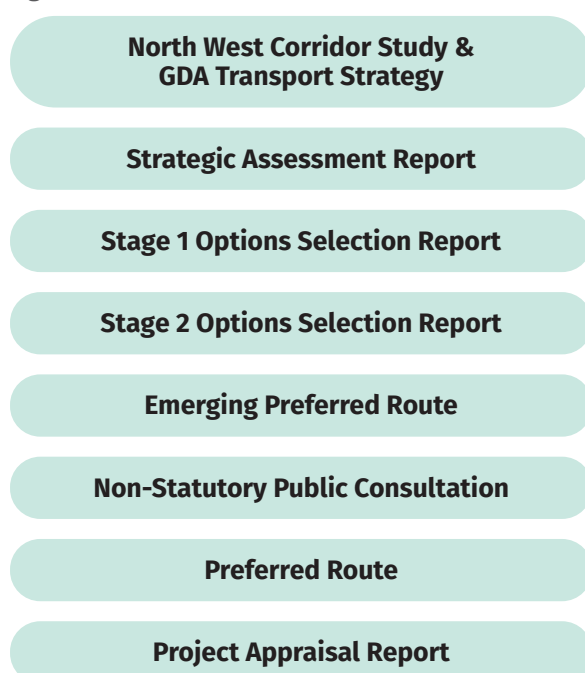
3 | Assessing Alternatives

3.1 Introduction

The consideration and assessment of alternatives is linked back to the policy context and the significant amount of work done to date to analyse the transport needs of the Finglas area. Specifically, alternative transport interventions were thoroughly analysed in the NTA's North West Corridor Study (NWCS)⁹ completed in advance of the publication of the Transport Strategy for the Greater Dublin Area 2016-2035. More recently, alternative light rail options were identified and assessed through a series of detailed options selection stages.

Figure 3.1 outlines the overall assessment process, starting with identification of light rail as an appropriate solution to serve the Finglas corridor through to the identification of the Preferred Route for the scheme. Further details on the assessment process are provided in the following sections of this chapter.

Figure 3.1 Assessment Process



3.2 Alternative Modes Assessment

In advance of the preparation of the Transport Strategy for the Greater Dublin Area 2016-2035, the National Transport Authority defined a number of study areas, including the north-west corridor, to understand the forecasted 2035 transport demand and services requirements. The NWCS Area, shown in Figure 3.2, encompassed the areas of Finglas, Cabra, Glasnevin and Phibsborough south of the M50 and Ashbourne, Tyrrelstown and Ballycoolin north of the M50. The NWCS was published by the NTA as background information alongside the Transport Strategy for the Greater Dublin Area 2016-2035.

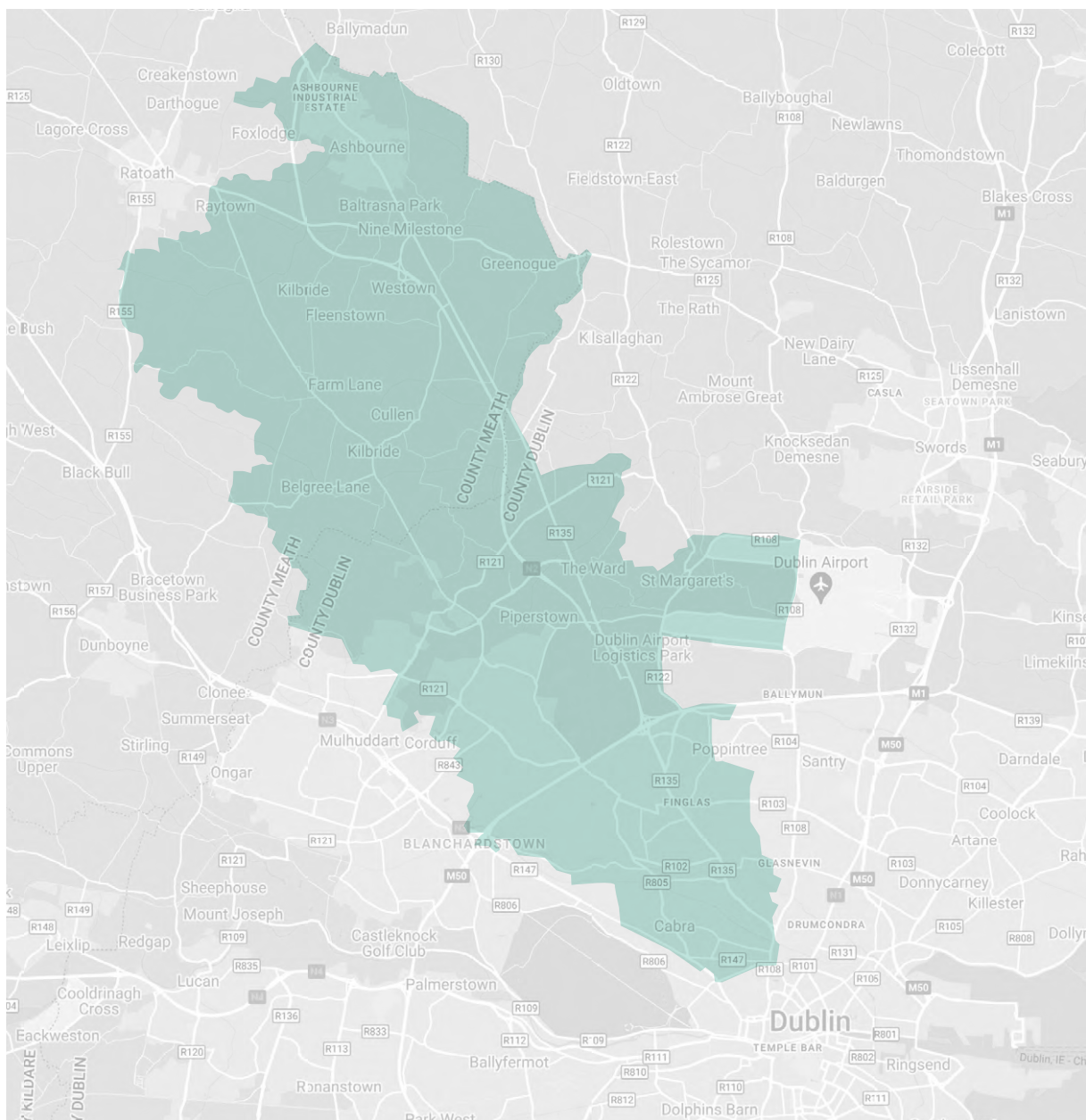
A particular aim of the study was to identify public transport options that could meet the forecasted growth in transport demand to the year 2035 between the North West Study Area and Dublin city centre. Demand for transport within and through the corridor was also analysed in reviewing both demand and potential public transport schemes.

9 https://www.nationaltransport.ie/wp-content/uploads/2015/10/North_West_Corridor_Study1.pdf

The study was undertaken in four stages:

- **Stage 1:** Establish Transport Demand in 2035 - the demand was identified using the Greater Dublin Area Regional Model (GDARM), a forerunner to the NTA's ERM.
- **Stage 2:** Identify Public Transport Options – consideration of alternative public transport modes (e.g. rail, light rail, BRT and bus) based on capacity thresholds
- **Stage 3:** Assessment of Most Appropriate Public Transport Options – sifting of options based on functionality (journey time and availability to meet demand) and cost (capital cost as related to service level)
- **Stage 4:** Testing of Preferred Options – modelling of preferred option within the GDARM to confirm its viability

Figure 3.2 North West Corridor Study Area



(Source: National Transport Authority, 2015)

Five alternative public transport modes were considered within the study:

- Option 1: Light Rail and Feeder Bus Services
- Option 2: BRT and Feeder Bus Services
- Option 3: New Rail Link with Feeder Bus Services
- Option 4: New Metro Line with Feeder Bus Services
- Option 5: Enhanced Quality Bus Corridor with Express Bus Services and Feeder Bus Services

The five options were considered in relation to the level of overall demand. Options 3 and 4 were discounted as the capacity provided was not proportionate to the demand requirements, which would result in an over-supply of transport infrastructure and capacity, and there was no clear geographical alignment for new heavy rail or metro lines. The remaining options were assessed against the criteria of demand, journey time and cost. The light rail option scored highest within the assessment. The public transport recommendations set out in the NWCS included the following:

- An extension of the Luas Green line from Broombridge to a terminus close to the N2/M50 junction
- Park & Ride provision to be catered for at this terminus
- Proportionate deployment of bus services to support access to the corridor.

It was noted in the study that the full impact of Demand Management Measures was not modelled, nor Park & Ride facilities and bus network redesign (later developed under BusConnects Dublin). Therefore, the study provided a conservative view of demand levels for public transport.

Subsequent to the preparation of the NWCS, the Transport Strategy for the Greater Dublin Area 2016-2035 was prepared using the outputs of the assessment alongside studies of other areas. Within the Strategy, Finglas lies within Corridor B – Navan – Dunboyne – Blanchardstown – to Dublin city centre.

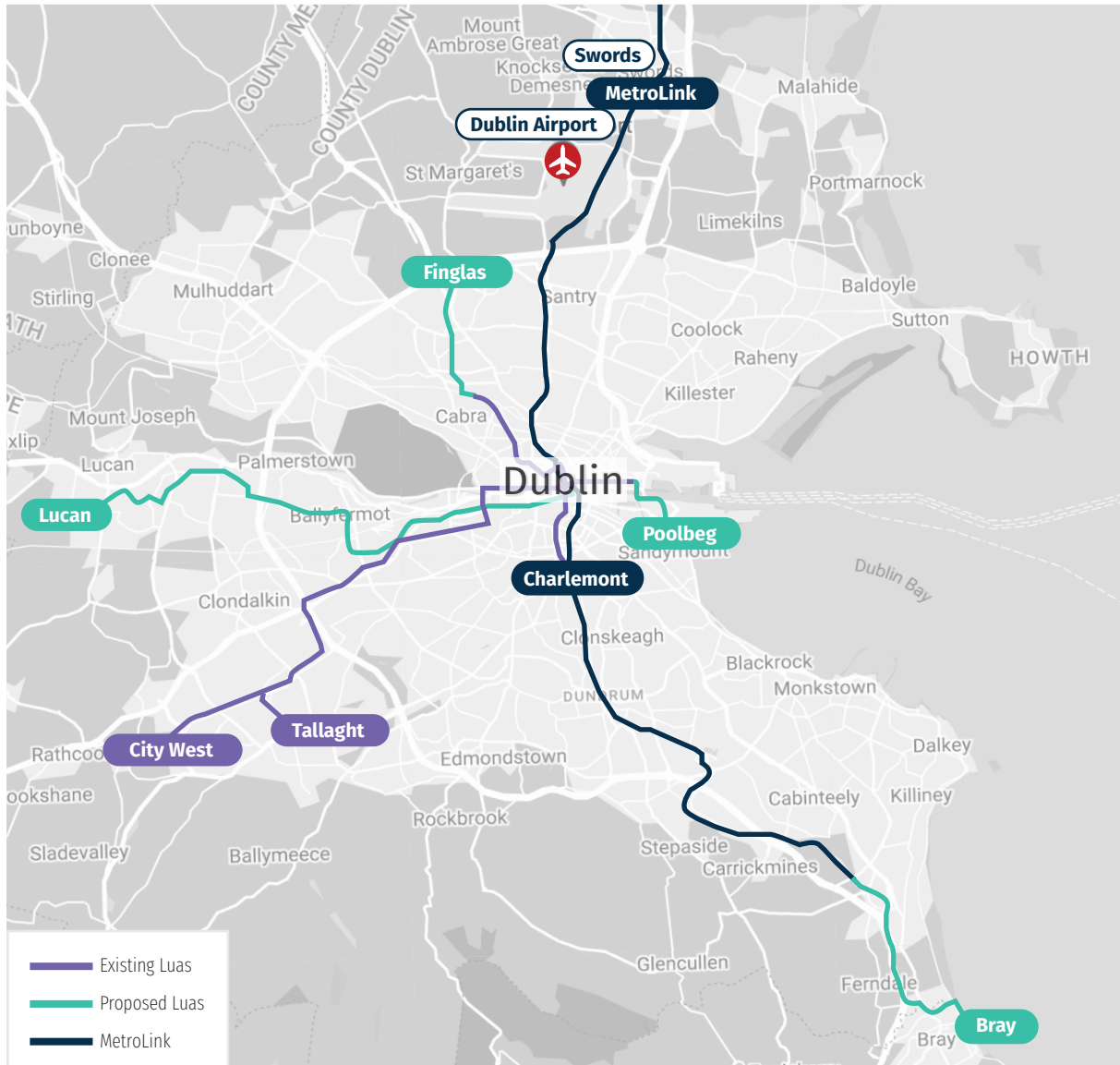
The combined public transport interventions identified for this corridor included:

- Extension of Luas Cross City further northwards to serve the Finglas area and a strategic Park & Ride site at the N2/M50 junction
- Enhanced bus services supported by a core bus corridor through Finglas along the N2

Alongside the specific corridor proposals, the Strategy proposes:

- Implementation of the GDA Cycle Network plan, including the expansion of the urban cycle network to 1,485+ kilometres
- Upgrading pedestrian facilities across the region
- National, regional, and local road improvements
- Transport demand management

Figure 3.3 Existing and proposed Transport links



More recently the NTA reviewed the Strategy and in early 2023 published the Greater Dublin Area Transport Strategy 2022-2042, following ministerial approvals. The Strategy identifies Luas Finglas as a forthcoming scheme, as an extension of the Luas Green Line, and recognising the completion of the public consultation on its Emerging Preferred Route and the expectation that a Railway Order application will be submitted in 2024.

Greater Dublin Area Transport Strategy 2022-2042: Measure LRT2 – Luas Finglas

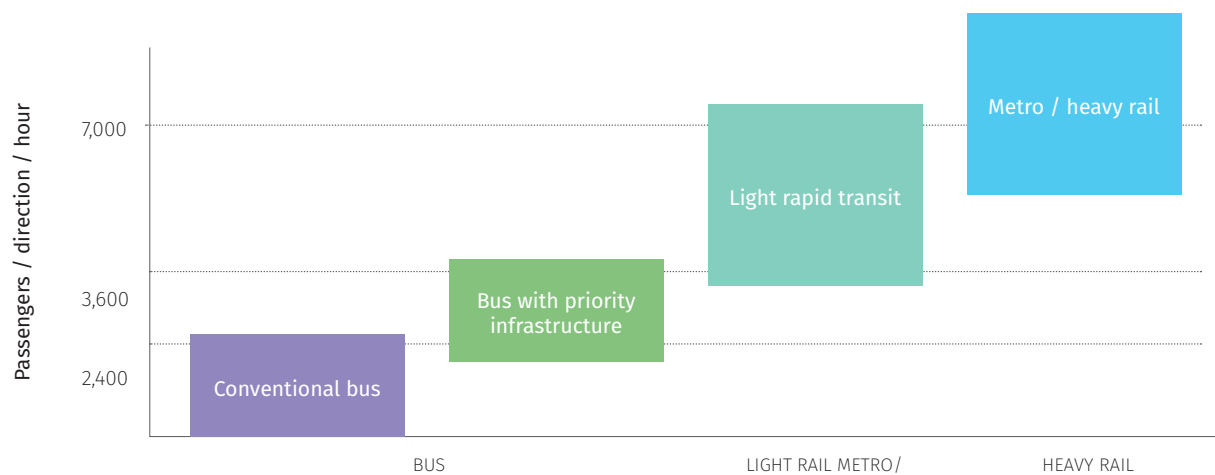
“It is intended to extend the Luas Green Line northwards to Finglas, inclusive of a potential Park & Ride facility at or close to its terminal stop.”

In addition to Luas Finglas, the Transport Strategy comprises:

- Twelve radial Core Bus Corridors including one serving Ballymun and Finglas
- A network of Orbital Core Bus Corridors, including a number serving the Finglas area
- Seven Regional Bus Corridors forming part of the Core Bus Network including one along the N2/M2 via Finglas Road

Transport modelling analysis undertaken as part of the development of the GDA Transport Strategy¹⁰ highlighted that the Finglas corridor could have a demand for public transport exceeding 5,000 passengers per hour per direction (pphpd) in the AM peak hour by 2042. It used the mode bands illustrated in **Figure 3.4**¹¹ to identify the appropriate public transport mode required to serve various levels of demand.

Figure 3.4 Public Transport Capacity Ranges



The analysis indicates that a bus-based solution, even with additional priority infrastructure, will not have the capacity alone to service the future demand for travel from the Finglas Corridor. It concludes that an LRT solution (such as Luas Finglas) is required, working in conjunction with upgrades to the bus service proposed as part of BusConnects.

3.3 Optioneering Process

Following identification of the need for light rail within the Finglas corridor, the assessment process to identify the preferred route began. Criteria specific objectives were set and assessed to ensure the project delivers economic productivity, environmental consideration, improved physical activity, improved personal safety, and accessibility and social inclusion benefits. The overarching objectives used in the assessment were:

¹⁰ Further information available at: <https://www.nationaltransport.ie/wp-content/uploads/2021/11/GDATS-Transport-Strategy-Development-and-Modelling-Report.pdf>

¹¹ UITP Conference 2009 – Public Transport: Making the Right Mobility Choices

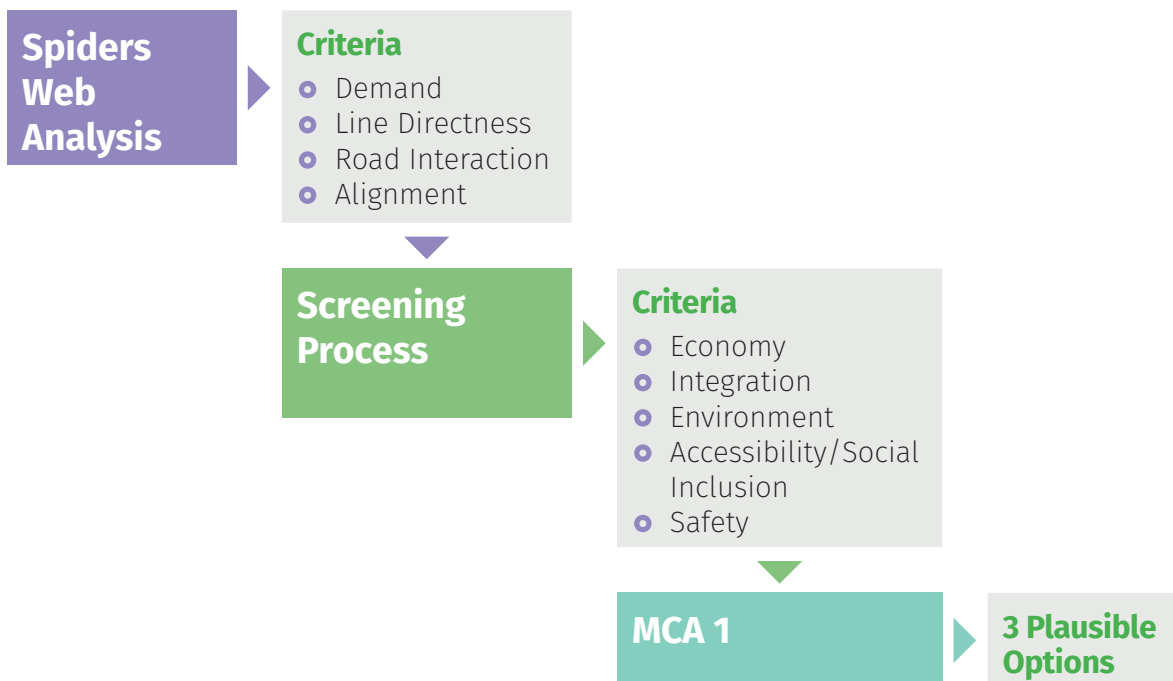
- To ensure the scheme can provide services for existing and future demand.
- To provide a frequent, reliable, efficient, safe, and sustainable public transport connection from the M50 (Park & Ride) to the city centre, through Finglas and Broombridge, along the existing Luas Green Line.
- To reduce public transport journey times between the city centre, Finglas and Charlestown.

Stage 1 Options Selection

A Stage 1 Options Selection Report was prepared to identify a number of plausible route options for the Luas Finglas scheme. This long list of options was assessed in a staged process comprising:

- **Spiders Web Analysis:** Every single possible section within the study area was analysed independently and assessed in relation to its suitability for a Luas corridor. As a result, 29 potential end to end route options were created for more detailed assessment.
- **1st Step Screening:** Elimination of less feasible light rail options based on four criteria: Demand (catchments), Directness of Line, Road Interactions (including number of junctions crossed at-grade), Alignment and Curvature.
- **2nd Step Multi-Criteria Assessment (MCA):** Evaluation of options based on the CAF criteria of Economy, Integration, Environment, Accessibility / Social Inclusion, and Safety.

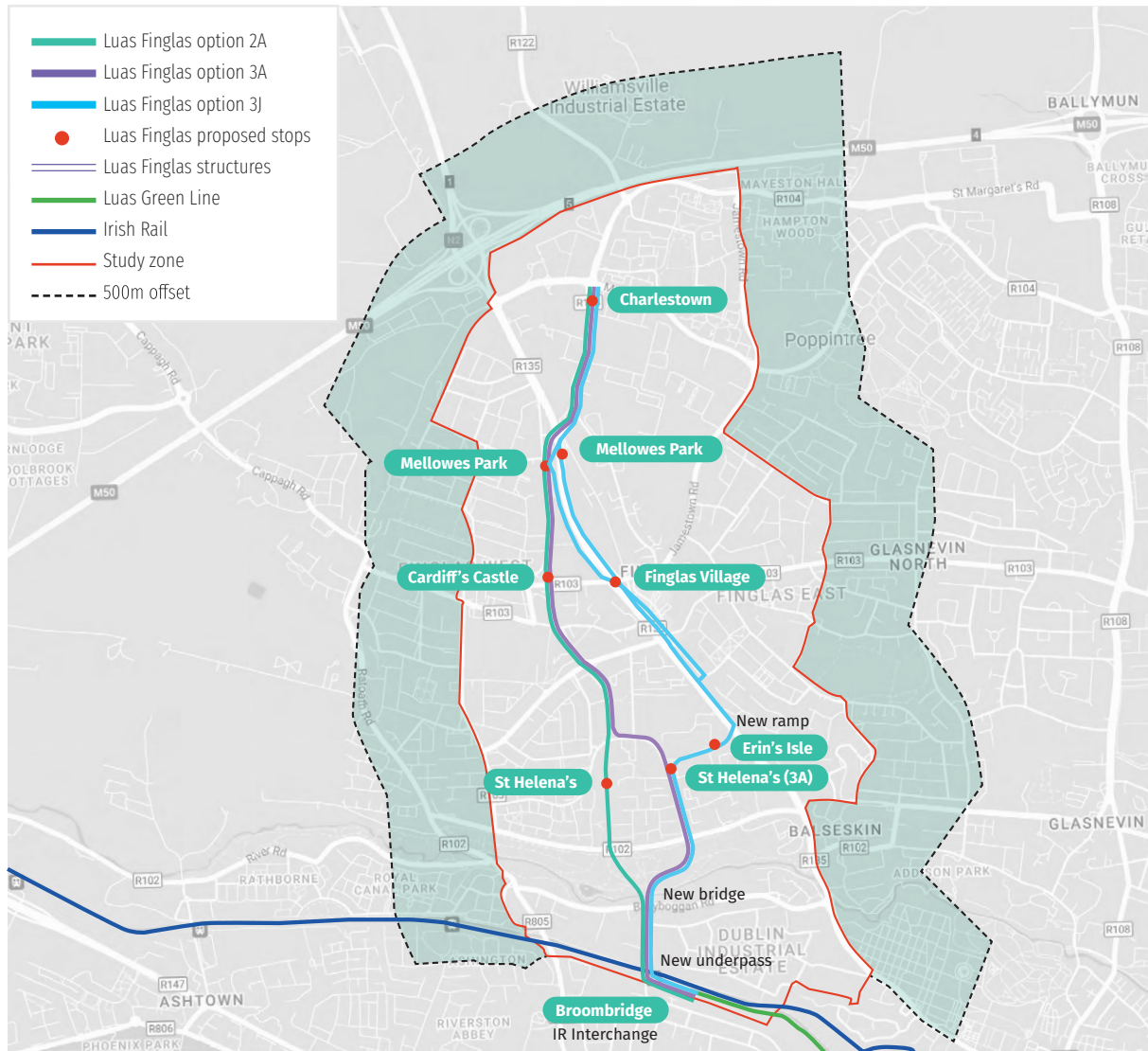
Figure 3.5 Stage 1 Assessment Process



Initially 29 technically feasible potential corridor options were identified. Following the 1st Step Screening, this list was reduced to 14 options considered feasible. These 14 potential options were then subject to the

MCA resulting in the identification of three shortlisted plausible options, illustrated in **Figure 3.6**. Further details of the assessment process and results are provided in the Stage 1 Options Selection Report¹².

12 Available at: https://downloads.luasfinglas.ie/reports/Luas%20Finglas%20OSR_Stage1_Website.pdf

Figure 3.6 Shortlisted Route Options from the Stage 1 Assessment

(Source: Transport Infrastructure Ireland, 2019)

Stage 2 Options Selection

The three plausible options were brought forward for further consideration. The Stage 2 Options Selection was initiated with a review of the outcomes of Stage 1. A top-down and bottom-up approach was taken to review the scoring of the three route options under each performance criteria and associated performance indicator. Overall, the review found that the approach and outcomes were reasonable with the shortlisted route options standing up to scrutiny.

Between Stage 1 and Stage 2, a number of optimisations were identified and developed

by TII. These improvements came in light of new analysis and design details being available. The optimisations, which also resulted in a fourth option being developed, comprised:

- Mellows Park route optimisation for Route 2A and 3A
- Cycle track and facilities inclusion
- Development of Route 3J sub-options divided into Route 3Ja and Route 3Jb respectively splitting the two directions of Luas travel to both sides of the R135 and maintaining both directions of Luas travel on the western side of the R135.

Figure 3.7 Options Assessed at Stage 2

Luas Finglas Option 2A



Luas Finglas Option 3A



Luas Finglas Option 3JA



Luas Finglas Option 3JB



Source: Transport Infrastructure Ireland, 2019

Additional technical work was undertaken at the Stage 2 phase including the production of cost models, transport models, journey time reliability assessments, the modelling of the Park & Ride, and the development of plans for cycle infrastructure. The recently added additional CAF criterion of Physical Activity was also considered. These activities informed the second MCA that captured the costs of the schemes as well as the breadth of the benefits to passengers, the environment, and the general public. The Stage 2 MCA Criteria and comparative

assessment of sub-criteria are shown in the table below.

Table 3.1 Comparative assessment of sub-criteria

Colour	Description
	Significant comparative advantage over other options
	Some comparative advantage over other options
	Comparable to other options
	Some comparative disadvantage over other options
	Significant comparative disadvantage over other options

Table 3.2 Stage 2 MCA Criteria

MCA Criteria	Assessment Sub-Criteria	2A	3A	3Ja	3Jb
Economy	BCR (Benefit and cost assessment)				
	Plausible catchment				
	Runtime				
Integration	Local, national policies & guidance				
	BusConnects compatibility				
	Integration with the road network				
	Public transport				
	Active modes (cyclists & pedestrians)				
Environment	Population & Human health				
	Biodiversity				
	Soil				
	Water				
	Air quality and climate				
	Noise				
	Vibration				
	Landscape				
	Material assets				
	Cultural heritage				
Accessibility & Social Inclusion	Access to key facilities				
	Improved provision of travel opportunities to deprived areas				
Safety	Road safety				
	Cycling safety				
	Personal safety				
Physical Activity	Cycle facilities at stops				
	Space availability for cycle tracks				
	Permeability and local connectivity				

Full details of the assessment and the basis of the scoring is presented in the Stage 2 Options Selection Report¹³. Overall, it was determined that Route 2A was the most strongly positive corridor for Luas Finglas scoring particularly well within the criteria

of Economy and Physical Activity, but also well in Accessibility and Social Inclusion and Safety. The outcome of Stage 2 was the assessment of the overall viability of Luas Finglas and the identification of Route 2A as the Emerging Preferred Route (EPR).

3.4 Process from emerging preferred route to preferred route

In 2020, the EPR was taken to non-statutory public consultation to gather feedback from local residents and stakeholders. As a result, TII undertook a review of the EPR and

brought forward a series of changes to form the Preferred Route. A summary of the key changes is provided in Table 3.3 and Figure 3.8 overleaf.

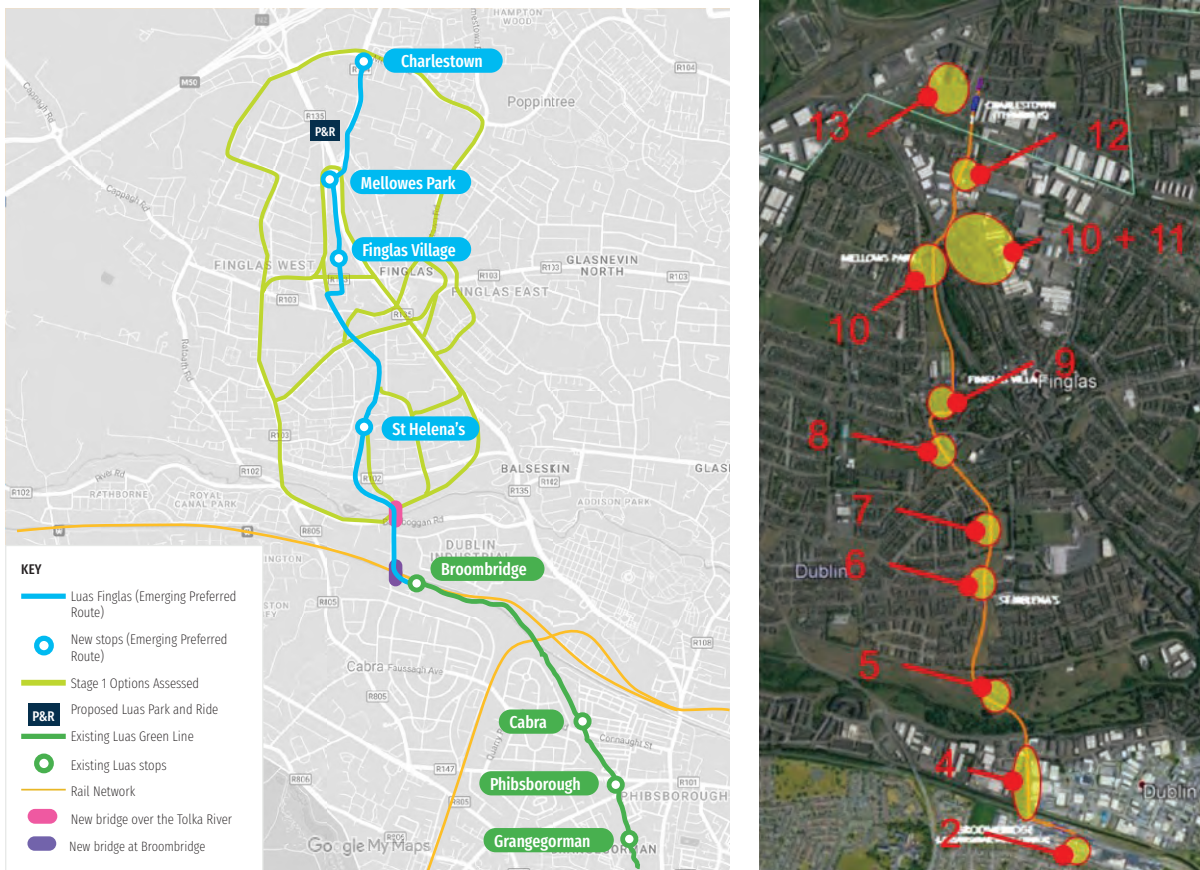
Table 3.3 Summary of the key decisions taken to date of the EPR changes for the PR

Ref	Description	Key changes
2	Depot Stabling Site	Improved site layout to avoid impact on third parties and better fit in DCC owned land.
3	Cycle Integration	Detailed assessment of the needs and provision of cycle facilities along Luas Finglas to tie in with the GDA Cycling Strategy providing improved cycle parking locations.
4	Broombridge Road Realignment	New Broombridge road configuration with footpaths on both sides, segregated cycle track off road to the west and Luas-Road alignment shifted west.
5	Tolka Valley Park minor realignments	Minor realignment of the Luas tracks and cycle track for design optimisation.
6	St Helena's Stop realignment	Minor Luas track realignment. Stop moved to the north, and local pedestrian accesses from the east removed.
7	Farnham Cres Park alignment	Alignment moved east of the park, now running adjacent to Farnham Drive.
8	Casement Road and Patrickswell Place alignment	The Luas corridor will now run over the current road footprint and the road will be shifted west and protected cycle tracks provided on both sides of the road.
9	Mellowes alignment	New track alignment is proposed to pass through the Garda Station carpark, with some property take in Raven's Court estate and the new stop is now located north of Mellowes Road.
10	Mellowes Park Stop and N2 Junction	"Mellowes Park" stop moved to the east of the North Road junction, now named "St Margaret's Road" stop, to better integrate with DCC plans for the re-zoned landbank of Jamestown and provide a close interchange for the relocated Park & Ride. Minor alignment changes to facilitate the stop and McKee road junction.
11	McKee Avenue	Minor track and road alignment changes. Ongoing liaison with DCC.

13 Available at: https://downloads.luasfinglas.ie/reports/Luas%20Finglas%20OSR_Stage%202_Website.pdf

Ref	Description	Key changes
12	Saint Margaret's Court	Purchasing land from the adjacent Industrial Estate entrance road to widen the road (three lanes plus bicycle lanes) and provide replacement car park for the four front houses impacted by the Luas corridor.
13	Park & Ride Alternatives	<p>New 350 space Park & Ride likely to be located at Lidl (North Road- St Margaret's Junction), in a new multi-storey structure. Accesses to be provided from North Road and McKee junction</p> <p>The scale of the Luas Finglas Park & Ride has been defined within the NTA Greater Dublin Area Transport Strategy, however the demand analysis and impact on service as a result of providing a 350 space P&R has been considered in the appraisal of the Luas Finglas scheme.</p> <p>The Luas Finglas Park & Ride (P&R) forms part of the wider P&R Strategy for the Greater Dublin Area conducted by the NTA in line with the GDA Transport Strategy objectives. The P&R Strategy set out objectives for Park & Ride which seeks to intercept private vehicle traffic at the earliest point on the network that would support the provision of higher frequency public transport. In developing the strategy in the GDA and applying these principles a key focus was ensuring that the demand generated along a corridor was served by Park & Ride Facilities on that corridor and in that regard provision of facilities within the M50 corridor should be limited. This approach is detailed in the GDA Park & Ride Strategy that was published as a background paper to the GDA Transport Strategy 2022-2042.</p> <p>A travel demand analysis was undertaken along the M2 corridor between the M50 and Ashbourne. Select links from the East Regional Model (ERM) were taken at various locations along the corridor for both the current and future year (2043), to determine the destinations of cars passing each location based on the model. The recorded data included the number of car trips passing each of the selected links, heading southbound during the AM peak and northbound during the PM peak. Two separate destination zones within Dublin City were chosen i.e. the Canal Cordon and Docklands Zone, and the Suburban Zone, defined as a 2 to 3km wide corridor between the M50 and the Canal Cordon Zone. Different capture rates for both base and future years were applied, and the results determined the optimal location and daily usage of the P&R facilities along the M2 corridor.</p> <p>For the M2 corridor a 350 bus based Park & Ride in the environs of Ashbourne complemented by a 350-space Luas P&R at Finglas was defined as the appropriate provision to meet demand in line with the objectives for Park & Ride. It should be noted that the northern bus-based P&R facility is currently at option selection stage and a planning application is expected to be lodged by the end of 2024.</p>

Figure 3.8 Luas Finglas EPR (left) and location of the changes to form the Preferred Route



Multi-Criteria Assessment

Following determination of the PR, a retrospective comparative assessment was undertaken. The PR was assessed through the MCA process with the route (and revised changes) measured against the Stage 2 CAF criteria and sub-criteria. The results of the MCA are outlined in [Table 3.2](#) with further details provided in the Project Appraisal Report. In summary, the PR delivers most comprehensively across the six assessed CAF

criteria and scheme objectives. It provides the most direct route (the shortest length and journey time) between Charlestown at its northern end and Broombridge at its southern. Also, for the PR the criteria of Environment and Integration scored slightly higher than the EPR due to the changes made to the realignment of the route and the integration with public transport and active travel. Further details on the Preferred Route are provided in Chapter 4.

Table 3.4 Summary of updated MCA Assessment with the PR

MCA2 Criteria and parameters	2A (EPR)	3A	3Ja	3Jb	PR
Economy	Green	Green	Red	Yellow	Green
Integration	Orange	Orange	Yellow	Orange	Yellow
Environment	Yellow	Green	Red	Yellow	Green
Accessibility & Social Inclusion	Yellow	Green	Red	Red	Green
Safety	Green	Green	Red	Orange	Green
Physical Activity	Green	Green	Orange	Orange	Green

4 | Exploring Luas Finglas

4.1 Description of Luas Finglas

Based on extensive work to date, as detailed in previous chapters, the Preferred Route¹⁴ for the extension of the Luas Green Line is as shown in Figure 4.1. Luas Finglas creates a new public transport connection between the communities of Charlestown, Finglas Village, Finglas west, St Helena's, Tolka Valley and the city centre, and delivers the following:

- A 3.9 km extension to the Luas Green Line, from Broombridge north through Finglas terminating south of the M50
- Four stops located at St Helena's, Finglas Village, St Margaret's Road, and Charlestown
- A tram in each direction every 7.5 minutes during peak times with an approximate journey time of 30 minutes from Charlestown to Trinity College. It is envisaged that this will increase to a tram every 5 minutes by 2050
- A new Park & Ride facility adjacent to the St Margaret's Road stop, close to the M50, with capacity for 350 vehicles
- New walking and cycling routes along most of its length, almost entirely segregated from traffic
- Interchange opportunities with bus networks at all the new stops and with mainline rail services at Broombridge

Broombridge to St Helena's

Luas Finglas is a northerly extension of the Luas Green Line, connecting to the existing line at Broombridge. Starting from Broombridge it travels north crossing the Maynooth rail line and Royal Canal over a new bridge. It then runs parallel to Broombridge Road, which will have extensive landscape changes including increases in tree planting along with widening of footpaths and segregated cycle facilities. This will help transform Broombridge Road into a more attractive environment to encourage walking and cycling connecting to the existing Royal Canal Greenway and Luas station.

From here, the alignment crosses Ballyboggan Road via a new signalised junction, before passing through Tolka Valley Park with a new bridge over the Tolka River. The design will use grass track to integrate with the surrounding parklands and a parallel combined footpath and cycle track will be provided through the park. Luas Finglas then crosses Tolka Valley Road and continues onto the stop at St Helena's.

¹⁴ Further details on how this preferred route was chosen can be found in the October 2021 document noting the EPR to Preferred Route changes

The area south of the St Helena's stop is currently unmaintained grasslands, however, a strong pedestrian desire line is evident from the worn path through the area. Luas

Finglas will deliver new accessible footpaths and a separate parallel cycleway opening up this greenspace for local residents and providing a connection to Tolka Valley Park.

Figure 4.1 Luas Finglas Route Map



Figure 4.2 Broombridge Road (left) and artistic impression of new bridge over Tolka River (right)



St Helena's to Finglas Village

The first stop on the extended Luas alignment is located just south of St Helena's Road adjacent to the St Helena's Family Resource Centre and the St Helena's Childcare Centre. It has been designed to provide an improved public realm and facilitate interchange with bus services.

From here, Luas Finglas crosses St Helena's Road via a new signal-controlled junction into the area of Farnham pitches and runs parallel to Farnham Drive. Farnham Drive roadway will be reduced in width and traffic-calmed for pedestrian safety and to facilitate a proposed future cycleway to be provided as part of the NTA Cycle Network Plan.

North of Farnham pitches, the alignment continues through the parklands alongside Casement Road before arriving at a controlled crossing of Wellmount Road. The line continues northwards through Patrickswell Place where the existing road is realigned west to accommodate the tramline within the existing corridor. It crosses Cappagh Road via a new signalised crossing before travelling through the Finglas Garda Station car park to Mellowes Road and the Finglas Village stop.

Figure 4.3 St Helena's Stop



Finglas Village to St Margaret's Road

The stop at Finglas Village is on the northern side of Mellowes Road and is incorporated into a new civic plaza which will enhance access to the nearby community facilities. It will be a key public transport interchange in the area, with the N4 orbital BusConnects route serving the stop, as well as the F2 and F3 BusConnects routes. Within a short 5-minute walk of the stop is the N6 orbital and the L89 local BusConnects routes.

Exiting the Finglas Village stop, the line continues north passing through Mellowes Park in grass track and then reaches the Finglas Bypass / North Road / St Margaret's Road junction. This will be converted from a roundabout to a signalised junction as part of the Luas Finglas project. It is proposed that the existing pedestrian overbridge is removed, with the signalised junction providing improved pedestrian access across Finglas Road (R135), and to/from the Luas stop, while also facilitating cyclists. Once it crosses Finglas Road, Luas Finglas continues on to the St Margaret's Road stop opposite the Lidl supermarket.

Figure 4.4 Proposed stop at Finglas Village



St Margaret's Road to Charlestown

The stop at St Margaret's Road will be incorporated into a new public plaza with pedestrian connections to the 350-space multi-storey Park & Ride facility, built as part of the scheme. It will allow passengers to interchange with the F1 and F2 BusConnects routes. Within a short 1-minute walk passengers can also interchange with the N6 orbital, F3, and L89 local BusConnects services.

From this point, the line crosses the newly configured McKee Avenue junction and runs along the eastern side of St Margaret's Road. Increased landscape areas, footpath

upgrades and segregated cycle facilities will be provided along St Margaret's Road. The line continues northwards until it reaches the terminus station of Charlestown located just south of Melville Road. The works here include a major reconfiguration to the Charlestown Place / Melville Road junction to provide better pedestrian and cycling infrastructure. This will provide a safer connection from Luas to the Charlestown Shopping Centre and residential areas. The stop at Charlestown is also a key interchange point located in close proximity to stops for the E2, F1, F2, F3, 23, N6 and L89 BusConnects routes.

Figure 4.5 St. Margaret's Road (Left) and Charlestown Stop (Right)



Whole route

Cycle parking is provided at each of the four Luas Finglas stops. There is provision for active travel along the Luas Finglas alignment, predominantly on routes separated from trafficked roads, and where applicable, cyclists and pedestrians are segregated from each other.

The active travel elements proposed as part of Luas Finglas have been developed taking account of the NTA Greater Dublin Area Cycle Network Plan. The GDA Cycle Network Plan includes for the future expansion of the cycle network. For the Finglas area, this

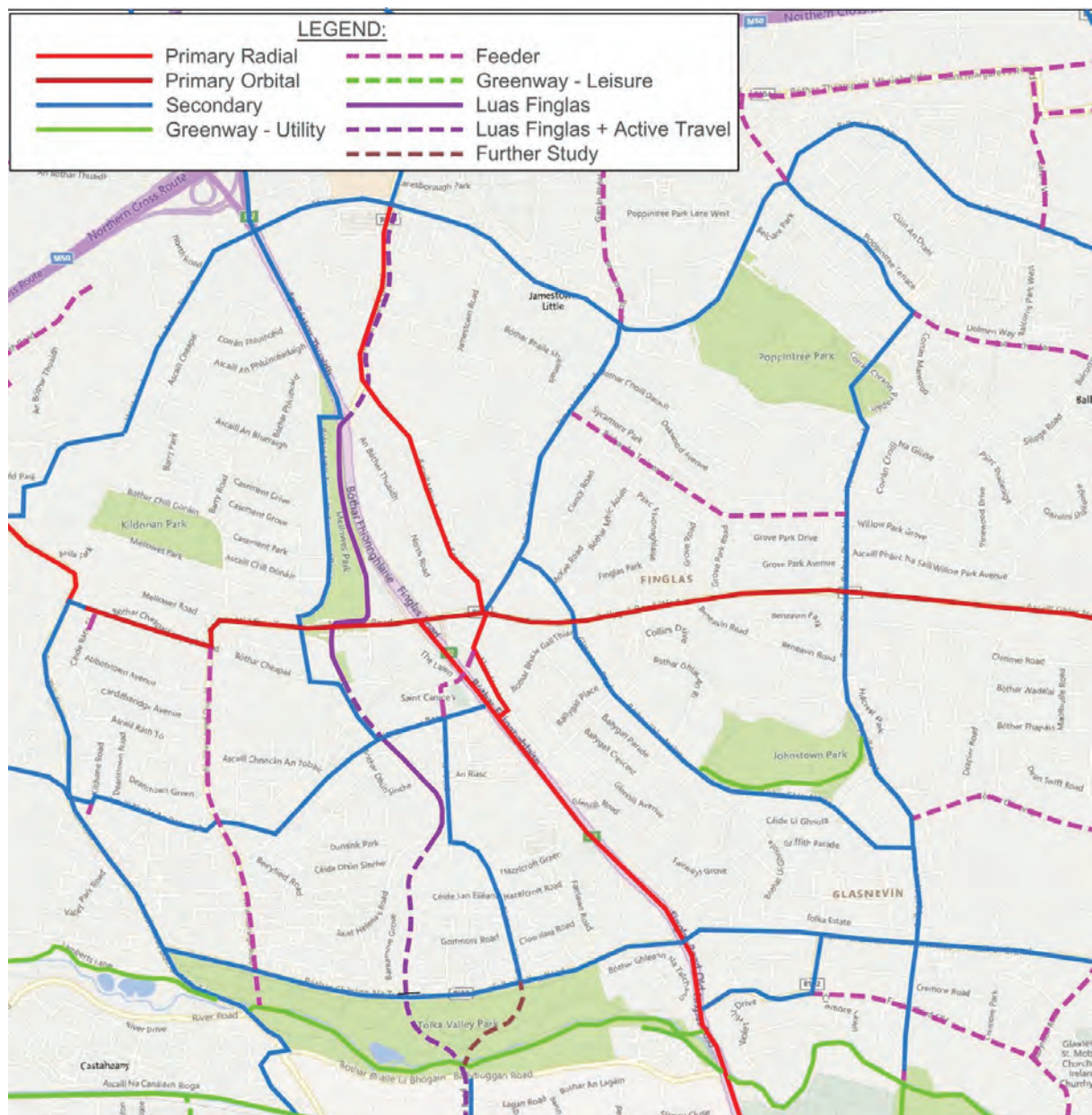
includes primary routes along St.Margaret's Road, McKee Avenue and the Finglas Road from the overpass of Mellows Road towards the city, an Orbital route along Mellows Road, and a series of secondary routes in the area, some of which will run along the proposed Luas corridor. Together with delivering the GDA proposed cycle routes when they fall within the proposed Luas corridor, Luas Finglas will also provide an additional segregated north-south route that links with these proposals through the Tolka Valley Park and St.Helena's green. In total, as part of Luas Finglas, active mobility schemes include approximately 1.2km of

segregated (off-road) two-way cycle track and approximately 1.8km of segregated and protected one-way cycle track on street. **Figure 4.6** shows the Luas Finglas Active Travel proposals in relation to the GDA Cycle Network Plan.

This active travel corridor not only provides a new route but also connects existing ones, for example linking the Tolka Valley Greenway and the Royal Canal Greenway.

The route follows some existing footways and cycleways and, in these instances, such as in Tolka Valley Park and Mellows Park, these routes are upgraded. Also, where the corridor meets a road, signalised junctions are installed with provision for active modes and vehicular traffic as required. In locations that currently only have islands or no provision at all for non-motorised users, for example on Ballyboggan Road and Wellmount Road, these improvements make it easier for cyclists and pedestrians to cross the road safely.

Figure 4.6 Luas Finglas Active Travel Proposals and NTA Cycle Network Plan



4.2 Detailed Costs

Introduction

The cost estimate for Luas Finglas has been prepared in accordance with the requirements set out in the “Cost Management Guidelines for Projects Funded by the National Transport Authority” and is based on the Luas Finglas preliminary design (further details of the basis of the cost estimates is provided in the Luas Finglas Consolidated Preliminary Cost Estimate Report).

The direct works cost of constructing Luas Finglas has been forecast by the project team using traditional bottom up costing principles (where possible), identifying work packages and considering the inputs to deliver the work package in terms of labour time, materials, equipment costs as well as unit prices of other various work activities. The accuracy of any direct works cost forecast is a function of the level of design and specification development that has been undertaken to which Luas Finglas is well advanced. Rolling Stock costs are factored into the estimate based on the resultant tram numbers emanating from operations assessments. Added to the direct construction works forecast, TII has included for its costs (authority costs). The authority costs have been established based on the resources required and assumptions of the project management model adequate to oversee the delivery of the project and control the associated risks. The property acquisition cost forecast has been established based on the property requirements envisaged for the construction and operation of Luas Finglas.

Due to the intricate nature of work involved in the Luas Finglas scheme, the project team have taken a comprehensive approach to dealing with risk / contingency. This stems from lessons learned from other public infrastructure projects including the ‘PWC Independent Review of Escalation in National Children Hospital Costs’, one of the key findings from which was that:

‘the capital budget did not contain sufficient risk contingency to allow for costs that would arise through the design development process’.

Base Cost

Taken together, direct works, rolling stock, land/property and authority costs add up to the base cost outlined in [Table 4.1](#).

Table 4.1 Luas Finglas Base Costs (prior to risk, inflation & VAT)

	Q1 / Q2 2022 (€ Million)	Prepared by
Direct Works (Construction)	€148	Barry Egis
Rolling Stock¹⁵	€23	Barry Egis
Land & Property	€27	Lisney
Authority / Client Costs	€36	TII
Base Cost Forecast	€234	

Independent Peer Review

Independent Peer Reviewers were involved at every step during the production of the individual components of the base cost, whereby they performed initial reviews of the draft estimates. This verified the robustness of the cost forecast and identified areas for further examination and refinement.

¹⁵ Purchase of four new trams to service the extension based on the Luas Finglas operations assessment

Risk Assessment

Having considered the base cost, the project team has also undertaken a vigorous assessment process to establish the risk allowance for the project. International experience demonstrates that almost no rail project can be delivered at the base cost figure. In practice all large projects have a myriad of risk factors that impact on their delivery. For this reason, a risk allowance must be added to the base cost of a project to deal with the cost implications of such risks materialising.

Risks can be assessed individually using a Quantified Risk Assessment methodology and/or established by examining the historic cost performance of completed projects of a similar type. This is known as “Reference Class Forecasting”, which uses a database of schemes of a similar “class” to ascertain risk allowances to apply to projects. Luas Finglas has undertaken both a comprehensive Quantified Risk Assessment and Reference Class Forecasting to validate the project delivery budget range.

The level of risk allowance to add to a base cost is dependent upon the degree of certainty required in relation to delivering a project within a specific budget – the risk appetite.

Risk Appetite

Risk appetite will be a function of the project owner’s experience in undertaking similar projects. A history of successful project undertakings can lead to potential optimism bias in the presentation of costs and risks, particularly as part of economic and financial appraisals, in an effort to achieve project approvals. The Public Spending Code, 2019 seeks to guard against the risk of optimism bias, while also in turn

Reference Class Forecasting:

Working with Bent Flyvbjerg of Oxford Global Projects, the cost estimate (base cost, plus risk and contingency allowance) was benchmarked against Reference Class forecasting cost curves. The cost curves utilised for Luas Finglas benchmarking were derived from the cost performance history of numerous complete light rail extension projects. Reference Class Forecasting considers the original base costs quoted for these historic projects against their final cost performance, to generate an assessment of uplift percentages that ought to be added to base cost estimates to generate a particular level of confidence that project budgets will be achieved.

guarding against the inclusion of excessive risk and contingency allowances.

The degree of uncertainty related to large projects makes the use of a cost forecast range more appropriate. The risk adjusted cost that provides a 50% probability that the overall outturn cost will be at, or less than, that figure (and a 50% probability that the overall outturn cost will be greater) is known as a “P50” figure. Similarly, a P80 cost forecast represents the estimate level at which there is an 80% probability that the overall outturn cost will be at or less than the stated figure. And a P30 cost forecast gives a 30% probability of the overall outturn cost being at or lower than the estimated amount. For Luas Finglas, the estimated P50 risk allowance for example, using Reference Class Forecasting (Outline Business Case Curve), is €100 million. A

range of cost forecasts associated with probabilities from P30 to P80 is deemed to provide an appropriate range for cost forecasting and budgeting purposes.

Table 4.2 Risk Allowance Range

OBC RCF – P30 Risk Allowance (Q1/Q2 2022)	OBC RCF – P50 Risk Allowance (Q1/Q2 2022)	OBC RCF – P80 Risk Allowance (Q1/Q2 2022)
€ 36 million	€ 100 million	€ 167 million

Luas Finglas Quantified Risk Assessment and Reference Class Forecasting results have been presented to an Expert Judgement Group (composed of experts in major

infrastructure delivery), who confirmed that a P80 Reference Class Forecasting (Outline Business Case Curve) risk allowance represented a best practice number for utilisation in the economic appraisal of the project. While a P50 Reference Class Forecasting (Outline Business Case Curve) was endorsed for the financial appraisal. TII has considered that this P50 risk allowance is likely to represent the most appropriate management target budget, subject to Approving Authority considerations.

The Luas Finglas base cost plus the risk allowance, represents the cost of the project in Q1/Q2 2022 values, meaning the cost of the project in the absence of inflation, and are set out below:

Table 4.3 Forecast Total Luas Finglas Cost Range P30 to P80 (€ Q1/Q2 2022)

	OBC RCF P30	OBC RCF P50	OBC RCF P80
Base Cost (Constant Prices)	€234 million	€234 million	€234 million
Risk Allowance	€36 million	€100 million	€167 million
Total Cost (Excl. Inflation & VAT)	€270 million	€334 million	€401 million

Inflation

A large project such as Luas Finglas takes a considerable number of years to construct and the costs of inflation over the full delivery period needs to be estimated and included in the scheme costs for financial planning purposes. A detailed inflation calculator has been developed to support the Luas Finglas inflation calculation. The inflation calculator build up is based on 4 subindices (drawn from Ireland and the UK predominantly): civil engineering, stations, rolling stock, indirect, land & property. Each index is forecast out to 2034 using statistical regression / econometric calculation approach based on historical trend lines.

Finally, a Market Condition Factor is applied to allow for the differences that exist between cost price and tender price inflation. Inflation has been forecast across the 4 individual indices prepared against specific cost elements for Luas Finglas using low, medium and high inflation scenarios which have been modelled to inform the Management Stretch Target, Management Base Target and Prudent Client Appraisal Value.

Table 4.4 sets out the unweighted inflation averages from 2022 through to 2034 across the 4 subindices. The inflation prepared

against the specific cost elements is set as the medium forecast and sensitivity analysis for low and high scenarios has been modelled as a 1 percentage point reduction and 1 percentage point increase respectively.

Table 4.4 Unweighted Average Inflation Rates

	Low Forecast (Unweighted Average)	Medium Forecast (Unweighted Average)	High Forecast (Unweighted Average)
Construction (Civil Engineering)	3.3%	4.3%	5.3%
Rolling Stock	4.0%	5.0%	6.0%
Land & Property	2.8%	3.8%	4.8%
Preparation & Administration Costs	2.0%	3.0%	4.0%

Table 4.5 sets out the inflation provision identified for application against the different probability levels. An allowance range of between €94 million and €255 million has been captured in the cost forecast and management budget targets.

Table 4.5 Inflation Ranges

	OBC RCF P30	OBC RCF P50	OBC RCF P80
Low	€94 million	€116 million	€139 million
Medium	€131 million	€162 million	€194 million
High	€172 million	€213 million	€255 million

Delivery Cost Summary

For Luas Finglas, Table 4.6 outlines the total preliminary cost forecast ranges from a low of €364 million, offering a 30% confidence in budget adherence with a low inflation forecast, to a high of €656 million offering an 80% confidence level and high inflation forecast, both figures excluding VAT.

Opportunity exists to deliver the project earlier than currently planned. Analysis indicates that an approximate €30 million saving on the Management Base Target of €574 million could be achieved with construction commencement in 2027.

Management Target (Stretch and Base)

To drive efficiency and promote value for money objectives for the taxpayer, TII expects to establish an internal project budget expectation that reflects the P50 risk assessment, together with the medium inflation assessment. While this is the established management base target, management will in so far as possible, seek out opportunities to achieve the target of P30 with low inflation.

Prudent Client Appraisal Value

While P30 Low and P50 Medium reflect TII's goals for delivering Luas Finglas, as a prudent client, TII has utilised the P80 High allowance in its estimation of the overall delivery costs for the purposes of evaluating the economic benefits of the project. This helps ensure that a conservative financial and economic appraisal is undertaken within this preliminary business case and that the assessment takes appropriate account of the potential for risk events to arise during forthcoming project phases.

Table 4.6 Delivery Cost Summary

Forecast Range	Risk P-Value	Without Inflation (Q1/ Q2 2022)	With Inflation	With VAT
Management Stretch Target	OBC RCF P30 Low	€270 million	€364 million	€421 million
Management Base Target	OBC RCF P50 Medium	€334 million	€496 million	€574 million
Prudent Client Appraisal Value	OBC RCF P80 High	€401 million	€656 million	€759 million

Utilising Reference Class forecasting via the Outline Business Case curves, TII has established a Management Base Target budget of €334 million (€ Q1/Q2 2022, before inflation & VAT) for inclusion in the financial appraisal and a Management Stretch Target to minimise the use of risk contingency of €270 million (€ Q1/Q2 2022, before inflation).

Despite these targets, to avoid potential optimism bias or other related risks, the Preliminary Business Case utilises a Prudent Client Appraisal Value of €401 million (€ Q1 / Q2 2022, before inflation & VAT), to undertake the economic appraisal of Luas Finglas and to compare it against its benefits. This has ensured that the results of the economic appraisal may be considered to be appropriately conservative for this stage of evaluation.

Operating & Renewal Costs

The operating and maintenance costs of Luas Finglas have been broken down into the following three items:

- The **annual base amount** which includes all general operation and maintenance costs and is based on a price per scheduled service kilometres taken from the existing Luas Operation and Maintenance (O&M) contract.

- **Light Rail Vehicle (LRV) overhaul costs** based on the vehicle km travelled for the new trams operating on the Luas Finglas line. The cost of tram overhauls has been derived from the existing Luas O&M contract, and it is estimated that these should occur every four years within the assumed 30 year lifespan of the asset.
- **Park & Ride operation costs** which have been derived from reviewing the costs associated with existing Luas Park & Ride sites of similar capacity including Stillorgan, Balally and Cheeverstown.

The operating and maintenance costs vary throughout the life of the scheme, as illustrated in [Figure 4.7](#), and the average annual costs for each element above is outlined in [Table 4.7](#).

Table 4.7 Average Annual O&M Costs (€2022)

O&M Item	Average Annual Cost (€ Million)
Annual Base Amount	€6.11
LRV Overhaul Costs	€0.30
Park & Ride Operation Costs	€0.15

Renewal Costs

Some asset components will need to be renewed to sustain the safe and functioning public transport service at its optimal

level and prolong the useful life of the asset. These renewal costs refer to items being refurbished, overhauled or replaced. Overhauls will be required to renew and extend the life of the Light Rail fleet with major overhauls on each tram required on or about their 15th year of operation. Following this, a tram will likely be replaced after its 30th year of operation.

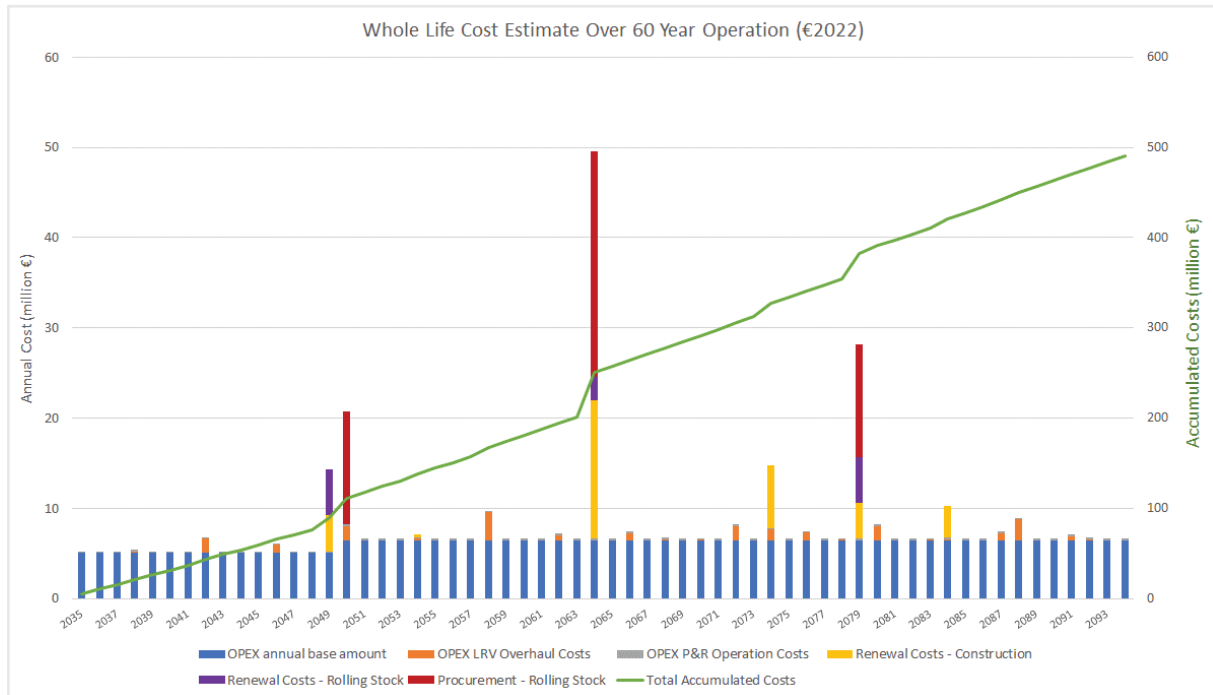
The wider Luas Finglas infrastructure system including items such as power systems, overhead contact wires and rails, signals, lighting, communications, safety systems, track, buildings, stations etc. will also be due for major overhaul, renewal or replacement over various intervals over the 60-year planning horizon. Further details on the estimation of the operating, maintenance and renewal costs for the Luas Finglas scheme are provided in the *Luas Finglas Whole Life Cost Estimation Report*.

Figure 4.7 illustrates the distribution of operating, maintenance and renewal costs for Luas Finglas per year. The Whole Life Cost Estimate has been made over a 60-year period of appraisal from the planned year of commissioning of the extension (2035). This is to coincide with the economic appraisal of the scheme which includes benefits for years 30-60 of operation as a reflection of the Residual Value of the asset.

The costs are presented in constant euros (€2022) with the following breakdown:

- Operation and maintenance costs (OPEX)
 - Annual costs based on the O&M price per kilometre
 - LRV Overhauls cost every 4 years
 - Park & Ride Annual operation
- Renewal
 - Construction renewals (e.g. track, signalling, overhead systems etc.)
 - Rolling stock cost (midlife refurbishment to extend the life of the Light Rail Fleet)
- Procurement
 - Procurement of two new LRVs in 2050 to facilitate an increase in headway from 7.5 minutes to 5 minutes in the peaks
 - This also includes the replacement of LRVs as they reach their end of life (30 years). The cost for purchasing the original LRVs for operating the extension is included in the base cost described previously

Figure 4.7 Evolution of the Luas Finglas whole life costs estimate over 60 years



4.3 Scheme Impacts and Demand Analysis

The Logic Map (illustrated in Figure 2.6) outlines the process used to define objectives for the scheme. As outlined in Section 2.3, ten key Appraisal Criteria have been developed across the CAF headings of economy, safety, integration, environment, accessibility and social inclusion, and physical activity. A series of Key Performance Indicators (KPIs) have been identified which are used to measure the success of the Luas Finglas scheme in meeting the overarching study objectives. This provides a framework to evaluate the scheme against a number of criteria, including impacts which cannot be monetised easily.

The following sections provide an overview of the key impacts of Luas Finglas, and its performance in achieving the study objectives across the six CAF headings. Where possible, extensive analysis and transport modelling have been undertaken to quantify the likely impacts of the scheme. Qualitative analysis is presented where

quantified benefits are not obtainable or suitable.

Economic Impacts

The Economic Appraisal Criteria are:

- Efficiently provide capacity for transport demand within the study area, supporting existing and future development
- Improve journey time reliability and reduce public transport journey times within the study area

Luas Finglas delivers on these by increasing public transport capacity and shortening journey times from Finglas to Dublin city centre and other destinations through direct services or interchange. Luas will benefit those living or working close to a stop, in addition to those travelling from further afield and accessing the line via bus or by car when they make use of the Park & Ride at St Margaret’s Road. This enhanced mobility for people in Finglas, the rest of Dublin, and beyond, generates economic

benefits by reducing barriers to travel and widening the catchment areas for access to jobs and services.

The key economic performance indicators used to measure the success of this scheme are:

- Public transport capacity utilisation (annual passenger boardings)
- Public transport journey times
- Public transport reliability
- Agglomeration, Land Value Uplift and employment

In its opening year (2035), it is estimated that Luas Finglas will contribute to an annual increase of around 3.7 million public transport boardings within its 1km catchment area¹⁶. This is an increase of 46% when compared to a scenario without the delivery of Luas Finglas. Whilst some of these boardings will be interchanges from existing bus services, the Luas will support significantly higher levels of demand for public transport¹⁷.

Luas Finglas will significantly reduce public transport journey times between the Finglas area and the city centre by an average of 12% during the AM peak hour. When compared to travel via private car, the delivery of Luas Finglas will lead to an average reduction in journey times to the city centre of 15 minutes (over 30%) during the congested peak periods. As an example, journey time by Luas Finglas from Charlestown to the city centre¹⁸ is expected to be around 30 minutes in the AM peak, whilst the equivalent trip by car in the opening year is estimated to take approx. 47 minutes.

Figure 4.8 2035 Annual Boardings (millions) - Luas Finglas catchment

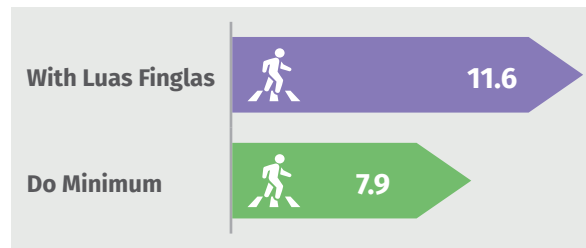
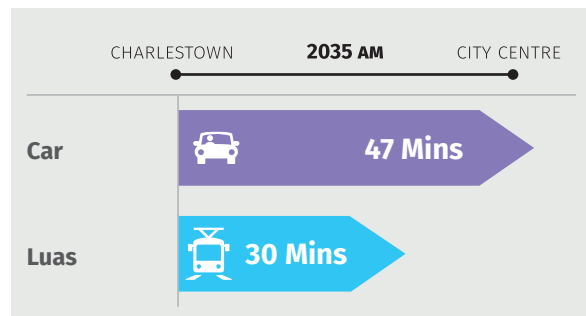


Figure 4.9 Journey time comparison



The delivery of Luas Finglas will create a largely off-road, protected rail-based corridor from the M50 to O’Connell Street that can deliver more reliable journey times. This is of particular benefit to existing road users who decide to switch to Luas Finglas. Increases in transport demand throughout the appraisal period will put additional pressure on the already congested road network, with Luas Finglas offering an increasingly attractive alternative to the car leading to modal shift to Luas. It is estimated that the delivery of Luas Finglas will lead to an effective saving in journey time variability of over 4 minutes in the AM and PM peaks, over and above the average journey time differential noted above. Knowing exactly how long a journey will take provides a greater level of confidence and assurance to passengers, and allows them to plan their time more efficiently.

16 Note this does not include additional boardings as a result of the 350 space Park & Ride facility at the St Margaret’s Road stop.
 17 Further analysis of boardings is provided in Appendix C Transport Modelling Report
 18 For the purpose this analysis, the ‘city centre’ has been defined as Trinity College

Light Rail and the Transport Benefit Delivery Evidence Review – Luas, Dublin

For individual travellers, the delivery of Luas from 2004 clearly had an impact on the attractiveness of public transport, increasing trip making in the Luas corridors for shopping and work purposes, and helping to improve local area satisfaction. Luas was widely seen as quicker and more reliable than both bus and car. Businesses also recognised the value of Luas in improving ease of travel around Dublin, increasing staff punctuality, and offering a positive impact for recruiting and retaining staff.

Source: Luas 'After' Household, Household Travel Diary and Employers & Retailers Studies, DTO, 2006

Through the substantial increase in public transport capacity and improvements to journey times and reliability due to the delivery of Luas Finglas, the scheme will have a significant economic impact, improving the attractiveness of the Finglas area supporting the delivery of regeneration and development investment, and providing capacity to enable medium and long-term compact and sustainable economic growth. Of particular benefit will be the areas in and around Finglas Village and Jamestown earmarked as a Strategic Development and Regeneration Area (SDRA).

Light Rail and the Development Economy Evidence Review

In their report 'What Light rail can do for City Regions', Steer notes evidence from the UK light rail systems that employment in towns and cities served by light rail has grown, while the number of peak hour car commuting trips has remained static or fallen. Net public transport trips and mode share have increased. The report also points to evidence that housing and commercial (employment) developments have happened at a faster rate in locations served by light rail than comparators, and that complementary land use and economic policies have amplified the gain.

Source: Leading Light: What Light Rail can do for City Regions, 2021, Steer for the Urban Transport Group

Light Rail and the Development Economy Evidence Review

Findings from the Luas 'After' Household Survey showed that the system was an incentive to move to a particular location. Three in every ten residents in the Luas zones who had moved to the area within the previous four years suggested that the Luas network had been an influence on their decision to move to that locality. This supports the hypothesis that light rail can encourage (the demand side of) economic redevelopment and regeneration.

Source: Luas 'After' Household, Household Travel Diary and Employers & Retailers Studies, DTO, 2006.

A number of further economic impacts are likely to be delivered by Luas Finglas. These elements are recognised in CAF as programme impacts that cannot be readily captured in a quantitative appraisal. Therefore they are not included in the formal Benefit to Cost Ratio calculations presented in this PBC. Appraisal methods are continuously developing. Future updates to guidance and changes in appraisal practice may result in the estimation of benefits arising from these elements. These impacts include:

- Agglomeration benefits – including productivity impacts associated improved connectivity, improved worker productivity due to better access to jobs and an increase in people entering the labour market
- Land value uplift – drawing in bespoke research commissioned from this business case
- New employment impact

Agglomeration

A consideration of agglomeration benefits will be included in the later business case stages as application methodologies in Ireland become more established. If appropriate and practical, a methodology for the quantification of impacts arising from agglomeration will be developed and applied as part of the Final Business Case.

Land Value Uplift

Dublin’s north-west corridor has the potential to support significant levels of new housing in locations such as the Finglas and Jamestown SDRA.

It is likely that Luas Finglas would enable a higher level of development to come forward than would otherwise be the case.

In alignment with Dublin City Council’s “compact development” policies, it would add capacity to a constrained corridor, promote increased use of sustainable travel choices, and could increase the viability and appropriate density of development sites.

Should a clearly evidenced dependence of additional development on Luas be established, the associated land value uplift could be calculated and captured as part of the wider value for money case.

This can be estimated by measuring the difference between the price of land with a transport scheme (and new use) in place and its former uses. This is an emerging methodology which is being increasingly used in the appraisal of transport projects in the UK, particularly in a London context for schemes with a strong housing dimension. Assessments of dependent development and land value uplift formed part of the economic appraisal for schemes including the Northern line extension to Battersea Power Station, and the extension of the London Overground network to Barking Riverside.

TII has commissioned Transport for London to undertake a study on incorporating land value uplift in scheme appraisal with specific consideration of how it may relate to Luas Finglas. Work to date has highlighted the importance of determining the scale of development dependence. As more becomes known about the scale of the potential development impacts associated with Luas Finglas through engagement with Dublin City Council, TII will consider opportunities to quantify the impacts of Luas Finglas in developing the Final Business Case for the scheme.

Employment Impact

A preliminary assessment of forecasting employment impacts has been developed to assess the impact of the delivery of Luas Finglas during its construction phase. In due course, as the proposals develop further and construction management plans are produced, employment requirements will be confirmed. For this stage in the business case process an indicative analysis has identified that the Luas Finglas extension will deliver direct employment benefits equivalent to the creation of 350 – 520 full time jobs (based on a standard assumption that 10 years of employment is the equivalent of one full time job). These estimates include indirect job creation generated by the spending in construction supply chain, and induced job creation generated in the economy from higher expenditure due to the additional direct and indirect employment.

In addition to the quantified economic benefits, Luas Finglas will result in a range of social and wider economic benefits that are discussed in the paragraphs below. Some of these benefits are not monetisable; but are significant. Overall, within the context of the fuller multi-criteria assessment which considers both quantifiable and unquantifiable impacts, it is deemed that Luas Finglas will deliver good value for money, as detailed further in [Section 5.2](#).

Construction Disruption

Whilst it is a temporary impact, there is likely to be disruption caused by the construction of Luas Finglas. Businesses and people living within the vicinity of proposed stations, or along the route alignment, will be particularly impacted. This will include traffic diversions, heavy

vehicle traffic congestion and safety issues, noise, dust and other construction related inconveniences.

Construction management and stakeholder engagement will be critical to managing the relationship between Luas Finglas and the impacted communities, businesses, commuters and wider stakeholder groups during construction. Construction impact mitigation measures, including traffic accommodation plans, will be considered in detail as part of the application to An Bord Pleanála for the railway order. This will ensure that any disruption during construction is minimised.

Safety

The Safety Appraisal Criteria of the Luas Finglas scheme are to:

- Improve safety for transport users by providing additional alternatives to the private car

Light rail is an attractive form of travel and will reduce the number of private cars on the road network as motorists opt for the convenient, fast journeys Luas offers. For pedestrians and cyclists, the provision of new complementary infrastructure will allow these active journeys to be made away from busy roads resulting in a reduced chance of collision with motorised vehicles. The cycle and pedestrian components of the scheme are designed with everyone in mind, adopting principles of universal design to achieve the highest possible levels of accessibility for all and to mitigate any exposure to safety risks associated with Luas Finglas.

The key performance indicators that will demonstrate the safety benefits delivered by the scheme are:

- Vehicular road safety
- Active mode safety

In terms of improving highway safety, transport modelling using the NTA's ERM and COBALT (Cost and Benefit to Accidents – Light Touch) analysis tool has shown that, over the appraisal period, the scheme is forecast to deliver €547,000 of road safety benefits due to a reduction in the number and the severity of collisions. This is in part derived from the reduction in traffic volumes driven by modal shift from car to Luas leading to fewer collisions on the network. Luas Finglas is estimated to lead to an annual reduction in around 440,000 vehicle trips on the road network along the corridor in the opening year 2035.

Whilst collisions are expected to reduce overall, it is acknowledged that the delivery of Luas Finglas may lead to more Luas-based accidents particularly at junctions where the scheme interacts with vehicular traffic. However, given the largely off-road alignment, it is expected that the risk of additional Luas-based accidents is low.

The scheme also delivers safety benefits for cyclists and pedestrians, with the dedicated infrastructure running parallel to Luas Finglas providing an active travel environment mostly away from motorised vehicles and, therefore, greatly reducing the likelihood of a collision. Active design measures will mitigate safety risks where pedestrians and cyclists interact with Luas, including at stops and in crossing the Luas route. The delivery of the active travel elements of the scheme will provide €5.4m in benefits over the 30-year appraisal period due to the improved quality and safety of the walking and cycling infrastructure.

Integration

The Integration Appraisal Criteria of Luas Finglas are to:

- Improve integration between transport modes and the opportunity for interchange
- Deliver strategic transport infrastructure to support wider goals for the future sustainable development as envisaged in Project Ireland 2040 and other relevant national, regional and local policy.

The design of Luas Finglas ensures it serves communities, with four stops along its 3.9km route, integrating in multiple locations with existing bus services as well as connecting with Irish Rail services at Broombridge and providing a new Park & Ride facility at St Margaret's Rd. As Luas Finglas is an extension of the existing Luas Green Line, it offers many more integration opportunities further south such as the Luas Red Line and city centre bus and rail services. Luas Finglas has been planned with an outlook on the future, with integration with BusConnects, including with the E2, F1, F2, F3, 23, 24, N4, N6 and L89 routes and consideration of the future delivery of DART+ West and MetroLink. The delivery of walking and cycling infrastructure, along with cycle parking at the new stations also supports the integration between active modes and public transport use.

The integration of transport and land use policy is highly important. The delivery of Luas Finglas as part of an integrated transport network for the Greater Dublin Area allows the scheme to support the key Project Ireland 2040 National Strategic Outcomes of compact growth, sustainable mobility, a strong economy, supported by enterprise, innovation and skills and transition to a climate-neutral and climate

resilient society. It aligns with a range of Government Policy as outlined in **Section 2.2**, including the NIFTI investment priorities of decarbonisation, mobility of people and goods in urban areas and enhanced regional and rural connectivity.

The key performance indicators used to measure the success of this scheme in terms of integration are:

- Park & Ride Journey Time Savings
- Accessibility to development areas by public transport
- Public transport interchange

The provision of a 350-space Park & Ride site located just off the M50 at St Margaret's Road significantly extends the catchment area of Luas Finglas, connecting the N2/M50 to the city centre and the entire Luas network. Integrating Luas Finglas with the road network at this location supports the reduction of vehicular traffic closer to the city centre, providing a viable public transport alternative for people living further away outside the M50. Modelling analysis indicates that during the AM peak hour in 2035, people using the Park & Ride and Luas Finglas will save 8.7 minutes on average when compared to completing their journey by car. This is also likely to be a conservative estimate, as it does not include the time taken searching for a parking space in the city centre when travelling by car. The journey time benefits provided by the Park & Ride will encourage its usage, thus increasing sustainable trips to the city centre and beyond.

Luas Finglas will pass close to a number of significant development areas, including:

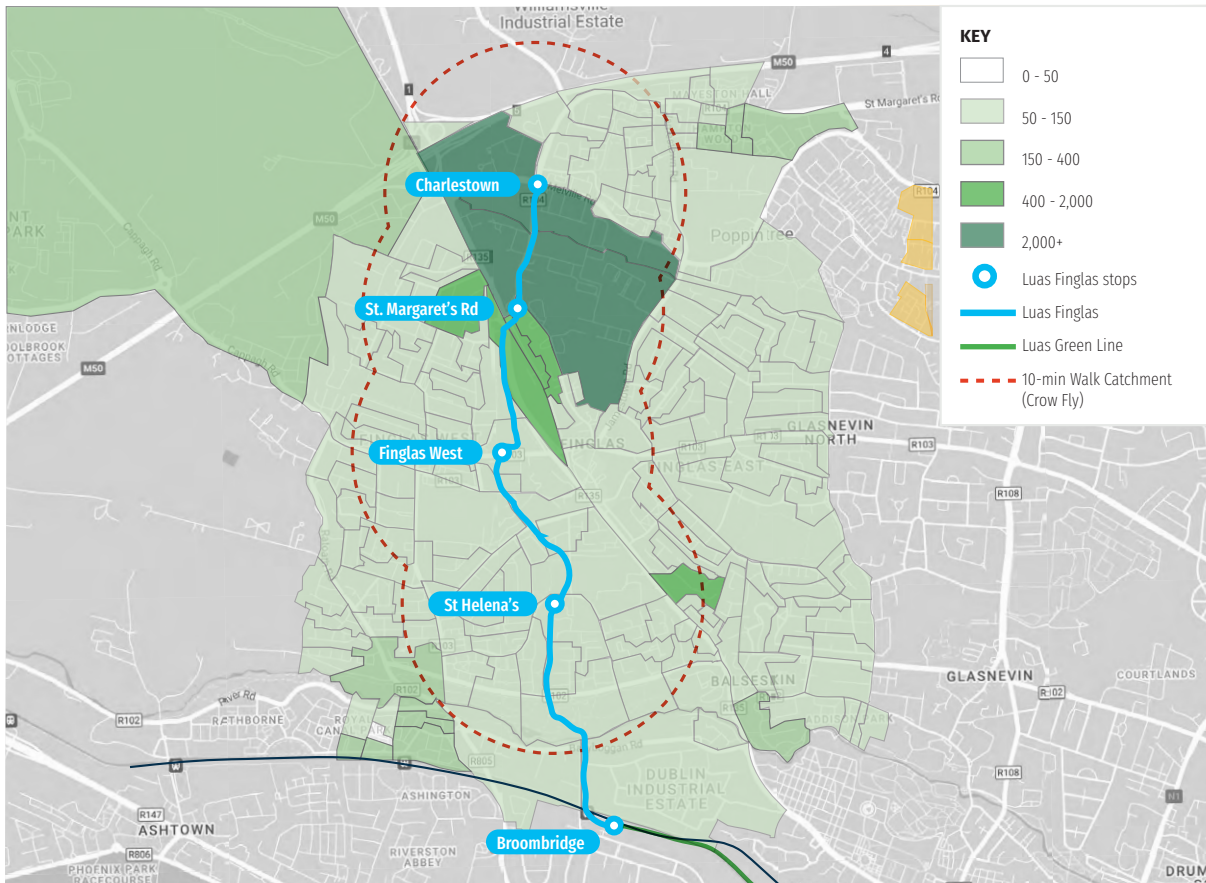
- 101 residential units in and around Charlestown
- 69 residential units on Cappagh Road
- the recently delivered 92 residential units in Hampton Wood
- 70 residential units in Scribblestown
- 46 residential units in Royal Canal Park

In addition, a 52 hectare site has been identified for redevelopment as part of the Jamestown Strategic Development and Regeneration Area planning for 3,500 – 3,800 new homes.

It is expected that 73% of the forecasted population growth in Finglas will be within a 10-minute walk of a Luas stop. 55% will be within a short 5-minute walk. Luas Finglas will bring high-quality public transport mobility to more people and, in doing so, support the sustainable growth of the city.

The integration of Luas Finglas into the city's public transport network offers new opportunities to make multi-leg journeys. It complements the delivery of other schemes in the area such as the roll-out of the BusConnects network and infrastructure, along with the DART+ West Rail upgrades, to create an integrated public transport offering.

Figure 4.10 2035 Population Growth

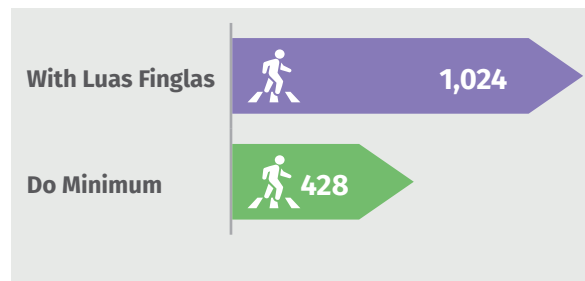


Light Rail and Land-Use Integration Evidence Review

There is evidence from across the UK's light rail network that new systems can drive development and regeneration that would otherwise not have happened or would happen later, at lower densities and potentially lower value. The opening of Langdon Park station on the Docklands Light Railway generated a step change in local development activity, resulting in around twice as many residential units coming forward than an equivalent nearby area without a new station; around 700 to 1,700 net additional homes were delivered compared to the control areas.

Source: No Train, No Gain: The local economic impact of Langdon Park DLR station Arquati, TfL 2013.

Figure 4.11 2035 AM Peak Hour Interchanges



Modelling analysis indicates there will be **1,024 public transport interchanges** in the AM peak hour within the north-west of the city during the opening year of Luas Finglas (2035). This is well over twice as many that would occur without the delivery of the scheme. This high number of public transport interchanges illustrates the integration of Luas Finglas with the wider network.

Environment

The Environment Appraisal Criteria of the Luas Finglas scheme are to:

- Reduce the impact of the delivery of transport infrastructure on the natural environment
- Encourage the use of sustainable transport to reduce the levels of harmful transport emissions

The design of Luas Finglas will incorporate sustainable development principles to limit the impact on the environment during construction and operation. The scheme will draw people away from cars and towards the more environmentally sustainable options of light rail, walking and cycling. As an extension to the existing Green Line, Luas Finglas will provide a significant increase in transport capacity in the area avoiding the need for other new physical infrastructure or increases in bus service levels or road traffic use to support economic growth.

While there will be some localised impacts of construction and operation in the urban area and on green space and biodiversity, careful design mitigations both for the construction period and in operations will minimise any medium to longer-term impacts. The significant contribution of the scheme to encourage public transport use, alongside improvements in the walk and cycle networks further promoting sustainable modal shift, is expected to make a significant contribution to helping achieve Climate Action targets, whilst supporting the sustainable growth of the Finglas area. The key performance indicators that demonstrate the environmental benefits brought about by the scheme are:

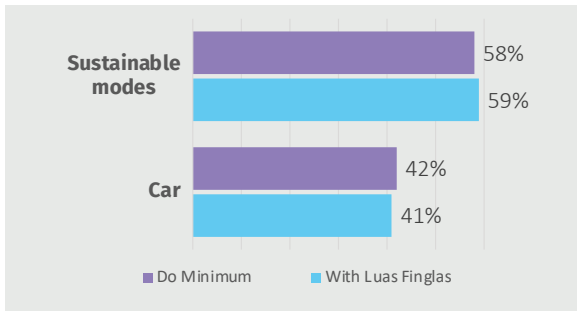
- Impact of transport infrastructure on the natural environment
- Transport emissions (CO₂, NO_x)
- Percentage increase in trips by walking, cycling and public transport

A comprehensive Sustainability Plan¹⁹ has been developed for Luas Finglas outlining how the project will address key sustainability challenges, risks and opportunities. Luas Finglas will incorporate sustainability objectives into its design, construction and operation, and thereby contribute to the economic efficiency, develop, protect, and enhance the environment and contribute to the overall well-being of society.

A Biodiversity Net Gain (BNG) approach has been applied to deliver improvements through the creation or enhancement of ecological habitats, and an extensive landscape strategy has been developed to **replant many more trees than will be removed during construction**. Design mitigation measures, especially in sensitive areas crossing Tolka Valley Park and Mellows Park will be outlined to **avoid, negate, or minimise adverse construction and operational phase impacts on identified ecological features or designated sites**. Where possible, the project design will include **the use of grass track to integrate with the surrounding areas** and improve the visual impact of the scheme. Further details on the mitigation measures identified to reduce the impact of the delivery of Luas Finglas on the natural environment are outlined in the Environmental Impact Assessment Report (EIAR).

¹⁹ Further information provided in the Luas Finglas Sustainability Plan in Appendix B. This is a live document which will be updated throughout the delivery of Luas Finglas.

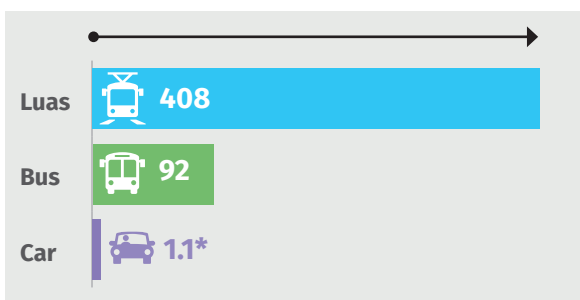
Figure 4.12 2035 AM Mode Share



Climate Impact

It is estimated that Luas Finglas will lead to an overall decrease in car mode share of around 1% for the north-west of the city in its opening year. In percentage terms this might seem modest. In actual trip numbers it represents a significant increase in sustainable travel. In the opening year 2035, Luas Finglas will deliver an increase of 1.3 million low carbon public transport trips per annum. This increases to 1.8 million additional public transport trips in the design year 2050 due to underlying development growth and modal shift from car.

Figure 4.13 Passengers per vehicle type



* Average car occupancy from survey data

The increase in sustainable trips due to Luas Finglas will have a positive impact on the environment. Emissions analysis undertaken using ENEVAL²⁰ indicate that in the opening year 2035, the delivery of Luas Finglas will lead to reductions in NO₂, particulate matter (PM₁₀ and PM_{2.5}), CO₂, and other emissions that harm the natural environment and

human health. In total, it is estimated that Luas Finglas will deliver reductions in carbon emissions from transport of approximately 300 tonnes per annum. Luas Finglas also provides significant environmental resilience on the network, removing a number of car-based trips and freeing up road space for buses and active travel modes along the Finglas corridor. One tram can carry the same number of passengers as around 370 cars with lower carbon emission and energy consumption per person. This aligns with the Climate Action Plan 2023, which aims to achieve a 51% reduction in greenhouse gas emissions by 2030, setting us on a path to reach net-zero emissions by 2050.

Accessibility & Social Inclusion

The Accessibility and Social Inclusion Appraisal Criteria of Luas Finglas are to:

- Improve accessibility to socially deprived areas within the study area by providing enhanced opportunities to access education and employment facilities
- Enhance the quality of transport to encourage and support regeneration, investment and employment opportunities in the identified development areas of Jamestown and Charlestown and elsewhere along the transport corridor.

The key performance indicators used to measure the success of this scheme in terms of accessibility and social inclusion are:

- Accessibility to areas of social deprivation by public transport
- Transport corridor capacity - number of person trips from the north-west corridor towards the city centre

20 ENEVAL (Environmental Evaluation Model) is a software that sits within the NTA's Environmental Appraisal Tool and can be used to estimate the impact of transport related tailpipe emissions.

Some areas around the Luas Finglas Preferred Route are classed as disadvantaged by the Pobal HP deprivation index. In total, 10,212 people who are identified as disadvantaged will live within a 10-minute straight-line catchment of a Luas Finglas stop.

Accessibility and Social Inclusion Benefits Evidence Review – Luas, Dublin

The improvement in public transport accessibility for areas on the Green and Red Luas lines has been apparent, with a perception of between 40-45% of local residents that Luas has expanded their employment opportunities. The proportion of residents making extra journeys since the arrival of Luas has also been significant, including more shopping trips and to a greater range of locations than before the implementation of Luas.

Source: Luas 'After' Household, Household Travel Diary and Employers & Retailers Studies, DTO, 2006

Developing and constructing Luas Finglas

will support improvement through increased accessibility to work, education, health and community facilities. It will provide direct connectivity to TU Dublin and Trinity College, and in general bring education, jobs, and leisure activities to within greater reach of a significant number of currently disadvantaged residents.

Through an integrated public transport network, Luas Finglas will support accessibility to major destinations beyond the direct catchment of the extension. For example, St James' Hospital and the new National Children's Hospital will be accessible via Luas Finglas and a single transfer to the Red Luas Line. St Vincent's Hospital can be accessed via interchange with the future DART at Broombridge or bus connections via transfer in the city centre.

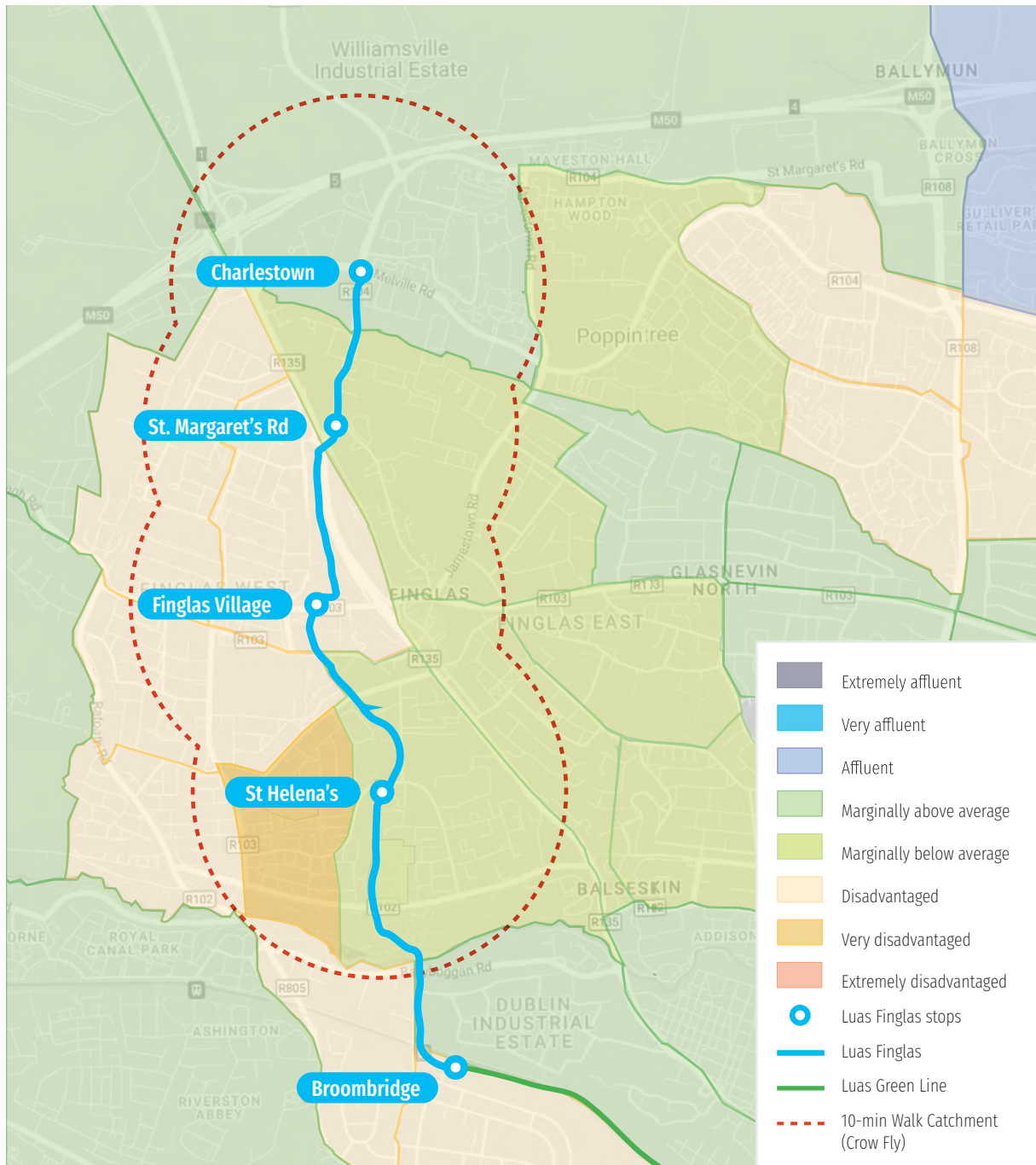
With a strong emphasis on legible and physical accessibility to stops and level boarding to the Luas vehicles, accessibility will be significantly increased for all users, including those with mobility, visual, hearing and sensory impairments.

Accessibility and Social Inclusion Benefits Evidence Review – Nottingham Express Transit (NET), UK

Surveys identified that around 50% of all mobility impaired users who changed their employment location in the past 5-6 years cited NET as essential in moving to their new job. Impacts on access to other services were also apparent, with firm views that NET had improved the quality of life for these travellers.

Source: Nottingham Express Transit Phase Two Monitoring and Evaluation –Year Five Report (2022)

Figure 4.14 Deprivation Index and Luas Finglas Walk Catchment (Crow Fly)



The delivery of Luas Finglas will help unlock potential capacity for people movements to and from the north-west corridor. Modelling analysis indicates that in the opening year 2035, the delivery of Luas Finglas will lead to a 50% increase in transport capacity utilisation for trips travelling south towards the city centre in the AM peak. Without Luas Finglas, travel from the north-west corridor

is constrained by pinch points on the road network for both cars and bus-based public transport crossing the Royal Canal at Phibsborough, Broombridge and Ratoath Rd.

Physical Activity

The physical activity Appraisal Criteria of the Luas Finglas scheme is to:

- Encourage increased levels of physical activity to support the health and wellbeing of the population of the study area

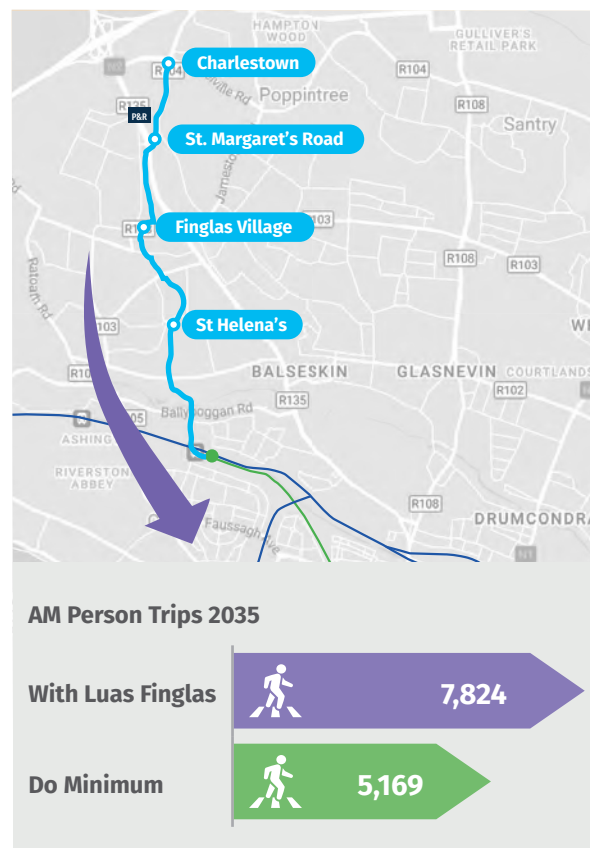
The scheme includes the provision of pedestrian and cycling paths running parallel to the Luas line. These will be almost entirely separated from vehicular traffic and as such will provide a pleasant environment to walk and cycle. This will also raise the attractiveness of the local area and boost civic pride. Each Luas stop will include cycle parking facilities, making it even easier to undertake multimodal trips (i.e. Cycle+Ride) and include physical activity as part of daily life.

Accessibility and Social Inclusion Benefits Evidence Review – Manchester Metrolink, UK

Ex-post evaluation of the Metrolink line to Wythenshawe, a relatively deprived community 12km south of Manchester, found a perception that the tram has been the catalyst for additional investment and regeneration of Wythenshawe town centre and its hinterlands. The research provided strong evidence that Metrolink has enhanced the social experiences of residents and led to enhanced employment opportunities.

Source: Metrolink Phase 3: Monitoring and Evaluation Second Report, March 2021, TfGM

Figure 4.15 Modelled Person Trips Crossing the Royal Canal (2035 AM Peak)



Measured monetary benefits due to the increase in the levels of physical activity is the key performance indicator that demonstrates the success of the scheme in meeting this criterion. TII's TEAM tool indicates that the scheme will deliver **€6.1m of benefits** over the 30-year appraisal period due to **improvements in modal shift and general health and wellbeing**. The proposed off-road walk and cycle infrastructure will link a number of residential areas, local schools, parks and recreational facilities along the route encouraging sustainable travel, in particular for vulnerable road users and unconfident cyclists. There are 11 primary and 3 secondary schools within approximately 1km of the Luas Finglas alignment. In total about 3,000 primary school children and 1,500 secondary school pupils attend these schools. The new active travel facilities

delivered as part of Luas Finglas will also provide a connection to the Royal Canal Way which offers a mainly off-road link towards

Dublin city and is also a great local amenity for recreational trips along with the Tolka Valley Greenway.

4.4 Summary

As outlined above, Luas Finglas performs extremely well in achieving the overall scheme objectives and will deliver a number of positive impacts for the north-

west of the city. The performance across all indicators is better with Luas Finglas than without, and the table below summarises the key results.

Criteria	Luas Finglas Impacts and Benefits	Outcome
Economy	<p>Luas Finglas supports sustainable economic growth of the wider Finglas area through enhanced mobility with increased public transport capacity, improved journey times and reliability.</p> <ul style="list-style-type: none"> • By 2035, Luas Finglas will drive an annual increase of 46% in public transport boardings within its 1km catchment and through modal shift reduce the number of car trips in area • When compared to travel via private car, the delivery of Luas Finglas will lead to an average reduction in journey times to the city centre of 15 minutes (over 30%) during the congested peak periods. 	Very positive economic benefits
Safety	<p>Luas Finglas removes around 440,000 vehicle trips from the road network in 2035. The delivery of walk and cycle infrastructure parallel to the alignment provides safe routes away from busy roads.</p> <ul style="list-style-type: none"> • Luas Finglas is estimated to deliver €547,000 of benefits from improved highway safety • €5.4m of benefits for those walking and cycling through safety and journey quality benefits. 	Positive for highway safety Very positive for active mode safety
Integration	<p>Luas Finglas supports the integration of transport and land-use development directly serving key population growth areas of Charlestown and Jamestown. It integrates with the wider public transport network supporting improved accessibility across the city.</p> <ul style="list-style-type: none"> • Luas Finglas provides a wider range of interchange opportunities, including facilitating multi-modal journey by bus, rail and Luas, and providing Park & Ride to widen the Luas catchment within the north-west of the city and reduce the traffic flows and central area parking demand • 73% of the new population expected in the Finglas area by 2035 will be within a 10-minute walk of one of the new Luas Finglas stops 	Positive for transport interchange Very positive for land use integration

Criteria	Luas Finglas Impacts and Benefits	Outcome
Environment	<p>The design, construction and operation of Luas Finglas will limit the impact on the natural environment. The provision of a fast, reliable public transport alternative will shift people onto sustainable modes, thus providing environmental benefits and align with Climate Action targets.</p> <ul style="list-style-type: none"> • Luas Finglas will generate 1.3 million additional low carbon public transport trips in 2035, increasing to 1.8 million in 2050 • The delivery of Luas Finglas will lead to reductions in NO₂, particulate matter (PM₁₀ and PM_{2.5}), CO₂, and other emissions that harm the natural environment and human health 	Positive environmental benefits
Accessibility and Social Inclusion	<p>The delivery of Luas Finglas will provide a frequent and fast service improving accessibility and connecting more people with employment, education and leisure facilities. It will increase the transport capacity for the north-west corridor improving opportunities for sustainable growth and regeneration.</p> <ul style="list-style-type: none"> • Over 10,000 residents identified as disadvantaged based on the POBAL index will be within a 10-minute straight line walk from one of the four Luas stops improving connectivity to employment and education • The overall carrying capacity of the transport network within the north-west corridor will increase by over 50% in the AM peak due to the delivery of Luas Finglas 	Very positive for accessibility Very positive for social inclusion
Physical Activity	<p>The proposed off-road walking and cycling infrastructure delivered as part of the scheme will link a number of local schools, parks and recreational facilities encouraging additional active travel and physical activity.</p> <ul style="list-style-type: none"> • It is estimated that the infrastructure will deliver €6.1m of health benefits over the appraisal period due to increases in physical activity as a result of the scheme 	Very positive for physical activity

5 | Project Appraisal

5.1 Introduction

Luas Finglas will deliver significant benefits to society during its lifetime. The detailed scheme appraisal aims to provide a basis for a decision on whether to proceed with a project in principle or not.

5.2 Economic Appraisal

Economic Appraisal Core Assumptions

The economic appraisal of Luas Finglas has been undertaken in line with the PSC and CAF guidance. Individual economic parameters, such as Value of Time, have been based on industry-standard variables extracted from DoT CAF and TII PAG. Core assumptions used in the economic appraisal are:

- Price base year and present value year of 2011 as defined in the DoT CAF
- Standard appraisal period of 30 years with a residual value period of a further 30 years. For major transport schemes, the residual value is a measure of the net present value of the infrastructure over a specified period beyond the 30-year appraisal period. This value is calculated in the same manner as the initial appraisal period using outputs from the ERM and TUBA. For all major national transport projects, a residual value period of 30 years is applied based on the guidance outlined in CAF. The residual value is included in the results table of the economic appraisal

- Discount rate of 4.0% for 30 years from current year, 3.5% for years 31-60 and 3.0% thereafter
- Shadow price of public funds of 130% applied to all costs
- Shadow price of labour of 100%

Understanding the Scenarios

Standard practice in undertaking assessments of transport projects requires that a number of demand and network configuration scenarios are generated to provide a range of appraisal results. Each scenario is offering a different assessment of the future by comparing a “Do Minimum” development scenario with a “Do Minimum plus Luas Finglas” (also known as “Do Something”) scenario. This allows for a more robust understanding of the likely impacts of Luas Finglas across a range of potential future “Do Minimum” states, as well as gaining more appreciation for the potential trade-offs and behaviours that underpin the demand modelling results.

Table 5.1 summarises the scenarios that have been evaluated as part of the Luas Finglas Economic Appraisal in the preparation of this PBC.

Table 5.1 Economic Appraisal Scenarios

Scenario	Do Minimum Scenario Description
Core	Assumes that all committed ²¹ projects are implemented along with the delivery of DART+ West and the BusConnects Core Bus Corridor infrastructure that have planning applications submitted and directly serve Broombridge and the Finglas corridor. MetroLink, located to the east of Finglas, has not been included in this scenario, but is introduced in scenario 3 below.
Alternative Growth Future	Assumes delivery of the 'Core' scenario projects and demand patterns aligned with the NTA's 'Alternative Future Scenario for Travel Demand'. This aims to reflect changes in transport demand e.g. increased working from home.
Core + MetroLink	Assumes that all the projects of the 'Core' scenario are delivered along with MetroLink.
Core + MetroLink + Alternative Growth Future	Assumes that all the projects of the 'Core + MetroLink' scenario are delivered, along with demand patterns aligned with the NTA's 'Alternative Future Scenario for Travel Demand'.

The 'Core' scenario includes the following key future schemes:

○ **DART+ West:**

- The Preliminary Business Case for the DART+ programme has been approved by Government
- The Government granted Approval in Principle to the NTA to enable the submission by CIÉ / Iarnród Éireann of a Railway Order application to An Bord Pleanála for the DART+ West element of the programme (Approval Gate 1)
- The DART+ Southwest Preliminary Business Case has been approved by Government and a Railway Order application was submitted to An Bord Pleanála on the 22nd March 2023 (<https://www.dartplus.ie/en-ie/projects/dart-south-west>)
- The DART+ Coastal elements of the overall DART+ Programme will be subject to separate approvals by Government
- A Railway Order application for DART+ West was submitted to An Bord Pleanála on the 29th July 2022 (<https://www.dartplus.ie/en-ie/projects/dart-west>)

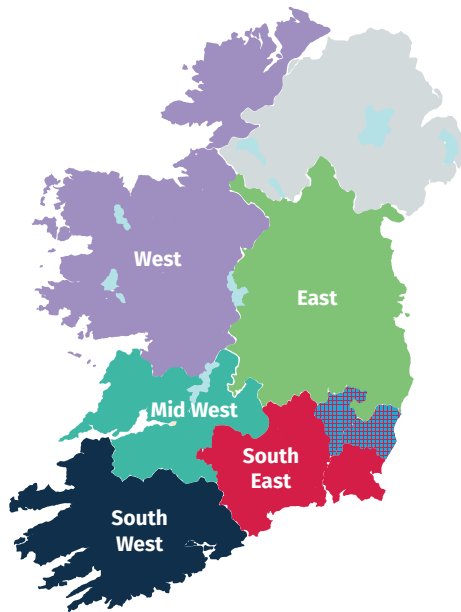
- Broombridge Station is on the DART+ West alignment and there will be a significant enhancement in the level of rail service provided

○ **BusConnects Core Bus Corridor Infrastructure:**

- The Preliminary Business Case for the BusConnects programme has been approved by Government
- Currently a number of the corridors, including the Ballymun/Finglas to city centre scheme have been submitted to ABP for approval

These schemes have been included as they have progressed significantly through the planning process and are listed as Strategic Investment Priorities within the National Development Plan. The inclusion of the BusConnects Core Bus Corridor scheme also allows for a more robust appraisal of Luas Finglas. The provision of an improved bus service running parallel to the Luas route along the Finglas Road is likely to have some impact on patronage. As such, the exclusion of the Core Bus Corridor scheme in the 'Core' scenario would potentially lead to an over-inflation of Luas Finglas benefits.

21 The full list of schemes included in the 'Core' Do Minimum scenario is provided in the Transport Modelling Report in Appendix C

Figure 5.1 NTA Regional Model Boundaries

Modelling Approach

The NTA's Regional Modelling System (RMS)²² has been used to estimate the scheme impacts. It comprises a National Demand Forecasting Model (NDFM) and five Regional Multi-Modal Transport Models.

The NDFM takes input attributes such as land-use data, population etc., and estimates the total quantity of daily transport demand produced by, and attracted to, each of the 18,488 Census Small Areas in Ireland. Of the five regional models, the Finglas/North Dublin area is covered by the ERM. The models capture all day transport demand, enabling more accurate modelling of mode choice behaviour and increasingly complex travel patterns.

The NTA's RMS is the most sophisticated modelling tool available for assessing complex multi-modal movements within an urban context. It is significantly more responsive to future changes in

demographics, economic activity and planning interventions compared to more traditional models.

The outputs of the ERM include estimated demand for four modes of transport (walking, cycling, public transport and private vehicles). It also includes a number of metrics on network performance including journey times, queuing, delay, passenger boardings, fare revenue etc. that can be extracted from the model runs. These have been combined with transport appraisal tools to monetise various impacts of the Luas Finglas scheme.

Monetised Benefits

The ERM modelling results have been used to monetise the following Luas Finglas impacts for the economic appraisal:

- User benefits
- Park & Ride user benefits
- Journey time reliability benefits
- Active mode benefits
- Road safety benefits

User Benefits

Users of Luas Finglas will be the primary beneficiaries of the line's development. As recommended within TII PAG, the Transport User Benefit Appraisal (TUBA)²³ software has been used to monetise the user benefits associated with the delivery of Luas Finglas, including:

- Journey time savings
- Impact on revenues (tolls, fares and other charges)
- Impact on tax revenues

²² Further details on the NTA RMS are available at: <https://www.nationaltransport.ie/planning-and-investment/transport-modelling/regional-modelling-system/>

²³ TUBA was developed by the UK Department of Transport for the explicit purpose of undertaking detailed analysis of transport projects. It has been adjusted to ensure the values and parameters are relevant for the Irish market and in-line with CAF guidance.

Park & Ride User Benefits

The provision of a 350-space Park & Ride beside the St Margaret's Road Luas stop will provide a number of benefits. It will support the removal of vehicular traffic from the road network, thus contributing to the decarbonisation of travel. For users of the Park & Ride, there will also be significant journey time savings when using the Luas Finglas which have been captured separately from the TUBA analysis.

A bespoke tool was created that uses outputs from the ERM to calculate the time saving by parking at the Park & Ride and taking the Luas when compared to completing the full journey by car. Vehicle occupancy surveys from existing Luas Park & Ride sites were used in combination with modelling data to estimate the likely occupancy rate for the St Margaret's Road site. The tool uses the standard CAF value of time parameters to monetise the time savings for the Park & Ride users over a 60-year appraisal period with discounting to 2011 prices and values in-line with CAF guidance.

Journey Time Reliability Benefits

Luas Finglas will deliver a level of segregation and priority for trams that will reduce the variability in journey times currently being experienced by public transport users (bus) and private vehicle users travelling along the corridor. Reliability benefits are those attributable to the improved confidence in arrival time at users' destinations. Improving the reliability of journey times allows users to better plan and make use of their time, for example, providing more consistent travel times to work, or for better use of time before leaving one's home.

The monetisation of reliability benefits is a relatively new component of economic appraisal and whilst there are draft guidelines in place from DoT they are not yet included in the current CAF guidelines. Reliability benefits are separate from journey time savings. They capture the perceived benefit associated with reduced uncertainty and stress users experience when the variation in their journey times is reduced. Improvements in the variability of a service do not necessarily result in journey time savings. It is therefore appropriate that the appraisal of Luas Finglas captures both the journey time savings (due to reduced headways, improved speeds and more direct journeys) and reliability savings (through segregation and priority infrastructure reducing the likelihood of delays and protecting Luas passengers from the impact of congestion).

The 'Core' scenario includes the planned improvements to bus priority under BusConnects. It is expected that future bus service reliability will perform significantly better than at present. For the 'Core' scenario, it is assumed Luas Finglas will not have any additional journey time reliability benefits over the provision of the future Finglas Core Bus Corridor. Therefore, reliability benefits have only been derived from Luas users who have transferred from private vehicles. A standard mean-variance method is generally applied to calculate highway reliability disbenefits. This is the basis for the estimation of reliability disbenefits foregone by private vehicle users once they transfer to the more reliable form of transport offered by Luas Finglas.

A bespoke tool was developed for the appraisal of reliability impacts, which aligns with draft guidance set out by the DoT. The monetised value of these reliability benefits is calculated based on the formula below:

$$\text{Benefit} = \text{Reliability Ratio} \times \text{Value of Time} \\ \times \text{Reduction in Variability} \times \text{Demand} \times \\ \text{Correction Factor}^{24}$$

Travel time variation is expressed as the standard deviation of travel time, and the following sources were used to estimate this change in variability:

- Observed TomTom journey time information for the Finglas corridor on access to the city centre for road users
- Bus AVL data for the route 140 travelling along the Finglas corridor
- Luas AVL data for a section of the existing Green Line

Outputs from the NTA ERM were used to quantify the number of unique passengers travelling along the corridor and who will therefore gain the most benefit from the reliability improvements.

Active Mode Benefits

As outlined in [Section 4.1](#) previously, Luas Finglas will include the delivery of walking and cycling infrastructure along the majority of its route. The TII Tool for Economic appraisal of Active Modes (TEAM) has been used to estimate the monetised benefits associated with delivery of walking and cycling infrastructure, including health, mode shift, journey time, journey quality and recreation benefits. Demand analysis was undertaken using the ERM to identify the potential usage of the proposed Luas

Finglas walking and cycling infrastructure which was fed into the TEAM tool to monetise the benefits.

Road Safety Benefits

As the delivery of Luas Finglas will encourage a shift away from private car use, the reduction in vehicles will produce safety benefits associated with collisions on the network. The COBALT (Cost and Benefit to Accidents – Light Touch) programme has been used to assess and quantify the change in the number of collisions and casualties between two model scenarios.

The COBALT assessment is based on a comparison of collisions by severity and associated costs across an identified network in a 'Without-Scheme' and 'With-Scheme' scenario, using details of link characteristics, collision rates, casualty costs and projected traffic volumes from the ERM.

Economic Appraisal Costs

In-line with the PSC and CAF guidance, the costs used for the economic appraisal are taken as the economic costs, rather than the financial costs which are presented in Chapter 4. In summary

- All costs are presented in 2011 prices and values using a 4% discount rate for the first 30 years, 3.5% for the next 30 and then 3% thereafter
- Costs do not include projected inflation or VAT
- Additional passenger fare revenue resulting from the scheme is assumed to partly offset operational costs

In addition to these adjustments, further additional economic costs are captured

²⁴ Where reduction in variability is the difference between the sums of the variability of travel time for Do Minimum and Do Something scenarios, Reliability Ratio is 0.8 based on CAF and Correction Factor used is 1.0

in the economic appraisal, which are not considered financial costs. For example, Luas Finglas construction will need to be funded using public funds, raised through taxes. While taxes are clearly required to support any developed economy, it is important to note that taxes have a cost. In line with the PSC a “shadow price” of 30% has been applied to all government funding required for Luas Finglas. This means that for every €1 of tax-based funding, the cost to society is estimated to be €1.30.

As outlined in Chapter 4, TII has produced a range of cost estimates for delivery of Luas Finglas across varying risk assumptions. For the purpose of economic appraisal at this PBC stage, the Reference Class Forecasting (RCF) P80 allowance was used as the core cost scenario. This helps ensure a conservative appraisal is undertaken within the PBC and the assessment takes appropriate account of the potential for risk events to arise during forthcoming project phases. Costs under the ‘Management Stretch Target’ (P30), ‘Management Base Target’ (P50) and ‘High Risk’ (P90) scenarios have been included as sensitivity tests.

Scenario	Risk	Present Value Costs 2011 Prices & Values (€ 'm)
Management Stretch Target	P30	€170.98
Management Base Target	P50	€205.19
Prudent Client Appraisal Value	P80	€240.85
High Risk Sensitivity	P90	€308.25

TII has a proven track record in delivering light rail in Dublin including the original Green and Red line, along with more recent extensions to the Point Village, Brides Glen and Luas Cross City. While the more conservative P80 cost estimate has been used in the Economic Appraisal, given TII’s experience in delivering light rail, there is a good chance that the outturn costs for Luas Finglas will be lower.

Luas Cross City – Case Study Evidence

Luas Cross City (LCC) was launched on schedule on December 9th, 2017. The route travels through the heart of Dublin city centre and there were a number of challenges during construction including a variety of stakeholders, maintaining access for businesses and residents, pre-existing services and detailed traffic management.

Despite all of the constraints the project encountered, including additional scope, LCC was delivered at a cost of €382.5 million, which is only 4% higher than the target budget of €368 million set in 2012.

This illustrates TII’s track-record in delivering LRT in Dublin under extremely challenging circumstances. The project was completed on time and within 4% of budget, which by international benchmarks is a remarkable achievement.

Source: Luas Cross City Early Review on Completion, September 2019

Economic Appraisal Results

All Values Presented in 2011 Prices & Values (€ 'm)				
Scenario	Core	Alt Future Scenario	Core + MetroLink	Core + MetroLink + Alt Future
Public Transport Users	336.8	278.6	233.6	202.2
Road Network Users	-47.7	-47.7	-34.8	-34.8
Active Mode Users	11.5 ²⁵	11.5	11.5	11.5
Indirect Tax Revenue	-9.7	-8.8	-3.9	-6.8
Reliability	43.3	37.6	37.6	37.6
Park & Ride Users	14.6 ²⁶	14.6	14.6	14.6
Road Safety	0.5 ²⁷	0.5	0.5	0.5
PV Benefits	349.2	286.2	259.1	224.8
PV Costs (P80)	240.8	251.0 ²⁸	263.1	269.3
BCR (P80)	1.4	1.1	1.0	0.8
PV Costs (P50)	205.2	215.4	227.5	233.6
BCR (P50)	1.7	1.3	1.1	1.0
Sensitivities:				
P30 Costs	2.0			
P90 Costs	1.1			
Benefits (-20%)	1.2			

Core Scenario

The incremental cost and benefit of Luas Finglas in the Core Future scenario generates a Benefit to Cost Ratio (BCR) of 1.4, and a Net Present Value (NPV) of €108 million. This means that for every €1 of incremental economic cost, Luas Finglas delivers €1.40 of incremental economic benefit to the Irish economy. Luas will

deliver significant monetised benefits, valued at €349.2 million in the Core Future scenario. As discussed in Chapter 4, there are additional benefits which have not been monetised at the PBC stage and some that cannot be monetised. The BCR should be considered within the context of the Multi-Criteria Analysis to capture the actual value to society.

- 25 Users benefiting from active mode improvements have been derived from ERM and catchment analysis based on future population levels and the potential for use of the new infrastructure. The new walk and cycle links will connect communities to local schools, recreational facilities and services. For the purpose of economic appraisal, it is assumed that the usage of the new infrastructure, and associated benefits are the same across all scenarios.
- 26 It is estimated that the 350 space Park & Ride site will be well utilised in all scenarios tested. As such the associated journey time benefits are assumed to be the same for the purpose of economic appraisal.
- 27 Road safety benefits represent a very minor proportion of overall scheme benefits (<1%). As such, the impacts are assumed to be equal across all scenarios for the purpose of calculating a BCR.
- 28 Note: Costs vary between scenarios due to the impact of fare revenue which is offset against operational and maintenance costs. Each scenario has different levels of Luas Finglas boardings, and associated fare revenue.

Alternative Future Scenario

An alternative scenario for future transport demand has been developed by the NTA which considers the medium to long-term impacts associated with an accelerated transition to remote working, remote education and associated changes for a proportion of the population. In respect to employment, there is an assumption that a higher proportion of white-collar employees will utilise working from home when commuting distances are longer, while short distance commuters or blue-collar workers will be less able or inclined to work from home. For education, the greatest change is assumed in respect to university or college travel where it is assumed that a substantial shift to online learning and partial attendance will occur.

Other economic assumptions include an increase in online shopping, a reduction in business travel and an increase in freight volumes to service growing demand for online deliveries. Overall, the scenario assumes that economic trends and factors, such as unemployment remaining unchanged. The full details of the transport demand assumptions used in the alternative scenario are described in a separate NTA report entitled 'Alternative Future Scenario for Travel Demand'²⁹.

As part of this test, the trip rates assigned with the NTA National Demand Forecasting Model have been adjusted to reflect the impact of greater working from home on different cohorts of the population considering employment type and trip type. Overall, the alternative future scenario results in a significant decrease in the total number of trips on the transport network, leading to a reduction in passenger demand and associated journey time savings from

Luas Finglas (when compared to the 'Core' scenario). In this scenario Luas Finglas is estimated to deliver around €286 million Present Value Benefits and a positive BCR of 1.1.

Core + MetroLink

The modelling analysis indicates that the introduction of MetroLink leads to a reduction in patronage on Luas Finglas and associated user benefits. A detailed technical note has been produced (Appendix E) which investigates the sensitivity test with MetroLink in further detail. It looks at Luas Finglas and MetroLink together from a first principles approach to allow for an informed interpretation of the transport modelling results.

GIS analysis was used to identify the walk catchment to both Luas Finglas and MetroLink stations. It uses the latest Open Street Map network which contains a detailed representation of the road network including residential streets and walking paths. As such, the walk distance to stations is reflective of the available network including elements such as impermeable housing estate links, cul de sac roads etc. The results of the GIS Catchment Analysis are illustrated in **Figure 5.2**, which outlines the areas within a 20-minute walk (based on an average walk speed of 4.8km/hr) of the proposed Luas Finglas and MetroLink stations.

Overall, the GIS analysis shows that there is very limited overlap in areas served by both Luas Finglas and MetroLink, meaning for the most part these lines serve two different catchment areas. The majority of the Luas Finglas demand is likely to be within a 10-15 minute walk of the stops which would be 25-30 minutes (and longer in some cases) from

29 https://www.nationaltransport.ie/wp-content/uploads/2021/03/Alternative-Scenario-Development-Note-v-6.1_Final.pdf

the nearest MetroLink station. Luas Finglas will provide a high-capacity, reliable and fast public transport offering for existing

residents and new development areas along the Finglas corridor which will not be directly served by MetroLink.

Figure 5.2 Luas Finglas and MetroLink 20-Minute Walk Catchment

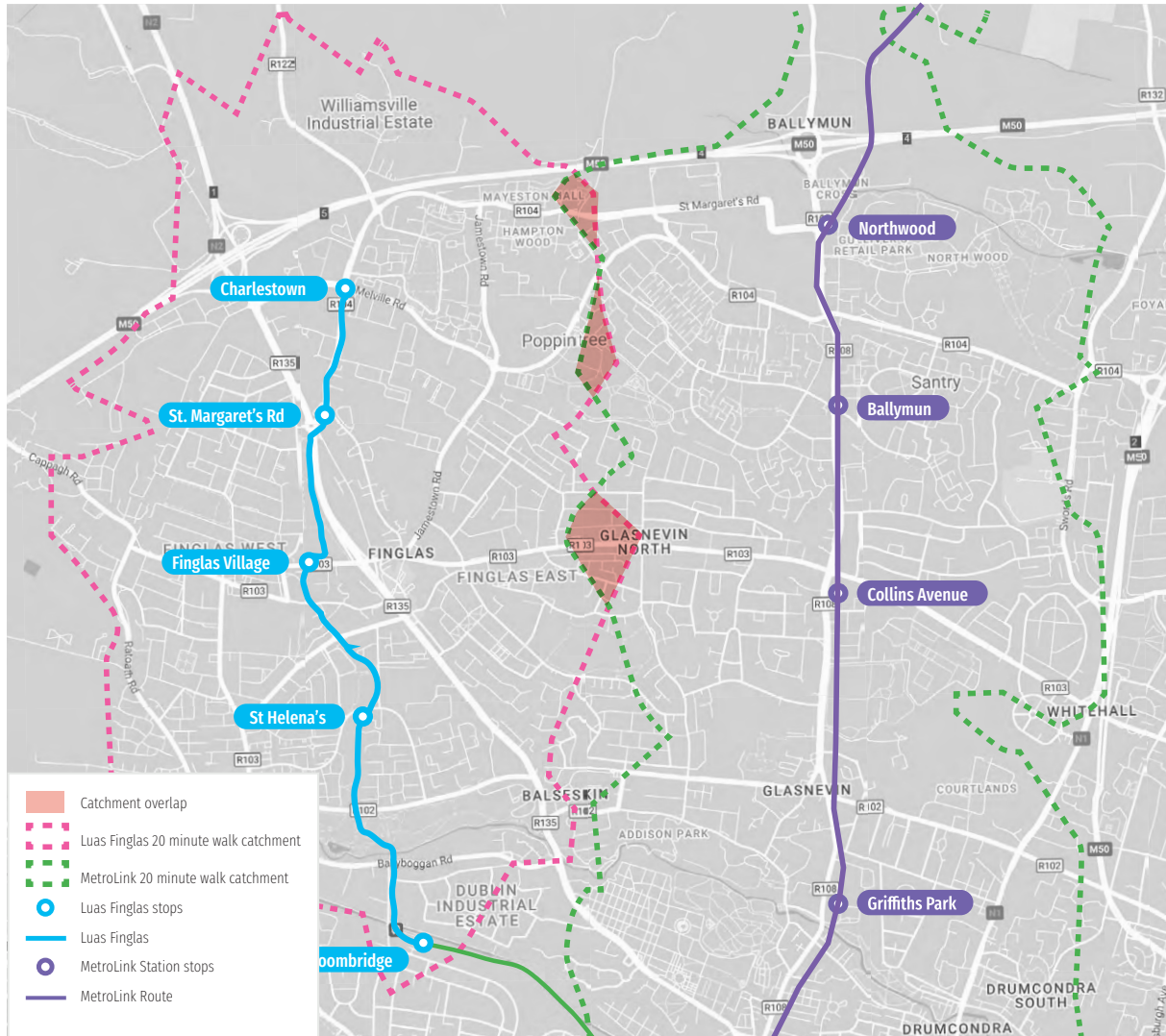
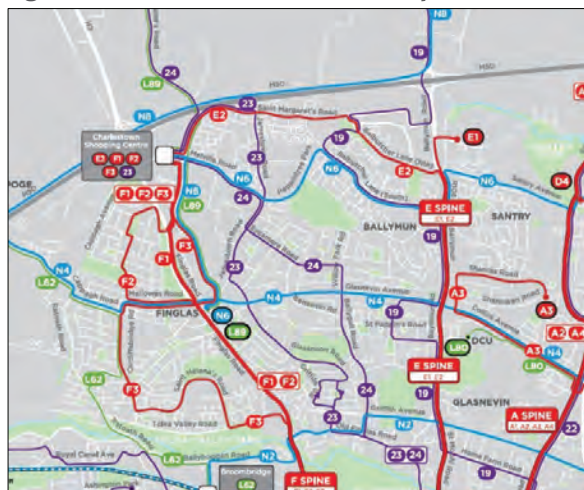


Figure 5.3 BusConnects Network Map



Another element leading to a modest decline in Luas Finglas patronage in this scenario is due to a reduction in bus transfers. As illustrated in Figure 5.3, Charlestown is identified as an interchange hub in the BusConnects network allowing transfer between bus services and Luas Finglas. In-line with the ‘branch and spine’ BusConnects network, the modelling results indicate a number of orbital passengers transferring from services such as the N6 and E2 onto Luas Finglas and travelling towards the city centre. If MetroLink is

introduced, the number of passengers interchanging at Charlestown reduce, with an associated increase at Ballymun station. This indicates that some passengers may choose to interchange with MetroLink to avail of shorter headways and quicker journey times.

Taking into account all of the above, if MetroLink is also delivered, there remains a strong case for Luas Finglas as:

- Demand for Luas Finglas in the 'Core+ MetroLink' scenario is still strong with around 2,900 passengers boarding across the four new stations in the AM peak hour.
- The modelling analysis also illustrates the synergies that could arise from the delivery of both services and the positive impact this would have on public transport usage. Within the Luas Finglas 20-minute walk catchment, the public transport demand is significantly higher with both Luas Finglas and MetroLink in operation, than when either scheme is delivered in isolation. The overall journey times and cost of travel by public transport also significantly improves when both services are delivered. This indicates that the public transport user benefits for people within the Luas Finglas catchment would be greatly improved due to the delivery of both schemes when compared to a scenario where one or neither are delivered.
- As outlined in Chapter 4, there are a number of non-monetised benefits associated with Luas Finglas that cannot be delivered by MetroLink. These include significant accessibility improvements for residents in disadvantaged areas in Finglas to employment and education and supporting the regeneration and

sustainable development of the area. Therefore, the actual benefit to residents along the Finglas corridor is likely to be significantly higher than presented in this economic appraisal.

- The costs used in the Preliminary Business Case economic appraisal represent a conservative estimate with a large value associated with future risk and contingency (P80). When a lower risk value is applied in-line with the 'Management Base Target' (P50) the BCR in the 'Core+ MetroLink' scenario increases to 1.14.

Core + MetroLink + Alternative Future

In order to present a robust assessment of the Luas Finglas scheme, a sensitivity test was undertaken combining scenarios which impact on Luas Finglas patronage and associated benefits. This sensitivity includes the delivery of MetroLink in advance of Luas Finglas, along with a future demand scenario which considers the medium to long-term impacts associated with an accelerated transition to remote working, remote education, increased online shopping etc. As outlined previously, the 'Alternative Future' demand scenario leads to a significant reduction in the total number of trips on the transport network. This, combined with the impact of MetroLink, leads to a modelled reduction in Luas Finglas patronage and associated user benefits. It is unlikely that the conditions represented in this sensitivity test will come about in reality as:

- It represents an accelerated reduction in overall trip making predominantly as a result of Covid-19. It is impossible to predict what the long term impact will be on trip making and trip patterns. Recent data suggests that whilst trip patterns are currently different to pre-Covid there

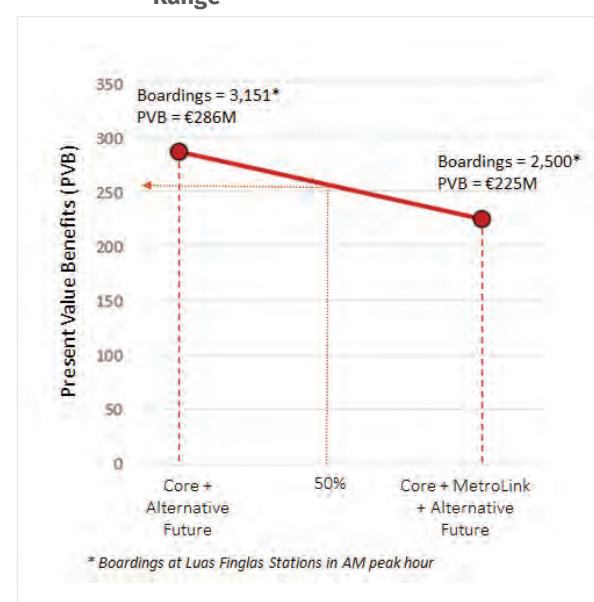
has been a strong bounce back in public transport travel with patronage returning above pre-Covid levels at the end of 2022³⁰.

- Since the modelling for the Economic Appraisal was undertaken, development planning in the areas has progressed. At the time of writing this PBC, the draft Jamestown SDRA Masterplan includes for 3,500 – 3,800 new homes which is significantly higher than was originally proposed. Further work is also ongoing for the redevelopment of the Dublin Industrial Estate lands with a Local Area Plan being developed to regenerate the area. These areas will be directly served by Luas Finglas and are conservatively represented in the modelling analysis.
- The modelling analysis doesn't include for any demand management measures which support a reduction in vehicle kilometres travelled and a shift to sustainable modes. Significant work is ongoing currently to develop a National Demand Management Strategy and Demand Management is an element of the Greater Dublin Area Transport Strategy. The reallocation of road space from private car use to accommodate better public transport and active travel will likely be a key element of any Demand Management Strategy.
- The Reference Class Forecast (Outline Business Case) P80 cost estimate includes a large value associated with future risk and contingency. When a lower risk value is applied in-line with the 'Management Base Target' (RCF - P50), the BCR in the 'Core + MetroLink + Alt Future' scenario increases to around 1.0. If the 'Management Stretch Target' (RCF -

P30) is used, the BCR rises just above 1.1. As outlined earlier in the PBC, TII has a proven track record of delivering LRT on time and in line with budget.

GIS analysis (presented earlier in the PBC) shows that there is very limited overlap in the catchments of Luas Finglas and MetroLink. MetroLink will provide a very high quality public transport option and, as the model reflects, some passengers will be willing to walk longer distances to use MetroLink instead of Luas Finglas. However, personal preferences that impact people's willingness to walk long distances cannot be fully reflected in the model, which might affect the outcome. Therefore, MetroLink might not reduce the number of people using Luas Finglas as much as the model predicts. **Figure 5.4** outlines the difference in boardings at Luas Finglas stations, and associated present value benefits, with and without MetroLink. The results indicate an abstraction of approx. 600 passengers (20%) in the MetroLink scenario resulting in approximately 20% reduction in benefits.

Figure 5.4 Alternative Future + MetroLink Benefit Range



30 <https://www.transportforireland.ie/news/bus-passenger-numbers-return-to-pre-pandemic-levels-nla/>

It is not possible to ascertain by exactly how much the model is overestimating the impact of MetroLink on Luas Finglas boardings, however, the chart in [Figure 5.4](#) illustrates the potential change in benefits across an upper and lower limit. For example, if it is estimated that half of the people modelled as switching to MetroLink actually remained on Luas Finglas, then the benefits in the 'Core + MetroLink + Alternative Future' scenario could increase to approximately €256m (if a general proportional change is applied) leading to a BCR of 1.0 in the RCF P80 cost estimate. This would increase to a BCR of over 1.1 in the 'Management Base Target' (RCF - P50) scenario.

Sensitivity Tests

Three sensitivities have been considered on the 'Core' future scenario as follows:

- Increasing the project costs by applying the P90 risk, while holding all other things equal, would result in a BCR of 1.1. Given the economic appraisal utilises the already conservative P80 cost estimate, this sensitivity is considered unlikely
- Decreasing the project costs by applying the P30 risk, while holding all other things equal, would result in a BCR of 2.0
- Accounting for the risk associated with the calculation and monetisation of Luas Finglas benefits by applying a 20% reduction in their value, would result in a BCR of 1.2.

On the whole, the sensitivity tests indicate the scheme is robust even if current assumptions change. However, it is recommended that additional sensitivity testing is undertaken at Final Business Case Stage to examine assumptions and

uncertainties again. Further details in support of all BCR calculations are provided in Appendix D.

Economic Appraisal Summary

Overall, the results of the economic appraisal across the various scenarios and sensitivity tests indicate that the delivery of Luas Finglas will provide good value for money with BCRs ranging from 0.83 to 2.0. However, it should be noted that whilst the Net Present Value (benefits minus costs) and BCR are relevant indicators, they do not provide information on benefits and costs not directly monetisable such as enhancements or negative effects on the natural or built environment. In other words, although an important input, the economic analysis should not be used as the sole basis for decisions.

5.3 Financial Appraisal

In line with the PSC and CAF, a financial appraisal has been undertaken for Luas Finglas developed from the perspective of TII as the Sponsoring Agency and reflects those elements of cash flow for which TII has clarity and control at this stage of the project lifecycle. The Financial Analysis sets out cash inflows and outflows over and above the 'Do Minimum' scenario, with the following core assumptions:

- The financial appraisal is presented in nominal prices discounted to 2022 values where stated
- The appraisal period for the Financial Analysis is 30 years beyond the capital investment period
- A discount rate of 1.79%³¹ has been used for discounting project cash flows in-

31 <https://www.gov.ie/en/policy-information/1a0dcb-project-discount-inflation-rates/#q3-2022-discount-rate>

line with DPER / National Development Finance Agency (NDFA) guidance included in the PSC

- A residual value has been included as Luas Finglas will have an asset life in excess of the 30-year financial appraisal period. This has been estimated to equal the construction costs of Luas Finglas discounted from the end year of the appraisal period
- Inflation rates have been included in-line with NDFA guidance:
 - For services with a labour component below 50%, the Harmonised Index of Consumer Prices (“HICP”) has been applied. The applicable medium to long-term HICP rate is 2%.
 - For services with a labour component in excess of 50%, HICP + 1% has been applied.
 - A separate inflation rate has been applied for construction and construction-related services.

Cash Flow

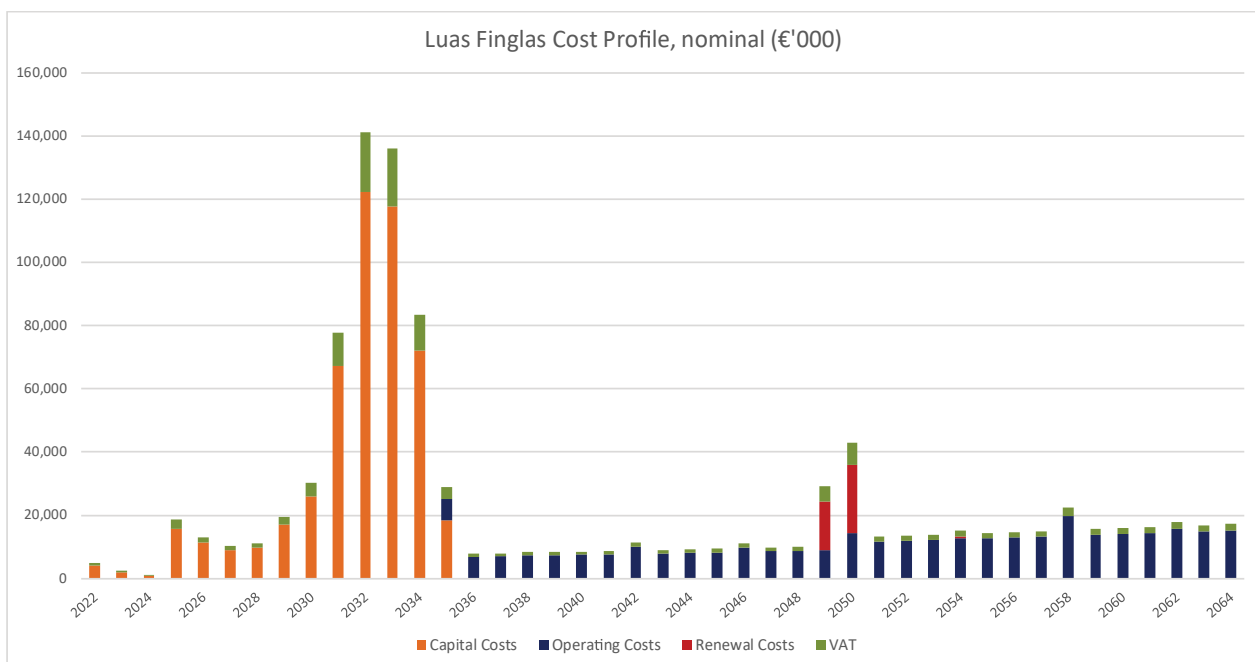
Project Outflows

The costs associated with delivery of the Luas Finglas have been discussed in further detail in Chapter 4. For the purposed of the financial appraisal, the costs have been broken down into:

- total upfront capital costs (or investment costs)
- total operating costs
- future renewal (or maintenance) costs

The financial appraisal uses the RCF P50 risk allowance with medium inflation delivery cost assumptions in order to test affordability at the ‘Management Base Target Budget’. **Figure 5.5** outlines the cost profile for Luas Finglas including inflation and VAT over the appraisal period.

Figure 5.5 Luas cost profile for construction and Years 1 to 30 of operations



The peak exchequer funding request, net of VAT, will occur in 2032 and 2033, for approximately €240 million combined. This represents a peak activity, with all contracts procured and all project activity underway. Most of the heavy construction will conclude in 2034, leaving more minor integration and construction finishing works to be funded by the Exchequer before commencing operation in 2035.

Project Inflows – Fare Revenues

Luas Finglas will attract higher numbers of passengers to public transport and, therefore, generate higher fare revenues. These revenues are exempt of VAT. An estimate of the fare revenue impact of Luas Finglas has been calculated using data extracted from the ERM on changes in passenger boardings. This has been used in conjunction with an estimated average fare level based on the existing fare structure in Dublin incorporating the impact of period tickets and concessionary fares. A rate of inflation of 2% per annum has been applied to future fares.

Table 5.2 Discounted Cash Flow Summary Table (Nominal, incl. VAT)

Cash Flow (€'000)	Nominal Prices	Net Present Value
Total Capital Cost (CAPEX)	(573,637)	(491,996)
Total Operating Costs (OPEX)	(375,175)	(226,798)
Total Renewal Costs	(46,459)	(28,885)
Total Revenue	412,537	247,789
Residual Value	379,118	319,856
Total	(203,615)	(180,034)

Discounted Cash Flows

Table 5.2 outlines the results of the Discounted Cash Flow analysis based on the revenues and costs associated with the delivery of Luas Finglas. The results are presented in nominal terms including VAT along with the Financial Net Present Value (FNPV) using the NDFA discount rate.

Affordability

The PSC requires an assessment of affordability setting out total investment required, timing of costs and ongoing operation and maintenance impacts. Table 5.3 below, provides details of the profile of Nominal Costs excluding VAT and net expenditure from 2019 to 2064.

Overall, the results indicate that the total cost of implementing Luas Finglas is just over €117 million when inflation is taken into account (excluding VAT). The costs of the scheme are somewhat offset by the increase in fare revenue generated by Luas Finglas along with the Residual Value reflecting the life of the asset beyond the 30-year appraisal period.

The Government’s 2022 Budget reaffirms that Project Ireland 2040 remains the long-term overarching strategy to make Ireland a better country for all its people. It also reaffirms its commitment to improving the long-term potential of the economy through, amongst other things, carefully planned investment.

The National Development Plan 2021-2030 provides €165 billion in public capital funding for Ireland over the next 10 years as part of Project Ireland 2040, comprising over 300 major projects across transport,

housing, health, education, environment, climate and communications. The NDP 2021-2030 outlines the proposed public capital expenditure during the period 2026 – 2030 as approximately €91.3 billion.

The Summer Economic Statement (SES) published by Government in July 2021 sets out the Government’s medium-term budgetary strategy up to 2025. This strategy seeks to reach a headline deficit broadly in line with the fiscal position of comparable European countries by the mid-part of the decade, reducing Ireland’s deficit in a gradual, incremental matter while also reflecting Government’s commitment to investment in capital expenditure (see [Figure 5.6](#)) to meet the goals of the National Development Plan 2021-2030 and the priorities set out in the Programme for Government.

Almost €50 billion is allocated to be spent on the provision of vital infrastructure between 2022 – 2025. Luas Finglas is not expected to commence the construction phase in the above 2019-2025 expenditure profile. However, the implementation

phase has the potential to commence in the period 2026-2030, where an increased capital expenditure profile of €91.6 billion is planned within the Government investment profile set out in the NDP 2021-2030. Light rail and Luas Finglas is a listed transport project within the NDP 2021-2030, therefore it is expected that the capital investment necessary for the implementation is accounted for as part of the overall NDP expenditure commitments.

The total expenditure of Luas Finglas from 2022 up to the end of the construction stage (2035) is expected to be approximately € 502m (excl. VAT) which includes planning, land costs, construction, testing and commissioning, rolling stock, risk and inflation along with initial operating costs. Assuming a similar rate of capital expenditure for 2031-2035 to 2026-2030, the total government capital expenditure on infrastructure from 2022-2035 is approximately €233.2 billion. Luas Finglas therefore accounts for approximately 0.2% of the proposed government capital expenditure between 2022 and 2035.

Figure 5.6 SES 2021 Government Capital Expenditure 2019-2025

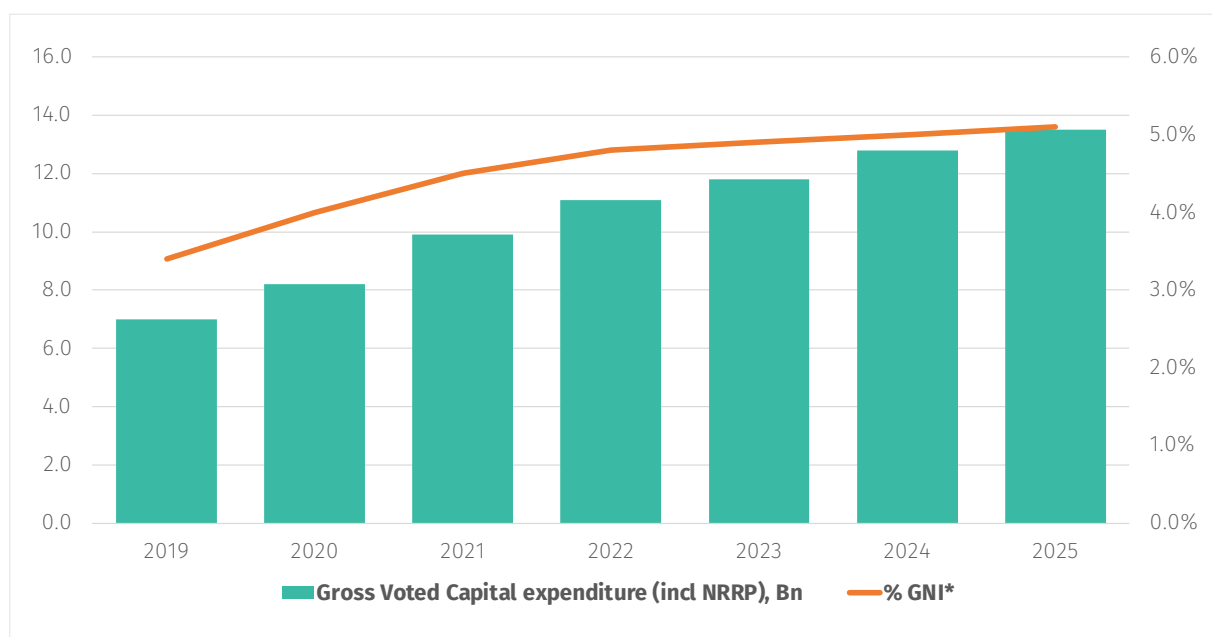


Table 5.3 Luas Finglas Project Cashflow Summary (Non discounted, Nominal prices, excl. & incl. VAT)

Cash Flow (€'000)	2019-2023	2024-2025	2026-2030	2031-2035	2036-2045	2046-2055	2056-2064	Total
Inflows								
Fare Revenue	-	-	-	7,432	93,846	137,720	173,538	412,537
Residual Value	-	-	-	-	-	-	334,024	334,024
Total Inflows	-	-	-	7,432	93,846	137,720	507,563	746,562
Outflows								
Construction	-	-	(22,869)	(311,156)	-	-	-	(334,024)
Preparation & Admin	(8,412)	(8,377)	(8,782)	(40,400)	-	-	-	(65,971)
Land & Property	-	(8,244)	(36,576)	-	-	-	-	(44,820)
Rolling Stock	-	-	(4,716)	(46,101)	-	(21,832)	-	(72,649)
Operating Costs	-	-	-	(6,772)	(78,119)	(111,734)	(133,925)	(330,550)
Renewal Costs	-	-	-	-	-	(15,939)	-	(15,939)
Total Outflows	(8,412)	(16,621)	(72,942)	(404,429)	(78,119)	(149,506)	(133,925)	(863,954)
Total Cash Outflow (Nominal)	(8,412)	(16,621)	(72,942)	(396,996)	15,728	(11,785)	373,637	(117,392)
VAT	(1,935)	(3,040)	(11,129)	(62,816)	(10,546)	(23,772)	27,013	(86,224)
Total Cash Outflow (Nominal, incl. VAT)	(10,347)	(19,661)	(84,071)	(459,812)	5,182	(35,557)	400,651	(203,615)

If the project delivery was commenced earlier the 2026-2030 cashflow profile will increase significantly. However the overall capital cost of the project would be reduced due to less inflation accruing.

6 | Delivery

Luas Finglas seeks to deliver a robust cost-benefit case, with a target BCR of 1.4. It is critical that TII is focused on the delivery of the project in a manner that increases the likelihood of realising the target benefits, while also achieving the best cost outturn possible. This will require a disciplined project management and risk management approach, as well as fit for purpose governance arrangements.

In this section we detail the emerging contracting and procurement strategy for Luas Finglas, project implementation considerations, the current project risk assessment, and the proposed governance arrangements, to best ensure the project is successfully delivered.

6.1 Emerging Contracting and Procurement Strategy

The procurement strategy guides the considered acquisition of works, goods and services in a manner which maximises value for money, aids the achievement of project and programme objectives and is consistent with EU and national law and regulations. The procurement strategy objectives aim to achieve the following:

- High quality of finished product
- Value for money
- Sustainability and Circular Economy
- Timely and efficient completion of works
- Flexibility
- Process risk minimisation
- Technical compatibility with the Luas network
- Systems integration with other future Luas projects

The emerging preliminary contracting and procurement strategy

At this preliminary business case stage, TII has undertaken a review exercise to assess its contracting and procurement options for Luas Finglas, drawing on the experience in delivering similar projects in the past, as well as appreciation for various project specific considerations. This assessment is preliminary in nature. A full and robust options assessment will be necessary as part of the Approval Gate 2 process.

The emerging procurement strategy is:

- To procure separately, the Enabling Works encompassing utility diversions, road augmentation, modification of wetlands, pitch reconfiguration & demolitions as Employer Designed based on either PW CF3 contract format or an NEC equivalent

- To procure separately, the Main Construction Works (including Bridge Structures) as a mandated Design & Build approach based on PW CF4 contract format or an NEC equivalent
- To procure separately, the Systems Works as a Design and Build mechanism based on PW CF4 contract format or an NEC or FIDIC equivalent. Further exploration of potential variations to this proposed approach is expected prior to Approval Gate 2, including for example, investigation on the possible derogation for using the CWMF suite of contracts in favour of a more innovative and collaborate approach such as the NEC form of contract.

Luas Finglas is an extension of the existing green line, the operation of which is procured using competitive tender process. As such, Luas Finglas will not be operated in isolation. The option for the operation of Luas Finglas will be included at the appropriate time during the cycle of contract renewals.

6.2 Implementation

The Construction of the Works is to be procured under Enabling Works contracts, a Main Works contract and a Power and Systems contract.

Enabling Works Contracts

The construction phasing will include certain enabling works being progressed in advance of a main contract to facilitate the construction of the Luas infrastructure and ancillary works and to reduce risk of delay to programme during the main works contract. The currently proposed Enabling Works Contracts are as follows.

- D100 Site Clearance/Demolitions - The scope of works to include certain elements of site clearance, removal of contaminated lands and demolitions identified as of benefit progressing in advance of the main construction works.
- D101 Utilities Diversions / Road Augmentation - Road augmentation combined with utility diversions performed in advance of the main infrastructure works will facilitate clearing of the swept path particularly along Broombridge Road and St Margaret's Road. Advanced works may also be of benefit at the other junctions where kerb lines are substantially staying the same. Some advance enabling works will also be required by the ESB in order to provide incoming electrical services to the Traction substations and other electrical infrastructure.
- D102 - Wetlands advance works - It is envisaged that it would be of benefit to construct the wetlands at Tolka Park in advance of the bridge construction so as to alleviate any delay to commencing this area of the main contract.
- D103 - Pitch reconfiguration - The pitch reconfiguration at Wellmount is to be progressed in advance so as to alleviate any delay to the main contract.

Main Works and Power and Systems

The Scheme has been divided into four distinct areas as part of the preliminary design, namely:

- Area 30 Broombridge Depot. This area includes for the provision of four stabling tracks and the extension of the pedestrian overbridge to cross the canal.
- Area 31 Broombridge to Tolka Valley Road: This area is approximately 850m long and includes two major bridge structures, the tie-in to the existing Luas Green Line at Broombridge and the crossing of Tolka Valley Park and Tolka River, no Luas stops are included in this section.
- Area 32 Tolka Valley Road to Finglas Village Stop: This area is approximately 1,450m long including two stops: St Helena's and Finglas Village.
- Area 33 North of Finglas Village Stop to the terminus (Charlestown Stop): This area is approximately 1,420m long and includes two stops: St Margaret's and Charlestown terminus. This area also includes a major road junction with the N2, and the whole section along St Margaret's Road. This area includes the Park & Ride.

The main civil works will encapsulate the following, non exhaustive, list of activities: site preparation works, Traffic Management, earthworks, track work, bridge construction, all power substation work (four locations), retaining wall structures, the Park & Ride, road, walking and cycling works, ticket vending machines and fit out, drainage, lighting, fixtures and fitting and hard and soft landscaping.

A separate Power and Systems will be procured as a Design and Build Contract. The phasing will allow for the development of the Power and Systems design and the progression of the construction phase in tandem with the latter stages of the Main Works when areas are made available.

The total Construction duration, excluding Enabling Works, is estimated at approximately 36-42 months with an additional 6-month Testing and Commissioning and trialling period.

6.3 Assessment of Delivery Risk

Risk Management and Function

The project team has created a live risk register for Luas Finglas. The register has identified risk events related to the pre-procurement, procurement, design and construction stages, and associated uncertainties and assumptions using light rail development experience from other jurisdictions, other Irish project experience and the experiences of the project team and technical advisors.

Risk management is a continuous activity and the risk assessment must continue to be refined, enhanced and updated as the project progresses. The risk register has two primary purposes:

- It is a proactive risk management and mitigation tool used to record, assess and analyse risks. This allows risks to be allocated to the party best placed to manage them and to identify/record mitigation strategies implemented to remove the risk, reduce the likelihood of it occurring and the impact if it does occur.

- To provide an input upon which an assessment can be carried out to establish a risk value for incorporation into cost estimates.

The register is in a continuous review and update cycle. As the project progresses, certain risks will expire (as the risk event will have passed for example or no longer be relevant). In other instances, new risks may be identified, perhaps by a bidder during the tender process, or due to a new technical standard or world event, or generally new information. This may occur through the procurement, design, or construction stages.

Accordingly, the approach to risk management as an active and ongoing function is critical to overall programme budget management and effective execution of contracting strategy. Furthermore, it has a significant and direct link to achieving overall value for money goals.

A robust approach including qualitative and quantitative analysis has been implemented to assess project risks.

Qualitative risk assessments are used to calculate a risk score which enables the project to determine the significance of specific known risks. The determination of risk significance feeds into risk quantification when assumptions around the probabilities and cost/delay impacts of specific risk events are developed.

In addition, quantification through a Quantitative Risk Assessment (“QRA”) is also performed, consisting of two elements:

- Quantitative schedule risk analysis (“QSRA”) to analyse the impact of known risk events and uncertainties to the project duration and completion date.
- Quantitative cost risk analysis (“QCRA”) including consideration of prolongation (cost impacts caused by schedule delays identified in the QSRA).

Both the QSRA and QCRA utilised a three-point estimate of schedule/ cost impact (low, medium, high) for a probable risk event. Monte Carlo simulation is utilised to generate a risk cost distribution (for the QCRA).

To assist in appropriate risk management and mitigation activity, various project activities have been identified as having critical impacts on the project schedule and therefore have the greatest potential to generate delay costs. Risk events that impact these tasks must be managed effectively to reduce the delay cost risk implications on the project budget.



















Risk information (such as risk registers, risk reports and subsequent risk analysis) are reviewed on an on-going basis, as the project proceeds through its lifecycle. The aim of these efforts is to recognise project progress, and to facilitate risk-based decision making using the most up to date and accurate information and methods available.



















Key risks (those with an overall high or critical risk rating), including risk management associated with the project currently are detailed below:

C	CRITICAL RISK
H	HIGH RISK
M	MEDIUM RISK
L	LOW RISK

PROBABILITY						
Over 75%	Almost Certain 5	5	10	15	20	25
50 to 75%	Likely 4	4	8	12	16	20
26 to 49%	Possible 3	3	6	9	12	15
10 to 25%	Unlikely 2	2	4	6	8	10
0 to 9%	Rare 1	1	2	3	4	5
	IMPACT	Insignificant 1	Minor 2	Moderate 3	Major 4	Critical 5

Table 6.1 Current Key Risks

Risk	Cause/Event/ Effect	Impact	Mitigation
Scope changes / variations - amendments to the Employers Requirements arising from ambiguous or incorrect Employer's Requirements and / or changes to standards	Scope Changes / Variations issued during the contract	Contractor claims for additional cost and delay  Probability: 5 (Almost Certain)  Impact: 5 (Critical)  Overall: 25 (Extreme)	Prior to issue of tender documents review all current design standards and update design as necessary / permitted. Check for any inconsistencies in documentation
Location of Park & Ride	Difficulties with landowner negotiations, timing of existing landowner development works, CPO procedures	Delays to the Programme, Risks in relation to securing planning, landowner agreements, additional scheme extents and costs  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Engage with property owners as early as possible, assess implications of any extension to scheme. Obtain early agreements with landowner. Consider inclusion of land in Railway Order Compulsory Purchase order
Irish Rail Interface	Obtaining Agreements - delay to bridge approvals	Re-working designs, Delays to the Construction Programme  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Early and regular engagement with Irish Rail to agree parameters, forms of structure, etc. Consideration of developing the detail design and associated approvals in advance of the main construction contract.
Failure to record new and decommissioned utilities following utility advance works contracts	Enabling Works Contractor not recording correct location of diverted services	Claims from Main Infrastructure Contractor  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Fully defined requirement and contractual conditions.
Garda PEM Building	Delays by the OPW in relocating the Garda PEM building	Contractual claims for non-possession of site  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Keep liaising with an Garda Siochana (AGS) and the OPW in relation to the relocation of the PEM building. Do not award the main works contract without full possession of the site.
Unforeseen Utilities (advance works)	Unforeseen Utilities	Additional liaison with utility companies, additional relocations, additional scope  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Complete GPR Surveys, CCTV and slit trenching. On-going liaison with all utility companies

Risk	Cause/Event/ Effect	Impact	Mitigation
Traffic Management (TM)	Delays in Approvals from DCC / FCC and / or Poor TM planning / phasing /additional TM requirements	Contractual claims  Probability: 4 (Likely)  Impact: 3 (Moderate)  Overall: 12 (High)	Early discussions with DCC/ FCC, Define time allowances in contract - for approvals, etc strong supervision
Unforeseen Utilities (Main Civils Contract)	Unforeseen Utilities	Additional liaison with utility companies, additional relocations, additional scope  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Complete GPR Surveys, CCTV and slit trenching. On-going liaison with all utility companies
Other 3rd parties infrastructure / developments	Overlapping construction time and site 1. additional interfaces / coordination required. 2. PSCS Conflict or additional PSCS requirements for Main Contractor 3. Claims by main contractor due to working restrictions	Additional costs, claims and programme delays  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Early discussion with possible stakeholder early agreement
Delays due to non-attendance of utility companies	Outages are required before work is undertaken on or near ESB Transmission Cables or BGE Main, testing, connections. Delay to works until an Outage/supervision/ acceptance can be obtained. Contractor held risk/responsibility to liaise with utility companies	Additional scheme costs and programme extension  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	1. Fix construction methodology/establish process with Statutory Authorities by early agreement for sequencing and durations 2. Programme discussions with utility companies 3. Contractors' responsibility as outlined in the Works Requirements.
Acquiring Land & Property	Land & Property values increasing or be re-zoned to become more valuable	Increase to land and property costs  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Monitor land costs and liaise with DCC / FCC with regard to potential re-zoning of land
Systems global supply issues	Worldwide shortages of microchips, economic sanctions, transportation delays, war, Asian conflicts (e.g. China / Taiwan), would each contribute to shortages in the availability of microchips for many systems equipment	Lead times for systems equipment would be dramatically increased Delays to service commencement, additional construction costs due to supply shortage and demand  Probability: 4 (Likely)  Impact: 4 (Major)  Overall: 16 (High)	Monitor availability of systems equipment. Review timing of awarding systems contract.

Risk	Cause/Event/ Effect	Impact	Mitigation
Direct Impact on commercial properties and dwellings	Acquisition of properties or part of properties	Impact on access, reduced parking area, viability of business, objections to the scheme ■ Probability: 4 (Likely) ■ Impact: 3 (Moderate) ■ Overall: 12 (High)	Clear record of decision making including justification of route alignment, identifying the requirement and extent of property included in the Compulsory Purchase Order/ Railway Order
Inflation higher than anticipated	Inflation of material and/ or labour higher than anticipated	Additional costs to the construction contracts ■ Probability: 3 (Possible) ■ Impact: 4 (Major) ■ Overall: 12 (High)	Monitor inflation rates
Contaminated Ground	Potential for contaminated ground particularly in Tolka Valley and St Helena's	Programme delays, additional costs associated with disposal. ■ Probability: 4 (Likely) ■ Impact: 3 (Moderate) ■ Overall: 12 (High)	Undertake Ground Investigations and testing
Construction above live railway line	Interface issues with Irish Rail, agreement on possession times, possible interface issues with Irish Rail Dart + project construction works	Impact on live railway, additional constraints imposed during construction ■ Probability: 3 (Possible) ■ Impact: 4 (Major) ■ Overall: 12 (High)	Close liaison with Irish Rail, early agreements, monitor Dart + programme, consider advance works bridge design and construction
Objections to the scheme by local resident groups / communities	Challenges to the scheme due to impacts, route choice, safe access	Delays to the scheme, additional scheme costs ■ Probability: 4 (Likely) ■ Impact: 3 (Moderate) ■ Overall: 12 (High)	Clear justification for route choice, develop design to minimise impact, engage with landowners

6.4 Governance

A Luas Finglas governance framework has been established to align with the requirements of the Government's PSC and integrates with the corporate governance requirements of TII (as the Sponsoring Agency) and the NTA (as Approving Authority).

This framework describes the involved parties and the framework for approvals and reporting requirements during the delivery of Luas Finglas.

Table 6.2 The involved parties and their associated roles in the Luas Finglas governance framework

Involved Parties	Role	Responsibility
Government	Ultimate Approving Authority	Government consent is required at specified Approval Gates.
Department of Public Expenditure, NDP Delivery and Reform	Technical Review	An independent technical review will be carried out at specified Approval Gates
Department of Transport	The Parent Department	It is the responsibility of the Parent Department to facilitate seeking Government approval at specified Approval Gates. The Parent Department is also responsible for managing overall capital budgets and ensuring that policies and procedures are in place to comply with the Public Spending Code.
Major Projects Governance Oversight Group	Major Transport Investment in Bus and Rail	Oversight group (chaired by Department of Transport) provides challenge at a central Government level.
National Transport Authority	Approving Authority	The Approving Authority has ultimate responsibility for Luas Finglas.
Transport Infrastructure Ireland	Sponsoring Agency	The Sponsoring Agency has primary responsibility for evaluating, designing, tendering, managing design and construction contracts, supervising the works, testing and commissioning and operating/maintaining Luas Finglas.
Project Board	Luas Finglas Specific	<p>The Luas Finglas Project Board is a governance function whose role is to oversee the project and is the main decision-making body on matters not reserved for the Approving Authority’s and Sponsoring Agency’s Boards or Government.</p> <p>The Project Board is a key approver for most decisions on Luas Finglas which do not require elevation to the NTA as the Approving Authority or beyond. The Project Board will take responsibility for forming the Luas Finglas strategy and overseeing the delivery of Luas Finglas. It will endorse all documents required to be referred to the TII Board, NTA Board, or Government and will be responsible for communication with the other key stakeholders identified above.</p> <p>The Project Board is responsible for the monitoring and management of the project in accordance with the monitoring and evaluation plan (Section 6.5)</p>

Approving Framework

NTA is the Approving Authority for day to day approving functions, however, in line with the Public Spending Code (PSC), 28th March 2023 update, Government consent is required at the following two Approval Gates:

- 1.** Preliminary Business Case (Approval Gate 1)
- 2.** Final Business Case to award the contract (Approval Gate 3)

As required by the Public Spending Code, at each of the above Approval Gates, Government consent will be facilitated by

the Department of Transport, which has put in place arrangements, including external assurance of project documentation and the establishment of a Major Projects Governance Oversight Group, to assist in the discharge of its obligations under the Public Spending Code. The Public Spending Code currently requires that the Preliminary Business Case be subject to a technical review by the Department of Public Expenditure, NDP Delivery and Reform prior to consideration by Government.

The PSC requires approval processes prior to implementation which includes Approval Gates by the Approving Authority at:

1. Preliminary Business Case (Approval Gate 1)
2. Design & Panning and Procurement to proceed to tender (Approval Gate 2)
3. Final Business Case to award the contract (Approval Gate 3)

The relevant Minister and Accounting Officer (Department of Transport) are responsible for approval at Approval Gate 2, pre-tender stage

Reporting Framework

Throughout the lifecycle of the project, the Luas Finglas Project Board will be the primarily responsible body for Luas Finglas on all matters not reserved for the Approving Authority's and Sponsoring Agency's Boards or Government and will be given the necessary delegated authority to carry out this function by the TII and NTA Boards.

The Luas Finglas Project Board (composed of senior executive NTA and TII representatives) will be responsible for regularly updating and informing NTA and TII throughout the life cycle of the programme.

The Luas Finglas governance framework will provide:

- **Informed decision making:** Well-defined reporting protocols and procedures will allow for the timely dissemination of information to inform decision making;
- **Oversight:** The governance framework clearly identifies the day-to-day reporting framework for the programme, highlighting the decision and information flows between stakeholders at each level including NTA as the Approving Authority and TII as the Sponsoring Agency. The reporting framework ensures that the Luas Finglas Project Board, the TII Board and the NTA Board, Department of Transport and the Government will be aware of project developments in a timely manner, allowing for early intervention and action;
- **Scrutiny and challenge:** Independent experts and TII will provide scrutiny and challenge the Project Team. Robust challenge will also come from a central Government level, through the Department of Transport's Major Projects Governance Oversight Group; and

- **Accountability:** A programme specific governance framework has been established, clearly identifying the roles and responsibilities of each stakeholder. This framework ensures risk can be managed in a controlled manner and that appropriate levels of authority and accountability are assigned to enable key decisions to be made throughout the lifecycle. A strong leadership team is being put in place with clear, single point accountabilities to enable the Project Director to take a strategic role – ensuring the key strategies and plans are in place, with a focus on managing upwards and outwards and looking ahead to deal with upcoming risks / issues before they impact.

Luas Finglas Delivery Team

TII has gained significant LRT project delivery experience to date. The delivery of complex capital programmes such as Luas Cross City in recent years, has resulted in significant in house expertise and competency being built up. Added to this existing competency and capability set, TII has retained an engineering designer - ED - (Barry Transportation EGIS), a commercial advisor (Turner & Townsend) and Land Valuer advisors (Lisneys) among other specialists to aid with the delivery of the

design, railway order and cost estimates for the planning phase of the project. There will be a requirement for other advisory support as the project moves through the project lifecycle.

The day-to-day leadership for the project will be undertaken by the Project Director. This role is to:

- Act as “sponsor”, own the case for investment and is accountable for the outcomes and benefits;
- Direct and manage the delivery of the project to meet Luas Finglas’s Overarching Objectives;
- Ensure compliance with relevant legislation and regulations;
- Liaise with the Project Board, TII, NTA and other stakeholders;
- Adhere to Quality and Safety guidelines;
- Ensure the project delivers value for money; and
- Perform such other duties as are necessary.

The Project Director will act as the nexus between the Project Board and the project team.

6.5 Monitoring and Evaluation Plan

Monitoring and Evaluation

Monitoring and evaluation of the implementation of Luas Finglas will be essential to understand the issues around:

- the development of the scheme (effectively a process evaluation); and
- the delivery scheme impacts (the impact evaluation).

There is an opportunity arising from the implementation of Luas Finglas to ensure transfers of knowledge and processes for any ongoing or new proposals for delivering additional Luas lines, particularly Luas Lucan and Luas Cork that are currently at route options selection stage.

As set out in the Transport Appraisal Framework, the formal Project Completion Report will be prepared just prior to the completion of the project as a review of delivery of Luas Finglas. Also set out in the guidance is the requirement for a later Ex-Post Evaluation within 5 years of completion of Luas Finglas.

The initial development of the requirements for the Project Completion Report and the Ex-Post Evaluation are set out in this section of the PBC so required baseline data can be collected and plans put into effect for the monitoring of the delivery and operation of Luas Finglas.

The Review and Ex-Post Evaluation Plans will be refined at Final Business Case (FBC) stage. These plans will build on the Monitoring and Evaluation logic path model outlined in Figure 6.7 to illustrate the linkages between primary project inputs, outputs and short and medium term outcomes and long- term impacts.

Furthermore, a Benefits Realisation Plan will be prepared at FBC stage, effectively allocating a responsibility to ensure the expected benefits of the scheme are delivered.

Project Completion Report

The Project Completion Report will consider elements of the process evaluation and early elements of the impact evaluation, with the aim to determine that:

- the basis on which the project was undertaken proved correct;
- the business case and management procedures were satisfactory; and
- the operational performance and initial benefits have been realised.

The initial development of the Project Completion Report should run in parallel to completion of the scheme to ensure that feedback can be obtained from the contractor and promoter teams before the teams are disbanded on project completion. The reports should draw on project development documentation, the business case appraisals, tendered and actual delivery costs and provisional benefits assessments, including formal and informal feedback from stakeholders.

Following delivery of the Project Completion Report, a Monitoring Plan will maintain and develop the data sources used in the provisional benefits assessments, looking towards the development of the ex-post evaluations.

Ex-Post Evaluation

There is a risk that any ex-post evaluation can become disproportionate and impractical with a focus on ‘interesting’ impacts that are very difficult and costly to measure and assess, such as seeking to attribute economic benefits to the individual elements of scheme delivery. It is envisaged, therefore, that the ex-post plans will seek to:

- Ensure that the effort and resources dedicated to the ex-post evaluation are proportionate, and that any efficiencies in handling the ex-post evaluations across projects by using common processes and data are realised;
- Develop an assessment of the performance of the transport and socio-economic benefits against the overarching objectives, the project objectives and anticipated benefits of the scheme;
- Revisit the business case appraisals to confirm that the key project assumptions were correct and if the anticipated costs were broadly as expected, including capital costs and maintenance cost. This review should also consider whether the expected benefits, both quantified and qualitative have materialised over time;
- Undertake interviews with key stakeholders (and potentially, transport users, local businesses and wider society) to understand project delivery and acceptance, and to consider the value of the Luas Finglas Project relative to a number of realistic of counterfactuals; and

- Consider the potential use of Value for Money Review or Focused Policy Assessment methodologies to look at the efficiency, effectiveness and/or impact of the Luas Finglas Project.

Some of the objectives for Luas Finglas (such as promoting economic growth for the residents and businesses of Charlestown, Finglas and the surrounding areas) will take several years to be apparent. To ensure that these are fully captured, a second evaluation may be carried out at the 10-year point to ensure that every benefit has been captured, even those which took many years to develop. If possible, this evaluation will be timed around the 5-yearly Census and associated release of anonymised Census data which can take up to 18 months. This anonymised data will be the primary source of information on population, employment, travel and other socio-demographic indicators, which are intrinsically linked to the benefits of Luas Finglas and for which a longitudinal and comparable dataset exists. For this reason, the ex-post evaluation may not fall perfectly into five and ten year periods.

Monitoring and Evaluation Indicators

The logic map first introduced in Chapter 2 is further developed here to show the relationship between monitoring and evaluation indicators and the outputs, outcomes and anticipated impacts of Luas Finglas. The table below provides further detail on the potential performance indicators identified at PBC stage and data sources that can be used for monitoring and evaluation purposes.

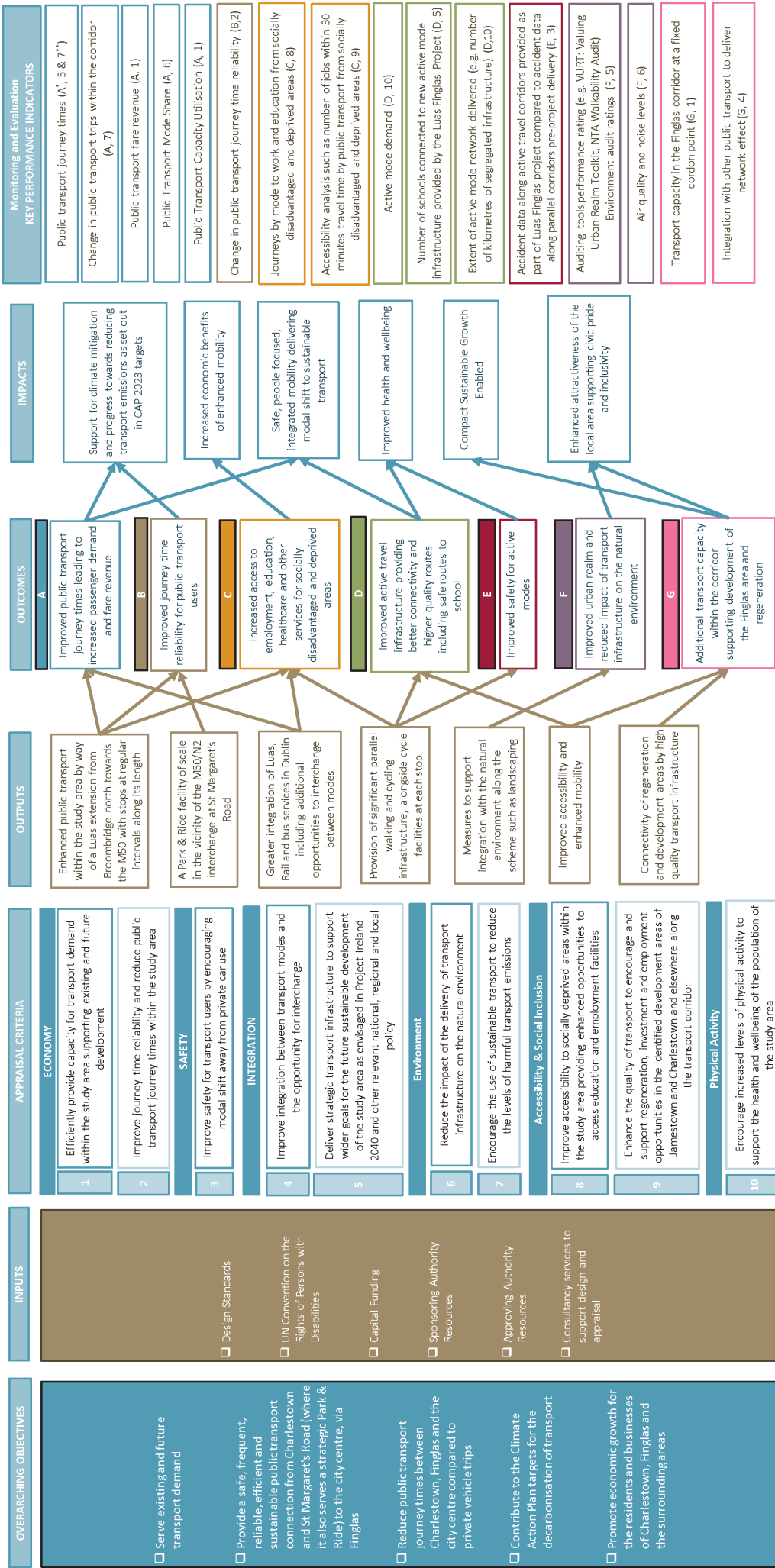
It is not proportionate at PBC stage to assign final metrics and targets for the different impacts. This will be defined at FBC stage based on the updated economic analysis, availability and cost of baseline data and monitoring effort. The potential indicators included in Table 6.3 are not exhaustive, and not all will be included within the final monitoring and evaluation plan. In some instances, multiple indicators could be combined to produce a single overall indicator, yet this will be determined at FBC stage.

Where possible, readily available key performance indicators and data sources are leveraged. For example, from existing monitoring processes, including historical and baseline data covering passenger demand patterns. New analysis and primary research approaches may be needed to address some other key issues, for example covering wider user and business perceptions of the value of the Luas Project; the established Luas customer satisfaction surveys are unlikely to offer the sample sizes required for a robust analysis and would not be readily able to focus on particular outcomes from the scheme.

In all cases where new data is sought, especially involving primary research, there will be a need to ensure proportionality in allocating resource for evaluation purposes.

Further details on the Monitoring and Evaluation Plan is set out in Appendix F.

Figure 6.1 Luas Finglas Monitoring and Evaluation Logic Map



* Link to key Outcomes

** Link to Appraisal Criteria

Table 6.3 Potential Key Performance Indicators

Ref	Outcomes	Potential Key Performance Indicators	Potential Data Sources	Timing
A	Improved public transport journey times leading to increased passenger demand and fare revenue	<ul style="list-style-type: none"> Public transport journey times Change in public transport trips within the corridor Public transport fare revenue Public transport mode share Public transport capacity utilisation 	<ul style="list-style-type: none"> Luas operational data and bus AVL Census total public transport trips data and mode share data Annual public transport surveys Luas fare revenue 	<ul style="list-style-type: none"> Journey times to be examined within Project Completion Report Change in public transport trips and fare revenue to be periodically monitored from start of project operation to Ex-Post Evaluation
B	Improved journey time reliability for public transport users	<ul style="list-style-type: none"> Change in public transport journey time reliability 	<ul style="list-style-type: none"> Bus AVL data as baseline Luas operational data 	<ul style="list-style-type: none"> Baseline data collected pre operation of Luas Finglas Luas operational data gathered at start of project operation and periodically until Ex-Post Evaluation
C	Increased access to employment, education, healthcare and other services for socially disadvantaged and deprived areas	<ul style="list-style-type: none"> Journeys by mode to work and education from socially disadvantaged and deprived areas Accessibility analysis such as number of jobs within 30 minutes travel time by public transport from socially disadvantaged and deprived areas 	<ul style="list-style-type: none"> Census data Accessibility tools (e.g. PTAL) 	<ul style="list-style-type: none"> Census data as available Accessibility analysis immediately pre and post implementation (to reduce the impact of external factors)
D	Improved active travel infrastructure providing better connectivity and higher quality routes including safe routes to school	<ul style="list-style-type: none"> Active mode demand Number of schools connected to new active mode infrastructure provided by the Luas Finglas Project Extent of active mode network delivered (e.g. number of kilometres of segregated infrastructure) 	<ul style="list-style-type: none"> Active mode counters Luas project construction data Analysis of school connectivity to active travel infrastructure delivered as part of the Luas Finglas project 	<ul style="list-style-type: none"> During project design At project completion
E	Improved safety for active modes	<ul style="list-style-type: none"> Accident data along corridors of active travel provided as part of Luas Finglas project compared to accident data along parallel corridors pre-project delivery 	<ul style="list-style-type: none"> Accident data along active mode corridors provided as part of the Luas Finglas project Accident data along parallel routes Surveys of residents to assess perceived safety (Potential to leverage NTA Walking and Cycling Index, though likely limited given sample size and likelihood to be specific to the geography of Luas Finglas) 	<ul style="list-style-type: none"> Accident data is collected habitually by the Road Safety Authority and should be available for analysis as required Surveys of users to be undertaken post project completion and periodically until Ex-Post Evaluation.
F	Improved urban realm and reduced impact of transport infrastructure on the natural environment	<ul style="list-style-type: none"> Auditing tools performance rating (e.g. VURT: Valuing Urban Realm Toolkit, NTA Walkability Audit) Environment audit ratings Air quality and noise levels 	<ul style="list-style-type: none"> Audits Periodic surveys Noise receptors (existing or bespoke) Air quality receptors (existing or bespoke) 	<ul style="list-style-type: none"> Before construction At project completion Prior to Ex-Post Evaluation
G	Additional transport capacity within the corridor supporting development of the Finglas area and regeneration	<ul style="list-style-type: none"> Transport capacity in the Finglas corridor at a fixed cordon point Integration with other public transport to deliver network effect 	<ul style="list-style-type: none"> Traffic data and public transport capacity calculations Quality and frequency of interchange opportunities 	<ul style="list-style-type: none"> Prior to construction of Luas Finglas At start of Luas Finglas operation Prior to Ex-Post Evaluation

Understanding how Luas Finglas achieves the Overarching Objectives

The PBC has demonstrated how the Overarching Objectives for Luas Finglas align with specific, measurable, attributable, realistic and time-bound outcomes. Through the monitoring and evaluation key performance indicators it will be possible to ascertain how well Luas Finglas is performing against the Overarching Objectives. The following provides an outline of linkages that show how the performance of Luas Finglas against the Overarching Objectives can be understood through the analysis of particular KPIs:

Serve existing and future transport demand

Measurable through: Patronage defined as the number of people using Luas Finglas; and Transport capacity in the Finglas corridor at a fixed cordon point.

- Linked KPI: Change in public transport trips within the corridor
- Linked KPI: Active mode demand within the corridor
- Linked KPI: Public transport capacity utilisation
- Linked KPI: Transport capacity in the Finglas corridor at a fixed cordon point

Provide a safe, frequent, reliable, efficient and sustainable public transport connection from Charlestown and St Margaret's Road (where it also serves a strategic Park & Ride) to the city centre, via Finglas

Measurable through: KPI performance monitoring for frequency and reliability; accident data.

- Linked KPI: Public transport capacity and utilisation
- Linked KPI: Change in public transport

journey time reliability

- Linked KPI: Accident data

Reduce public transport journey times between Charlestown, Finglas and the city centre compared to private car trips

Measurable through: Average journey time comparisons between Charlestown, Finglas and the City Centre for Luas Finglas and private car.

- Linked KPI: Public transport journey times

Contribute to the Climate Action Plan targets for the decarbonisation of transport

Measurable through: Reduction in carbon emissions from transport related to travel in the Finglas corridor; and Carbon emissions related to Luas Finglas.

- Linked KPI: Change in public transport mode share within the corridor

Promote economic growth for the residents and businesses of Charlestown, Finglas and the surrounding areas.

Measurable through: Uplift in population and employment in area of influence of the scheme available from Census data.

- Linked KPI: Journeys by mode to work and education from socially disadvantaged areas within the corridor
- Linked KPI: Accessibility analysis of jobs within 30 minutes travel time from specific areas along the corridor

Over time many other factors will change that will influence travel demand and isolating the contribution of Luas Finglas will be a challenge. The use of large datasets that enable comparisons with areas outside the catchment of Luas Finglas will help address this challenge. For example the use of Census data as referenced in the monitoring and evaluation approach.

7 | Next Steps

7.1 Introduction

The delivery of this Preliminary Business Case is an important milestone for Luas Finglas as it sets out to all stakeholders, a summary of where Luas Finglas progress is today, and the large degree of work and diligence conducted to date, including:

- Development of the preliminary design and identification of the best performing route and technology
- Risk management plans and detailed understanding of the issues and known risks and initial mitigation strategies for same
- A relatively high degree of certainty with regards to the project costs (including risk impacts) and an appropriate risk allowance for unknown risks
- Significant benefits which Luas Finglas can deliver providing value for money under various sensitivities, and a 'Core' BCR of 1.4
- A robust rationale for proceeding in line with CAF for transport projects and the PSC

Aligned with the PSC, this Luas Finglas Preliminary Business Case is required to be reviewed by the Department of Public Expenditure and Reform. Together with the review report from the Department of Public Expenditure and Reform, this Preliminary Business Case will seek "Approval in principle" from NTA and Government, to proceed through Approval Gate 1 of the Public Spending Code.

7.2 Key Milestones

There are several key near-term milestones for Luas Finglas, which need to be achieved to maintain the Luas Finglas schedule and avoid unnecessary inflationary pressures on the project budget:

Milestone	Anticipated Timeline
Preliminary Business Case Submission	Quarter 2 2023
Approval in Principle: Approval Gate 1	Quarter 3 2024
Submit Railway Order Application	Quarter 4 2024
Railway Order Granted	Quarter 1 2026
Approval to Proceed to Tender: Detailed Business Case, Project Design, Planning and Procurement Strategy Submission Approval Gate 2	Q2 2028
Tenders Issued	Q1 2030
Final Business Case Submission	2030
Approval to Proceed: Post-tender – Final Business Case Approval Gate 3	2030

The initial milestones to the submission of the railway order are fixed, however subsequent milestones could be influenced by the duration of the planning process and availability of funding which may allow for earlier delivery of Luas Finglas.

7.3 Delivering on the Milestones

If Approval in Principle is received, the next major milestone for Luas Finglas is the submission of the Railway Order Application. To meet this milestone and maintain overall project schedule, work on the Railway Order Application will be ongoing during the period of review of the Preliminary Business Case.

Other workstreams that support tender document development, project brief and procurement strategy refinement, or obligations of the project for other reports such as the environmental impact reportings will be advancing during the review of the Preliminary Business Case. This will allow the project to maintain its timetable on the assumption of a positive approval in principle in Q4 2023 / Q1 2024.

After the submission of the Railway Order, but before tenders are issued, Luas Finglas will submit its Detailed Project Brief, Detailed Business Case and full Procurement Strategy to support decision making at Approval Gate 2. Only with approval to proceed at Approval Gate 2 will Luas Finglas issue tenders for works.

Once preferred tenders are identified, the Final Business Case can be prepared for consideration in the final Approval Gate 3.

Having received tender prices, Luas Finglas's value for money expectation will be updated, along with benefit realisation plans and associated monitoring and evaluation plans. No tender can be awarded until the project receives approval to pass through Approval Gate 3 as well as an Enforceable Railway Order.

7.4 Recommendation to the Approving Authority

This Preliminary Business Case is submitted seeking approval in principle to continue to advance Luas Finglas. The process from Preliminary Business Case (Approval Gate 1) to Final Business Case (Approval Gate 3) is a structured set of steps designed to ensure that a project is designed and prepared to the highest possible standard to minimise project costs, maximise value for money and project impact.

Passing through Approval Gate 1 does not create an obligation on the part of the approving bodies to automatically allow for Luas Finglas to pass through subsequent gates which will be and should be assessed based on the merits of the updated documentation submitted. TII is fully aware of this and it is on this basis that it is pleased to submit this Preliminary Business Case for review and acceptance.

Appendix | A

Glossary of Terms

Abbreviation	Definition
BCR	Benefit to Cost Ratio
BNG	Biodiversity Net Gain
CAF	Common Appraisal Framework
CAP23	Climate Action Plan 2023
COBALT	Cost and Benefits to Accidents Light Touch
CO₂	Carbon Dioxide
DCC	Dublin City Council
DoT	Department of Transport
DPER	Department of Public Expenditure and Reform
EIAR	Environmental Impact Assessment Report
ENEVAL	Environmental Evaluation Model
EPR	Emerging Preferred Route
ERM	East Regional Model
EU	European Union
GDA	Greater Dublin Area
GIS	Geographical Information Systems
KPI	Key Performance Indicator
LRT	Light Rail Transit
LRV	Light Rail Vehicle
MCA	Multi Criteria Analysis
NDP	National Development Plan
NIFTI	National Investment Framework for Transport in Ireland
NO_x	Nitrous Oxide
NPF	National Planning Framework

Abbreviation	Definition
NPV	Net Present Value
NTA	National Transport Authority
NWCS	North West Corridor Study
OPEX	Operation and maintenance costs
PAG	Transport Infrastructure Ireland Project Appraisal Guidelines
PBC	Preliminary Business Case
PM10, PM2.5	Particulate Matter, PM10 has diameter of 10 microns or less, PM2.5 has diameter of 2.5 microns or less
PSC	Public Spending Code, 2019
P30/P50/P80	Risk adjusted cost that provides a 30%/50%/80% probability that the overall outturn cost will be at, or less than, that figure
RCF	Reference Class Forecasting
RMS	NTA's Regional Modelling System
RSES	Regional Spatial & Economic Strategy
SAR	Strategic Assessment Report
SDRA	Strategic Development and Regeneration Area
TEAM	TII Tool for Economic appraisal of Active Modes
TII	Transport Infrastructure Ireland
TUBA	Transport User Benefit Analysis
VAT	Value Added Tax

Appendix | B

Sustainability Plan

Luas Finglas Preliminary Design & Statutory Process



Sustainability Plan

May 2023



Document Control Sheet

Client:	Transport Infrastructure Ireland
Project Title:	Luas Finglas Preliminary Design & Statutory Process
Document Title:	Sustainability Plan
File Name:	LDD101-BEV-GN-ROUT-XX-RP-LE-00002
Suitability:	Suitable for review and comment

Table of Contents <i>(incl. Y/N)</i>	List of Tables <i>(incl. Y/N)</i>	List of Figures <i>(incl. Y/N)</i>	Pages of Text <i>(No.)</i>	Appendices <i>(No.)</i>
Y	N	Y	31	0

Document Information:		Verification:	Name:
Revision:	<i>P04.04</i>	Originator	<i>J.Fallon</i>
Description:	<i>For Preliminary Business Case Appendix Inclusion in Preliminary Business Case</i>	Quality Checker	<i>J.Fallon</i>
Date:	<i>2023-06-01</i>	Approver	<i>E.Daly</i>

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SECTION 1: INTRODUCTION

Barry Transportation EGIS have been appointed by Transport Infrastructure Ireland (TII) to undertake the Luas Finglas Preliminary Design and Statutory Process.

Luas Finglas involves the proposed extension of the Luas Green Line from its current terminus in Broombridge to Finglas. The preferred route (PR) for the proposed extension is approximately 3.9 km long and includes four new stops, St Helena's, Finglas Village, St Margaret's Road and Charlestown. The scheme also includes cycle and pedestrian path along much of the route, a 350-vehicle Park and Ride facility near the St Margaret's Road stop close to the M50, and an extension to the tram storage area at the Hamilton Depot at Broombridge. The route will provide interchange opportunities with bus networks at 3 of the 4 proposed stops and to the rail network via the existing Luas Broombridge Stop. Most of the route will be built using grass track which is a sustainable innovation for urban transport in Ireland.

Luas Finglas aligns with several objectives of Project Ireland 2040, the government's overarching National Planning Framework plan for the state. With the increased emphasis on sustainability, climate change emergency and protection of our environment the project enables compact growth, sustainable mobility, access to services like education and healthcare, and crucially, a transition to a low carbon society. The scheme aims to serve the existing and future demand, provide a safe, reliable, efficient, environmentally friendly and socially inclusive public transport connection from the M50 to the city centre, via Finglas and Broombridge. It will use part of the existing Luas Green Line and reduce public transport journey times between Charlestown-Finglas and the city centre.

The current stage of the proposed Luas Finglas project requires Barry Transportation EGIS to develop a reference design to a level suitable for the purposes of supporting a Railway Order Application to An Bord Pleanála.

This document presents the Sustainability Plan for Luas Finglas. The purpose of this document is to establish the plan for addressing the key sustainability challenges, risks and opportunities to the Luas Finglas scheme and its long-term planning and operation. This document provides basis of the project's approach to sustainability and how the design and implementation will be undertaken. This Plan promotes the benefits of the project and addresses the socio-economic and environmental issues.

The Sustainability Plan will be updated as the project progresses, and this will ensure that sustainability is at the core of the project and central to the decision-making process.

To support this sustainability plan, a Sustainability Tracker will be developed as a framework mechanism to track sustainability performance throughout the project progresses and support evidencing of progress towards to fulfilling the Luas Finglas sustainability targets.

1.1 Relevant Plans, Policy and Guidelines

The report has been prepared by Barry Transportation EGIS in consultation with the following guidelines:

- Sustainable Development Goals, United Nations;
- Project Ireland 2040, National Planning Framework, Department of Housing, Local Government and Heritage (2019);
- The Sustainable Development Goals National Implementation Plan 2022-2024, Department of Communications, Climate Action & Environment (2022);
- National Development Plan 2021-2030, Department of Public Expenditure and Reform (2021);
- Sustainability Implementation Plan, TII;
- TII Statement of Strategy 2021 to 2025, TII (2020);
- Environmental Strategy, TII (2019);

- Applying a Gender Lens to TII Public Transport Projects, TII (2021);
- Dublin City Council Climate Action Plan 2019 – 2024 (2020);
- Transport Strategy for Greater Dublin Area 2016-2035, NTA (2015);
- National Biodiversity Action Plan 2017-2021, Department of Culture, Heritage and the Gaeltacht;
- Dublin City Biodiversity Action Plan 2021-2025, Dublin City Council (2021);
- All Ireland Pollinator Plan 2021-2025, National Biodiversity Data Centre (2021);
- Dublin Region Air Quality Plan 2021, Dublin City Council, Fingal County Council, South Dublin County Council and Dun Laoghaire-Rathdown County Council (2021).

SECTION 2: PROPOSED DEVELOPMENT

2.1 Site Location

Luas Finglas is the proposed new northern extension of the Luas Green line from its current terminus in Broombridge to a new terminus in Charlestown, refer to PR in Figure 1. The PR for the Luas Finglas is 3.9 km long and has four new stops.

A non-statutory consultation for the Luas Finglas Emerging Preferred Route (EPR) took place from Tuesday 28th July to Thursday 17th September 2020. A PR has been developed based on the primary changes made to the emerging preferred route (EPR) as a result of the feedback received during the consultation.

After leaving Broombridge Stop, also serving the railway station, the Luas corridor turns north where it will overpass both the Royal Canal and the Maynooth railway line. The Luas Finglas will enter the Tolka Valley Park adjacent to the protected structure, the Finglas Wood Bridge (RPS 906), which will be fully preserved and protected in situ. From here it will cross the park on a new bridge approaching Tolka Valley Road in proximity of the Carrigallen Estate. The new bridge of the Tolka River will carry two tracks and cycle lanes. The bridge is anticipated to have a span of 70m. The St Helena's stop has been relocated slightly north closer to St Helena's Road to improve accessibility and interchange with bus routes. The alignment has also been slightly shifted to preserve trees and improve the pedestrian facilities. As the line continues north, the alignment has been shifted to the east of the original proposal to avoid bisecting the Farnham Park playing pitches. This will reduce environmental and visual impacts while enhancing Luas operational safety. The alignment has also been adjusted when it crosses Wellmount Road, to preserve trees that had been impacted by the EPR.

The PR for Luas Finglas also changes from the EPR as it enters Finglas village, to ensure the Finglas Village stop design integrates with proposals in the local area plan. The route continues straight along Cardiff Castle Road, passing through a new corridor created within the Garda Station car park, making its eastern turn onto Mellows Road, where the stop will be located, aligned east/west. The newly positioned stop will be more open and accessible with visual links as well as walking and cycling links enabling direct interchanges with bus services along Mellows Road. The route then proceeds north along the Mellows Park, with the proposed stop on St Margaret's Road to the other side of Finglas Road opposite to Lidl supermarket. The proposed stop will be closer to newly rezoned Jamestown Industrial Estate, providing improved accessibility to existing and future residential and commercial development. The route then continues from the Finglas Road (R135) junction along the eastern side of St Margaret's Road, mainly off-road or segregated from the traffic in grass track until it reaches the terminus stop at Charlestown. On-street cycle facilities will be provided on both sides of St Margaret's Road. This stop provides convenient access to the Charlestown Shopping Centre, high-density residential areas and the Jamestown Industrial Estate.

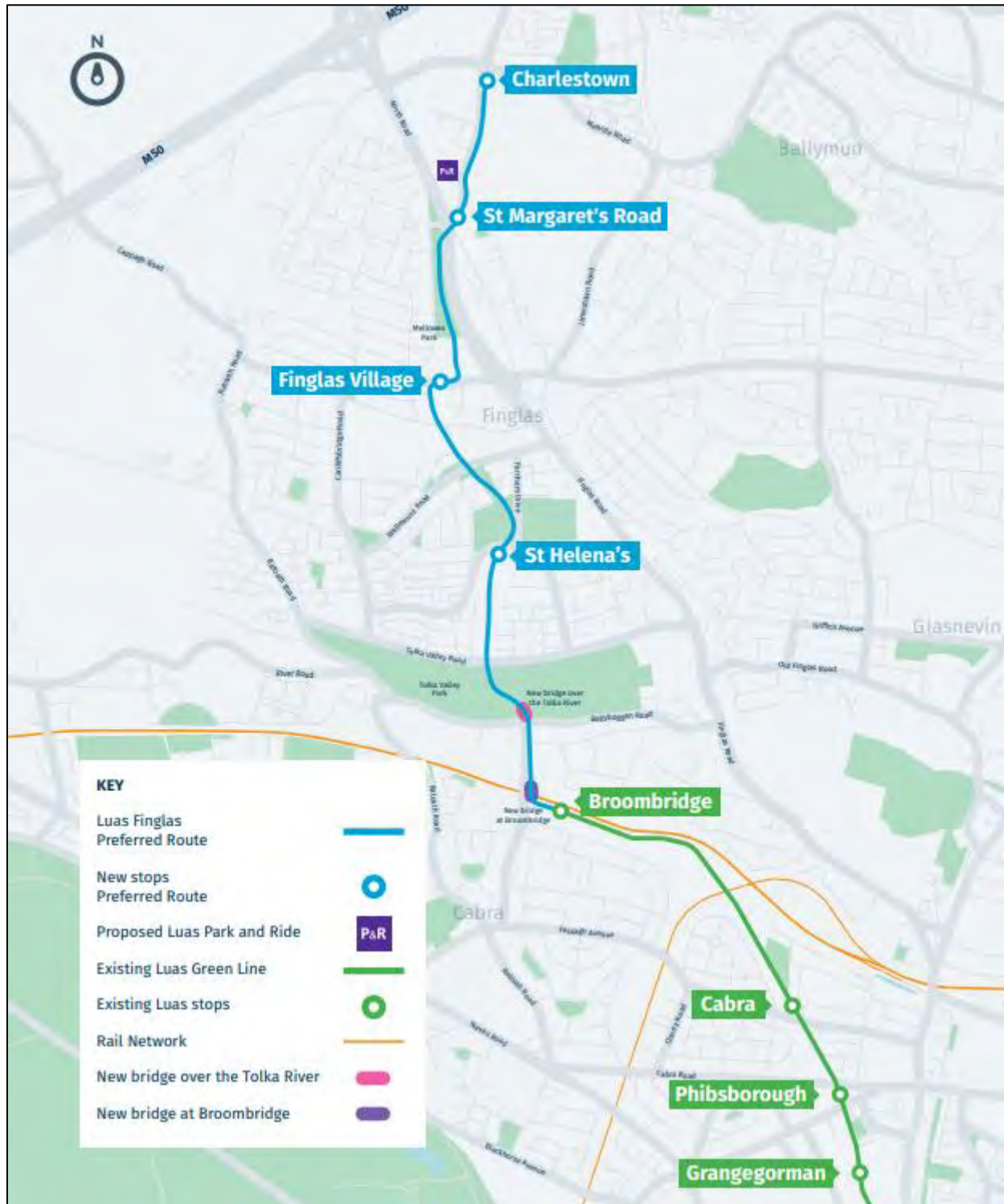


Figure 1 Overview of Preferred Route for Luas Finglas

2.1.1 Receiving Environment

The proposed Luas Finglas project extends through an urban area containing within it sections of green space, three parkland areas (Tolka Valley Park, Farnham Drive Park and Mellows Park); and two watercourses, namely the River Tolka and Royal Canal, the latter of which is also a proposed Natural Heritage Area (pNHA), and both of which hydrologically connect the project to Dublin Bay.

Public and Active Transport

The study area is served by various Dublin Bus routes. Under BusConnects, the 'F corridor' from Charlestown to the city centre is proposed as one of 16 core bus corridors which will consist of three spines, one of which would travel along Finglas Road. Cycle infrastructure includes the Tolka Valley Greenway, Royal Canal Greenway and the Finglas Road cycle path which is segregated from the road and connects the city centre with Finglas Village. Secondary routes proposed in the Greater Dublin Area Cycle Network Plan (2013) follow Mellowes Road, North Road and Charlestown Place. All these active transport measures which help reduce the carbon transport within the study area.

Land Use and Amenity

There are a broad range of different land uses in the proximity of the proposed project. The Broombridge and Dublin Industrial Estates are located in the southern extent of the study area bordering the Royal Canal. This area is separated from residential areas to the north by the Tolka Valley Park. The residential areas themselves are bordered to the west by Cardiffstown Road (R103) and, further out by Ratoath Road, and to the east by Finglas Road (R135) which is the major artery for the area extending north to the N2 and possessing dedicated bus lanes. East-west connections are provided by Ballyboggan Road, Tolka Valley Road (R102), Wellmount Road, Cappagh Road (R103) and Mellowes Road. Finglas Village is on the eastern side of this Finglas Road, to the north of which is Jamestown Business Park which extends north as far as the Charlestown Shopping Centre and the M50. Residential areas continue to the north on the west side of Finglas Road. Throughout the study area there are community facilities, including playing fields and areas of green space. Other local attractors and community facilities, most of which are accessed by mainly local vehicle, pedestrian and cycle traffic, include St. Oliver Plunkett's Church, St. Canice's Roman Catholic Church and the Kingdom Hall of Jehovah's Witnesses.

Open Space

The proposed scheme route goes through a number of open space areas. Parks and green space include Tolka Valley Park (including golf course), Barnamore Grove Linear Park, Kildonan Park and Mellowes Park, refer to Figure 2. The PR sees the Luas Finglas line continue from the existing terminus and turn northwards over the Royal Canal towards Tolka Valley Park. Tolka Valley Park is set upon a former landfill site, which was closed in the 1970s and was then reclaimed as a public open space. The proposed Luas route after crossing Tolka Valley Rd, passes through the middle of the linear green space continues north towards St. Helena's Rd and into the Farnham Park area and then passes through Farnham Park to connect St Helena's Road to Wellmount Rd residential areas. St Helena's comprises a linear north – south green space between St Helena's Road and Tolka Valley Road/Park bordered by Barnamore Grove and St Helena's Road residential areas. Farnham Park is an active local open space located between Erins Isle Sports Club and St Helena's Road. It presently accommodates both soccer and GAA sports pitches within an amenity park setting. The Luas extension also traverses Mellowes Park in a north-south direction parallel to Finglas Rd (R135) between Finglas Sports Centre and the Finglas Road/North Road roundabout towards the Charlestown Shopping Centre.

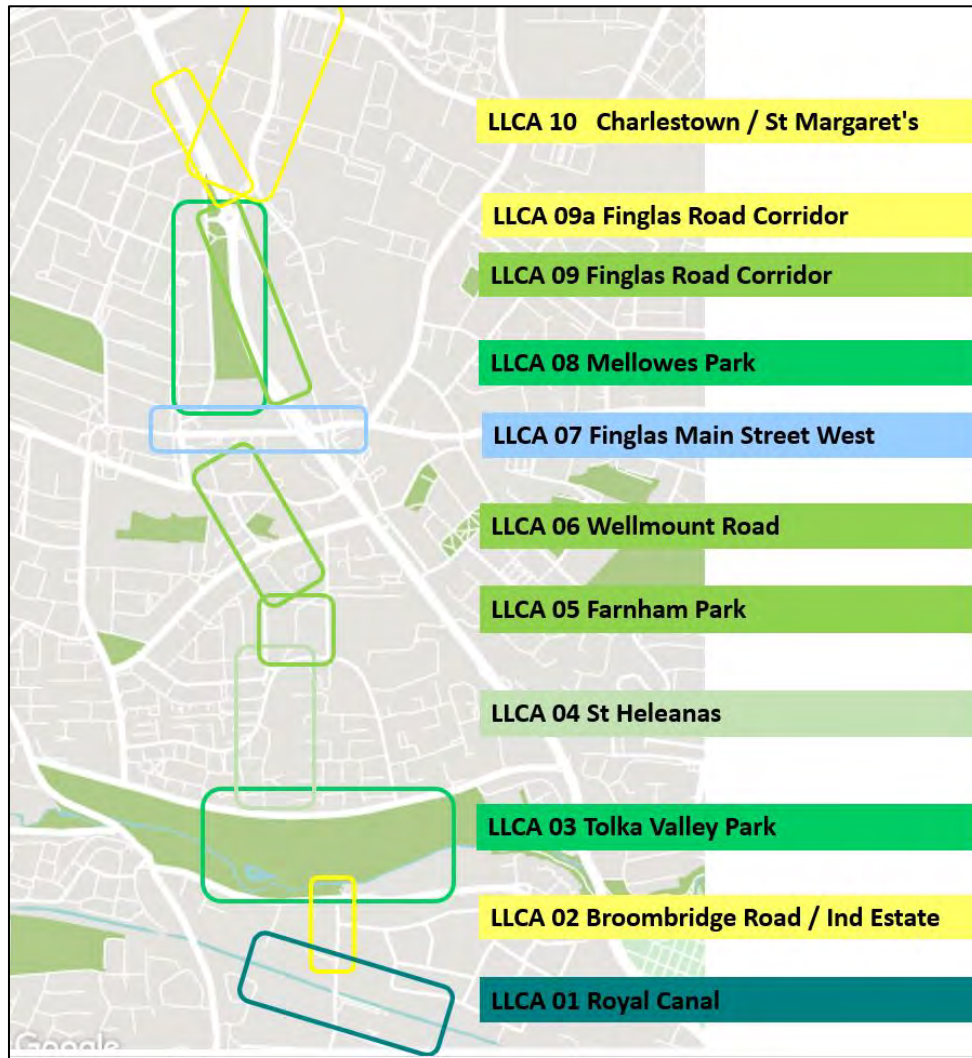


Figure 2 Local Landscape Character Areas (Source: Urban Integration Report)

Education, Sports and Leisure

There are also a large number of schools and colleges near the proposed development. Sports and leisure facilities in the study area include Erin's Isle GAA, Rivermount Boys FC, Valley Park United FC, Finglas United Youth FC, Leisure Point Sport and Fitness Centre, and Finglas Area Office and Sports Centre.

Health Services

There are social and family support services that include St Helena's Family Resource and Childcare Centre, Finglas Childcare, Finglas Youth Services, St Michael's House Technical Services for people with disabilities, Finglas Intreo Centre (Department of Social Protection) and Finglas Medical Centre.

Economic Activity

There are also numerous local neighbourhood shopping centres scattered throughout the area. The principal destinations or attractors are the Key District Centre of Finglas Village and Charlestown Shopping Centre, including also supermarkets and adjacent retail at Tesco (Clearwater), Aldi (St. Margaret's Road), Lidl (St. Margaret's Road), Dunnes Stores (Charlestown and Cardiffsbridge Road), as well as the Broombridge and Dublin Industrial Estates, Finglas Business Centre, and the North Road Commercial Area.

2.2 Description of the Proposed Works

2.2.1 Proposed Works

The proposed works for Luas Finglas involve the following:

- A 3.9 km extension to the Luas Green Line track from Broombridge to Finglas, see Figure 1;
- An extension to the Broombridge Luas depot stabling for extra tram storage;
- Provision of approximately 350 park and ride spaces near the St Margaret's Road stop, close to M50;
- Demolition of the existing overbridge at Mellows Park;
- Construction of a new bridge over the River Tolka within the Tolka Valley Park;
- Construction of a new bridge over the Royal Canal and the Maynooth railway line at Broombridge;
- Site preparation including levelling and excavation works for track infrastructure;
- All associated utility diversions;
- New road layouts, new or modified junction layouts, footpaths and road layouts including junction signalling;
- Dedicated cycle facilities necessary as part of the scheme, including adjacent cycling on or off-road tracks along the entire length of the alignment;
- Provision of two new substations;
- Provision of additional traffic signalling infrastructure;
- Provision of additional lighting and street furniture; and
- Provision of landscaping and urban integration measure.

A detailed construction plan and schedule will be developed for the proposed scheme to ensure that the construction phasing allows for maximum efficiency while minimising potential for environmental impact.

The general sequence of activities to be followed when constructing the proposed scheme will be broadly as follows:

- Establishing the works area/site and the establishment of site offices, compounds and security;
- Site preparation including demolitions where required;
- Utilities diversion;
- Construction of bridges;
- Installation of light rail tracks;
- Construction of Luas stops;
- Installation of operating equipment;
- Fitting out of stops; and
- Finishing and landscaping.

2.3 Sustainability Measures for the Proposed Scheme

As detailed in the Tender brief, the following sustainability measures are to be incorporated as part of the project:

- Suitable native and low maintenance landscaping along the track corridor along with integration and improvement of the landscaping;
- Creation or enhancement of ecological habitats;
- Maximising use of green track, for landscaping, reducing of urban heat island intensity; also resulting in minimising noise and vibration;
- Sustainable Drainage Systems and minimising attenuation structures:
 - Sand trapping via the drainage system;
 - Rainwater infiltration (in soil and plantation tree holes)
 - Rainwater harvesting, green buildings and water saving measures;

- Sustainable building management systems;
- Sustainable material use, such as Green Cement and recyclable materials;
- Hazardous waste management;
- Provision for cyclists including routes and cycle parking.

Further measures to be considered as part of the proposed scheme as discussed in sustainability workshops (09/11/2021 and 15/12/2021) circular economy workshops (27/10/2021, 09/03/2022 and 23/09/2022) and recent TII publications include the following:

- To incorporate circular economy throughout the different phases of the project;
- The sustainable design for the project is based on the theme of space relocation to enhance public transport and to prioritise active travel above road traffic;
- Design and construction phases to be focused on waste reduction;
- Adoption of flexible construction lengths to reduce concrete waste;
- Adopting smaller footprint for construction elements;
- Refrain from oversizing and overengineering;
- Coordinated approach and sharing of infrastructure and overlap design needs to avoid overspecification;
- To promote active travel by reduced carriageway, increased pedestrian space and more accessible public areas;
- Sustainable design process to take into account track alignment and optimise gradients to reduce operational energy demand;
- Reducing stop and go by combining road junctions and stops in close proximity and increasing fully segregated/ off road sections to allow trams longer coasting at low energy consumption;
- Reduce energy needs/requirements for substation buildings, provision of vegetal roof or photovoltaic panel on top; provision of natural ventilation, using equipment standing wide range of temperature to avoid air conditioning;
- Consider concrete with 50% Ground Granulated Blastfurnace Slag (GGBS) to be used to reduce the carbon footprint and improve the overall sustainability of finished structures and this will be considered in future design stages. Concrete is a highly durable material, however, the production process of one of its main constituents- cement is highly energy demanding and has a larger carbon footprint.
- Regenerative design and nature-based solutions;
- Corridor design to provide for ecological and landscape connectivity and pollinator friendly spaces;
- All new roadside planting to have a significant proportion of pollinator-friendly plants;
- Design to include for ease of recovery and disassembly of the trackform;
- Design accommodates future environmental conditions including accounting for climate change effects on rainfall, storm occurrences and temperature;
- Design includes soil testing plan and strategy for enabling soil reuse;
- New landscaping to include tree pits for bioretention and stormwater management on hard surfaces along Broombridge and Finglas Road. Soil from construction site to be used to fill the tree pit post assessment for suitability of the soil. Stormwater tree pits provide a versatile stormwater management device for passive irrigation of street trees, stormwater quality treatment, peak flow and volume attenuation, canopy interceptions, evapotranspiration and infiltration and reduction in pollutants entering the waterways;
- Quantifying infiltration for new tree planting as part of landscaping to assist drainage design for the scheme;
- Carbon sequestration by new tree planting as part of landscaping and quantifying the sequestering value;
- Creating safe, segregated, family-friendly cycle and walking paths along much of the route, improving the quality of life for all. Also, to provide sufficient, secure and adequate cycle storage facilities and safe, efficient and convenient access to different transport modalities;
- Applying gender lens to enable inclusion of public life opportunities into the design process;
- Provide accessibility and social inclusion as the Luas will be fully accessible to people with a mobility impairment, the elderly and also to those with a hearing or visual impairment;

- Undertaking public life tools surveys along the route and also capturing data by questionnaires circulated to stakeholders in the area. The public life survey is aimed at capturing data for physical and social elements along the preferred route;
- Emphasis on place-making, public realm and greening infrastructure;
- Social aspect of sustainability is as important as economic and environment. To prevent anti-social behaviour social development around the proposed project before, during and after construction is integral to this plan;
- During environmental studies and public consultation, consider specific presentations to present positive aspects of transportation and urban renewal in schools along the Luas corridor, to ensure the students then educate their families about the Luas Finglas scheme as a sustainable transport option thereby increasing the acceptability of the scheme in the community;
- For construction phase, TII may introduce in contracts some proposals for local employment, so that local unemployed people take the opportunity to make their skills known and have a significant experience for their future jobs after completion of construction;
- For long term, the Luas corridor can be a positive opportunity for social development around different themes such as sport (Farnham pitches), nature (Royal Canal and Tolka river valley are high value places linked to others in the city), culture heritage (protected walls and bridges can be highlighted through story maps and expanding on previous Luas Cross City Story Maps, famous people appearing in city's road names can be emphasised, and contemporary culture can be developed);
- Citizens should be able to use it not only as transport corridor but for dedicated activity, sport, nature, culture, be proud of it, that's the key for general enhancement of the area.

These sustainability topics are considered further in Table 1 Sustainability Objectives, Measures and Governance and Sustainability Tracker.

2.4 Need for the scheme

Since the completion of the Luas Green Line to Broombridge in 2017, the potential to extend the line to Finglas has been explored by TII and the National Transport Authority (NTA). Finglas and the surrounding areas need improved public transport services to connect with Dublin's wider public transport network. The arrival of Luas Finglas will bring significant benefits to the area by providing a reliable, efficient and high-capacity public transport service to the city centre via Broombridge.

The proposed extension will also:

- Support development of Finglas as a key centre within the Greater Dublin Area and promote local regeneration;
- Help Ireland reduce emissions and carbon output from transport by providing an attractive alternative to car use;
- Provide for reduced journey times by delivering a high-priority corridor to deliver consistent journey times throughout the day;
- Provide walking and cycling integration by creating safe, segregated, family-friendly cycle and walking paths along much of the route, improving the quality of life for all. This will be achieved by reduced carriageway, increased pedestrian space and more accessible public areas. Each of the Luas stops will include cycle parking facilities;
- Provide improved transport interchange and integration by connecting several existing public transport services including national, regional and commuter rail, Luas and bus services. The park and ride facility will allow people to switch from their cars onto the Luas network;
- Support ambitions for further development of Dublin as an attractive, vibrant location and focus for economic growth;
- Provide for gender equality, child, and elderly friendly spaces by recognising the needs of people and addressing them by the design process; and
- Provide societal benefits for Finglas by emphasis on place making and public realm.

2.5 Policy Overview

2.5.1 Transport Strategy for the Greater Dublin Area 2016-2035

The Sustainability Plan for Luas Finglas should align with the key policies for the Greater Dublin Area. The Transport Strategy for the Greater Dublin Area 2016-2035 is integral to the sustainable implementation of the Luas Finglas, as it prioritises addressing urban congestion, to improve the efficiency and sustainability of the urban transport system, increase public transport capacity and to improve and enhance walking and cycling infrastructure. The strategy also intends to develop the Light Rail network in the Greater Dublin Area through the implementation of an extension of Luas Cross City from its terminus at Broombridge to Finglas.

The Transport Strategy for the Greater Dublin Area is a plan at regional level and is informed by the National plans such as the National Planning Framework and National Development Plan which then informs and updates the Dublin City Development Plan and Local Area Plans. All these plans and strategies ensure better co-ordination in planning and development policy matters across local authority boundaries.

The Transport Strategy for the Greater Dublin Area 2016-2035 outlines the following strategic transport infrastructure that is proposed to be delivered within the lifetime of the strategy:

Heavy Rail Infrastructure

As part of this strategy, it is intended to enhance the rail network and create a full Metropolitan area DART network for Dublin to provide better connectivity and integration. The upgraded rail network will provide the core high-capacity transit system for the region and also aims to deliver a substantial increase in peak-hour capacity on all lines from Drogheda, Maynooth, Hazelhatch and Greystones. The proposed works will include the Phoenix Park Tunnel Link, Dart Expansion Programme, City Centre Re-Signalling, Train Control Centre Upgrade, Provision of Additional Rail Stations, Station Upgrades and Enhancements, Train Fleet and other rail investments.

Light Rail Infrastructure

It is intended to develop further the Light Rail network in the GDA through the implementation of a number of projects such as Metrolink, Luas Green Line Capacity Enhancement, Metro South- Luas Green Line Capacity Upgrade, Luas Cross City, Finglas Luas, Extension of Luas Green Line to Bray, Lucan and Poolbeg Luas. All these proposed works will ensure that the existing Light Rail network is maintained in an adequate and safe condition and that services are efficiently delivered.

Bus Infrastructure

In order to ensure efficient, reliable and effective bus system, as part of the Bus Connects Strategy, the National Transport Authority's programme to greatly improve bus services in Irish cities, it is proposed to develop the Core Bus Network and provide continuous priority for bus movement on the Core Bus Network within the Metropolitan Area. This will include enhanced bus lane provision on these corridors to improve journey times. The proposed projects include Core Radial Bus Network, Core Orbital Bus Network, Core Regional Bus Network, Bus Rapid Transit, Combined Core Bus Network and other bus related measures.

Cycling Infrastructure

As part of the Greater Dublin Area Cycle Network Plan, it is proposed to expand the urban cycle network to over 1485 km in length and to provide over 1300 km of new connections between towns in the rural areas of the GDA. The network intends to provide for increased numbers of cyclists.

Walking

This strategy also intends to provide safer and convenient walking environment for those with mobility, visual and hearing impairments and for those using buggies and prams. Further enhancement of pedestrian movement along the strategic pedestrian routes is proposed by widening footpaths and to ensure that permeability and accessibility of public transport stops and stations for local communities is maintained and enhanced.

Road Network

This strategy aims to prioritise road investment to maintain, renew, manage, and operate the extensive infrastructure consisting of roads, bridges, tunnels, footpaths, signposting and markings, traffic signals and traffic management systems. A number of development and enhancement projects for national roads, regional and local roads and freight movement are also proposed.

The other key national level policies and guidelines that the Luas Finglas must align with includes:

- Climate Action Plan 2023 (Department of the Environment, Climate and Communications, 2022);
- Dublin City Council Climate Action Plan 2019-2024 (Dublin City Council, 2019);
- Smarter Travel: A Sustainable Transport Future (Department of Transport, 2019, updated 2022);
- National Mitigation Plan (Department of the Environment, Climate and Communications, 2017, updated 2021);
- Planning Land Use and Transport Outlook 2040 (Department of Transport, Tourism and Sport, 2018);
- Spatial Planning and National Roads (Department of Housing, Local Government and Heritage, 2012, updated 2020); and
- Design manual for Urban Roads and Streets (Department of Transport, 2013, updated 2022).

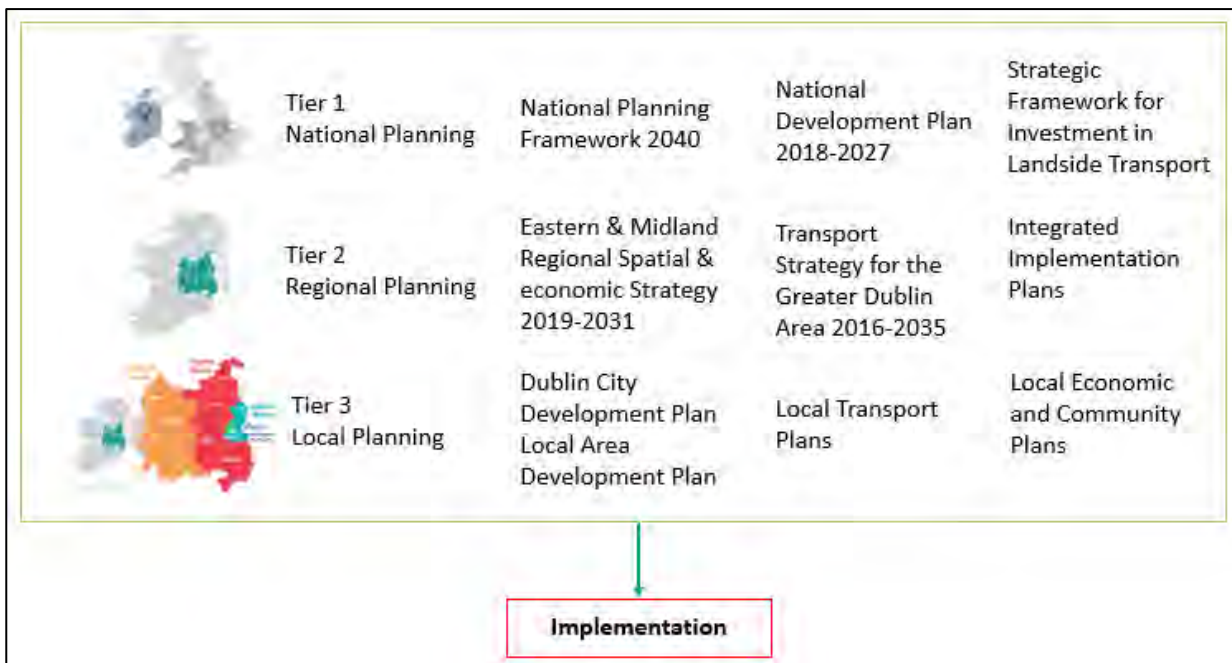


Figure 3 Transport Planning Hierarchy

2.5.2 Biodiversity Action Plans

The environmental pillar of the sustainability plan for Luas Finglas is guided by national and local biodiversity action plans as detailed below:

National Biodiversity Action Plan 2017-2021

The National Biodiversity Action Plan 2017-2021 sets objectives, targets and actions for biodiversity that will be undertaken by a wide range of government departments, civil, society and private sectors to achieve

Ireland's Vision for Biodiversity. Hence, these objectives frame the sustainability measures for the proposed scheme.

These objectives include:

- Mainstream biodiversity into decision-making across all sectors;
- Strengthen the knowledge base for conservation, management and sustainable use of biodiversity;
- Increase awareness and appreciation of biodiversity and ecosystem services;
- Conserve and restore biodiversity and ecosystem services in the wider countryside;
- Conserve and restore biodiversity and ecosystem services in the marine environment;
- Expand and improve management of protected areas and species; and
- Strengthen international governance for biodiversity and ecosystem services.

Dublin City Biodiversity Action Plan 2021-2025

The Biodiversity Action Plan 2021-2025 sets seventeen objectives for biodiversity management and conservation along with a series of targeted actions with measurable outcomes to achieve these objectives. These link back to the strategic objectives of the National Biodiversity Action Plan (2017-2021). The plan focuses on restoration of biodiversity to reflect EU policy. The themes and objectives set here frame the sustainability objectives and measures for the proposed Luas scheme. The themes set within the action plan include:

- Maintaining nature in the city;
- Restoring nature in the city;
- Building for biodiversity;
- Understanding biodiversity in the city; and
- Partnering for biodiversity.

All Ireland Pollinator Plan 2021-2025

All Ireland Pollinator Plan (AIPP) is a shared plan of action to help restore pollinator populations in Ireland. The AIPP is supported by the Transport Authorities who promote pollinator friendly management of transport corridors. The plan sets out six objectives as below:

- Making farmland pollinator friendly- *By working together with the farming community, we want to achieve an increased awareness of pollinators and the resources they need in order to survive on farmland.*
- Making public land pollinator friendly- *By working together with Councils, Transport Authorities, Local Communities and others, we want to better coexist with biodiversity and help return food and shelter for pollinators to our island.*
 - Target 2.2 under this objective specifically sets actions for pollinator friendly transport corridors. It set measures for improvement of grassland management and pollinator friendly planting across transport corridors, to move grass-cutting frequency from condition-based maintenance to specified programme that is reduced number of cuts per year. It also set measures for roadside planting to have a significant proportion of pollinator friendly plants, reduction in use of pesticides and control and manage the spread of invasive plant species. All new landscaping planting specifications to incorporate AIPP pollinator-friendly planting code and creation of pollinator-friendly habitat on non-operational lands.
- Making private land pollinator friendly- *From gardens, to businesses, faith communities and sports clubs, we want to work together to create networks of biodiversity-friendly habitat across our landscape.*
- All-Ireland Honeybee Strategy- *By supporting beekeepers, we want to achieve healthy, sustainable populations, and for honeybees to be part of a cohesive pollinator message that balances managed and wild pollinator populations.*

- Conserving rare pollinators- *By improving our knowledge on rare pollinators, and by raising awareness through dedicated initiatives, we want to achieve a Plan that protects as much wild pollinator diversity as possible.*
- Strategic coordination of the Plan- *By continually raising awareness; addressing gaps in our knowledge through research; and by tracking where pollinators occur and how populations are changing, we want to work from an evidence base that enables us to coordinate a dynamic plan that is targeted and effective.*

Dublin Region Air Quality Plan 2021

The purpose of Dublin Region Air Quality Plan 2021 is to address reducing nitrogen dioxide emissions from transport in the Dublin region. The dominant primary source of nitrogen dioxide in ambient air in the Dublin Region is vehicular traffic. Increased nitrogen dioxide levels are of concern as it has been demonstrated to be associated with number of health effects. While individual vehicle engines have become less polluting and more efficient over time, the population increases, the number of vehicles and their pattern of movement have given rise to continuing elevated levels of nitrogen dioxide. This stresses the continued and improved use of land use and transportation planning strategies to deliver sustainable living. The plan sets specific measures and actions for consideration.

2.5.3 Aarhus Convention

The Luas Finglas will also be in line with the Aarhus Convention which establishes several rights of the public with regard to the environment. This includes:

- Access to environmental information;
- Public participation in environmental decision making; and
- Access to justice.

SECTION 3: SUSTAINABILITY

Sustainable development can be described as ‘*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*’ Sustainable development ensures long term business resilience with a positive contribution to the economy, society, and environment. In September 2015, UN Member States adopted the 2030 Agenda for Sustainable Development which focuses on 17 Sustainable Development Goals (SDGs) and their respective 169 sub-targets. The UNSDGs provide a consistent framework for defining and considering sustainability and measuring positive actions against different plans, programmes, and policies. These UN SDGs are visible across the strategies of many government departments. Ireland has adopted the National Planning Framework to manage the growth in a planned, productive, and sustainable manner.

The objectives and strategies for Luas Finglas align with those laid down in the National Planning Framework as part of Project Ireland 2040 and the Sustainable Development Goals National Implementation Plan 2018-2020 and are reflected throughout this plan. The National Strategic Outcomes as set in the National Planning Framework sets goals for sustainable mobility in line with Ireland’s Climate Change mitigation plans and to transition to a low carbon, climate resilient and environmentally sustainable economy.

The sustainability approach to Luas Finglas is guided by the goals set out in the TII’s Statement of Strategy 2021 to 2025, refer to Figure 4. TII has set out this strategy for the period of 2021 to 2025 for the implementation of national transport strategy as determined by the Department of Transport. The strategic goals set by TII will be supported by specific actions to be included in annual plans and their fulfilment will be monitored. Other TII documents assisting in the implementation of sustainability for the proposed project include, Environmental Strategy, TII (2019), Applying a Gender Lens to TII Public Transport Projects, TII (2021) and TII Sustainability Implementation Plan.

The importance and benefits of incorporating sustainability for Luas Finglas and aligning it to the UNSDGs will enhance:

- Sustainable mobility;
- Active transport;
- Regional accessibility;
- Compact growth;
- Transition to low carbon and climate resilience;
- Biodiversity;
- Health and well-being impact from the projects;
- Stakeholder and public engagement;
- Efficient and productive resource planning;
- Societal benefits for Finglas by emphasis on place making and public realm;
- Gender Equality;
- Enhancing design by applying gender tool; and
- Clear working plan towards environmental, economic, and social challenges.



Figure 4 Strategic Goals as set out in the TII's Statement of Strategy 2021-2025

3.1 Pillars of sustainability

Sustainable development is supported by three pillars of economy, society, and environment. The project aims to provide economic prosperity without damaging the natural environment or exhausting natural resources and to include all stakeholders working together at national or international levels. Figure 5 lists the key impacts of the project on the three pillars of sustainability and alignment of the project objectives with the Sustainability Themes as set out in the SDG National Implementation Plan 2018-2020 and also with the TII Sustainability Principles as set out in Sustainability Implementation Plan.

Sustainability Plan			
Pillars	Environment	Economic	Social
Luas Finglas Objectives	<ul style="list-style-type: none"> Urban ecological habitats Biodiversity enhancement Carbon assessment and reduction Waste reduction and management Sustainable material use Air Quality Green track SuDS 	<ul style="list-style-type: none"> Circular economy Maximise whole life value Infrastructure resilient to climate change Efficient and high capacity public transport Support local businesses 	<ul style="list-style-type: none"> Enhance collaborations Stakeholder and public engagement Local employment Provision for active transport Development of Finglas as a key centre within Greater Dublin Area Societal benefits by emphasis on place making and public realm Applying gender lens to design
Our Sustainable Future Themes (SDG National Implementation Plan)	<ul style="list-style-type: none"> Satisfaction of human needs by the efficient use of resources Respect for ecological integrity and biodiversity Respect for cultural heritage/ diversity 	<ul style="list-style-type: none"> Economy 	<ul style="list-style-type: none"> Equity between generations Gender equity Social equity
TII Sustainability Principles (Sustainability Implementation Plan, TII)	<ul style="list-style-type: none"> Transition to net zero. 	<ul style="list-style-type: none"> Provide effective, efficient, and equitable mobility. Enable safe and resilient networks and services. 	<ul style="list-style-type: none"> Collaborate for a holistic approach. Deliver end-to-end improvements Create total value for society.

Figure 5 Pillars of Sustainability

3.1.1 Environmental

It is essential for the Project plan to improve air quality, reduce the use of fossil fuels and transition to a low carbon energy transport by accelerating a modal shift to public and active transport.

With regards to the environmental aspects of concern, the Environmental Impact Assessment process has identified the following significant environmental aspects detailed in the EIA Scoping Report:

- Human Health;
- Population;
- Biodiversity;
- Water;
- Land and Soils: Soils, Geology and Hydrogeology;
- Land Take;
- Air Quality;
- Climate;
- Noise and Vibration;
- Electro Magnetic Compatibility and Interference;
- Cultural Heritage;
- Material Assets: Infrastructure and Utilities;
- Material Assets: Traffic and Transport;
- Material Assets: Waste Management;
- Landscape and Visual Amenity;
- Risk of Major Accidents and disasters; and
- Interactions between Impacts on Different Factors.

Urban Integration and Planning

Transport has become a critical issue as cities expand, congestion is increasing, and energy resources are getting scarce. The vision of Barry Transportation and Egis is that public transport projects, should be a tool to promote the cities of tomorrow, by including innovation in the design of the infrastructure and by using the light rail project as a foundation for urban planning strategy. These urban transformations are implemented through various means as below:

- Transit Oriented Development, which seeks to create or enhance centralities around the Luas Finglas, and particularly around Stops. The project facilitates integration of major urban development, contributing to the city's growth and socio-economic dynamism;
- The opportunity to recreate, refurbish and upgrade public spaces, which is of vital importance as the place where social interactions and cultural activities occur. It is a way to reshape the appearance and ambience of a city and to enhance social life;
- The opportunity to redefine the functionalities of the streets in order to re-order the shared space between all modes (cars, pedestrians, cycles and public transport). Dedicated spaces and landscaping enhancements along the line enhance the sense of safety, and smoother traffic flows;
- Consideration of the whole network in order to increase the connectivity of the city centre but also to extend the Luas network to suburban areas. Redesigning the existing public transport system to feed the Luas line to improve public transport performance, as it becomes more visible, integrated and understandable;
- The opportunity to promote active travel by providing for a modal shift from cars to public transport and cycle paths. It also provides for integration of the extension's terminus within a new multi modal transport hub including its the connectivity to the proposed park and ride facilities and bus stops with clear wayfinding and user-friendly layout;

These aspects, when studied together contribute to a higher attractiveness and quality of life in the areas served. Other means to include sustainability in the proposed project include:

- The infrastructure should be designed in such a way as to optimise resources and achieve maximum possible energy efficiency;
- The project aims to prioritise walking routes, increase social safety, ease the access and provision of secure parking for cyclists, inclusive gender and child safe streets, efficient mobility, allocate space for people and reclaim excess carriageway space and integrate adjacent spaces.

Further details are also included in the [Urban Integration Report](#). The project team is continuously liaising with Dublin City Council on careful integration of the alignment and stops with future redevelopment at particular nodes such as St Helena's, Finglas Village, Mellowes and Charlestown stops and also for mitigating anti-social behaviour as part of this approach.

3.1.2 Socio-Economic

In conjunction with the environmental impact assessment process there are also social-economic impacts associated with the works. The impacts are largely associated with the disruption caused during construction that is to be managed through positive engagement with the local stakeholders affected. This is detailed in the Engagement Implementation Plan, Engagement Plan and the Stakeholder mapping. Integral to this is the development of key stakeholder engagement, those stakeholders that have a direct and defined influence upon the design and construction of the route. This is captured in the Communications Plan.

The study area includes areas of high population density and pockets of social and economic disadvantage which will be assessed through a demographic analysis and through consultation with local bodies familiar with these issues locally.

The proposed Luas scheme will have a positive impact in facilitating access to community facilities in the study area, primarily by people living within and outside of the area who are not within convenient walking distance. It will also have a positive impact in providing people living in the study area with quicker and more convenient access to facilities outside of the study area, including the city centre and places of employment, especially for those people living further away from existing principal bus routes. This accessibility will provide local people with more opportunities in terms of access to employment, retail, and social facilities, and also provide benefits in terms of social and economic inclusion. The accessibility benefits will be realised particularly by people falling within lower CSO socio-economic categories, people with disabilities and those without access to a private car.

In addition, the proposed cycle paths alongside the line will enhance this accessibility providing further benefits in terms of safer and more convenient journeys and health benefits. There will be further effects in terms of stimulating economic growth through enhanced access to employment opportunities to the benefit of both workers and employers, and by releasing the potential of unused lands for infill residential or business development.

Applying gender lens to the proposed Luas scheme will also provide a more complex understanding of mobility patterns and will help include public life opportunities into the design process.

Within the social and economic spheres, there are several specific areas where there is an opportunity for enhancement or further consideration in design and construction. These include:

- Aiding regeneration at adjacent re-development sites and increasing the range of transport options provided;
- Use of local supply chain to provide materials for construction;
- Local employment during development and construction and providing opportunities for apprentices and trainees;
- Provision of resilient infrastructure;
- Increased accessibilities between transport modalities;
- Public and stakeholder engagement;
- Minor intervention of seats at GAA pitches to provide more inclusive neighbourhood for multigenerational viewers of games and reduce social isolation in Finglas;
- Enhanced societal benefits to Finglas area by emphasis on place-making and public realm;
- Applying gender lens during design and public consultation; and
- Increased social benefits by provision of better and sustainable access to education and work.

Circular Economy

Circular economy couples growth to positive environmental and social outcomes. The key principles of circular economy include designing out waste pollution, regenerating natural systems and keeping products and materials in use.

Luas Finglas is a pilot project to incorporate circular economy objectives and principles. Project specific design opportunities will be identified to incorporate circular economy within the project followed by integration and implementation across all disciplines and stages of the project.

The circular economy approach benefits in the following ways:

- Value capture and reducing consumption of natural resources will result in cost savings to TII compared to the linear approach;
- Regeneration of natural systems contributes to a biodiverse environment and reinstatement of self-sustaining systems. 90% of biodiversity loss and water stress come from resource extraction and processing;
- Minimising the carbon footprint of roads and rail will not only cost less, but also reduce infrastructure contribution to climate change;
- Reduction in consumption of unsustainable resources;
- Design to include for ease of recovery and disassembly of the trackform;
- Design accommodates future environmental conditions including accounting for climate change effects on rainfall, storm occurrences and temperature;
- Design includes soil testing plan and strategy for enabling soil reuse;
- Implementation of a circular economy strategy will reduce waste generation from projects, close loops and reduce planning risk; and
- Increase in energy efficiency by reducing energy demands for schemes and operating systems and the costs that come with this. Transition to responsible energy consumption adds to value capture and reduces climate change impacts.

Circular economy opportunities for the proposed scheme:

- Active travel and integration with wider network;
 - Facilitating active travel to minimise car use and trips on public transport, allowing for a range of transport modes on the same scheme;
 - Cycle lanes and footpaths can use surplus materials from construction to prevent removal from site e.g. demolition aggregate and recycled asphalt ;
 - Sharing of infrastructure e.g. stations between agencies, modes and routes ;
- Regenerative design and nature-based solutions;
 - New trees, tree pits and planting for bioretention and stormwater management;
 - High value soil reuse (for example in tree pits);
 - Quantifying infiltration for new tree planting as part of landscaping to assist drainage design for the scheme;
 - Quantifying carbon sequestration by new tree planting.
- Infrastructure sharing and overlap in design needs;
 - Assess overlaps in design to avoid overspecification;
- Design for disassembly of trackside infrastructure;
- Design for deconstruction; and
- Bio-based trackside infrastructure.

Circular economy opportunities for the proposed scheme (including the above) are to be tracked by means of specific circular economy checklists developed for each stage of the process i.e Preliminary Design Report, Reference design etc... and include the following::

- Landscape CE Checklist;
- Soil Re-Use CE Checklist;
- Trackform / Track Disassembly CE Checklist;
- Existing Buildings / Infrastructure & Streets CE Checklist; and
- Gender lens Checklist

SECTION 4: LUAS FINGLAS SUSTAINABILITY VISION

Barry EGIS along with TII commit to incorporate sustainability objectives for Luas Finglas scheme into the design, construction and operation of the Luas Finglas and thereby contribute to the economic efficiency, develop, protect, and enhance the environment and contribute to the overall well-being of society. This plan will complement the TII Statement of Strategy and the TII Sustainability Implementation Plan, both of which set the overarching approach to applying sustainability to all TII activities.

This plan establishes the framework for defining and addressing the key sustainability challenges, risks and opportunities for Luas Finglas and its effective and efficient long-term operation. The plan is to support consistency, collaboration, and action across the project to deliver and operate a more sustainable and resilient infrastructure and align the Luas Project to the UNSDGs and *Our Sustainable Future Themes* (National Implementation Plan 2018-2020).

The sustainability vision for Luas Finglas focuses on the following key points:

- **Reduce the environmental impact:** Protect, preserve, and improve the biodiversity, promote urban ecology, ecosystem services and biodiversity net gain.
- **Low carbon transport:** Provision of a low-emission light-rail. Carbon assessment and offset of carbon footprint.
- **Resource efficiency:** To minimise waste, to sustainably use and re-use materials and natural resource.
- **Infrastructure Resilience:** Provision of a reliable and climate resilient light-rail service.
- **Circular Economy:** Adopt the principles of circular economy to enable sustainable planning and land use management of natural resources and assets.
- **Regenerative or restorative design:** Creating resilient systems which integrate societal needs with nature
- **Accessibility and sustainable growth:** To provide for integrated transport solution with better linkages between people, places and resources to drive economic activity and enhance regional productivity.
- **Active travel:** Reduced carriageway, increased pedestrian space and more accessible public areas.
- **Health and well-being:** Address air quality problems in urban and rural areas through better planning and design.
- **Engagement and collaboration:** Enhance collaborations, stakeholder, and public engagement.
- **Leadership:** Demonstrate leadership and commitment to sustainability through guidance to staff and suppliers.
- **Teamwork:** Effective teamwork, communication, and partnership.
- **Gender equality:** Applying gender lens to better address the complex understanding of mobility and inclusion of public life opportunities into the design process.
- **Societal benefits:** Emphasis on place-making and public-realm.



Figure 6 Luas Finglas Sustainability Vision

SECTION 5: SUSTAINABILITY OBJECTIVES

This section details on the sustainability objectives for the Luas Finglas under the ‘three pillars’ identified in the previous sections. It also details how the project design team will contribute to the fulfilment of these objectives in line with the UNSDGs, Our Sustainable Future Theme and TII Sustainability Principles. The sustainability aspects will cover not only design, but construction, maintenance and operations. Table 1 below lays down the sustainability objectives, measures, and metrics for the Luas Finglas. These measures and metrics will be further refined and streamlined as the project progresses.

UNSDGS are represented by the following references:

- SDG1- No poverty
- SDG2- Zero hunger
- SDG3- Good health and well-being
- SDG4- Quality education
- SDG5- Gender equality
- SDG6- Clean water and sanitation
- SDG7- Affordable and clean energy
- SDG8- Decent work and economic growth
- SDG9- Industry, innovation, and infrastructure
- SDG10- Reduced inequalities
- SDG11- Sustainable cities and communities
- SDG12- Responsible consumption and production
- SDG13- Climate action
- SDG14- Life below water
- SDG15- Life on land
- SDG16- Peace, justice, and strong institutions
- SDG17- Partnerships for the goals

Our Sustainable Future themes are represented by the following references:

- SF1- Economy
- SF2- Satisfaction of human needs by the efficient use of resources
- SF3- Equity between generations
- SF4- Gender equity
- SF5- Respect for ecological integrity and biodiversity
- SF6- Social equity
- SF7- Respect for cultural heritage / diversity
- SF8- Equity between countries and regions.

TII Sustainability Principles:

- SIP 1- Provide effective, efficient and equitable mobility
- SIP 2- Enable safe and resilient networks and services
- SIP 3- Collaborate for a holistic approach
- SIP 4- Deliver end-to-end improvements
- SIP 5- Transition to net zero
- SIP 6- Create total value for society

Table 1 Sustainability Objectives, Measures and Governance

Sustainability Pillar	Luas Finglas Objectives	Potential Metric	Project Design Team Action	Preliminary Design Report Sections	EIAR Chapter	UNSDGs	TII Sustainability Implementation Principles	Our Sustainable Future Theme (National Implementation Plan)	Regional and Local Area Plan Objectives	Appraisal Objectives - Business Case	
Environment	Reduce our whole life carbon footprint across projects and operations	Reduce embodied carbon and green house (GHG) gas emissions	TII 'Carbon Assessment and Reduction Tool'	Assessment of key materials to focus carbon calculations as appropriate. Details of carbon calculations to be populated and continuously updated in the TII 'Carbon Assessment and Reduction Tool' and coordinated with standardisation of designs. Incorporate appropriate plans/strategies and scheme design to reduce carbon footprint and GHG emissions.	All sections of the PDR	All Chapters	8, 11, 12, 13	SIP 5	SF1, SF2, SF3	Environment (6,7)	
		Assess, monitor, report and set appropriate targets for energy consumption	Calculate kWh electricity per passenger km during operation Using operation consumption forecasting tools (models) to assess effects of the measures outlined.	Optimise gradients to reduce operational energy demand.	Section 3 (Sustainability) Section 4 (Track Alignment) Section 5 (Track Systems) Section 6 (Power and Systems)	Chapter 13 - Air Quality and Climate	7, 9, 11, 12, 13	SIP 5	SF1	Dublin City Council Climate Action Plan 2019-2024	Economy (2) Environment (6,7)
				Reducing stop and go by combining road junctions and stops in close proximity and increasing fully segregated/ off road sections to allow trams longer coasting at low energy consumption.							
				Reduce high speed limit steps and frequent speed limits variations, using medium speeds where possible between consecutive junctions (avoid over 50kph for short sections).							
				Reducing high energy consuming maintenance activities like rail grinding, welding and rail replacements, by adopting resilient track systems.							
		Reduce energy needs/requirements for substation buildings: vegetal roof or photovoltaic panel on top; natural ventilation, equipment standing wide range of temperature to avoid air conditioning. Optimise substation locations.									
Provision of a low-emission light-rail. Carbon assessment and offset of carbon footprint.	Calculations for % of transport contribution to GHG emissions. Calculations for %km travelled on public transport.	Operation carbon calculations will be considered as part of optimising operational efficiency in outline design, then refined at detailed design. Constructors will be asked to reduce carbon for transportation during works and also for implementation of the transport system.	Section 18 (Traffic)	Chapter 13 - Air Quality and Climate Chapter 18 - Traffic and Transport	9, 12, 13	SIP 5	SF1, SF2	Environment (6,7) Physical Activity (10)			
Secure bicycle storage spaces as % of expected peak passenger numbers. Calculate for % use of park and ride spaces and	Promote active transport by provision of bicycle and walking tracks along route and dedicated bicycle storage provisions.	Section 7 (Roads and NMU facilities)									

Sustainability Pillar	Luas Finglas Objectives	Potential Metric	Project Design Team Action	Preliminary Design Report Sections	EIAR Chapter	UNSDGs	TII Sustainability Implementation Principles	Our Sustainable Future Theme (National Implementation Plan)	Regional and Local Area Plan Objectives	Appraisal Objectives - Business Case	
Environment	Enhance resource efficiency		shift in mode of transport.								
		Provision of waste minimization and management	Number of construction phases	Larger construction sites, reducing number of construction phases to reduce waste. To be incorporated from design stage to facilitate optimised construction phases and cycles.	Section 20 (Construction phasing)	Chapter 19 - Waste Management	12, 14, 15	SIP 2, SIP 6	SF1, SF2, SF5	Eastern Midlands Regions Waste Management Plan 2015-2021	Environment (6)
			% Landfill diversion (excluding contaminated ground encountered) % of soil reuse for new tree planting	Management Plans including method statements will be developed for excavations and construction activities that may encounter contaminated or hazardous material. The soil recovered from on-site works will be assessed for suitability for use in new tree plantings and filling tree pits. From the results of the geotechnical survey, a strategy will be defined in order to undertake actions necessary to improve any nutrient deficient depleted topsoil at each location. Refer to the soil re-use checklist: LDD101-BEV-GN-ROUT-XX-RE-CE-00005	Section 8 (Earthworks)						
			% Vegetal to compost % Concrete and asphalt waste managed for reuse % Road equipment sent back for reuse	Waste material arising from construction will be reused on site where possible (for example reuse of suitable soil for new tree planting), and otherwise sent to a suitably licenced waste facility (concrete, asphalt), or given back to the local road authority (DCC) (stone curbs, road equipment such as signage).	Section 8 (Earthworks)						
	Use of sustainable and recycled material [Also see Economic – Circular Economy]	Calculation of material recycled	The project will source all material sustainably such as use of green cement and recyclable materials. In particular the use of concrete with 50% Ground Granulated Blast furnace Slag (GGBS) and also investigate the potential for also consider the utilisation of recycled aggregate types (e.g 6F2) from footpaths, walls, pedestrian bridge etc.. under Article 28 – End of Waste.	Section 19 (Environment)	Chapter 19 - Waste Management	8, 9, 11, 12	SIP 5	SF1, SF2			
Reduce the environmental impact	Assess biodiversity enhancement	Biodiversity net gain metric system	Baseline ecology and biodiversity assessment to be carried out by Ecologists to identify constraints as part of EIAR. Where necessary, mitigation measures will be outlined to avoid, negate, or minimise adverse construction and operational phase impacts on identified ecological features or designated sites. Following the collection of all required field survey data, detailed mitigation	Section 19 (Environment)	Chapter 9 - Biodiversity	11, 12, 14, 15	SIP 6	SF3, SF5	Draft Dublin City Biodiversity Action Plan 2021-2025, Dublin City Council (2021); All Ireland Pollinator Plan	Environment (6,7)	

Sustainability Pillar	Luas Finglas Objectives	Potential Metric	Project Design Team Action	Preliminary Design Report Sections	EIAR Chapter	UNSDGs	TII Sustainability Implementation Principles	Our Sustainable Future Theme (National Implementation Plan)	Regional and Local Area Plan Objectives	Appraisal Objectives - Business Case
Environment	Reduce the environmental impact		<p>measures will be designed during the consultation process.</p> <p>The project design will also assess:</p> <ul style="list-style-type: none"> Creation and enhancement of ecological habitats and biodiversity net gain Provision of suitable native and low maintenance landscaping along the project corridor 						2021-2025, National Biodiversity Data Centre (2021).	
		Assess Water quality and hydrology	<p>Calculation for 100% coverage of facilities/ land with SuDS, number of systems employed, % change in run-off volume, quantifying infiltration for new tree planting</p>	<p>The risk of flooding and pollution to nearby watercourses will be assessed by the data and surveys as part of the EIAR process. Relevant water quality and flood mitigation measures will be implemented as identified.</p> <p>The project design will also assess:</p> <ul style="list-style-type: none"> Sustainable Drainage Systems (SuDS) and minimising attenuation measures Sand trapping via the drainage system Rainwater infiltration (infiltration in soil and plantation tree holes/ tree pits) Rainwater harvesting, green buildings and water savings measures 	Section 9 (Drainage)	Chapter 10 - Water	3, 6, 9, 11, 12, 13, 14, 15	SIP 3	SF3, SF5	River Basin Management Plan 2018-2021
		Monitor air quality and climate	<p>Air quality surveys to determine nitrogen dioxide levels, modelled PM10 emission reduction</p>	<p>Baseline air quality survey will reference to EPA background PM10 and PM2.5 monitoring data at Finglas monitoring station, close to the Luas Finglas preferred route. Nitrogen dioxide surveys will be conducted at a number of locations representative of background air quality in proximity to existing residential properties along the length of the proposed project. Detailed construction mitigation measures will be outlined in the form of a Dust Management Plan which will be implemented as part of the Construction Environmental Management Plan.</p>	Section 19 (Environment)	<p>Chapter 7 - Human Health</p> <p>Chapter 8 – Population</p> <p>Chapter 13 - Air Quality</p> <p>Chapter 14 - Climate.</p>	3, 9, 11, 12, 13, 14, 15	SIP 2, SIP 3, SIP 6	SF5, SF6	Draft Dublin Region Air Quality Plan 2021
		Monitor noise and Vibration	<p>Noise surveying and modelling number of noise sensitive receptors in the vicinity</p> <p>Low vibration track length</p> <p>Grass track length</p>	<p>Where required mitigation measures will be provided to minimise construction phase or operational phase noise and vibration impacts. During construction typical mitigation measures include:</p> <ul style="list-style-type: none"> Binding construction hours. Noise and vibration limits and monitoring during construction. Screening of construction work. The use of low noise and vibration construction techniques. Trackside screening and noise barriers. Speed restrictions. Noise enclosures to fixed route. 	<p>Section 19 (Environment)</p> <p>Section 5 (Track Systems)</p>	<p>Chapter 7 - Human Health</p> <p>Chapter 8 – Population</p> <p>Chapter 15 - Noise and Vibration</p>	3, 9, 11, 12, 15	SIP 2, SIP 3, SIP 6	SF5, SF6	Dublin Agglomeration Noise Action Plan for the Agglomeration of Dublin 2018-2023

Sustainability Pillar	Luas Finglas Objectives	Potential Metric	Project Design Team Action	Preliminary Design Report Sections	EIAR Chapter	UNSDGs	TII Sustainability Implementation Principles	Our Sustainable Future Theme (National Implementation Plan)	Regional and Local Area Plan Objectives	Appraisal Objectives - Business Case	
	Reduce the environmental impact	Improvement of traffic and Transport		The project design will maximise the use of green track which will result for landscaping, reducing of urban heat island intensity in better passenger comfort and minimise noise and vibration.							
			% Change (increase / reduction) in traffic queuing % Increased usage of active travel in vicinity of scheme	A detailed baseline analysis will be undertaken to characterise the baseline traffic and transport environment along the length of the proposed project in proximity to construction works and operational sources. Traffic management plan will be implemented during construction stage to minimise any impacts. During the operational phase of the development typical mitigation measures may include signal optimisation to provide required level of priority to vulnerable road users and the LUAS while at the same time limiting the impact on general traffic. Also provide for cyclists including routes and cycle parking	Section 18 (Traffic)	Chapter 18 - Traffic and Transport	3, 9, 10, 11, 15	SIP 1, SIP 2	SF6	Draft Dublin Region Air Quality Plan 2021	Environment (6,7) Integration (5)
			% Cycle track network that utilises existing streets	Some streets will be suitable for use as Bicycle Streets and thus avoids the need for creation of separate pavements for cycle tracks. Potential for Bicycle Streets to be assessed for Casement Road, Patrickswell Place and Cardiff Castle Road.	Section 7 (Roads and NMU Facilities)						
			% Cycle track and footpath network draining into grass verges as opposed to directly into surface water sewer	The utilisation of grass verges on streets will provide for sustainable drainage and limit the amount of water sent directly into surface water sewers. Wherever space permits, grass verges will be used.	Section 7 (Roads and NMU Facilities)						
			% Road upgrades that retain kerblines as-is	There are opportunities to retain one side of the road's kerblines when there is road widening or narrowing. This restricts major works to one side of the road and allows for re-use of surface water drainage systems, has less impact on services and on trees. All road upgrades to be assessed to examine opportunities to retain one side as-is.	Section 7 (Roads and NMU Facilities)						
			Improvement of the landscaping and Visual Amenity (LVIA)	Surveys to establish sites of special significance within study area, % of sites under threat of degradation, % compliance with land impact mitigation measures	A baseline survey will be undertaken by the landscape team to visit the locations of all known constraints, open spaces, and areas of significant vegetation to ascertain their existing condition, current land use, and potential sensitivities. The project design will also provide for: Improvement of the landscaping adjacent to the Luas corridor. Providing visual screening between the Luas corridor and stops and visually sensitive properties	Section 11 (Urban Integration)	Chapter 21 - Landscape and Visual Amenity	9, 11, 15	SIP 1, SIP 3	SF3, SF5, SF6, SF7	Fingal Development Plan 2017-2023, Dublin City Development Plan 2016-2022, Draft Dublin City Development Plan 2022-2028.

Sustainability Pillar	Luas Finglas Objectives	Potential Metric	Project Design Team Action	Preliminary Design Report Sections	EIAR Chapter	UNSDGs	TII Sustainability Implementation Principles	Our Sustainable Future Theme (National Implementation Plan)	Regional and Local Area Plan Objectives	Appraisal Objectives - Business Case
	Reduce the environmental impact		<p>or areas of sensitive landscape character using a mixture of landform and/or planting.</p> <p>Reconnection of severed and fragmented habitats and creation of green corridors and compensation planting within project corridor.</p> <p>Ensuring adequate space is maintained below bridges to allow for continuation of access and riparian strips.</p>							
		Use of Jan Gehl's public life tools to assess the benefits of the proposed project on the public life in the study area	Using public life tools for surveys such as 'People Moving Count', 'Stationary Activity Mapping', 'Age and Gender Tally' and 'Twelve Urban Quality Criteria' to understand the current use of public spaces and the impact the proposed project has on these spaces post development. These tools will be used to evaluate changes in site use and its impact on the population.							Environment (6,7)
		Assessment of Historic and Cultural Environment	Surveys to determine number of designated heritage sites within study area and % to be impacted	Baseline archaeological assessment to be undertaken by project archaeologist to determine and establish sites with archaeological value within the immediate and surrounding areas, to help protect and enhance these sites, and where required identify sufficient mitigation measures.	Section 19 (Environment)	Chapter 20 - Cultural Heritage	9, 11, 12, 15, 16	SIP 6	SF7	Fingal Development Plan 2017-2023, Dublin City Development Plan 2016-2022, Draft Dublin City Development Plan 2022-2028.
Assessment of Land and Geology	Application of geology and soil impact mitigation measures both in design and construction	Undertake a detailed ground investigation to establish a route-wide ground model which will inform structures, earthworks and drainage design. An accurate ground model reduces ground related construction risks, facilitating more efficient design thereby reducing the unnecessary use of carbon intensive materials. Another key sustainability objective will include the re-use of site-won materials and minimisation of off-site disposal. Laboratory testing of soil and rock samples will allow appropriate material classifications which in turn will inform re-use and disposal options during the construction phase. Baseline geological assessment to be undertaken by the geologist to determine impacts and implement appropriate measures to minimise exposure of lands and soils to pollutants.	Section 14 (Land use and accommodation works) Section 8 (Earthworks)	Chapter 11 - Land and Soils: Soils, Geology and Hydrogeology	12, 13, 15	SIP 2, SIP 3, SIP 6	SF5, SF7	Fingal Development Plan 2017-2023, Dublin City Development Plan 2016-2022, Draft Dublin City Development Plan 2022-2028.	Environment (6)	

Sustainability Pillar	Luas Finglas Objectives	Potential Metric	Project Design Team Action	Preliminary Design Report Sections	EIAR Chapter	UNSDGs	TII Sustainability Implementation Principles	Our Sustainable Future Theme (National Implementation Plan)	Regional and Local Area Plan Objectives	Appraisal Objectives - Business Case
Social	Enhance collaborations, stakeholder, and public engagement.	Public consultation events Public information (mailing, billposting) Public engagement surveys/questionnaire Jan Gehl's Public life tools and survey	Collaborate with local authorities (Dublin City Council / Fingal County Council) in the area. Ensure that stakeholders are provided with sufficient and appropriate information at key stages throughout the lifecycle and that public perception and acceptability of a proposal is considered. Public awareness campaigns & surveys. Use of Jan Gehl's Public Life Tools such as 'Age and Gender Tally', 'Participant Survey', 'People Moving Count' surveys to assess the impacts of the development on the society pre and post development.	All	All	8, 9, 11, 12, 16, 17	SIP 4	SF6		Accessibility & Social Inclusion (8,9)
		"likes" on web site	Propose emblem / mascot for the project to raise people's interest, support, commitment to make Finglas people aware of (specific) stages of the project to identify, propose mitigation, and communicate on construction noises							
		Use of BIM for developing the scheme design	Achieving stakeholder buy in at an earlier stage Higher quality design, including clash avoidance and gap analysis Promotion of project collaboration Improved Safety and Health planning Improved Construction Planning More accurate Tender pricing Construction stage benefits, i.e. more efficient construction by getting it right first time etc							
	Demonstrate leadership and commitment to sustainability through guidance to staff and suppliers. Effective teamwork, communication, and partnership.		Report sustainability principles, activities, goals and progress. Support development of Finglas as a key centre within the Greater Dublin Area.			8, 17	SIP 3	SF3, SF6		Accessibility & Social Inclusion (9)
Applying gender lens to better address the complex understanding of mobility and inclusion of public life opportunities into the design process.	Use of Jan Gehl's public life tools Use of public engagement surveys/questionnaires	Applying TII gender lens to enable inclusion of public life opportunities into the design process. Using Jan Gehl's public life tools surveys such as 'People Moving Count' and 'Age and Gender Tally' and public engagement surveys and questionnaire forms to capture the age and gender of the people moving through the study area or spending time in these public spaces pre and post development. The gender -focused questionnaires and the Jan Gehl's Participant Survey will also help capture the public life in the area and to evaluate any			5	SIP 6	SF4		Accessibility & Social Inclusion (9)	

Sustainability Pillar	Luas Finglas Objectives	Potential Metric	Project Design Team Action	Preliminary Design Report Sections	EIAR Chapter	UNSDGs	TII Sustainability Implementation Principles	Our Sustainable Future Theme (National Implementation Plan)	Regional and Local Area Plan Objectives	Appraisal Objectives - Business Case	
			gender-based constraints which could be addressed through scheme design.								
	Provision of landscaping and urban integration measure		Lighting design developed in conjunction with the ecologist to limit the impact on bats. Security features, such as lighting, emergency call points, and CCTV are to be considered as part of the gender lens and within the designs.	Section 11 (Urban Integration) Section 19 (Environment)		11	SIP 2			Environment (6)	
	To maintain health, safety, and wellbeing Address air quality problems in urban and rural areas through better planning and design.	Model km of cycle lanes connected to Luas Finglas, number of bicycle spaces, %change in users, number of transport hubs	Creating safe, segregated, family-friendly cycle and walking paths along much of the route, improving the quality of life for all. Also, to provide sufficient, secure and adequate cycle storage facilities and safe, efficient and convenient access to different transport modalities. Enhancement of pedestrian movement along the pedestrian routes is proposed by widening footpaths and to ensure that permeability and accessibility of public transport stops and stations for local communities is maintained and enhanced	Section 7 (Roads NMU facilities)	Chapter 7 - Human Health Chapter 8 – Population Chapter 18 - Traffic and Transport	3, 5, 10, 11, 13	SIP 6	SF2, SF6		Environment (6,7) Physical Activity (10)	
Economic	Provision of resilient infrastructure	Whole life cost analysis	Whole life considerations to be included to support design decisions. More detailed whole life costing to be considered at detailed design stage. Captured in meeting minutes, documents, and reports.	All		8, 9, 11, 12	SIP 2	SF1		Economy (1) Integration (5)	
	To provide for integrated transport solution with better linkages between people, places and resources to drive economic activity and enhance regional productivity.	Calculate % of km travelled on sustainable transport modes. Number of transport interchanges	Ensure there is access to different transport modalities for all users, and ensure access to these modalities is convenient, frequent, efficient and safe. Sustainable procurement and a shift to use of sustainable modes of transport that are cost-effective and accessible with frequent, efficient, convenient public transport links and encourage more sustainable patterns of travel behaviour.	All		3, 10, 11, 13	SIP 1	SF2, SF6		Integration (4) Environment (6,7)	
	Adopt the principles of circular economy to enable sustainable planning and land use management of natural resources and assets.	Estimated tonnes material per passenger km route.	Facilitating active travel to minimise car use and trips on public transport, allowing for a range of transport modes on the same scheme	All							
		Whole life cost analysis / Estimated % materials diverted from waste streams.	Design for disassembly of trackside infrastructure/ Design for deconstruction	Section 5 (Track systems)	All	8, 9, 12, 13	SIP 3, SIP 5	SF1, SF3		Environment (6)	
	Calculate % reuse of excavated materials onsite.	High value soil reuse	Section 8 (Earthworks)								

Sustainability Pillar	Luas Finglas Objectives	Potential Metric	Project Design Team Action	Preliminary Design Report Sections	EIAR Chapter	UNSDGs	TII Sustainability Implementation Principles	Our Sustainable Future Theme (National Implementation Plan)	Regional and Local Area Plan Objectives	Appraisal Objectives - Business Case				
		Calculate % reuse of excavated materials onsite.	Cycle lanes and footpaths can use surplus materials from construction to prevent removal from site e.g. demolition aggregate and recycled asphalt	Section 7 (Roads and NMU facilities)										
		Calculate % minimum non-virgin sourced materials (steel, aggregates etc) by mass.	Sharing of infrastructure e.g. stations between agencies, modes and routes Assess overlaps in design to avoid overspecification Bio-based trackside infrastructure Use of concrete with 50% Ground Granulated Blast furnace Slag (GGBS).	Section 10 (Structures)										
		% Cycle tracks utilising existing site won material	Cycle tracks and footpaths can use surplus materials from construction to prevent removal from site e.g. demolition aggregate and recycled asphalt	Section 3 (Sustainability)							11	5	SFT 2	Environment (6)
		Design Coordination	Sharing of infrastructure e.g. stations between agencies, modes and routes.	Section 3 (Sustainability)							9,5	3	SFT 2, 4	Economy (1)
		Design Integration												

SECTION 6: GOVERNANCE

For the successful and efficient delivery of the sustainability objectives good practice governance will be required. The implementation of the objective will be managed by the Sustainability Lead.

The key roles and duties of the Sustainability Lead (and the design team) will include:

- Prepare sustainability plans;
- Implementation of TII carbon assessment tool;
- Deliver sustainability objectives against measurable targets and indicators;
- Report and keep track of sustainability measures and plans as detailed in Section 5 above;
- Liaise with other team leads and sub-consultants to ensure sustainability targets are met and integrated across all disciplines; and
- Communication and raising awareness of sustainability requirements throughout all levels.

The ongoing review and updating of the Sustainability tracker for all stages of the scheme will be managed by the Sustainability Lead.

Appendix | C

Transport Modelling Report

Appendix C: Transport Modelling Report

Luas Finglas

Transport Modelling Report

June 2023

TRANSPORT MODELLING REPORT

LUAS FINGLAS

IDENTIFICATION TABLE

Client/Project owner	Transport Infrastructure Ireland
Study	Luas Finglas
Type of document	Transport Modelling Report
Date	01/06/2023
File name	20230601 Luas Finglas TMR v2.8

APPROVAL

Version	Name	Position	Date	Modifications	
2	Authors	Alessio Gaspardo	Consultant	01/06/2023	Draft for client review
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	Checked by	Diarmuid Bailey	Associate Director	02/06/2023	
	Approved by	Diarmuid Bailey	Associate Director	02/06/2023	

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1. INTRODUCTION

This Transport Modelling Report is an appendix to the Preliminary Business Case (PBC) for Luas Finglas, which has considered the projected transport impacts associated with the Luas Finglas scheme. It supplements the headline modelling results presented within the main PBC.

Luas Finglas is a 3.9km extension of the Luas Green Line from Broombridge to Charlestown via Finglas, with a 350-space Park & Ride facility located just off the M50 at St Margaret's Road. The alignment is primarily off-road and segregated from traffic providing a high quality public transport service. The scheme includes improvements to the walking and cycling network to enable access to Luas and deliver local connectivity benefits.

SYSTRA has been commissioned to undertake transport modelling using a variety of tools to inform the preliminary design and statutory process of the Luas Finglas project. This report summarises the methodology and results of the modelling exercise undertaken.

1.1 Modelling Methodology

The modelling methodology can be summarised as follows:

- The foundation of the modelling work undertaken is the National Transport Authority's (NTA) Regional Modelling System (RMS), specifically the East Regional Model (ERM). Chapter 2 provides an overview of the RMS and its components.
- Modelling was undertaken for the baseline year (2020) and two forecast years (2035 and 2050). Chapter 3 outlines the land use assumptions used to generate future transport supply and demand forecasts.
- Modelling was done for two main scenarios (Do-Minimum and Do-Something). The Do Minimum and Do Something transport supply scenarios were modelled for a number of future years (demand forecasts), in accordance with the assumptions outlined in Chapter 4. In addition, a number of sensitivity tests with changes to both the transport supply and demand were undertaken to test the performance of Luas Finglas across a range of potential future projections. Chapter 4 describes the modelled scenarios and Chapter 5 provides an overview of the modelling results.
- A highway Local Area Model (LAM) was developed, calibrated and validated for the base year and used to test the impact of Luas Finglas in the forecast years of 2035 and 2050. Chapter 6 details the calibration and validation process, and summarises the key results from future year testing.

1.2 Report Structure

The following outlines each Chapter of this Modelling Report:

- Chapter 2 provides an overview of the NTA's Regional Modelling System;
- Chapter 3 describes the forecast land use assumptions used in the modelling;
- Chapter 4 describes the individual modelled scenarios;
- Chapter 5 outlines the main ERM results;
- Chapter 6 focuses on the Local Area Model and its results.

2. NTA REGIONAL MODELLING SYSTEM

2.1 Introduction

This section provides an overview of the NTA RMS which comprises five regional transport models covering the Republic of Ireland centred on the five main cities of Dublin, Cork, Galway, Limerick, and Waterford (as summarised in Table 2-1 below).

Table 2-1: Regional Modelling System

Regional Modelling	Abbreviation	Counties Covered
East Regional Model	ERM	Louth, Monaghan, Cavan, Longford, Westmeath, Meath, Offaly, Laois, Kildare, Dublin, Wicklow, Carlow & Northern Wexford
South East Regional Model	SERM	Wexford, Kilkenny, Waterford & Tipperary South
South West Regional Model	SWRM	Cork & Kerry
Mid-West Regional Model	MWRM	Limerick, Clare & North Tipperary
West Regional Model	WRM	Galway, Mayo, Roscommon, Sligo, Donegal & Leitrim

Each regional model has the following key attributes:

- Full geographic coverage of the relevant region;
- A detailed representation of the road network;
- A detailed representation of the public transport network & services;
- A representation of all major transport modes including active modes (walking and cycling);
- A detailed representation of travel demand, e.g. by journey purpose, car ownership/availability, mode of travel, person types, user classes & socio-economic classes, and representation of five time periods (AM, Lunch Time, School Ride, PM and Off-Peak);
- A prediction of changes in trip destination in response to changing traffic conditions, transport provision and/or policy; and
- A prediction of mode-choice in response to changing traffic conditions.

Figure 2-1 below illustrates the geographical extent of each of the Regional Models.

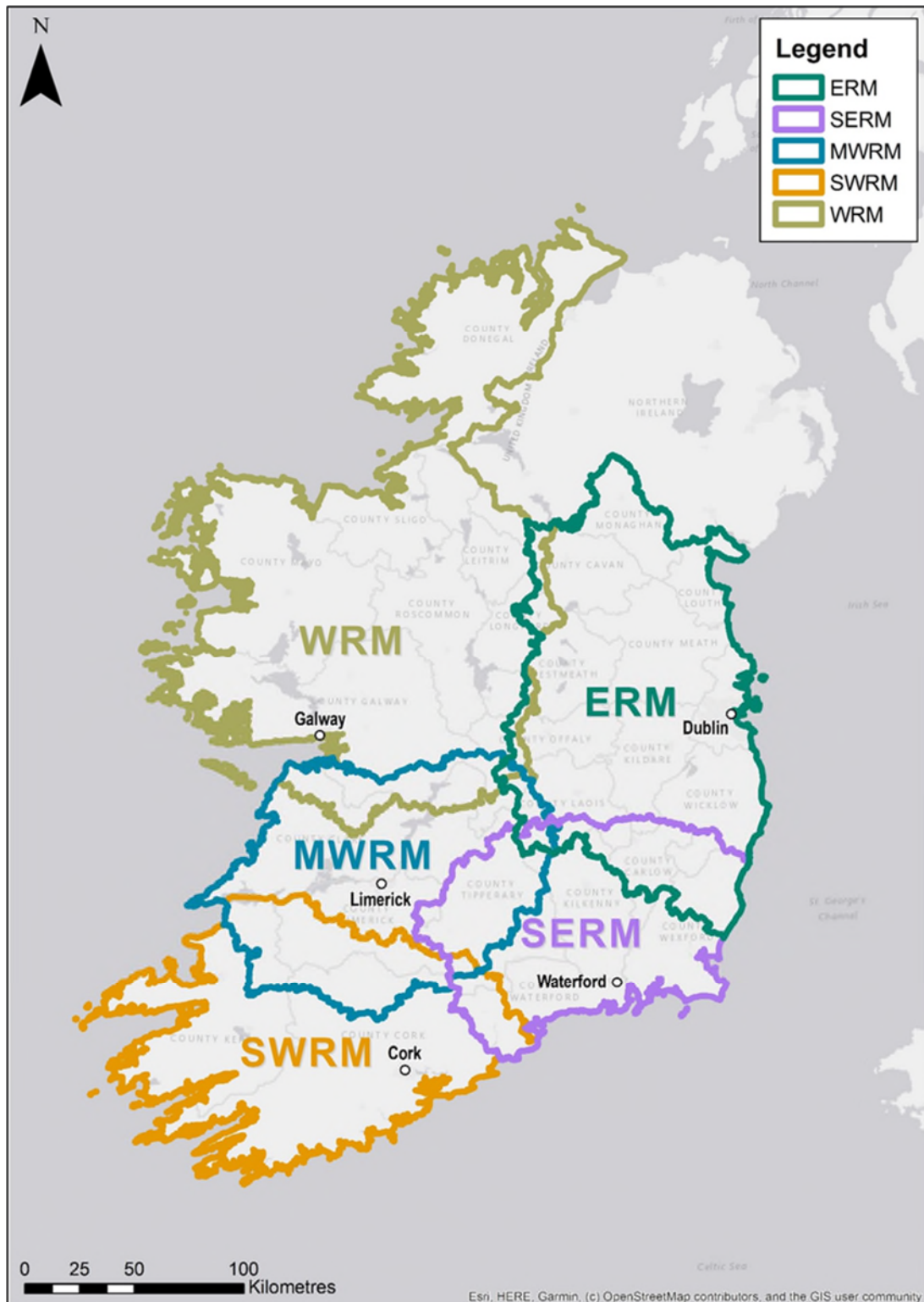


Figure 2-1: Regional Models – Areas of Coverage

The East Regional Model (ERM), which is centred around Dublin City and the Greater Dublin Area, has been used for modelling the Luas Finglas scheme.

2.2 RMS Overarching Structure

The regional models, including the ERM, combine three core modelling processes (i.e. Demand Model, Road Assignment Model, Public Transport Assignment Model) which receive inputs from the National Demand Forecasting Model (NDFM) and provide outputs for transport appraisal and secondary analysis. This process is shown in Figure 2-2.

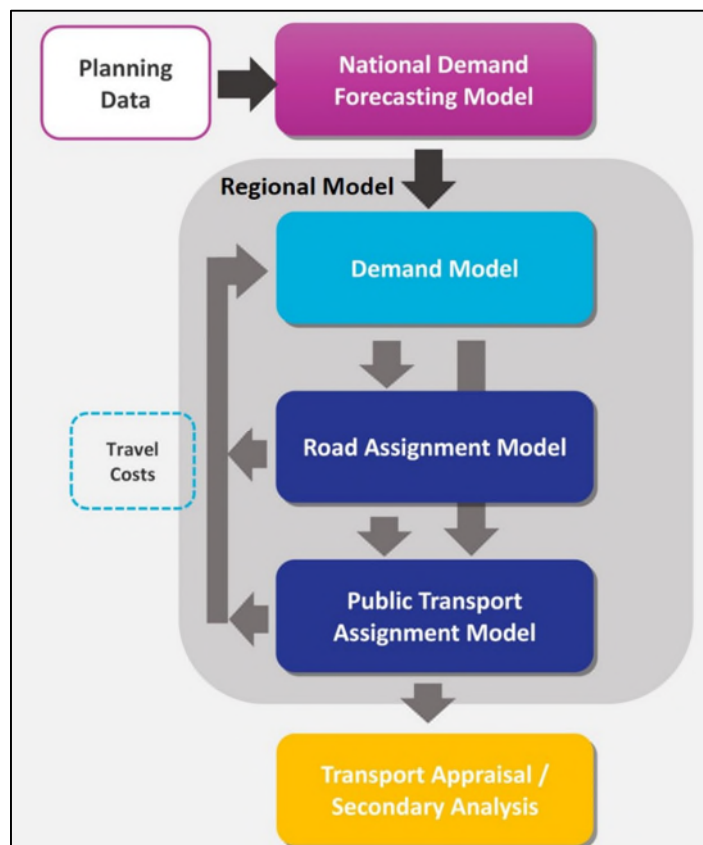


Figure 2-2: Regional Modelling System Structure

The two main RMS components (NDFM and Regional Model) are discussed in more detail in Sections 2.3 and 2.4.

2.3 National Demand Forecasting Model (NDFM)

The NDFM is a separate modelling system that estimates the total quantity of travel demand generated by and attracted to every Census Small Area (CSA) daily. The level of demand to and from each CSA (referred to as trip ends) is related to characteristics such as population, number of employees and land-use data. These trip ends are then used by the Regional Models to create travel demand matrices for the internal area of each of the Regional Models.

Additionally, the NDFM also estimates the inter-regional demand (demand crossing the boundary of each of the Regional Models), which then forms the external demand for each of the Regional Models.

The Planning Data represents a key input into the NDFM. It is a national database of 114 demographic and spatial variables for each of the 18,641 CSAs in the state. The main categories of planning data are:

- Spatial definitions (CSA/DED/NUTS names, area types etc.);
- Production related variables – demographic data about residents living in each CSA (e.g. total population living in each CSA, age bands, gender, employment status etc.);
- Attraction related variables – data related to employment and education in each CSA (e.g. number of jobs within each CSA, number of education places etc.).

Further details about the NDFM structure, its components and calibration can be requested from the NTA via the NTA’s website¹.

2.4 East Regional Model (ERM)

2.4.1 Model Dimensions

As outlined previously, the ERM covers most of the eastern side of the country centred on Dublin City, and its dimensions are defined in terms of:

- Zone system;
- Modes of travel represented;
- Base year;
- Time-periods; and
- Demand segmentation.

The following sections provide a description of each of these dimensions.

2.4.1.1 Zone System

The zone system definitions for each of the regional models are based on Census Small Area (CSA) boundaries. CSAs are the smallest geographic unit of data available with which to define the model zone system. Each CSA is a defined geographic area associated with demographic data (e.g. population, age distribution, employment status), and the work / school travel characteristics of the population (via Place of Work, School or College - Census of Anonymised Records (POWSCAR)). Regional Model zones can be smaller or larger than CSAs where required.

The East Regional model includes 1,953 zones, of which 1,907 are internal zones, 39 are external road route zones and 7 are external rail route zones. Figure 2-3 shows the ERM Zone System, and Figure 2-4 highlights the zones covering the Dublin City area.

¹ <https://www.nationaltransport.ie/planning-and-investment/transport-modelling/regional-modelling-system/ndfm-overview-rtm/>

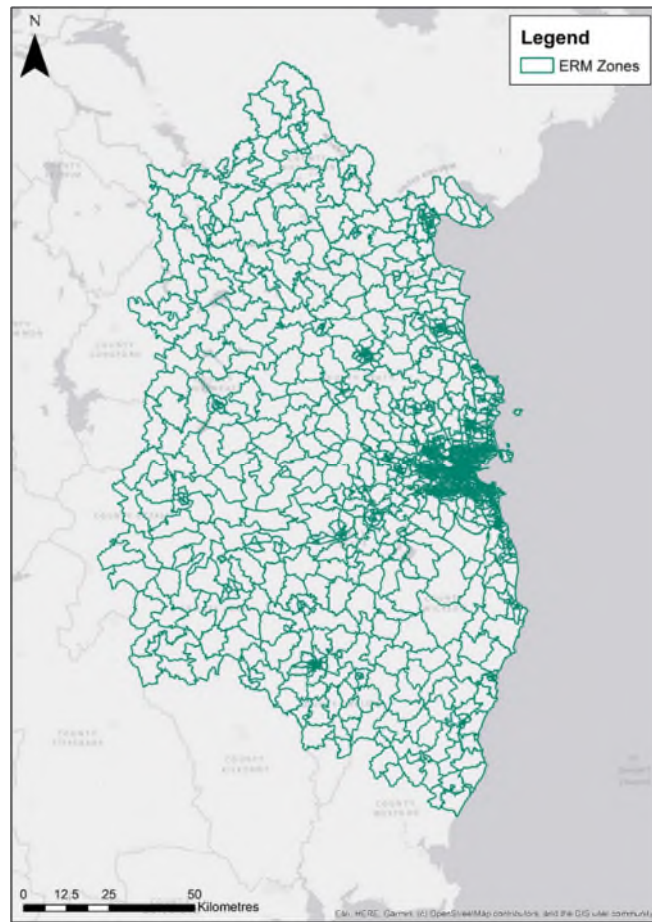


Figure 2-3: ERM Zone System



Figure 2-4: Dublin City zones

2.4.1.2 Modes of Travel

The regional model covers all surface access modes for personal travel and goods vehicles including:

- Private vehicles – cars;
- Public transport – bus, rail, Luas, Metro;
- Park and Ride;
- Taxis;
- Active modes – walking and cycling; and
- Goods vehicles – light goods vehicles and heavy goods vehicles.

2.4.1.3 Base Year

The base year of each regional model is 2016. This is largely driven by the date of the Census (POWSCAR) and the National Household Travel Survey (NHTS).

2.4.1.4 Time Periods

The regional model represents an average weekday. The day is split into five time periods detailed in Table 2-2 below. The periods allow the relative difference in travel cost between time periods to be represented. Representative peak hours are used in the assignment models, which are based on period to peak hour factors derived from survey data for each time period and mode.

Table 2-2: Time Periods

Period Name	Demand Model Period	Assignment Period
AM Peak	07:00-10:00	08:00-09:00
Morning Inter Peak – Lunch Time (LT)	10:00-13:00	12:00-13:00
Afternoon Inter Peak – School Run (SR)	13:00-16:00	15:00-16:00
PM Peak	16:00-19:00	17:00-18:00
Off Peak	19:00-07:00	20:00-21:00

2.4.1.5 Demand segmentation

Groups of people with similar travel behaviours (for example, commuters who own a car) are represented by distinct demand segments in the RMS. This allows those groups to be treated differently in the regional demand model according to their behaviour.

The NDFM demand segments were derived from the National Household Travel Survey (NHTS) data and Place of Work, School or College - Census of Anonymised Records (POWSCAR) data sets. They have been divided into 33 distinct classifications covering commute, education, shopping, visiting friends, business, escort to education and other.

2.4.2 Core Modelling Processes

The ERM includes the following core modelling processes:

- Demand Model;
- Road Assignment Model;
- Public Transport Assignment Model; and
- Active Modes Model

2.4.2.1 Demand Model

The Demand Model processes all-day travel demand from the NDFM through a series of choice models to represent combined mode, time of day, destination and parking decision making. The outputs of the demand model are a set of trip matrices which are assigned using the Road Assignment Model and Public Transport Assignment Model to determine the route-choice and generalised costs.

2.4.2.2 Road Assignment Model

The main purpose of the Road Assignment Model (RDAM) is to assign road users to routes between their origin and destination zones. It is implemented in the SATURN road assignment software and includes capacity restraint whereby travel times are recalculated in response to changes in assigned flows.

The inputs to the RDAM from the Demand Model are the road assignment matrices. The outputs from the RDAM for the demand model processes consist of generalised costs skims by time period and assigned road networks in CUBE Voyager format which are passed on to the PT model.

In addition to these requirements for demand model processes, there are a series of standard SATURN outputs that are produced for use in the specific interrogation of the road networks for scheme and/or scenario assessment e.g. network statistics, journey times, delay, volume/capacity, traffic volumes etc.

2.4.2.3 Public Transport Assignment Model

The Public Transport Assignment Model (PTAM) is used to allocate PT users to services between their origin and destination zones. The model includes a representation of the public transport network and services for existing and planned modes within the modelled area. In addition, the PTAM network includes walk links to provide for improved permeability and access.

The base model includes:

- Heavy Rail;
- Light Rail;
- Urban Bus; and
- Inter-Urban Bus.

The outputs from the Public Transport Assignment Model for the Demand Model processes consist of the assigned networks which are passed on to the Active Modes Model and generalised cost skim

matrices by user class for each of the assigned time periods that feed back into the main Mode and Destination choice demand model loop. An overview of the PTAM process is shown in Figure 2-5.

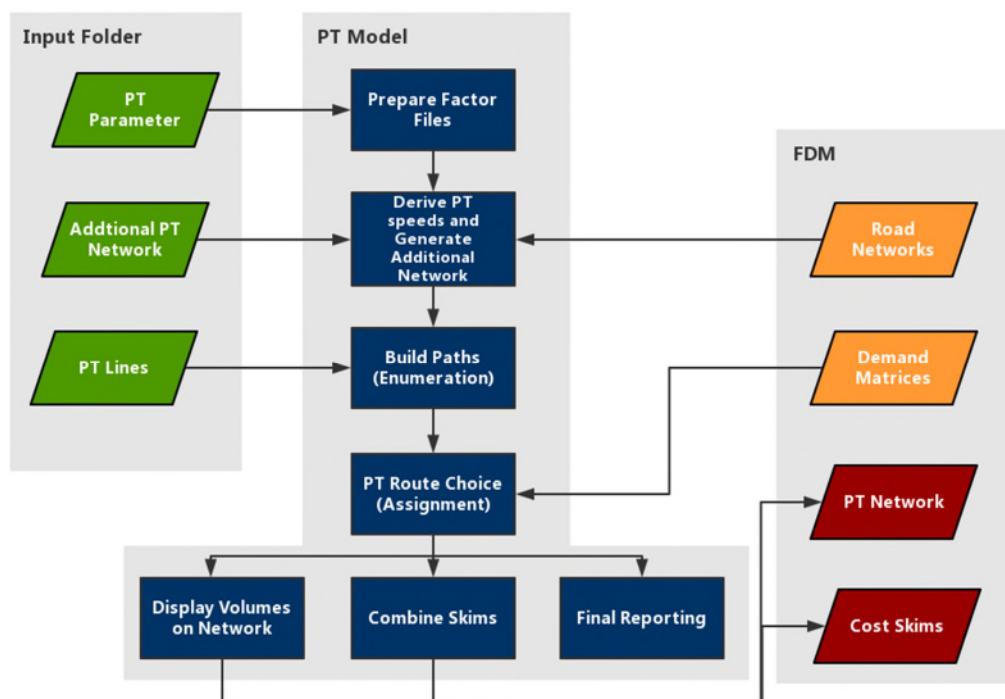


Figure 2-5: PT Model Process

2.4.2.4 Active Modes Model

The active modes assignment is run after the PTAM using the PT network with rail and motorway links removed. The active mode assignment is a shortest path assignment and does not include delays or crowding.

The inputs for the active assignment model are the output CUBE format PT networks, the demand model produced assignment matrices and separate input pedestrian only links and cycle lanes. The outputs of this process include an assigned network with walk and cycle flows by user class, and a set of generalised cost skims.

2.5 Suitability of East Regional Model

2.5.1 Model Calibration and Validation

The ERM has been subject to a comprehensive calibration and validation process in line with best practice guidelines. A substantial amount of observed data has been incorporated into both the demand model and the assignment models as presented in Table 2-3.

Table 2-3: Observed data used for Model Calibration and Validation

Demand Model	Assignment Models
Tour proportions	Road traffic volumes
Generalised cost distributions	Road journey times
Travel distance distributions	Road trip length distribution
Modal share	Public transport in-vehicle time factors
Journey time distribution	Public transport fares and ticket types
	Public transport passenger flows
	Public transport boardings and alightings
	Public transport journey times
	Public transport interchange/transfers

The calibration and validation process ensures that the ERM accurately reflects existing conditions and ‘costs’ associated with travel. This allows changes in the transport demand and impacts of strategic transport infrastructure schemes and transport policies to be modelled and tested using the ERM. Further details on the ERM calibration can be found in the Model Development and Calibration Reports available on the NTA’s website².

2.5.2 Use of ERM for Strategic Transport Planning

The model has many strengths and features that makes it the ideal tool to aid the strategic planning process. The ERM has been developed from first principles making best use of the most recently available data (POWSCAR and NHTS) to replicate travel choices and transport network conditions as accurately as possible.

Several distinct journey purposes and characteristics including car availability, employment status, and education level are considered within the model to evaluate travel choices more accurately. This carries through to forecasting whereby specific person type demand can be forecast to derive appropriate trip distributions and future year travel conditions.

The model utilises a tour-based approach which allows for more accurate mode choice modelling and consideration of travel costs.

Four main modes of travel are included in the model: private car, public transport, walking, and cycling. Each mode has been calibrated individually, for each journey purpose, to replicate observed trip cost distributions.

²<https://www.nationaltransport.ie/planning-and-investment/transport-modelling/regional-modelling-system/regional-multi-modal-models/east-regional-model/>

The use of SATURN software in the road model allows for junction modelling to be included which improves network representation in congested areas. Link speeds and delays are transferred to the public transport model which allows journey times of on-street modes (Bus) to reflect real traffic conditions rather than being based strictly on timetables.

2.5.3 Summary

The East Regional Model provides a comprehensive representation of travel patterns across the Study Area and it is a suitable tool for assessing the effects of the proposed scheme.

3. FORECAST LAND-USE ASSUMPTIONS

3.1 Introduction

ERM Future year travel demand is based on forecasts of population, employment and education data as defined by the NTA at the Census Small Area (CSA) level. This data is collated into a planning sheet. The National Demand Forecasting Model converts this forecast planning sheet to travel demand (in total productions and attractions per zone) for input to the ERM, as described in section 2.3.

Two forecast years have been used for the Luas Finglas PBC assessment:

- Opening Year: 2035
- Design Year: 2050 (opening year +15)

2035 and 2050 reference case planning sheets have been obtained from the NTA, which are aligned with National Planning Framework (NPF) forecasts as well as the latest planning policy for the Greater Dublin Area. These planning sheets are the basis for the forecast land use included in the 2035 and 2050 Core modelling scenarios.

To ensure the land use forecasting was as accurate as possible, a desktop review was undertaken of major planning applications within the study area around the Luas Finglas alignment. This was then compared to the values in the NTA reference planning sheet to ensure a robust representation of proposed developments in the area was included in the forecast ERM runs.

The following sections provide an overview of the growth in population, employment and education as outlined in the NTA 2035 reference planning sheets, along with alterations made to reflect local planning applications. For the 2050 forecast, minimal adjustment have been applied to the standard NTA 2050 planning sheets and the few alterations are mentioned in this section.

3.2 Population

Figure 3-1 highlights the key areas of population growth included in the NTA reference planning sheet between 2016 (ERM Base Year) and 2035.

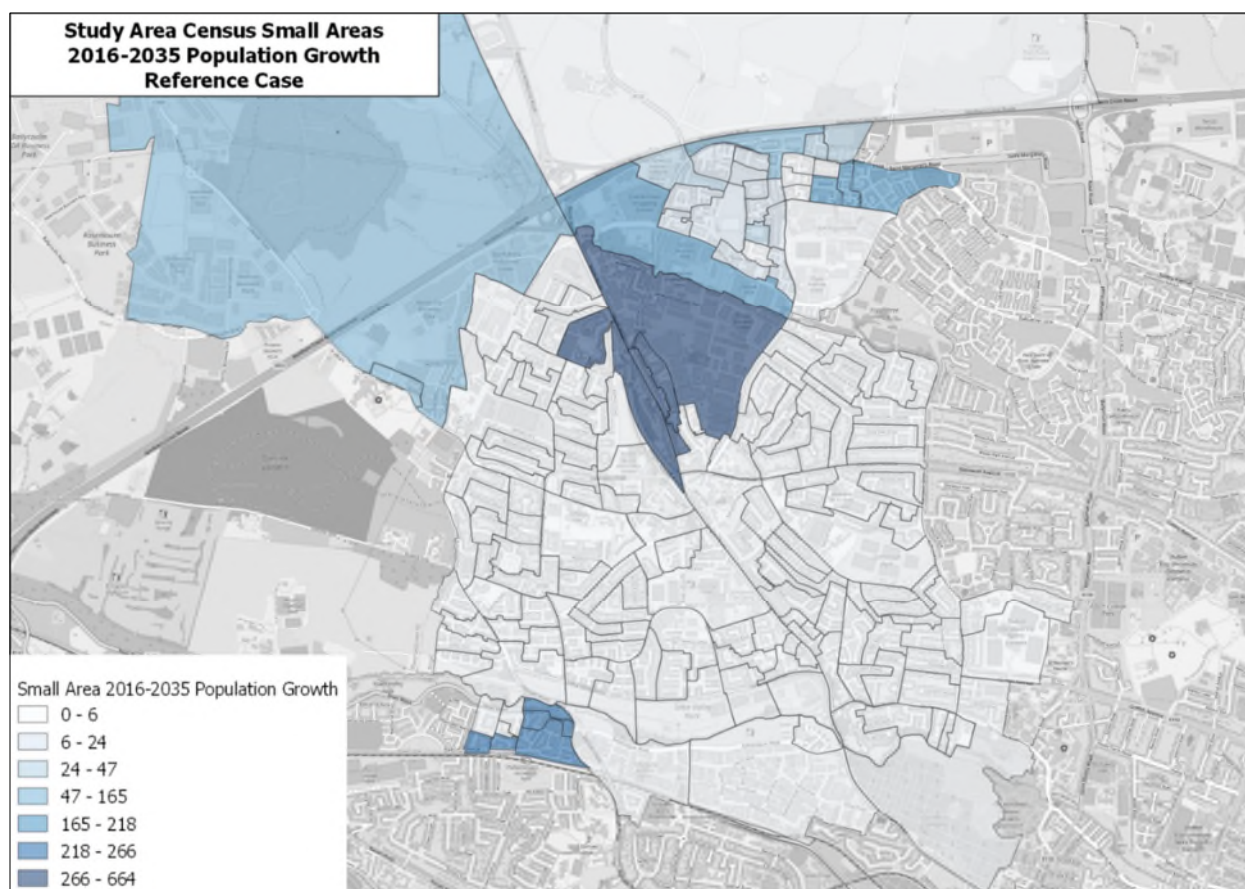


Figure 3-1: Reference Case Planning Sheet 2016-2035 Population Growth

This growth was then compared to major planning proposals within the study area outlined in Figure 3-2 and Table 3-1, to ensure they are fully captured in the future year test demand.

Table 3-1: Large Development Proposals within Study Area

Census Small Area	Development	Planning Ref	Residential Units
267066019	Charlestown Shopping Centre Phase 2	F19A/0146	377
267066019	Charlestown SHD (Car Park)	TA06F.310350	590
268012004	Merville Place	TA29N.310722	191
268015005/268015014	Hampton wood	TA29N.305538	129
268069004	Scribblestown	DCC Report No. 393/2017	70

Census Small Area	Development	Planning Ref	Residential Units
268027002	Royal Oak	PL29N.248996	69
268065013	Jamestown Road SDRA	City Development Plan 2016-2022, Variation No. 33: Jamestown Road SDRA ³	2,200

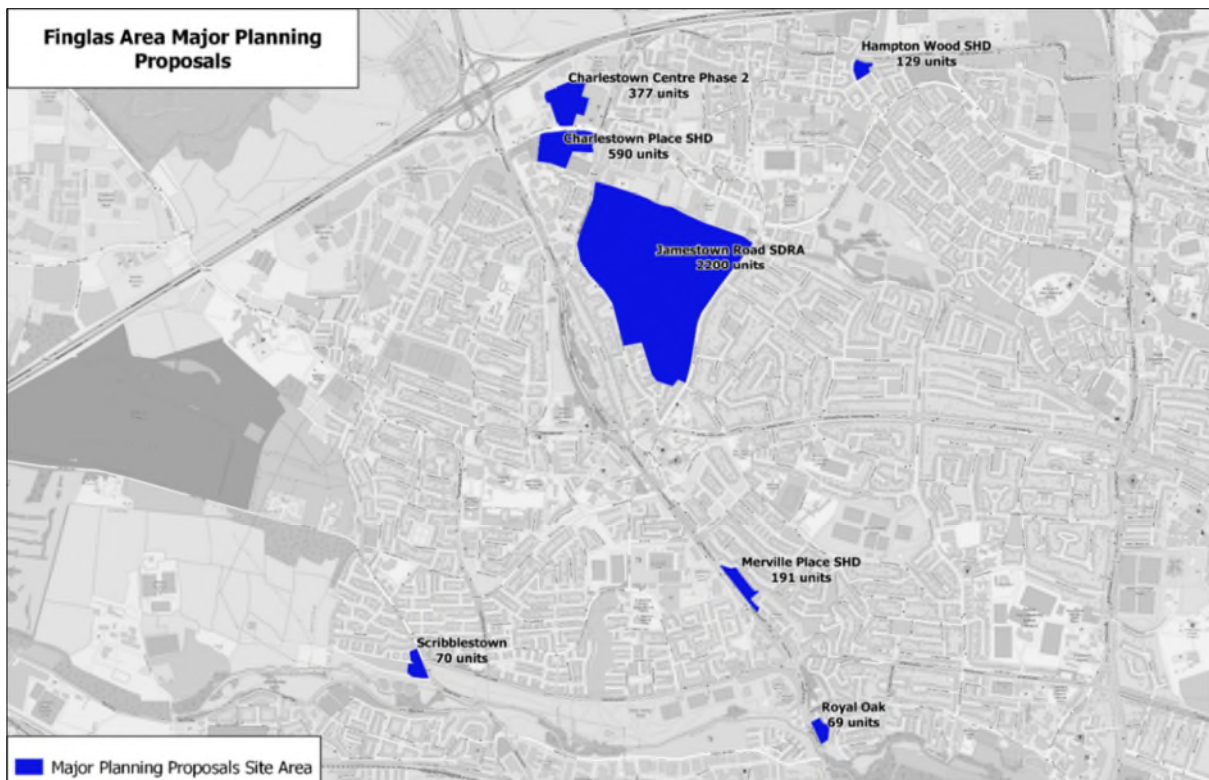


Figure 3-2: Finglas Area Major Planning Proposals

The above projects have progressed through the planning process and it is assumed that they will be complete by 2035, with the exception of the Jamestown Road SDRA which will take longer to complete.

The estimated development population was derived using 2016 Census data for Dublin City. The census classifies households based on the number of occupied rooms (kitchen, living room and bedrooms) and provides the number of households within each class and the total persons living in these households. This allows the approximate average population for different unit sizes to be estimated and the results are outlined in Table 3-2.

³ NOTE: The Jamestown Road SDRA was the latest planning document available for the Jamestown Road industrial estate at the time modelling was undertaken

Table 3-2: DCC Household Size by number of occupied rooms (2016 Census – Statbank Table E1035)

Household Type (no. of rooms)	No. Households	No. of Person	Estimated Household Size
All households	211,591	52,4687	2.48
1 room	11,337	17,353	1.53
2 rooms	26,105	51,726	1.98
3 rooms	31,446	72,930	2.32
4 rooms	31,796	73,817	2.32
5 rooms	39,358	107,892	2.74
6 rooms	28,889	80,990	2.80
7 rooms	13,698	42,238	3.08
8 rooms	7,867	26,153	3.32
9 rooms	2,046	7,072	3.46
10 or more rooms	1,457	5,395	3.70
Not stated	17,592	39,121	2.22

To estimate the development population, the household sizes were applied to the number of studio, 1 bed, 2 bed and 3 bed units in each development per approved planning permission. For the Jamestown Road SDRA, it was assumed that the unit profile would be in line with the other developments within the study area. Therefore, the average household size per unit across the other developments was applied to Dublin City Council’s estimated yield of 2,200 units for the SDRA to calculate overall population totals. Table 3-3 outlines the calculated projected population totals for each of the planning proposals in Figure 3-2. These values are then compared to the population total for the relevant CSAs in the NTA’s 2035 reference planning sheet.

Table 3-3: Study Area Development Proposals – Estimated Population

Census Small Area	Development	Planning Ref	Residential Units	Estimated Development Population	Planning Sheet CSA Population Total in 2035
267066019	Charlestown Shopping Centre Phase 2	F19A/0146	377	772	996
267066019	Charlestown SHD (Car Park)	TA06F.310350	590	1,306	
268012004	Merville Place	TA29N.310722	191	402	338

Census Small Area	Development	Planning Ref	Residential Units	Estimated Development Population	Planning Sheet CSA Population Total in 2035
268015005 /268015014	Hampton wood	TA29N.305538	129	284	688
268069004	Scribblestown	DCC Report No. 393/2017	70	161	203
268027002	Royal Oak	PL29N.248996	69	153	232
268065013	Jamestown Road SDRA	City Development Plan 2016-2022, Variation No. 33: Jamestown Road SDRA	2,200	4,796	995

To ensure that the 2035 planning sheet used in the forecast ERM runs is as robust as possible, the relevant CSAs from Table 3-3 have been updated to reflect the calculated estimated development population. For the Jamestown Road SDRA, there was limited information available on development phasing and likely unit levels by 2035 at the time of undertaking the modelling analysis. Therefore, for the Core development scenario, it has been assumed that 50% of the residential units (1,100) will be complete by 2035. The other 50% is assumed to be completed by 2050 and included in the 2050 forecast. Table 3-4 outlines the final 2035 population values for each of the CSAs with identified planning proposals.

Table 3-4: Planning Sheet Population Alterations by Small Area

Census Small Area	Planning Sheet CSA Population 2016	Original Planning Sheet CSA Population 2035	Estimated Development Population	New Planning Sheet CSA Population 2035
267066019	792	996	2,078	2,870
268012004	338	338	402	740
268015005/268015014	471	688	284	755
268069004	203	203	161	364
268027002*	232	232	153	385
268065013**	331	995	2,398	2,729
Total	2,367	3,452	5,476	7,843

3.2.1 2050 Population Levels

A similar exercise was undertaken for the 2050 population planning forecasts. Values from the NTA’s 2050 reference planning sheet were compared to the major applications noted above:

- If growth was sufficient to account for planned development, it was assumed that this development is included in the NTA's reference case Planning Sheet (i.e. no change needed).
- If growth was insufficient, the values in the NTA Planning Sheet were adjusted to included planned levels of development.

For the Jamestown SDRA it was assumed that the full 2,200 units would be delivered by 2050.

3.3 Employment

The growth in employment within the study area between 2016 and the reference case 2035 planning sheet is illustrated in Figure 3-3, overleaf. A review of major planning applications did not identify any significant industrial or employment developments planned for the Finglas area not already accounted for in the NTA reference case planning sheet with the exception of the Jamestown Road SDRA.

The Jamestown Road industrial lands have only recently been rezoned and are planned to transition from 100% employment to 30% employment under the SDRA scheme. As the area is predominantly low-density industrial development at present, it is assumed that any employment lost will be replaced by higher density employment development within the SDRA, but with no overall employment growth when compared to 2016 levels.

Therefore, for the Jamestown Road development, employment figures have been retained at 2016 levels in the 2035 and 2050 planning sheet. With no additional information readily available, employment levels for all other CSAs within the study area have been retained as per the NTA's 2035 reference planning sheet.

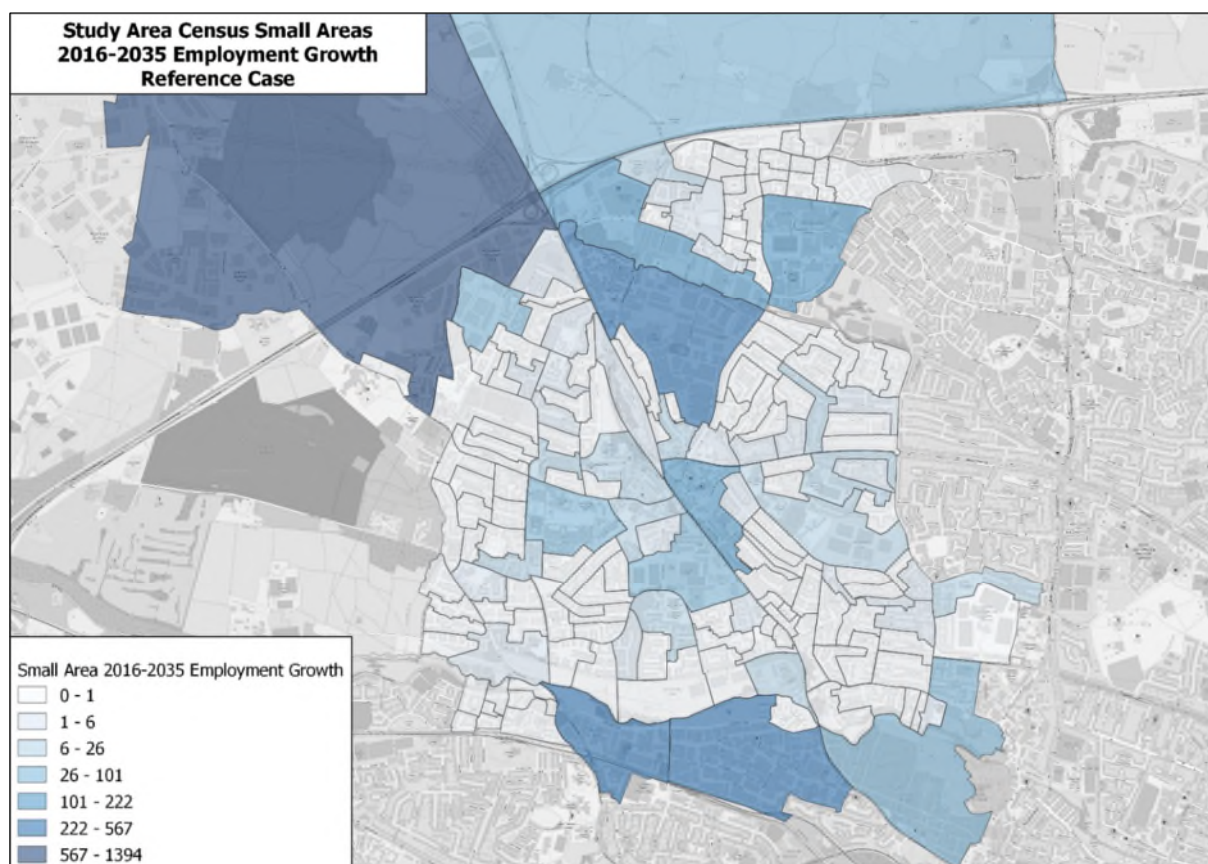


Figure 3-3: Reference Case Planning Sheet 2016-2035 Employment Growth

Table 3-5: Planning Sheet Employment Alterations by Small Area (Jamestown Rd SDR)

Census Small Area	Planning Sheet CSA Employment 2016	Planning Sheet CSA Employment 2035	Estimated 2016-2035 Growth due to Development	New Planning Sheet CSA Employment 2035
268065013	1,414	1,827	0	1,414

3.4 Education

The growth in education within the study area between 2016 and the reference case 2035 planning sheet is illustrated in Figure 3-4. As per the employment data, a review of major planning applications did not identify any significant education developments planned for the Finglas area not already accounted for in the NTA reference case planning sheet with the exception of the Jamestown Road SDR.

The Jamestown Road SDR stipulates that 10% of the lands be for “Community/Educational uses”. As outlined previously, at the time of modelling there was limited information available on development phasing for the Jamestown Road development, however, it is assumed that it will not be fully built out by the test year 2035.

For the purpose of this modelling assessment, it has been assumed that the 10% education facilities will be built post 2035. Therefore, education growth values from the NTA’s reference planning sheet have been used for the 2035 Core land use scenario.

In the 2050 forecast, 268 education places have been added in the Jamestown Road Small Area to account for the new school. This is based on a review of average school sizes within the study area.

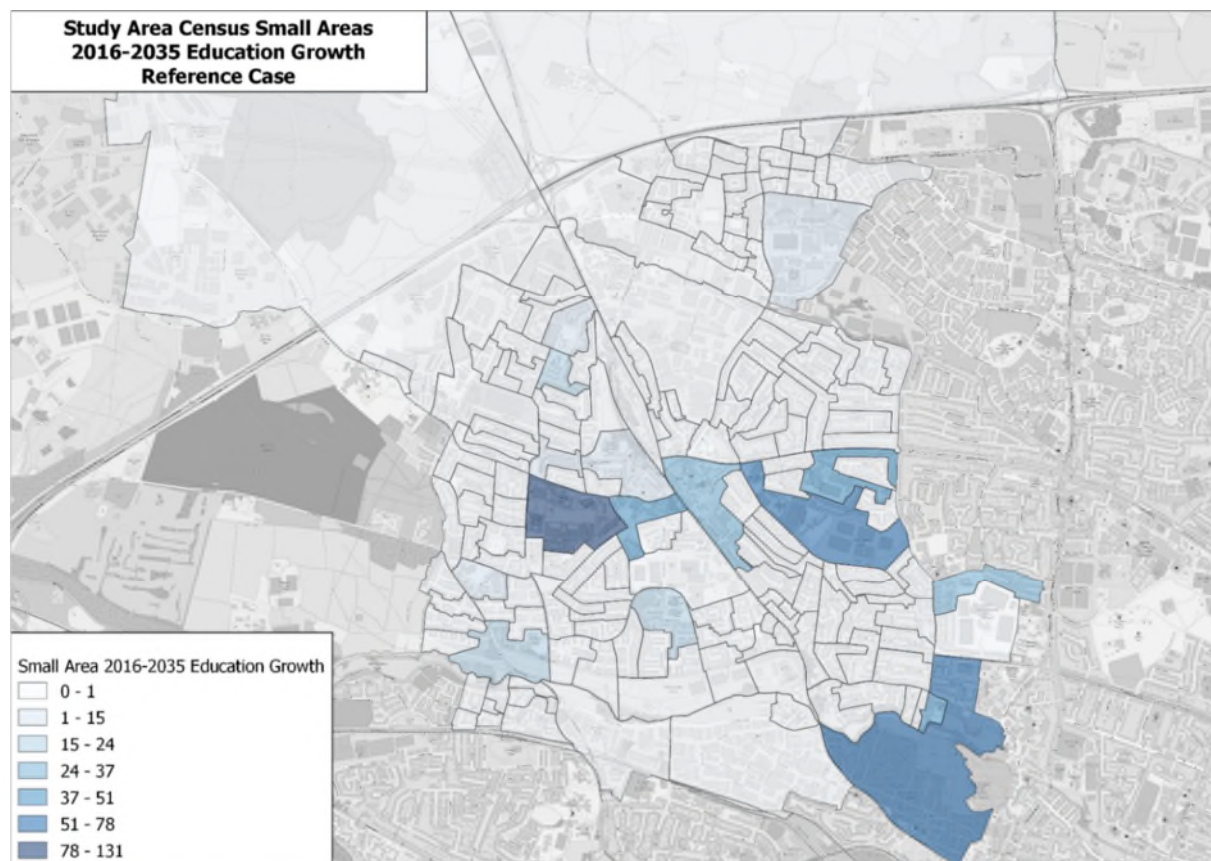


Figure 3-4: Reference Case Planning Sheet 2016-2035 Education Growth

4. MODELLED SCENARIOS

4.1 Overview

The following sections provide an overview of the scenarios modelled in the ERM for the 2035 and 2050 forecast years. It includes information on schemes included in the ‘Do Minimum’ Core scenario, along with details of how Luas Finglas has been coded in the ERM and key modelling parameters.

Further details on sensitivity tests modelled which included variations to both transport supply and demand is provided in Section 5.7.

4.2 Do Minimum

In order to accurately model future year transport conditions, assumptions have been made around the delivery of committed and planned transport proposals by 2035. A detailed review was undertaken of road, public transport and active travel (walking and cycle) schemes included in the latest draft Transport Strategy for the Greater Dublin Area 2022-2042⁴.

For active travel and public transport schemes, cognisance has been taken of their current delivery status, their proposed phasing within the draft GDA Transport Strategy, along with their inclusion in the National Development Plan (NDP) which sets out the investment priorities that will underpin the implementation of the National Planning Framework.

The following schemes are likely to significantly impact on the appraisal of the Luas Finglas, namely:

- **BusConnects:** delivery of high frequency bus services from Finglas to the city centre with improved public transport priority due to the creation of a Core Bus Corridor along the R135;
- **DART+ West:** electrification of the Maynooth Rail line with improved frequencies facilitating interchange with the Luas Finglas extension at Broombridge; and
- **Greater Dublin Area Cycle Network Plan:** Delivery of a high-quality cycle network providing improved accessibility to the Luas Finglas stations and supporting Cycle + Ride.

It is proposed that these schemes be included in the Core 2035 Do-Minimum scenario as they have progressed significantly through the planning process, they are name checked as Strategic Investment Priorities within the NDP and are outlined for implementation by 2030 in the draft 2042 GDA Transport Strategy Phasing. The inclusion of the BusConnects Core Bus Corridor scheme also allows for a more robust appraisal of Luas Finglas. The provision of an improved bus service running parallel to the Luas route along the Finglas Road is likely to have some impact on patronage. As such, the exclusion of the Core Bus Corridor scheme in the ‘Core’ scenario would potentially lead to an over-inflation of Luas Finglas benefits.

⁴ It should be noted that the strategic modelling for Luas Finglas was undertaken in Summer 2022. The GDA Strategy 2022-2042 was still draft at this stage. Although the strategy has since been approved, it is still referenced here as draft as that was the source information available to inform the modelling assumptions.

Since undertaken the Luas Finglas modelling, these schemes have progressed further through planning:

BusConnects Core Bus Corridor Infrastructure:

- The Preliminary Business Case for the BusConnects programme has been approved by Government.
- Currently a number of the corridors, including the Ballymun/Finglas to city centre scheme have been submitted to ABP for approval.

DART+ West:

- The Preliminary Business Case for the DART+ programme has been approved by Government.
- The Government granted Approval in Principle to the NTA to enable the submission by CIÉ / Iarnród Éireann of a Railway Order application to An Bord Pleanála for the DART+ West element of the programme (Decision Gate 1).
- A Railway Order application for DART+ West was submitted to An Bord Pleanála on the 29th July 2022 (<https://www.dartplus.ie/en-ie/projects/dart-west>).
- Broombridge Station is on the DART+ West alignment and there will be a significant enhancement in the level of rail service provided.

In the following sections, each of the schemes highlighted within the draft GDA Transport Strategy have been outlined with information on their status⁵ at the time the modelling was undertaken and whether they should be included within the 2035 Core Do-Minimum scenario.

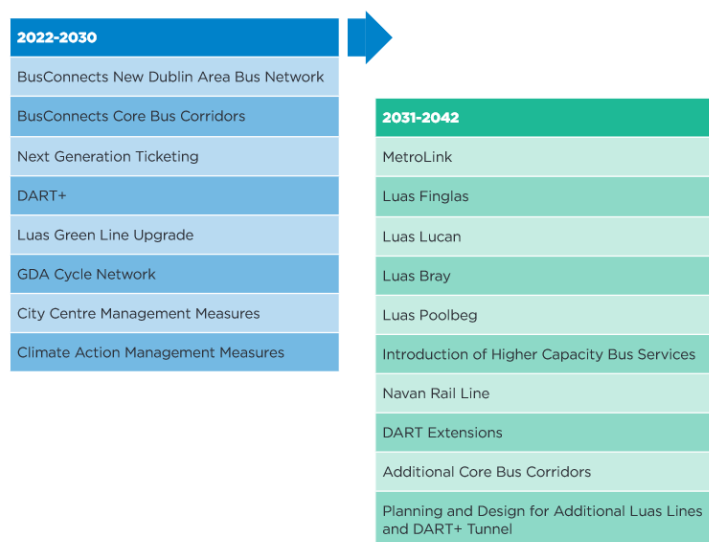


Figure 4-1: Draft Transport Strategy for the Greater Dublin Area 2022-2042 Phasing

⁵ As referenced previously, this represent the status of projects when the Luas Finglas strategic modelling was undertaken in the Summer 2022. It is acknowledged that schemes will have progressed since then, however, this was the latest information available at the time to inform the modelling assumptions.

4.2.1 Planned Road Schemes Overview

Table 4-1: ERM Future Road Schemes

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
R1	Road	Southern Port Access Route	Development of a road link connecting from the southern end of the Dublin Port Tunnel to the South Port area, which will serve the South Port and adjoining development areas	X	In pre-planning stage with ABP application anticipated Q1 2023. Aligned with GDA strategy and funded through Dublin Port Company. Forms key part of Port’s Masterplan 2040. www.dublinport3fm.ie
R2	Road	M/N11 Additional Capacity	Capacity enhancement and reconfiguration of the M11/N11 from Junction 4 (M50) to Junction 14 (Ashford) inclusive of ancillary and associated road schemes, to provide additional lanes and upgraded junctions, plus service roads and linkages to cater for local traffic movements	X	Has completed Phase 2: Options Selection of the TII Project Management Guidelines. Is name checked in the National Development Plan 2021-2030 and the draft GDA Transport Strategy
R3	Road	N3-N4 Link (Leixlip-Blanchardstown)	N3–N4: Barnhill to Leixlip Interchange	X	Included in Draft GDA Transport Strategy Stage, feasibility report not yet published.
R4	Road	N4-N7-N81 Link	North-South Road – west of Adamstown SDZ linking N7 to N4 and on to Fingal	X	N4-N7 corridor study published in 2017 and recommends “Western Dublin Orbital Route”, GDA Strategy mentions enhancing capacity between N3-N4-N7 but nothing specific – no detail of project advancement beyond this. https://www.tii.ie/tii-library/strategic-planning/strategic-reports/N4_N7-Corridor-Study_Feb17.pdf
R5	Road	N2 Slane Bypass	Enhancements of the N2/M2 national route inclusive of a bypass of Slane, to provide for additional capacity on the non-motorway sections of this route, and to address safety issues in Slane village associated with, in particular, heavy goods vehicles	X	Mentioned in GDA Strategy and National Development Plan. Is currently at Phase 3: Design and Environmental Evaluation of the TII Project Management Guidelines. http://www.n2slanebypass.ie/

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
R6	Road	N2 Upgrade	N2 Upgrade from the M2 Rath Roundabout to Kilmoon Cross to address safety issues	X	Mentioned in GDA Strategy and National Development Plan. Is currently at Phase 2: Options Selection of the TII Project Management Guidelines https://www.n2rath2kilmoon.ie/
R7	Road	N3 Junctions and Bus Priority	Junction enhancements and lane layout changes, including bus lane provision, to enhance safety, legibility and bus priority along the N3 between Junction 1 and Junction 4	X	Mentioned in GDA Strategy and National Development Plan. Is currently at Phase 2: Options Selection of the TII Project Management Guidelines https://consult.fingal.ie/en/consultation/n3-m50-clonee-non-statutory-public-consultation-scheme-update-emerging-preferred-option
R8	Road	M4 Junctions and Bus Priority	Improvements to junctions 5, 6 and 7 on the M4 in order to address queuing onto the mainline and associated traffic safety issues plus the provision of bus priority between Junctions 5 and 7	X	Mentioned in GDA Strategy and National Development Plan Is currently at Phase 2: Options Selection of the TII Project Management Guidelines https://maynoothleixlip.ie/phase-2/
R9	Road	N7 Removal of Uncontrolled Accesses	The removal of all direct uncontrolled accesses onto the N7 between the M50 and Naas, in accordance with the EU Guidelines for the Development of the Trans-European Transport network and the implementation of measures to facilitate efficient bus operations	X	Mentioned only in GDA Strategy, not in Development plan
R10	Road	N81 Enhancements and Bus Priority	Safety, alignment and bus priority enhancements to the N81	X	Mentioned only in GDA Strategy, not in Development plan

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
R11	Road	South Fingal Transport Study Roads	Roads as recommended in South Fingal Transport Study	X	Outlined in South Fingal Transport Study, no further publications and not mentioned in GDA Strategy or National Development Plan.
R12	Road	Level Crossing removal DART+ West	Closure of 5 level crossing on the Connolly-Maynooth rail line (Ashtown, Coolmine, Porterstown, Clonsilla and Barberstown)	✓	See PT1 DART+ West section below.

4.2.2 Planned Public Transport Schemes Overview

Table 4-2: ERM Future PT Schemes

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
PT1	Heavy Rail	DART+ West	DART expansion to Maynooth Line, Connolly enhancements, elimination of level crossings, new Docklands Station	✓	<p>Government has approved Preliminary Business Case for the DART+ Programme as a whole.</p> <p>DART+ West has completed a second round of Public Consultation and published the Preferred Route.</p> <p>Government has issued Decision Gate 1 approval for DART+ West in line with the requirements of the Public Spending Code. The project therefore has approval to apply to An Bord Pleanála for a Railway Order application once all necessary planning and environmental documentation has been finalised, expected in 2022.</p>
PT2	Heavy Rail	DART+ South West	DART expansion to Hazelhatch, four-tracking between Park West and Heuston, Phoenix Park Tunnel Enhancements	X	Government has approved Preliminary Business Case for the DART+ Programme as a whole.

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
					DART+ South West has completed a second round of Public Consultation and published the Preferred Route.
PT3	Heavy Rail	DART+ Coastal North	DART expansion to Drogheda, capacity enhancements through station modifications	X	Government has approved Preliminary Business Case for the DART+ Programme as a whole. DART+ Coastal North at Options Selection Stage, Emerging Preferred Option being developed.
PT4	Heavy Rail	DART+ Coastal South	Elimination of level crossings, possible capacity enhancements at Bray and Greystones	X	Government has approved Preliminary Business Case for the DART+ Programme as a whole. DART+ Coastal South at Options Selection Stage, Emerging Preferred Option being developed.
PT5	Heavy Rail	DART+ Tunnel	Heavy Rail Tunnel linking Docklands (Northern Line) and Heuston Station (Kildare Line)	X	DART+ Tunnel has been deferred in the Draft GDA Strategy until post 2042.
PT6	Heavy Rail	DART Further Expansion	DART expansion to Sallins, Kilcock and Wicklow	X	DART extensions scheduled for the latter period of the Draft GDA Strategy.
PT7	Heavy Rail	Navan Rail Line	The existing rail network in the GDA will be extended by the provision of a new rail line from the M3 Parkway terminus station (just west of Dunboyne) to Navan town, serving Dunshaughlin and Kilmessan along its route	X	Navan Rail Line scheduled for the latter period of the Draft GDA Strategy.
PT8	Light Rail	Metrolink (Swords-Charlemont)	Mostly underground Metro Line from north of Swords to Charlemont via northern suburbs and Dublin Airport including interchange stations with DART network at Glasnevin and Tara Street	X	Preliminary Business Case Submitted to Government in February 2021. Awaiting Decision Gate 1 approval. "TII is targeting the completion of all relevant planning material for MetroLink to allow a Railway Order Application to be made in the first half of 2022." https://www.metrolink.ie/#/news

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
PT9	Light Rail	Luas Extension to Finglas	Extension of Luas Green Line to Finglas and Charlestown	X	Luas Finglas will be excluded from the Do Minimum scenario and included in the Do Something scenario.
PT10	Light Rail	Luas Extension to Bray	Extension of the Luas Green Line southwards in order to serve the Bray and Environs area	X	Luas Bray scheduled for the latter period of the Draft GDA Strategy.
PT11	Light Rail	Luas Extension to Poolbeg	Extension of the Luas Red Line to Poolbeg	X	Luas Poolbeg scheduled for the latter period of the Draft GDA Strategy.
PT12	Light Rail	Luas to Lucan	Light rail line from Lucan to the City Centre	X	Luas Lucan scheduled for the latter period of the Draft GDA Strategy.
PT13	Light Rail	Luas Green Line Upgrade	Upgrade of Luas Green Line southern section to provide higher frequency	✓	Luas Green Line Upgrade scheduled for the first half of the Draft GDA Strategy.
PT14	Light Rail	Luas lines post 2042	Post 2042 delivery of Luas lines: <ol style="list-style-type: none"> 1. City Centre to Clongriffin; 2. City Centre to Beaumont and Balgriffin; 3. Green Line Extension to Tyrrelstown; 4. City Centre to Blanchardstown; 5. Red Line Reconfiguration to provide the following lines: <ol style="list-style-type: none"> a. Clondalkin-City Centre; and b. Tallaght-Kimmage-City Centre. 6. Tallaght to City Centre via Knocklyon; and 7. Green Line Reconfiguration to provide the following lines: <ol style="list-style-type: none"> a. City Centre to Bray via UCD and Sandyford; and b. Sandyford to City Centre 	X	Scheduled for post-2042 in the Draft GDA Strategy.

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
PT15	Bus	BusConnects Dublin (Core Bus Corridors, New Network, Fare Structure)	BusConnects Dublin programme as per National Development Plan including the 12 Core Bus Corridors	✓	<p>The Preliminary Business Case for the BusConnects programme has been submitted to Government for approval.</p> <p>Network rollout to be completed by 2024.</p> <p>Fare structure largely implemented November 2021.</p> <p>Three very large public consultations held on Core Bus Corridors, planned to be submitted for planning upon Decision Gate 1 approval by government.</p> <p>BusConnects Core Bus Corridors scheduled for the first half of the Draft GDA Strategy.</p> <p>https://busconnects.ie/</p> <p>https://www.kildarestreet.com/wrans/?id=2021-12-16a.98</p>
PT16	Bus	High Capacity Vehicles on CBCS	Introduction of Higher Capacity Vehicles on some BusConnects corridors to increase capacity	X	Higher Capacity Vehicles on CBCs scheduled for the latter period of the Draft GDA Strategy
PT17	Bus	Additional Corridors (Orbital, Regional, Additional Radial)	Additional Bus Priority Radial routes within Dublin, development of Orbital Core Bus Corridors within Dublin, and Regional Core Bus Corridors on National Roads Approaching Dublin	X	Additional CBCs scheduled for the latter period of the Draft GDA Strategy
PT18	Bus	Connecting Ireland: New Rural Bus Services	Connecting Ireland is the NTA's programme to address the gaps in connections to local and regional centres in rural Ireland, to allow for the access to local services without the need for a car and to provide the option of more sustainable transport across the region	✓	<p>"Rollout of new and improved services will happen on a phased basis from 2022 to 2025."</p> <p>https://www.nationaltransport.ie/connecting-ireland/timeline-and-what-were-doing-next/</p>

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
DM1	Demand Management	GDA Demand Management Measures	Demand Management Measures include restrictions on Workplace and on-street parking, congestion charging, additional tolls on radial motorways and along the M50	X	No specific information on Demand Management measures to implemented by 2035. Demand Management measures likely to improve performance of Luas Finglas against scheme objectives, therefore exclusion a prudent approach.

4.2.3 Planned Active Travel Schemes Overview

Table 4-3: ERM Future Active Travel Schemes

ID	Mode	Scheme Name	Description	In Do Minimum	Delivery Stage
AT1	Active Travel	Greater Dublin Area Cycle Network Plan (including Radial Core Bus Corridor elements)	The cycle network has been based on the Greater Dublin Area (GDA) Cycle Network plan and includes the Radial Core Bus Corridor elements.	✓	Cycle Network scheduled for the first half of the Draft GDA Strategy. Large increase of funding to €360m/year allocated to 2025.

4.3 Do Something Scenario

The Do-Something future year modelling scenario includes all the Do-Minimum schemes outlined in the previous section, plus the proposed LUAS Finglas extension. The following sections provide an overview of how Luas Finglas has been represented in the ERM, including information on:

- **Characteristics:** capacities, headways, scheduling etc.
- **Alignment:** Route coding, distances and travel times
- **Road Network Coding:** details of how the interaction between the Luas and road network has been represented within the model coding; and
- **ERM Assignment Parameters:** overview of the key parameters used to represent the Luas Finglas in the Public Transport Assignment model.

4.3.1 Characteristics

Table 4-4 outlines some of the key characteristics which have been used to model the Luas Finglas extension. For tram capacity, it has been assumed that the longer trams introduced as part of the Luas Green Line Capacity Enhancement Project will operate on the extension to Finglas. These are 55m trams with a seat capacity of 96 and overall passenger capacity of 408⁶.

It has been assumed that the service pattern for the Finglas Extension will include trams operating between Charlestown and Brides Glen with an average headway of 7.5 minutes in all modelled time periods for the Core Scenario in 2035. This headway has been reduced to 5 minutes in the design year 2050.

Table 4-4: Luas Finglas ERM Parameters in GDA Strategy Run

Parameter (Luas Finglas)	Value
Tram Seat Capacity	96
Overall Tram Passenger Capacity	408
Headway	7.5 mins (2035) / 5 mins (2050)

4.3.2 Alignment

Figure 4-2, outlines the Preferred Route for Luas Finglas which has been coded within the ERM Public Transport Model. It also illustrates the ERM zones in proximity to the Luas alignment, along with their connectors to the walk network facilitating access to the Luas stations.

⁶ Details available at:

<https://www.nationaltransport.ie/planning-and-investment/transport-investment/projects/luas-green-line-capacity-enhancement/>

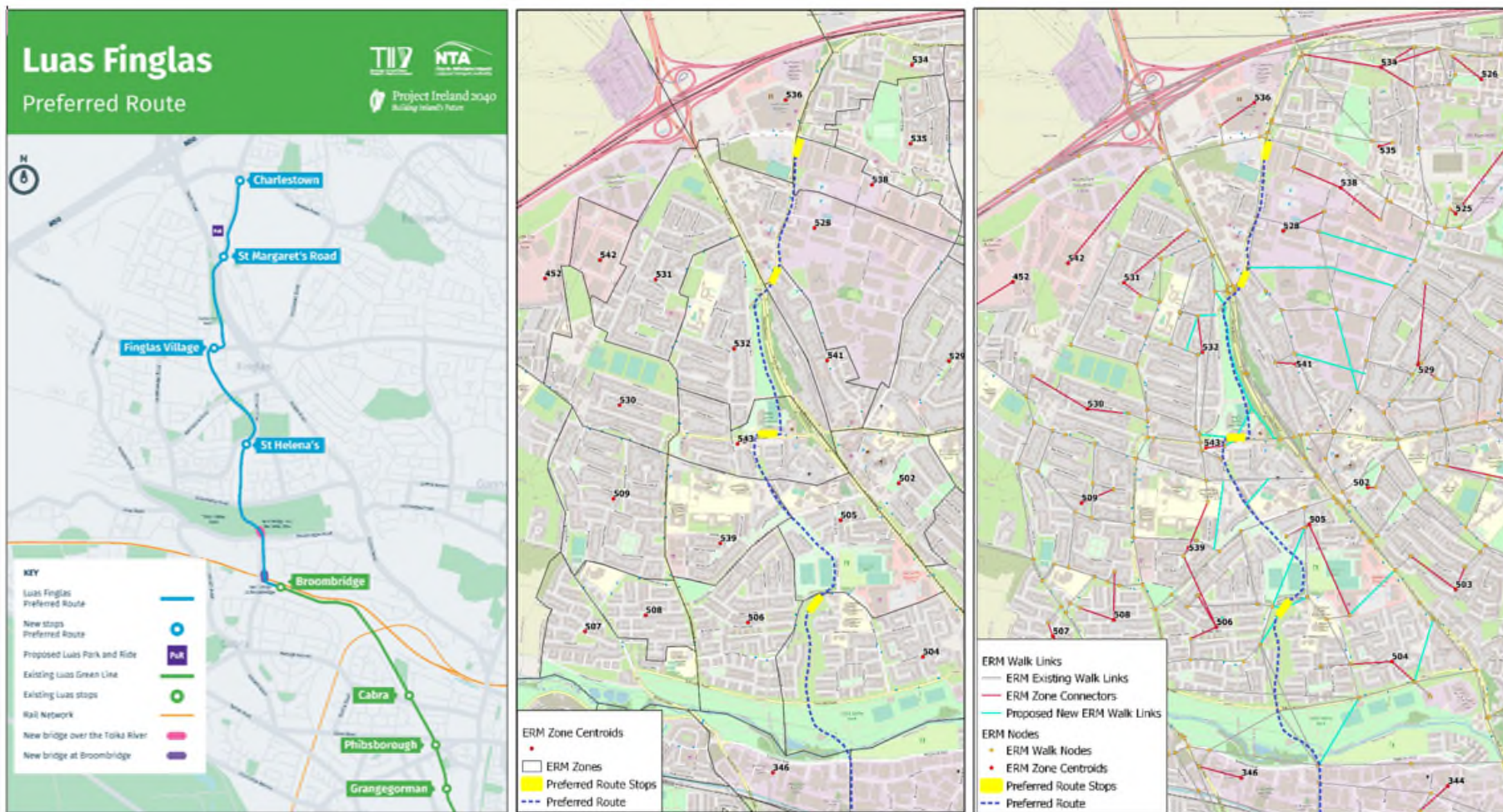


Figure 4-2: Preferred Luas Finglas Route Alignment and ERM Zone System

4.3.2.1 Walk Network and Links to Stations

Walk links have been generated in the ERM connecting the Luas stations to their nearest road network node, representing the station access points as accurately as possible. The ERM zone centroids have been calculated using GeoDirectory weightings to ensure their loading points are reflective of the average access to the network for each zone.

SYSTRA has undertaken a detailed review of the walk network along the Luas alignment to ensure that access is represented as accurately as possible. These new links, highlighted in Figure 4-2, represent walk access through housing estates, green areas, local streets etc. which may not have been included in the overall ERM road network. This ensures that walk access times to the Luas are represented as accurately as possible and that residents are loading on at the correct stations.

4.3.3 Run Times

Table 4-5 outlines the proposed distances between stations and overall travel time (including dwell time at stations) along the route. The proposed travel time has been taken from assumptions within the Initial Operation Plan for the Luas Finglas extension. In total, it is estimated that a journey from Charlestown to Broombridge will take 12.7 minutes.

Table 4-5: Luas Finglas ERM Parameters in GDA Strategy Run

Origin Station	Destination Station	Distance (km)	Total Time (sec)	Tot Time (min)
Charlestown	St. Margaret's Road	0.682	100	1.67
St. Margaret's Road	Finglas Village	0.846	165	2.75
Finglas Village	St. Helena's	1.025	237	3.95
St. Helena's	Broombridge	1.433	260	4.33
Total		3.986	762	12.70

4.3.4 Road Network Coding

The preferred route for the Luas Finglas Extension (Figure 4-2) will interact with the surrounding road network at a number of locations – new signalised junctions are proposed at Ballyboggan Rd, Tolka Valley Rd, St. Helena's Rd, Wellmount Rd, Cappagh Rd, Mellows Rd, North Rd (R135) and along St. Margaret's Rd to the terminus at Charlestown.

It is important that these road network changes are included in the Do-Something ERM assignment to reflect the impact of the Luas Finglas on strategic re-routing of traffic, journey times for vehicular traffic, congestion and mode choice. The latest available junction design drawings have been used to represent the network changes due to Luas Finglas in the ERM road assignment. A simplified version of the signalised junction coding, including signal phasing has been included. At some junctions, the Luas can cross in conjunction with a non-conflicting traffic phase. Where this is not possible, it is assumed the Luas will cross the junction during an elongated pedestrian crossing phase. This longer

pedestrian phase will slightly decrease vehicular capacity at these junctions. The individual signal timings have been optimised within SATURN in an attempt reflect the use of SCATS once operational.

One of the main junctions impacted along the Luas alignment is the R135/St. Margaret's Rd roundabout. The following section provides further details on how the proposed junction changes at this location have been included in the ERM SATURN road assignment including signal phasing and assumed Luas crossing times. Similar analysis has been undertaken for all other junctions along the Luas route, and they have been updated accordingly within SATURN.

4.3.4.1 R135 / St. Margaret's Road Junction

Figure 4-3 outlines one of the design proposals⁷ for the North Rd/St. Margaret's Rd junction along with its representation within SATURN. Figure 4-4 provides an overview of the proposed simplified signal phasing used in the initial ERM SATURN assignment.

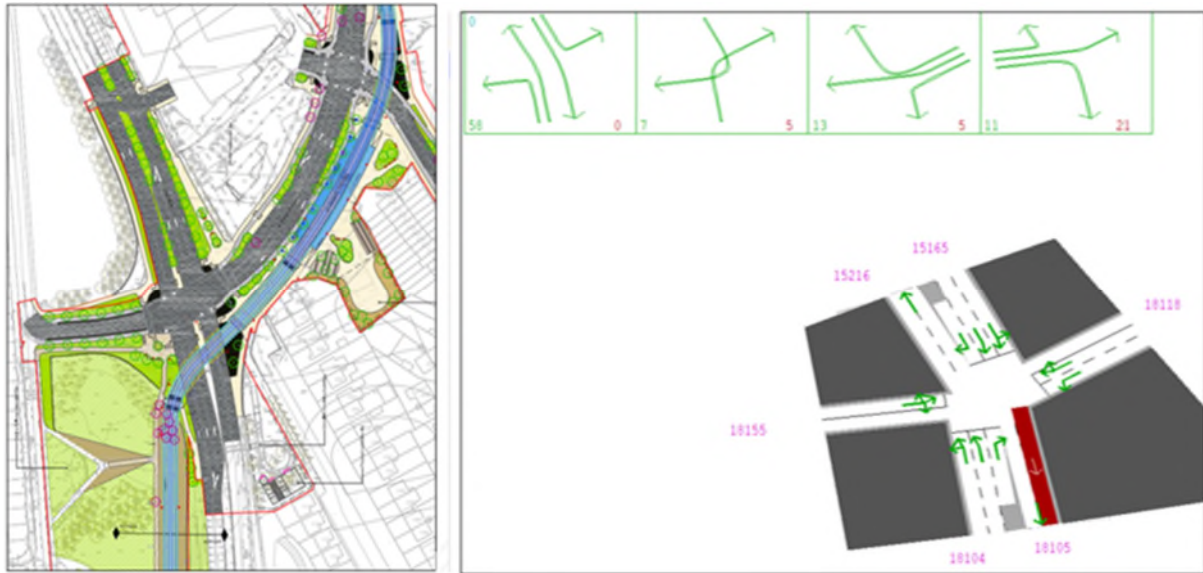


Figure 4-3: R135/St. Margaret's Road Do-Something SATURN Coding

⁷ Design proposals correct at the time of modelling (Summer 2022)

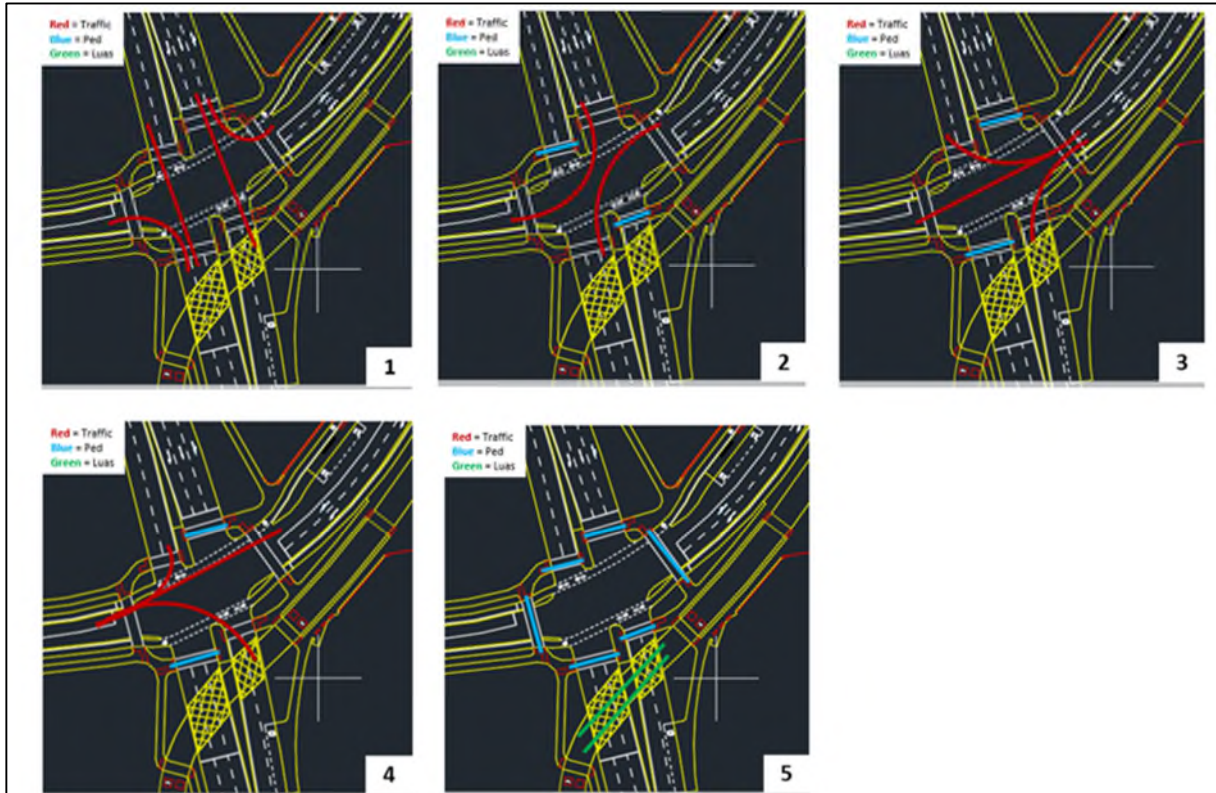


Figure 4-4: R135/St. Margaret's Road Do Something Indicative Traffic and Pedestrian Phasing

in SATURN it has been assumed that all traffic stops while the Luas is crossing the junction and all pedestrian crossings are green. Based on this assumption, traffic phasing was devised that prioritised North-South movements along the R135 and any possible pedestrian crossing phases.

To calculate the intergreen/all-pedestrian phase, it has been assumed that a Luas crossing occurs every 3.75 minutes, given the 7.5-minute headway in each direction proposed for 2035. A standard 120 second cycle time is being used for the junction. Using the 20kph Luas max speed approaching a station (given the proximity of the St. Margaret's Road station) in the Initial Operation Plan, the junction width and a 54.6m tram length, it has been calculated that it will take 16 seconds for a Luas to cross the junction. In addition to a 5 second intergreen time before and after, the Luas crossing phase will last 26 seconds.

Given the 120s cycle time and a 3.75-minute Luas headway, a Luas crossing will not occur every cycle. When a Luas is not crossing, an all-pedestrian phase will still occur but won't require the full 26 seconds. As illustrated in Figure 4-4, the pedestrian crossing at the east (Casement Road) and west (St. Margaret's Road) arms of the junction can't go until the all-pedestrian phase, and as such, these crossings are prioritised. Using *QuickGreen Intergreen Calculator software*, a 15 second intergreen time for the longer St. Margaret's Road crossing was derived.

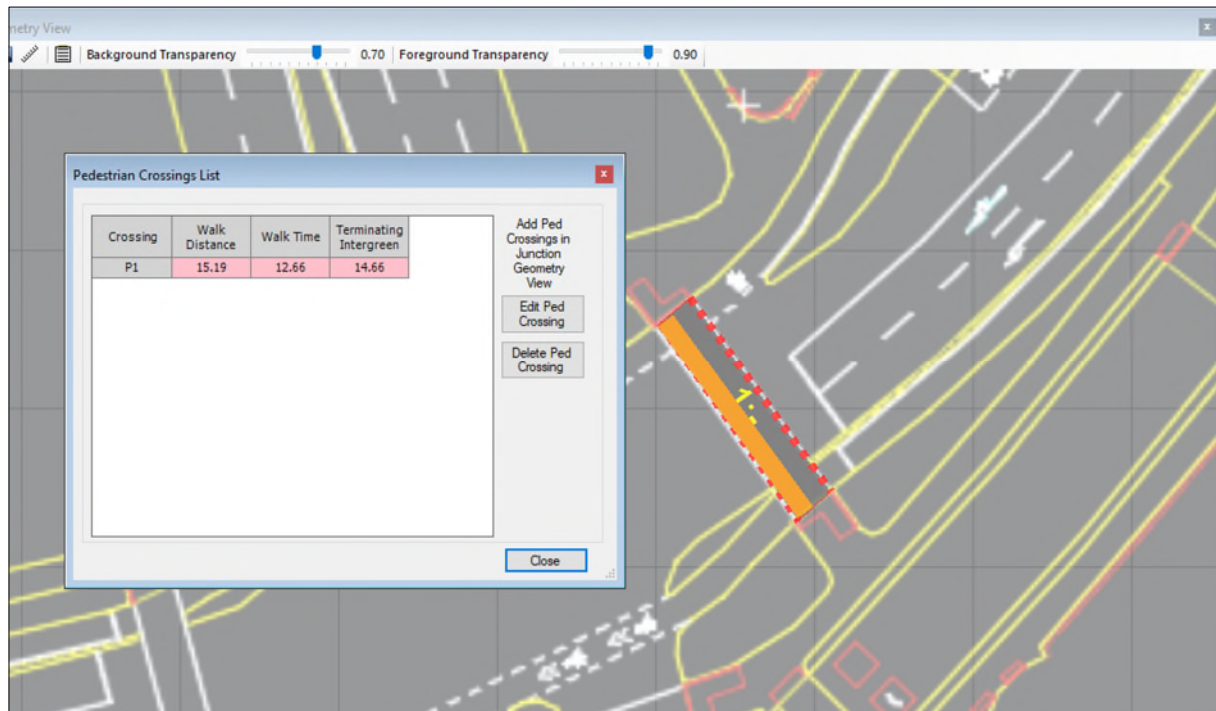


Figure 4-5: St. Margaret's Road Do Something Pedestrian Crossing Time in QuickGreen Intergreen Calculator

SATURN requires signal phase times for an average cycle throughout the peak hour. Therefore, a representative average time for the all-pedestrian/Luas crossing phase was needed:

- **With Luas:** 26 second all-red phase required
- **Without Luas:** 15 second all-red phase required
- **3.75 min Luas Headway:** Extra 11 seconds required every 3.75 mins (3 seconds extra per minute)
- **120 second cycle:** Average 6 additional seconds required for Luas on top of pedestrian crossings
- **Total All-Red phase:** 15 seconds (Pedestrian) + 6 seconds (Luas) = 21 seconds every cycle on average

It should be noted that this junction, and all others impacted by the Luas alignment, will be assessed in further detail through the design process using microsimulation modelling to reflect expected phasing as accurately as possible. The design of the junctions will be an iterative process between design and modelling to determine the preferred solution.

4.4 ERM Assignment Parameters

The following sections provide an overview of the key parameters used within the ERM Public Transport Assignment model. These parameters have been calibrated as part of the 2016 NTA Regional Model System calibration, and as such, it is recommended that they are retained for the Luas Finglas modelling.

4.4.1 Public Transport Generalised Cost

A person's choice of mode of travel is linked to the generalised costs associated each option available to them. In terms of public transport, the equation used to calculate the generalised cost for users is as follows:

Generalised cost = (A X Walk Time) + (B X Wait Time) + Boarding Penalty + Transfer Penalty + (C X In-Vehicle Time) + (Fare)

Where:

- Walk Time = time spent walking to access a public transport service
- Wait Time = time spent waiting at the station/stop for a service to arrive
- Boarding Penalty = penalty applied to represent the time associated with boarding a public transport service
- Transfer Penalty = penalty applied to represent the time and inconvenience associated with transferring between public transport services
- In-vehicle Time = time spent while travelling on a public transport service which may be factored to represent crowding impacts
- Fare = fare paid to undertake travel on public transport
- A = weighting applied to convert actual walk time into a perceived walk time for calculation of overall generalised cost. A value of 1.6 is included in the 2016 calibrated ERM
- B = weighting applied to convert actual wait time into perceived values for calculation of overall generalised cost. A value of 2 is included in the 2016 calibrated ERM; and
- C = Mode specific weight applied to the in-vehicle travel time to represent the perceived preference of one mode versus another. Values for these weightings have been derived for the ERM from stated preference research.

4.4.2 Calibrated Parameters

Table 4-6 outlines the ERM calibrated values for walk time factor, wait time factor, in-vehicle time factor and the boarding penalty. It is recommended that these values are retained as part of the Luas Finglas ERM modelling.

Table 4-6: Luas Finglas ERM Parameters in GDA Strategy Run

Parameter	Value	Source
Walk Time Factor (A)	1.6	TAG ⁸ suggests values between 1.5 and 2.0. A walk time factor of 1.6 was calibrated in the ERM model, following stated preference study recommendations.
Wait Time Factor (B)	2.0	TAG suggests values between 1.5 and 2.5. A mid-range value of 2.0 was used for the ERM calibration.
In-Vehicle Time Factor (C)	Rail = 1.3 Bus = 1.5 LUAS = 1.0 Metro = 1.0	ERM calibration process started with initial values from BRT stated preference research, which were then refined to improve sub-mode share during model calibration.
Boarding Penalty	5 minutes	Derived during model calibration based on observed boarding data.

4.4.3 Transfer Penalty

The Transfer Penalty reflects the cost of interchanging from one mode to another and the quality of the waiting facilities (information, security etc.). Table 4-7 outlines the values for Transfer Penalty calibrated in the 2016 ERM to match observed data on levels of interchange between public transport modes within Dublin City. It is recommended that these values are retained as part of the Luas Finglas ERM modelling.

Table 4-7: Luas Finglas ERM Parameters in GDA Strategy Run

Transfer	Time Penalty (mins)
All Modes to/from DART/Rail	15
Dublin City Bus to/from Dublin City Bus	15
Other Transfer	5

4.4.4 Fares

The BusConnects 90-minute fare structure has been applied for the Luas Finglas ERM runs. The public transport assignment within the ERM includes a simplified representation of fare structure by operator, with an average fare applied which is representative of all ticket types available.

A key element of the BusConnects fare structure is the facility to accommodate 90 minutes of travel across Dublin City Bus, Luas and Irish Rail without penalising the passenger for making an interchange. The best methodology to implement this within the ERM is to specify a single fare structure that covers all travel across these modes.

The single ‘Short Distance Fare’ has been set at a Leap value of €1.60 and the ‘Longer Distance Fare’ at €2.50. Analysis was undertaken to determine the weighted average fare paid across all ticket types using available ticket sales data. This analysis was used to calculate the percentage discount applied to the Leap single fare to estimate the average fare across all ticket types to be applied in the ERM.

⁸ UK Department for Transport (DfT) Transport Analysis Guidance (TAG) provides information and guidelines for transport modelling and appraisal.

5. LUAS FINGLAS MODELLING RESULTS

5.1 Introduction

The following chapter presents the modelling results for Luas Finglas for the years 2035 and 2050, focusing on:

- Luas Finglas Catchment Analysis
- Passenger Boardings and Public Transport Flows
- Public Transport Journey Times
- Travel Demand and Mode Share;
- Transport Capacity

Results are initially presented for the Core scenario across the headings outlined above. The results of additional sensitivity tests undertaken as part of the PBC Economic Appraisal are the provided in Section 5.7.

5.2 Luas Finglas Catchment Analysis

5.2.1 ERM vs Walk Catchment

The Openroute Service (ORS) plugin for QGIS⁹ was used to identify the walk catchment to Luas Finglas stations. It uses the latest Open Street Map network which contains a detailed representation of the road network including residential streets and walking paths. As such, the walk distance to stations is reflective of the available network including elements such as impermeable housing estate links, cul de sac roads etc.

The GIS walking catchment was then compared to the boarding catchment from the ERM for the 2035 AM peak hour and the results are illustrated in Figure 5-1. The blue dotted line represents the areas within a 20-minute walk (based on an average walk speed of 4.8km/hr) of the proposed Luas Finglas stations. Whilst the red shaded areas represent ERM boarders of Luas Finglas by ERM zone, with the darker areas representing higher levels of boarding.

Overall, the results indicate that the modelled ERM boarding catchments for Luas Finglas are sensible. The pattern of modelled boardings in the AM Peak Hour in 2035 at a zone level shows that few boardings come from zones more than a 20-minute walk from a Luas Finglas station. Most boardings come from zones close to a station with a visible correlation between proximity to a station and boardings.

⁹ © openrouteservice.org by HeiGIT | Map data © OpenStreetMap contributors

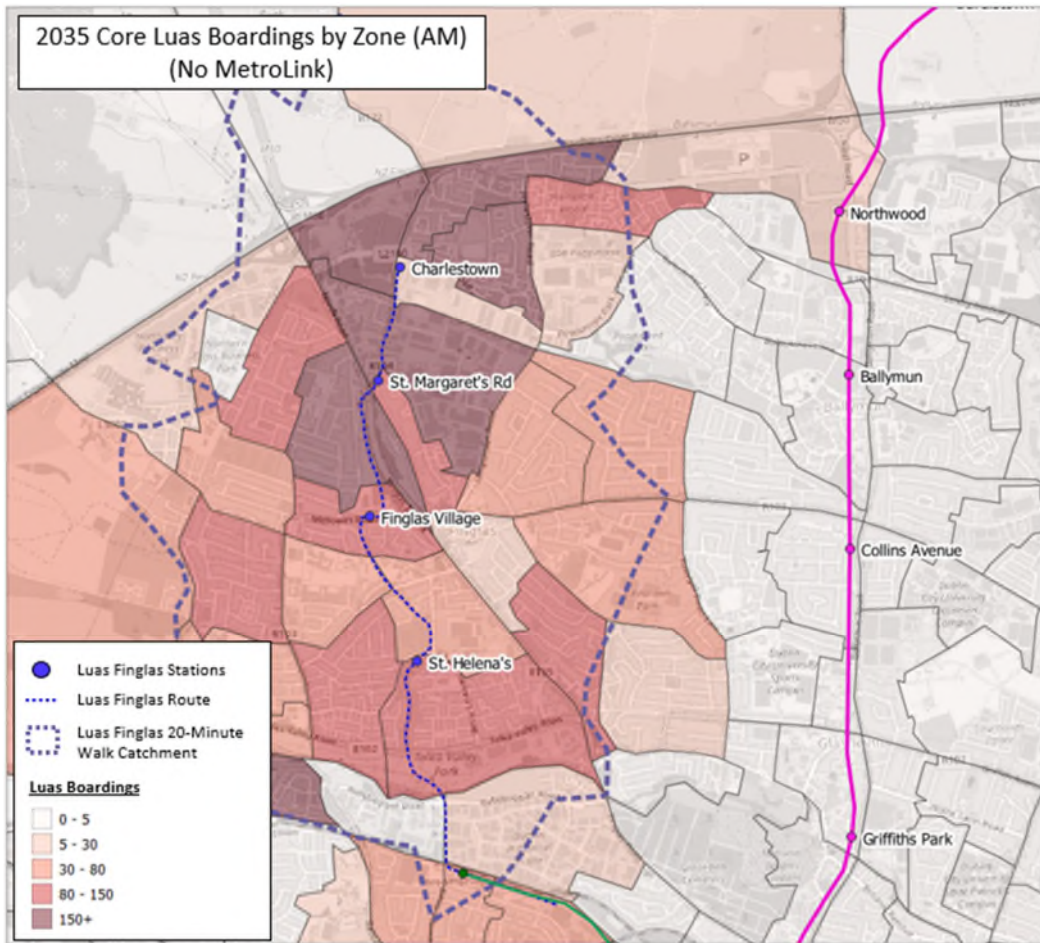


Figure 5-1: Luas Finglas Boarding Catchment (2035 AM)

5.2.2 Population Growth

As outlined in Section 3, detailed analysis was undertaken to estimate future population levels for the ERM using reference case planning sheets. The analysis suggests that within the catchment area around Luas Finglas, the population is forecasted to grow by over 10,500 people (23%) by 2035.

Luas Finglas will pass close to a number of significant development areas, including:

- The Charlestown Centre Phase 2 and Charlestown Place SHD with planning permission granted for 967 residential units;

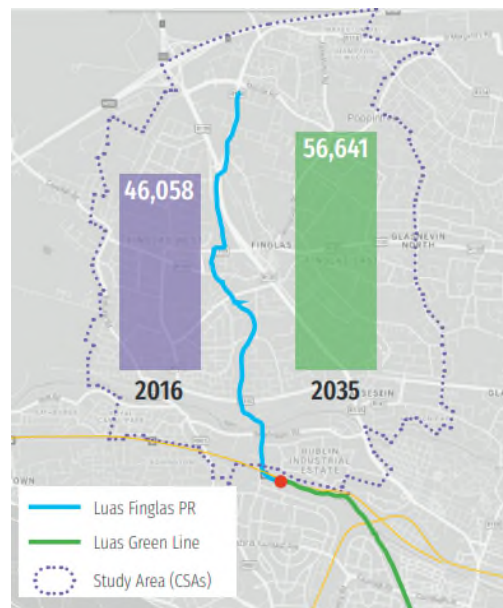


Figure 5-2: 2016-2035 Population Growth Estimate

- The Jamestown Strategic Development and Regeneration Area (SDRA) with the draft Masterplan indicating delivery of 3,500 – 3,800¹⁰ new homes; and
- The proposed regeneration of the Dublin Industrial Estate lands. At the time of writing this report, Dublin City Council (DCC) are preparing a Local Area Plan for these lands. Similar to the Jamestown SDRA, it is envisaged that the Dublin Industrial Estate lands will be redeveloped with more of a focus on residential use.

It is expected that 73% of the forecasted population growth in Finglas will be within a 10-minute walk of a Luas stop. 55% will be within a short 5-minute walk. This shows the success of the scheme in serving these areas of planned major development, contributing to the high level of boardings presented in Section 5.3.

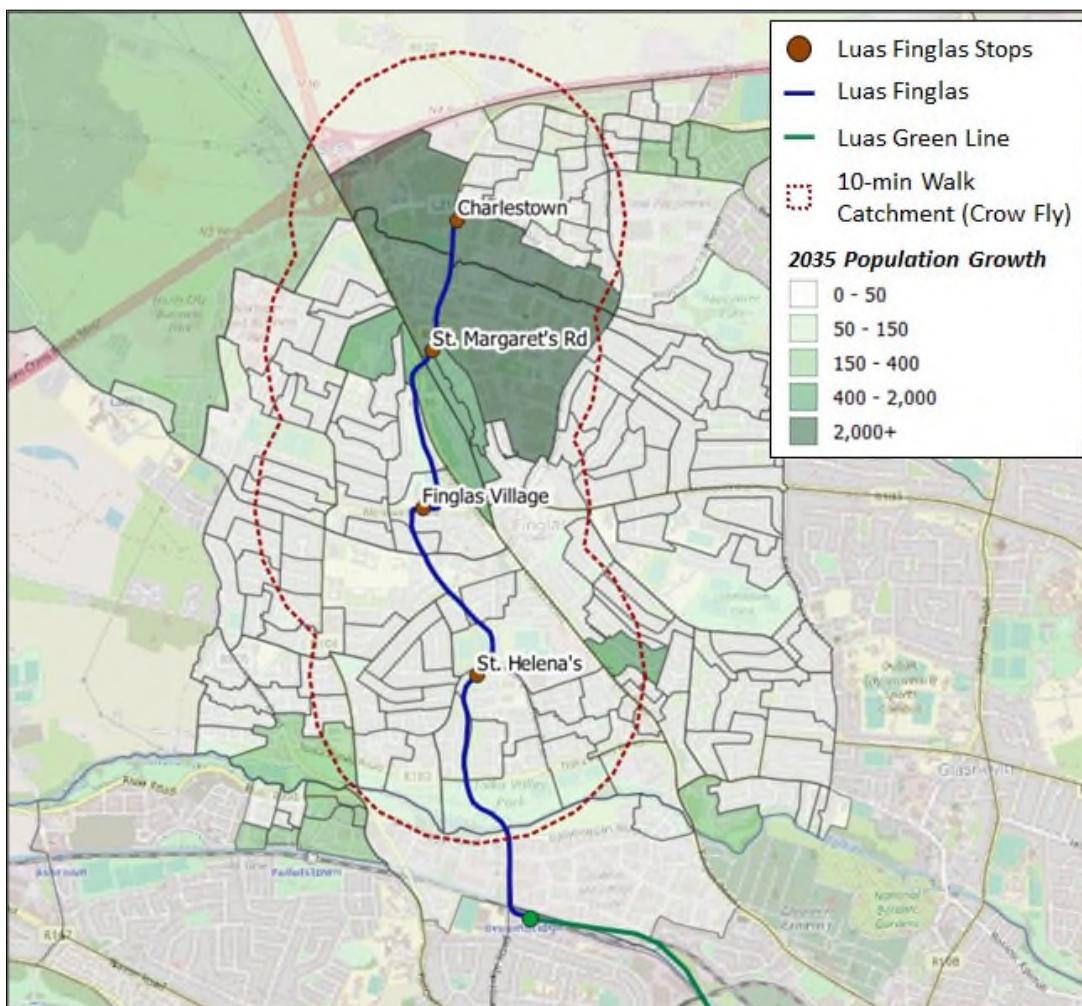


Figure 5-3: Population Growth by CSA in the Study Area (2016 – 2035)

¹⁰ https://consultation.dublincity.ie/planning/draft-jamestown/supporting_documents/Draft_Jamestown_Masterplan_2023.pdf

5.2.3 Accessibility & Social Inclusion

Figure 5-6 illustrates the 2016 POBAL Deprivation Index along with the Luas Finglas 10-minute crow-fly walk catchment. In total, 10,212 people who are identified as ‘disadvantaged’ will live within a 10-minute straight-line catchment of a Luas Finglas station.

Developing and constructing Luas Finglas will support improvement through increased accessibility to work, education, health and community facilities. It will provide direct connectivity to TU Dublin and Trinity College, and in general bring education, jobs, and leisure activities to within greater reach of a significant number of currently disadvantaged residents.

Through an integrated public transport network, Luas Finglas will support accessibility to major destinations beyond the direct catchment of the extension. For example, St James’ Hospital and the new National Children’s Hospital will be accessible via Luas Finglas and a single transfer to the Red Luas Line. St Vincent’s Hospital can be accessed via interchange with the future DART at Broombridge or bus connections via transfer in the city centre.

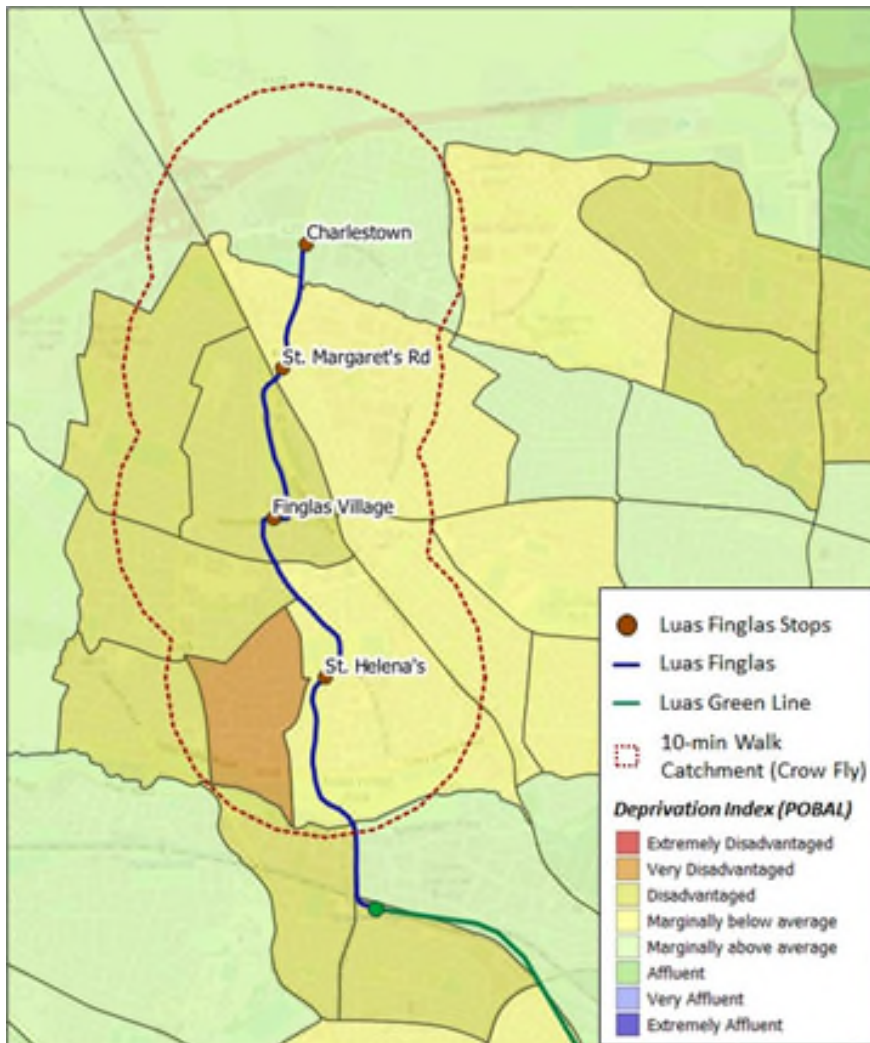


Figure 5-4: Deprivation Index and Luas Finglas Walk Catchment (Crow Fly)

5.3 Passenger Boardings

Luas Finglas will provide a high capacity, frequent and reliable public transport services shortening journey times from Finglas to Dublin city centre and other destinations through direct services or interchange with other services. Luas Finglas will benefit those living or working in walking distance to a stop, in addition to those travelling from further afield and accessing the line via bike, bus or by car through the proposed Park & Ride site at St Margaret’s Road.

Table 5-1 outlines the total boardings in both directions at the Luas Finglas stations across the representative modelled peak hours in 2035. The ERM results indicate that Luas Finglas will be well used, with over 3,600 boardings across the four stations in the AM peak. The largest number of boardings are at the Charlestown Place and St Margaret’s Road stations which serve the very large quantum of new and proposed development in the study area. As outlined in Section 3.2 previously, Charlestown has planning for 967 residential units whilst the Jamestown SDR was initially proposed for 2,200 additional residential units (this has since been revised upwards as part a Masterplan for the area).

Table 5-1: 2035 Peak Hour Boardings, Luas Finglas Stations (both directions)

Station/Peak Hour	AM	LT	SR	PM	OP
Charlestown	1,291	243	168	341	138
St. Margaret’s Road	955	184	117	139	93
Finglas Village	782	199	190	326	130
St. Helena’s	670	174	124	165	88
Total	3,697	799	599	970	449

Table 5-2 outlines the total alightings in the 2035 modelled peak hours. The relatively tidal nature of usage on the Luas Finglas line can be seen through the concentration of boardings in the AM peak hour and alightings during the SR and PM periods. Compared to the boarding profile, the alighting profile is more evenly spread between the stations.

Table 5-2: 2035 Peak Hour Alightings, Luas Finglas Stations

Station/Peak Hour	AM	LT	SR	PM	OP
Charlestown	257	162	620	783	144
St. Margaret’s Road	113	110	350	751	126
Finglas Village	319	143	278	503	115
St. Helena’s	160	132	297	500	124
Total	848	548	1,545	2,537	509

As would be expected given the projected population growth with the study area in both the short and medium term (see section 5.2.2), modelled boardings are substantially higher in 2050 than 2035. AM peak hour boardings grow to over 5,067 representing a 37% increase. This is reflective of the growth in population around the Luas Finglas stops and also the proposed increase in frequency of service.

The pattern of very large numbers boarding at Charlestown Place and St. Margaret’s Road is magnified in 2050 as all the projected development around these stops come to fruition. Growth is more modest, although still significant, at the other two stations.

Table 5-3: 2050 Peak Hour Boardings, Luas Finglas Stations

Station/Peak Hour	AM	LT	SR	PM	OP
Charlestown	1,700	287	201	506	152
St. Margaret’s Road	1,549	253	155	199	123
Finglas Village	953	220	208	423	144
St. Helena’s	865	189	136	225	97
Total	5,067	949	699	1,352	515

Similarly when looking at alightings, there is a large increase evident between 2035 and 2050, most notably during the School Run and PM peak hours. Growth is relatively evenly split across all four stops during the school run, while the pattern of higher usage at St Margaret’s Road and Charlestown Place is evident in the PM. Luas Finglas is a key enabler of the planned development around St Margaret’s Road and Charlestown.

Table 5-4: 2050 Peak Hour Alightings, Luas Finglas Stations

Station/Peak Hour	AM	LT	SR	PM	OP
Charlestown	324	184	765	1,015	161
St. Margaret’s Road	151	150	505	1,223	179
Finglas Village	412	159	325	638	126
St. Helena’s	231	152	355	639	136
Total	1,117	645	1,950	3,516	602

5.3.1 Luas Line Profile

The line flows for the AM peak hour in 2035 along the Luas Green Line are presented in Figure 5-5 below, showing the patterns of boarding and alighting along the line. The grey line shows the total passenger load along the line at each station.

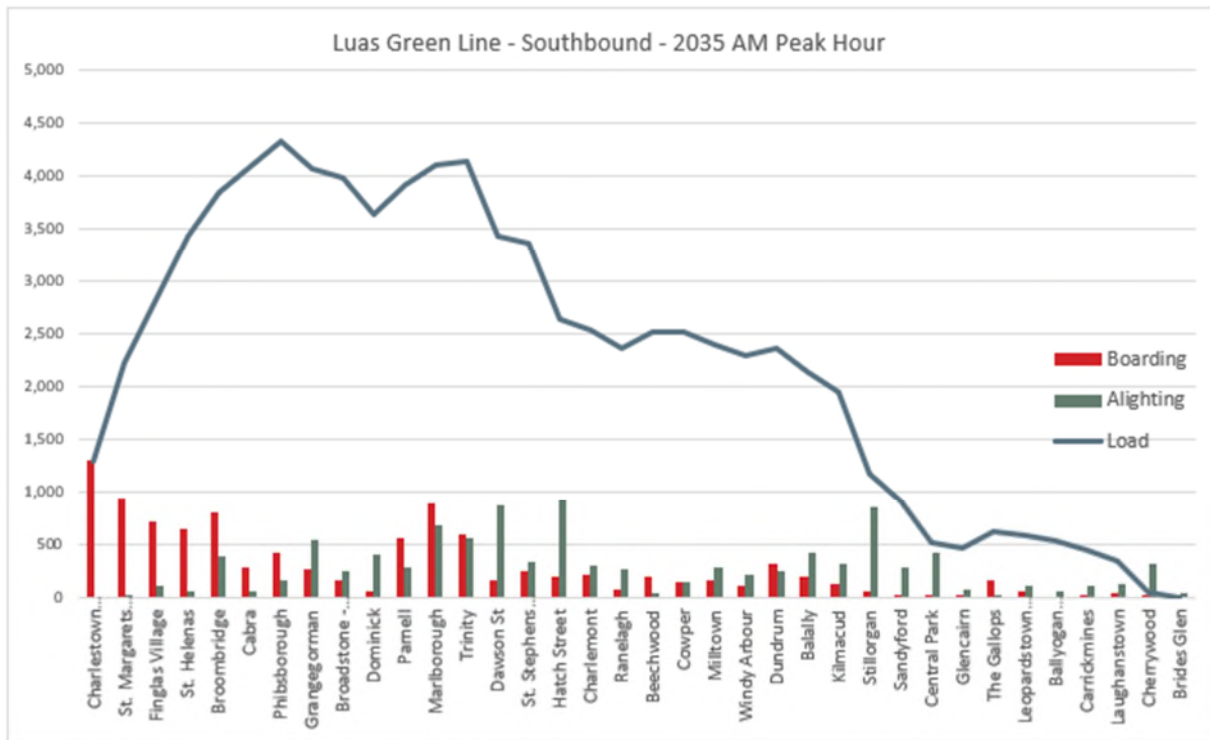


Figure 5-5: Line Flow for Luas Green Line Southbound for the AM Peak Hour in 2035

The line flows indicate that the Luas Finglas stations will be four of the best used stations along the line. Alightings are mainly concentrated at city centre stations as expected.

Similarly during the PM peak hour in a Northbound direction the Luas Finglas stops are among the four the best used in terms of alightings, the two most northern stops in particular. Broombridge is another station north of the city centre with a large number of alightings due to surrounding population levels and potential interchange with DART+ services.

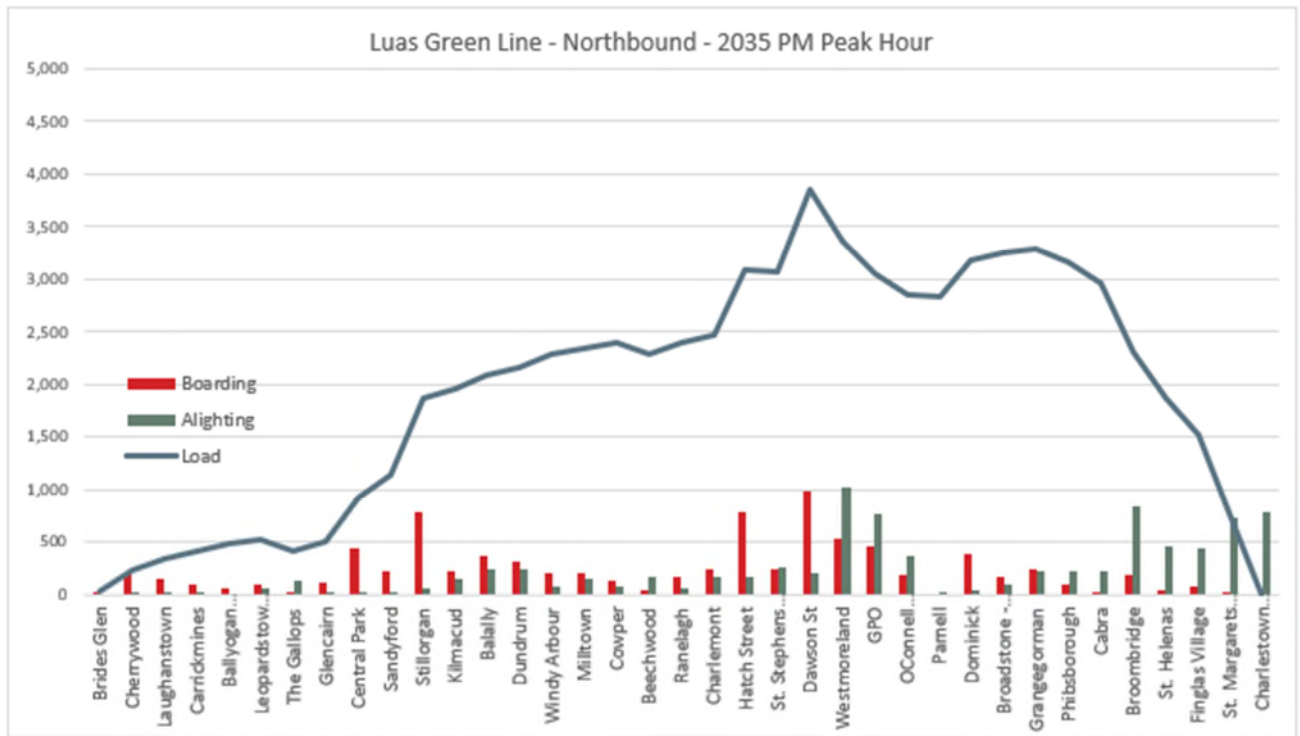


Figure 5-6: Line Flow for Luas Green Line Northbound for the PM Peak Hour

Line profile results for all time periods for the 2035 and 2050 modelled years are provided in Appendix A.

5.3.2 Interchanges

ERM outputs were extracted for the number interchanges between public transport services in the catchment area around Luas Finglas stations, and the results for the 2035 AM peak Do-Minimum and Do-Something scenarios are illustrated in Figure 5-7.

2035 AM Peak Hour Interchanges

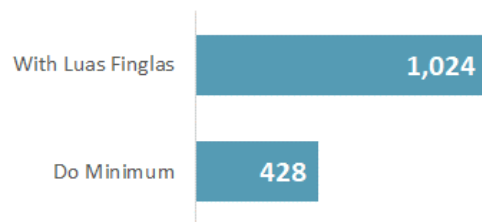


Figure 5-7: Public Transport Interchange by Scenario (2035 AM Peak Hour)

Modelling analysis indicates there will be 1,024 public transport interchanges in the AM peak hour within the north-west of the city during the opening year of Luas Finglas (2035), over twice as many that would occur without the delivery of the scheme. This high number of public transport interchanges illustrates the integration of Luas Finglas with the wider network.

These arise mainly from interchange between Luas and bus and Luas and DART+ services. Bus interchanges occur at Charlestown and Finglas Village stations with the new BusConnects Network E Spine, F Spine and N Orbital bus routes (see Figure 5-8). Luas and DART+ interchanges occur at Broombridge station, which is a high quality interchange location due to a redesign as part of the Luas Cross City project that will have a high level of heavy rail service arising from the DART+ West project.

The level of integration with other high quality public transport services further increases the utility of Luas Finglas to the surrounding population.



Figure 5-8: Luas Finglas and BusConnects Network

5.4 Public Transport Journey Times

As an extension to the Luas network, Luas Finglas services will, to a significant extent, utilise existing infrastructure. Together with the current Luas infrastructure between Boombridge and the City Centre, Luas Finglas will operate within a 7.5km corridor between Charlestown and the City Centre that is largely segregated from traffic. Luas Finglas will deliver a reliable public transport service offering journey times of 30-minutes from Charlestown to Trinity College.

Analysis was undertaken of the demand weighted average journey time from zones within the Luas Finglas ERM catchment to the city centre¹¹ by public transport and car in the Do-Something scenario

¹¹ Taken to be Trinity College for the purpose of this analysis

(2035 AM peak). The results of this analysis are illustrated in Figure 5-9 and indicate that the delivery of Luas Finglas will lead to an average reduction in journey times to the city centre of 15 minutes (over 30%) during the congested peak periods when compared to travel via private car.

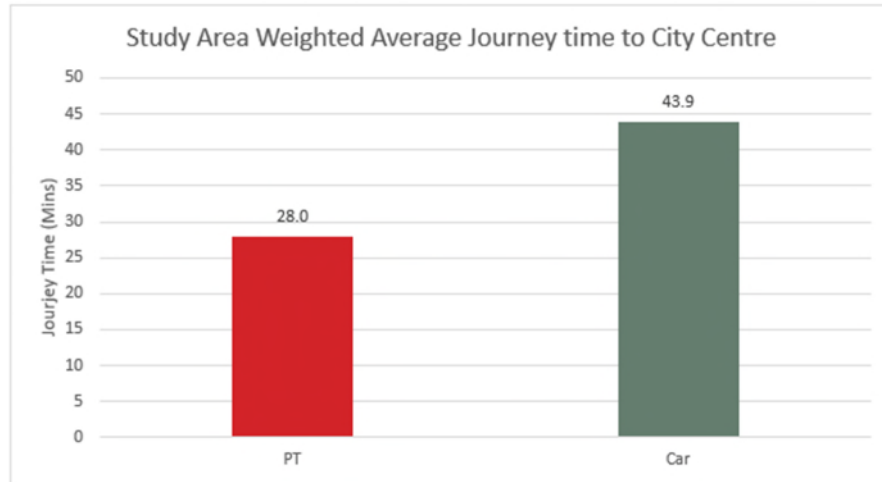


Figure 5-9: AM Peak Hour Average Car and PT Journey Time from Study Area to the City Centre

Taking the journey from Charlestown to Trinity College as an indicative example, journey time by Luas Finglas is expected to be around 30 minutes in the AM peak, whilst the equivalent trip by car in 2035 is estimated to take approx. 47 minutes.

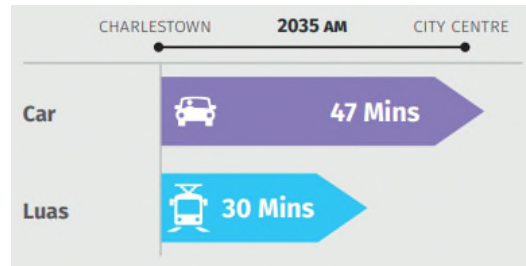


Figure 5-10: 2035 AM Journey Time Comparison

Similar analysis was undertaken for public transport journey times from the Luas Finglas catchment to the city centre in the Do-Minimum vs Do-Something scenario. The results are illustrated in Figure 5-11 for the 2035 AM peak hour, and indicate that Luas Finglas will significantly reduce public transport journey times between the Finglas area and the city centre by an average of 12% (just under 4 minutes) during the AM peak hour.

Luas Finglas provides an off-road light rail link almost completely separated from vehicular traffic. Even with the introduction of the BusConnects Core Bus Corridors, buses will have to contend with traffic on some links at pinch points and delays at busy junctions, particularly closer to the city centre. The segregation provided by the Luas Finglas results in shorter public transport journey times. This reduction in journey time increases the attractiveness of public transport compared to other modes. It also results in quality of life and economic benefits for public transport passengers resulting from travel time savings.

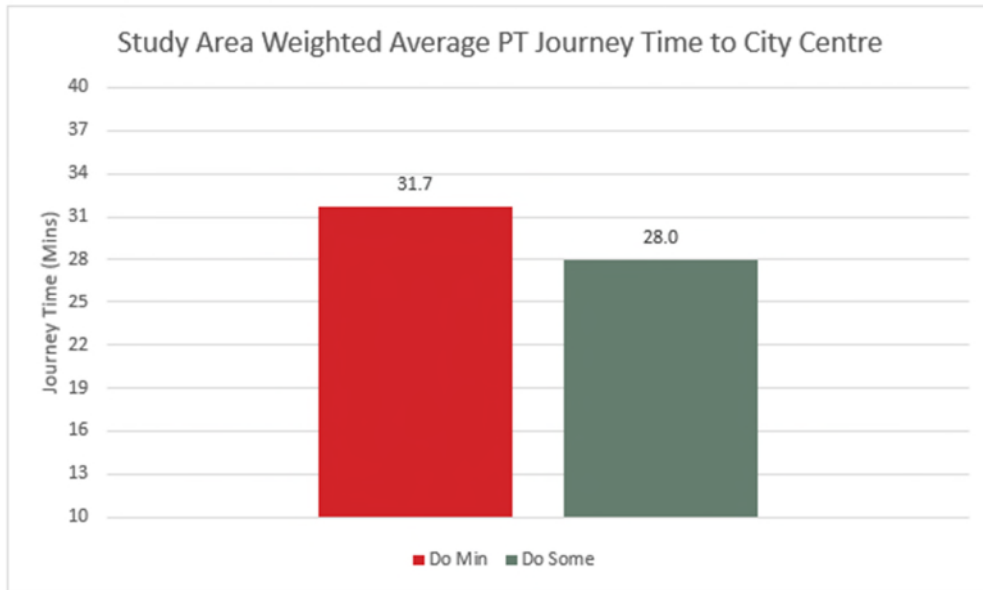


Figure 5-11: AM Peak Hour Change in average PT Journey Time from Study Area to the City Centre

5.5 Travel Demand and Mode Share

As outlined above, Luas Finglas will lead to a significant reduction in journey times for residents in the area and support an increase in public transport usage.

Figure 5-12 outlines the mode share for the Luas Finglas Catchment area for the 2035 and 2050 AM peaks. The results indicate that Luas Finglas will lead to an overall decrease in car mode share of around 1% for the north-west of the city.

In percentage terms this might seem modest. In actual trip numbers it represents a significant increase in sustainable travel. In the opening year 2035, Luas Finglas will deliver an increase of 1.3 million low carbon public transport trips per annum. This represents an 11% increase in public transport trips due to the delivery of Luas Finglas.

In 2050, this increases to an additional 1.8 million public transport trips which represents a 13% increase due to the delivery of Luas Finglas.

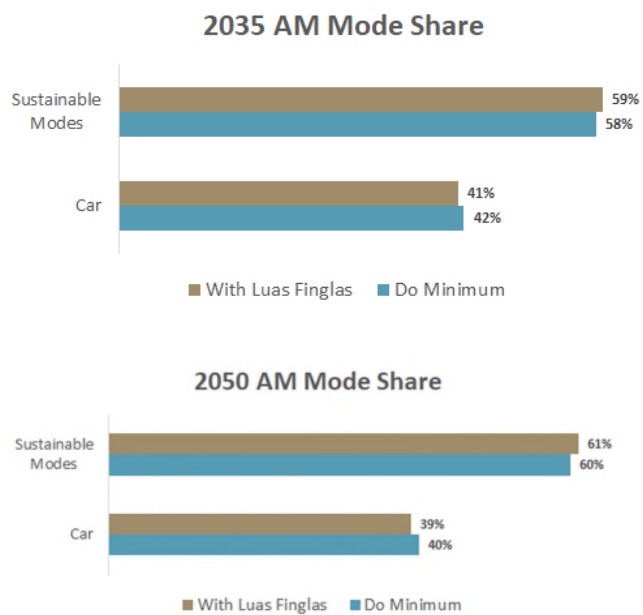


Figure 5-12: AM Peak Mode Share (2035 and 2050)

Figure 5-13 illustrates the impact of Luas Finglas on 2035 AM peak public transport demand. It shows the growth in public transport demand for each of the ERM model zones between the Do Minimum and Do Something Scenario.

The biggest increase in public transport usage is at the northern end of the alignment where significant new developments are proposed. As would be expected, model zones that are further from proposed stations show a lower level of increase and there is less of an impact towards the southern end of the line where the residential areas are much closer to the existing Luas station in Broombridge.

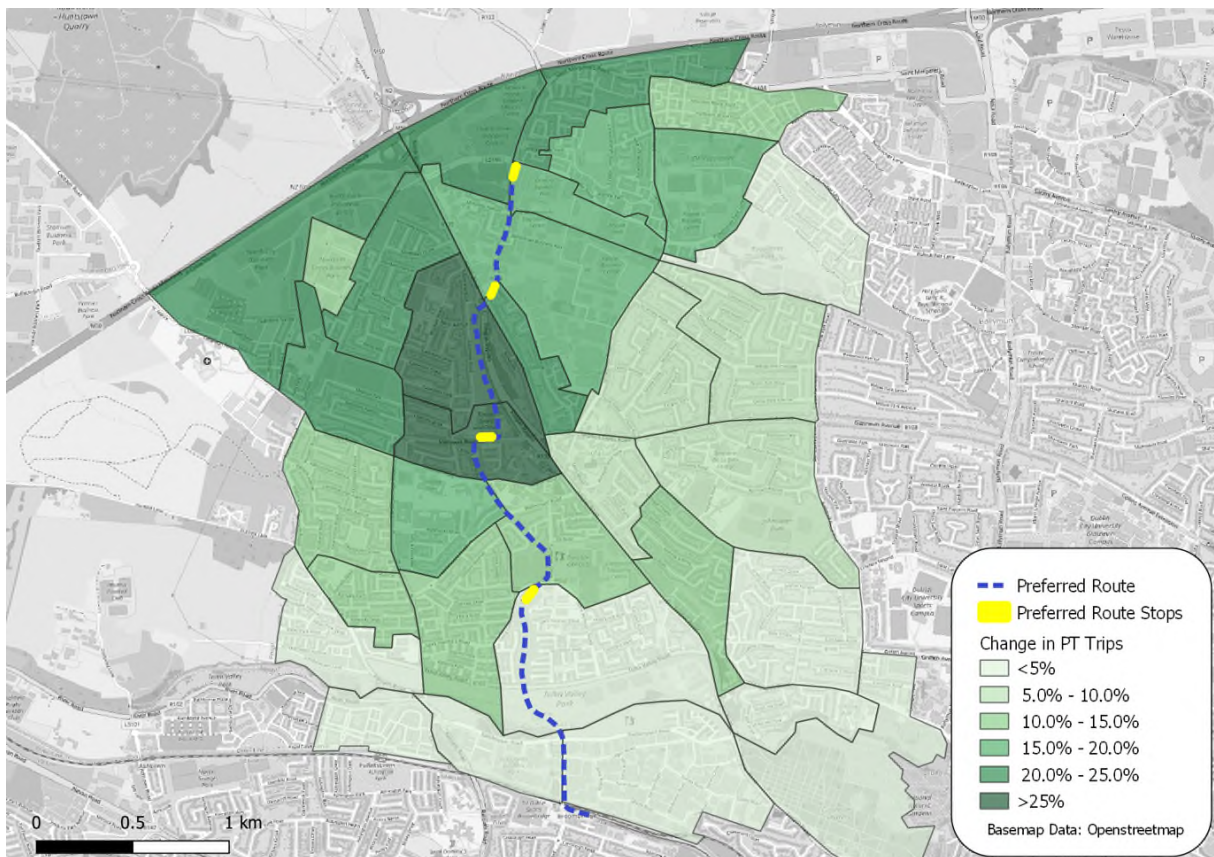


Figure 5-13: 2035 Change in AM peak PT demand with Luas Finglas

5.6 Transport Capacity

5.6.1 Do Minimum Transport Network Constraints

Access to Dublin city centre from the north-west corridor is constrained to a small number of bridge crossings over the Royal Canal at Phibsborough, Broombridge and Ratoath Road. These areas are currently over capacity during peak periods. If current rates of car use continue, traffic congestion is likely to increase in the future due to increased demand for transport arising from general population growth and proposed developments in the Finglas area and wider region.

Given the constraints, there is little scope for the capacity of the existing road based transport network to grow to meet future needs. Analysis was undertaken in the ERM to investigate total person trips crossing the Royal Canal Screenline illustrated in Figure 5-14.



Figure 5-14: Royal Canal Screenline Points

The ERM results forecast an additional 400 person trips crossing the Royal Canal from the north-west in the 2035 Do Minimum scenario AM peak hour (i.e., without the delivery of Luas Finglas) compared to a 2020 base scenario. This is including the proposed upgrades to the bus network and infrastructure to be delivered by BusConnects. An additional 400 trips represents a relatively low growth in trips to the city centre given the estimated population increase of around 10,500 persons within the same time period reflecting the transport capacity constraints.

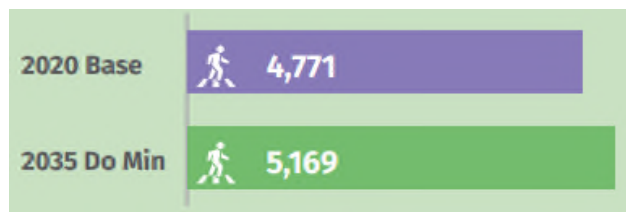


Figure 5-15: AM peak hour persons crossing the Royal Canal

5.6.2 Increased Transport Capacity from Luas Finglas

Similar analysis was undertaken to compare person trips crossing the screenline in the 2035 AM peak with (Do Something) and without (Do Minimum) Luas Finglas. Figure 5-16 illustrates the person trips by mode crossing each of the cordon points. Note that in the Do Something scenario Luas Finglas is separated as its own crossing.

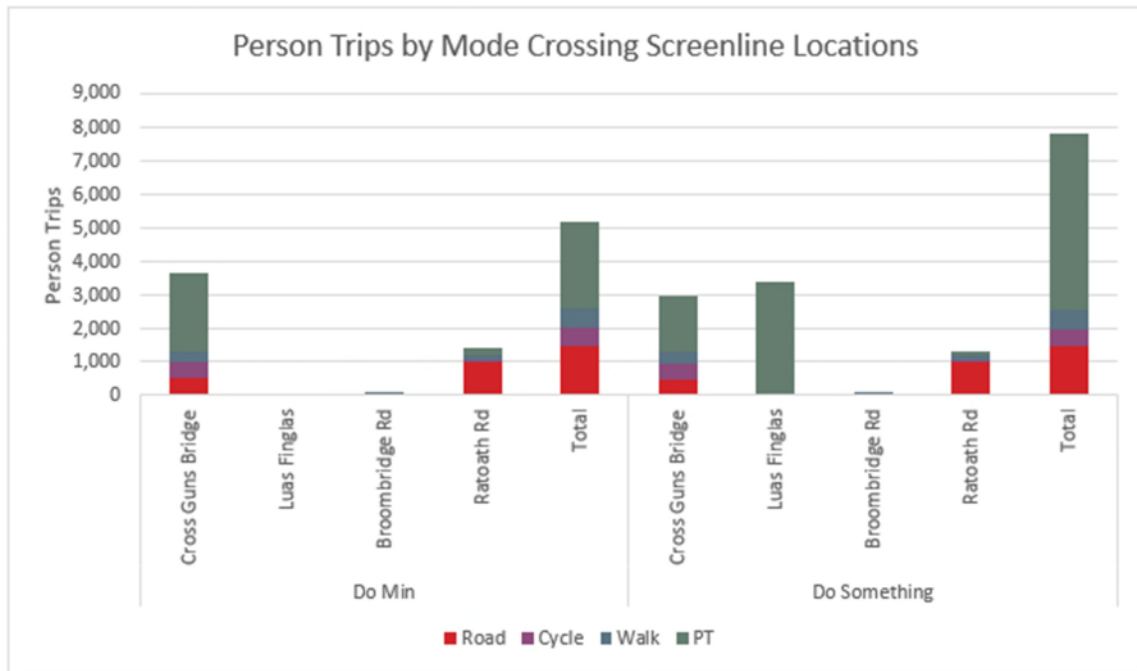


Figure 5-16: Results of Royal Canal Screenline Analysis (2035 AM Peak Hour)

As illustrated in Figure 5-16, the introduction of transport capacity brought by Luas Finglas enables a step change in public transport trips towards the city centre area (highlighted in green in the chart) – resulting in a doubling of public transport trips across the screenline.

The delivery of Luas Finglas will help unlock potential capacity for people movements to and from the north-west corridor. Modelling analysis indicates that in the opening year 2035, the delivery of Luas Finglas will lead to a 50% increase in transport capacity utilisation for trips travelling south towards the city centre in the AM peak. Without Luas Finglas, travel from the north-west corridor is constrained by pinch points on the road network for both cars and bus-based public transport crossing the Royal Canal at Phibsborough, Broombridge and Ratoath Rd.



Figure 5-17: Modelled Person Trips Crossing the Royal Canal (2035 AM Peak)

5.7 Sensitivity Tests

Standard practice in undertaking assessments of transport projects requires that a number of demand and network configuration scenarios are generated to provide a range of appraisal results. Each scenario is offering a different assessment of the future by comparing a “Do Minimum” development scenario with a “Do Minimum plus Luas Finglas” (also known as “Do Something”) scenario. This allows for a more robust understanding of the likely impacts of Luas Finglas across a range of potential future “Do Minimum” states, as well as gaining more appreciation for the potential trade-offs and behaviours that underpin the demand modelling results.

Table 5-5 summarises the scenarios that have been evaluated as part of the Luas Finglas Economic Appraisal in the preparation of this PBC.

Table 5-5: Demand and Network Configuration Scenarios Tested

Scenario	Do Minimum Scenario Description
1. Core	Assumes that all committed projects are implemented along with the delivery of DART+ West and the BusConnects Core Bus Corridor infrastructure that have planning applications submitted and directly serve Broombridge and the Finglas corridor. See section 4.2 for further details on what has been included in the Core scenario. MetroLink, located to the east of Finglas, has not been included in this scenario, but is introduced in scenario 3 below.
2. Alternative Growth Future	Assumes delivery of the ‘Core’ scenario projects and demand patterns aligned with the NTA’s ‘Alternative Future Scenario for Travel Demand’. This aims to reflect changes in transport demand e.g. increased working from home.
3. Core + MetroLink	Assumes that all the projects of the ‘Core’ scenario are delivered along with MetroLink.
4. Core + MetroLink + Alternative Growth Future	Assumes that all the projects of the ‘Core + MetroLink’ scenario are delivered, along with demand patterns aligned with the NTA’s ‘Alternative Future Scenario for Travel Demand’

5.7.1 Representation in the ERM

Alternative Growth Future

An alternative scenario for future transport demand has been developed by the NTA which considers the medium to long-term impacts associated with an accelerated transition to remote working, remote education and associated changes for a proportion of the population. In respect to employment, there is an assumption that a higher proportion of white-collar employees will utilise working from home when commuting distances are longer, while short distance commuters or blue-collar workers will be less able or inclined to work from home. For education, the greatest change is assumed in respect to

university or college travel where it is assumed that a substantial shift to online learning and partial attendance will occur.

Other economic assumptions include an increase in online shopping, a reduction in business travel and an increase in freight volumes to service growing demand for online deliveries. Overall, the scenario assumes that economic trends and factors, such as unemployment remain unchanged. The full details of the transport demand assumptions used in the alternative scenario are described in a separate NTA report entitled ‘Alternative Future Scenario for Travel Demand’¹².

As part of this test, the trip rates assigned with the NTA National Demand Forecasting Model have been adjusted to reflect the impact of greater working from home on different cohorts of the population considering employment type and trip type. This has been used to develop a new input demand scenario which has been run through the ERM.

MetroLink

The ERM coding for MetroLink has been taken from the latest model runs undertaken for the MetroLink Preliminary Business Case. This includes services with a seat capacity of 125, total capacity of 500 people operating at 2 minute headways in both directions throughout the day. The estimated journey times on MetroLink services are outlined in Table 5-6.

Table 5-6: MetroLink ERM Run Time (Estuary – Charlemont)

Origin Station	Destination Station	Section Travel Time (min)	Total Cumulative Time (min)
Estuary	Seatown	1.7	1.7
Seatown	Swords Central	1.55	3.25
Swords Central	Fosterstown	1.71	4.96
Fosterstown	Dublin Airport	2.65	7.61
Dublin Airport	Northwood	3.81	11.42
Northwood	Ballymun	1.49	12.91
Ballymun	Collins Avenue	1.43	14.34
Collins Avenue	Griffith Park	2.17	16.51
Griffith Park	Glasnevin	1.62	18.13

¹² https://www.nationaltransport.ie/wp-content/uploads/2021/03/Alternative-Scenario-Development-Note-v-6.1_Final.pdf

Origin Station	Destination Station	Section Travel Time (min)	Total Cumulative Time (min)
Glasnevin	Mater	1.54	19.67
Mater	O'Connell Street	1.58	21.25
O'Connell Street	Tara Metro	1.37	22.62
Tara Metro	St. Stephen's Green Metro	2	24.62
St. Stephen's Green Metro	Charlemont	1.43	26.05

The ERM zone and walk connectors at the MetroLink stations were also re-examined to ensure an accurate representation of loading onto MetroLink within the model.

5.7.2 Luas Finglas Passenger Boardings

Passenger boardings during the 2035 AM peak hour at each of the four proposed Luas Finglas stations are displayed in Table 5-7. This shows the impact of each of the changes in transport network and/or demand on the usage of Luas Finglas.

Table 5-7: 2035 AM Peak Hour Boardings at Luas Finglas Stations by Scenario

Station	Core	Alt Future	Core + MetroLink	Core + Alt Future + MetroLink
Charlestown	1,291	1,111 (-14%)	806 (-38%)	730 (-44%)
St. Margaret's Road	955	786 (-18%)	841 (-12%)	699 (-27%)
Finglas Village	782	687 (-13%)	658 (-16%)	583 (-26%)
St. Helena's	670	565 (-16%)	567 (-16%)	486 (-28%)
Total	3,697	3,151 (-15%)	2,874 (-22%)	2,500 (-32%)

As can be seen from the table, the Alternative Future demand scenario has a notable impact on boardings: a 15% overall decrease in AM peak hour boarding. Overall, the changes in trip rates as a result of accelerated working from home, online learning, online shopping etc. results in a significant decrease in the total number of trips on the transport network. This in-turn has an impact on the modelled Luas Finglas passenger demand.

It should be noted that the Alternative Future scenario was developed during Covid with estimations as to how travel patterns might change as a result. Recent data suggests that whilst trip patterns are

currently different to pre-Covid there has been a strong bounce back in public transport travel with patronage returning above pre-Covid levels at the end of 2022¹³

The introduction of MetroLink leads to a modelled reduction in Luas Finglas boardings of just over 20%. Charlestown station sees the largest decrease with the introduction of MetroLink. This is the station closest to the MetroLink alignment, but is also modelled to be a major interchange point on the BusConnects network (see Figure 5-8). MetroLink is forecast to deliver much faster journey times to the city centre than the Luas (25 minute journey time to O’Connell Street from Charlestown on Luas, 9 mins from Ballymun on MetroLink), making it a more attractive interchange point from bus for trips to/from the city centre.

A detailed technical note has been produced (Appendix E of the PBC) which investigates the sensitivity test with MetroLink in further detail. It looks at Luas Finglas and MetroLink together from a first principles approach to allow for an informed interpretation of the transport modelling results.

Whilst some abstraction from Luas Finglas onto MetroLink is expected, the modelling analysis likely overestimates this response due to the simplified nature of the residential zone system and access roads in the ERM. The model choices are also based on mathematical calculations without full consideration of local conditions. For example, aspects such as weather and quality/safety of available routes can impact on a person’s choice to walk to a particular service.

The ‘Core + MetroLink + Alternative Future’ represents a conservative stress test. The ERM results indicate that this scenario results in around a 30% reduction in Luas Finglas boardings when compared to the ‘Core’ scenario. It is unlikely that the conditions represented in this sensitivity test will come about in reality as:

- It represents an accelerated reduction in overall trip making predominantly as a result of Covid-19. It is impossible to predict what the long term impact will be on trip making and trip patterns. As outlined above, recent data suggests a strong bounce back in public transport demand.
- Since the modelling for the Economic Appraisal was undertaken, development planning in the areas has progressed. At the time of writing this PBC, the draft Jamestown SDRA Masterplan includes for 3,500 – 3,800 new homes which is significantly higher than was originally proposed. Further work is also ongoing for the redevelopment of the Dublin Industrial Estate lands with a Local Area Plan being developed to regenerate the area. These areas will be directly served by Luas Finglas and are conservatively represented in the modelling analysis.
- The modelling analysis doesn’t include for any demand management measures which support a reduction in vehicle kilometres travelled and a shift to sustainable modes. Significant work is ongoing currently to develop a National Demand Management Strategy and Demand Management is an element of the Greater Dublin Area Transport Strategy. The reallocation of

¹³ <https://www.transportforireland.ie/news/bus-passenger-numbers-return-to-pre-pandemic-levels-nla/>

road space from private car use to accommodate better public transport and active travel will likely be a key element of any Demand Management Strategy.

5.8 Summary

The previous sections have outlined the results of modelling undertaken in the ERM to support the Luas Finglas PBC. In summary:

- Luas Finglas directly serves a number of large sites marked for high-density development. It is estimated that 73% of the new population expected in the Finglas area by 2035 will be within a 10-minute walk of one of the new Luas Finglas stops.
- Luas Finglas will attract high levels of boardings at all four of the stations along the proposed extension. In total, Luas Finglas will lead to an increase of 1.3 million low carbon public transport trips in 2035, increasing to 1.8 million in 2050.
- Luas Finglas delivers an improved public transport service directly to the city centre, but also to a range of other destinations along the network through integration with other high quality public transport services. Interchange points are provided with DART+ at Broombridge station as well as a number of BusConnects Network spines and orbital routes at Charlestown and Finglas Village.
- The large level of population growth planned for the study area strains the transport system in the Do Minimum scenario, resulting in a bottleneck for travel towards the city centre. Luas Finglas relieves this bottleneck and increases the overall carrying capacity of the transport network over the Royal Canal in this area by 50%.
- Luas Finglas will significantly reduce public transport journey times between the Finglas area and the city centre by an average of 12% during the AM peak hour. When compared to travel via private car, the delivery of Luas Finglas will lead to an average reduction in journey times to the city centre of 15 minutes (over 30%) during the congested peak periods.

6. FINGLAS LOCAL AREA MODEL

6.1 Introduction

The analysis undertaken within the ERM regional model provided a valuable measure of the impact that the proposed scheme has on transport in the Finglas area to feed into the Economic Appraisal as part of the PBC.

In order to inform the junction designs and the Environmental Impact Assessment (EIA) for the scheme, a more detailed Local Area Model (LAM) was developed. This Chapter describes the steps undertaken to develop, calibrate and validate a Base Year LAM. It then explains how the future year LAM scenarios have been produced and finally, the main results of the local area modelling are reported. This Chapter is structured as follows:

- **Methodology:** Section 6.2 provides an overview of the methodology used to develop, calibrate and validate the Base Year LAM.
- **Model Specification:** Section 6.3 presents information on the LAM specification including the defined model area, demand segmentation, time periods modelled, model software and key assignment parameters.
- **Traffic Data:** Section 6.4 outlines the traffic data used to facilitate the calibration and validation of the LAM.
- **Road Network and Zone System Development:** Section 6.5 describes the development of the LAM road network and zone system to ensure that it provides an accurate representation of existing conditions.
- **Model Calibration Process and Results:** Section 6.6 outlines the calibration process adopted and the results achieved to ensure that the LAM is meeting relevant Transport Infrastructure Ireland (TII) and NTA guidelines.
- **Model Validation:** Section 6.7 presents the validation process and results, which demonstrate that the model is a suitable and robust tool to be used to assess the impact of the Luas Finglas within the boundary area.
- **Future Year Scenarios:** Section 6.8 outlines the steps undertaken for developing the future year scenarios.
- **Results:** Section 6.9 presents the main results obtained from the future year LAM scenarios.

6.2 Methodology

The methodology for developing the LAM from the RMS is illustrated in Figure 6-1.

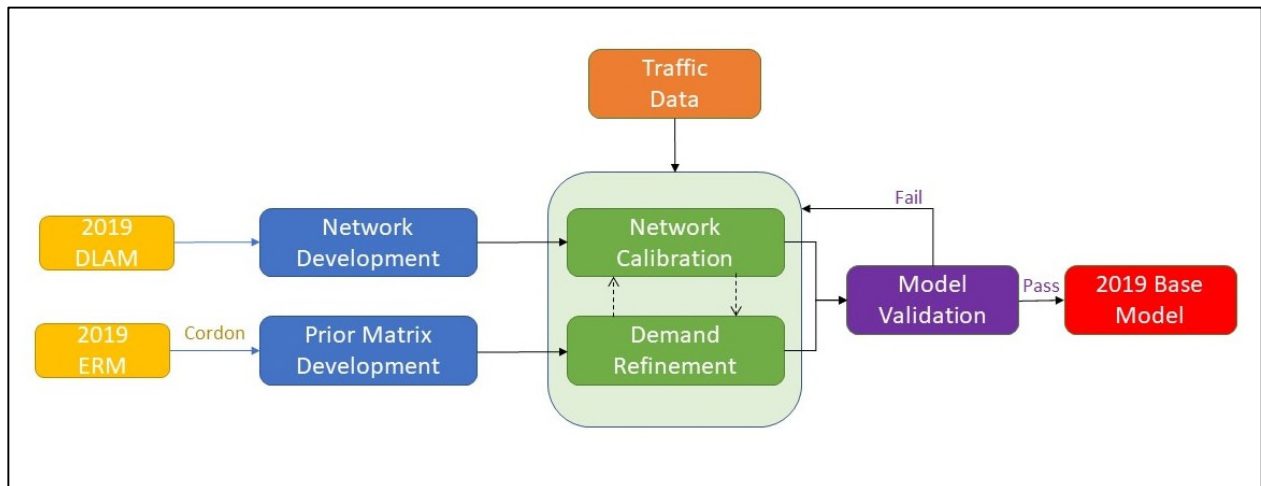


Figure 6-1: LAM Development Methodology

In Summary:

- **2020 ERM Run:** the ERM has been run with 2020 NTA planning data using inputs from the 2016 model and the addition of recent infrastructure developments.
- **ERM Cordon:** the 2020 ERM road assignment was cordoned to extract the initial traffic demand matrix covering the LAM extent. The network was derived from an existing LAM produced for a previous project (the Dublin Local Area Model).
- **Network and Prior Matrix Development:** the initial ERM cordoned road network was reviewed in greater detail for the study area for items including junction layouts, network speeds, missing links etc. The zone system from the ERM was disaggregated where necessary to provide a more accurate representation of traffic loading onto the road network. Further details on the network and zone system development are provided in section 6.5.
- **Traffic Data:** traffic count data was available from the NTA for late 2019/early 2020 (pre-COVID). However, these counts did not cover large sections of the LAM impacted by the new Luas scheme and therefore between November and December 2021 a new data collection campaign was carried out to enable a robust calibration and validation of the Finglas LAM (refer to section 6.4 for further information).
- **Calibration:** calibration is the process of adjusting the model to better represent observed data. This is normally undertaken in two steps:
 - **Network Calibration:** adjustments to the road network based on observations extracted from traffic survey data e.g. altering turning capacities at junctions, updating link speeds etc.; and

- **Demand Refinement:** adjustments to the prior matrix to better represent observed travel movements from count data.

Further information on the calibration processes is provided in section 6.6.

- **Validation:** validation is the assessment of the validity of the calibrated model and its robustness in representing observed traffic conditions. Calibration and validation is an iterative process. If the results of the validation checks are unsatisfactory, then adjustments will be made as required in order to achieve a better representation of reality. Further information on the validation process is provided in section 6.7 of this report.

6.3 Model Specification

This section provides an overview of the key parameters that define the LAM, with specific reference to the following aspects:

- Model Area;
- Model Time Periods;
- Demand Segmentation;
- Model Software; and
- Assignment Parameters.

6.3.1 Model Area

The area to be analysed in detail in the LAM is illustrated in Figure 6-2. The LAM boundary was reviewed and agreed with TII, and was developed to capture the proposed Luas Finglas catchment and likely traffic impacts due to the delivery of the scheme. Traffic entering and exiting this area was also modelled, so traffic passing through the study area has been considered.

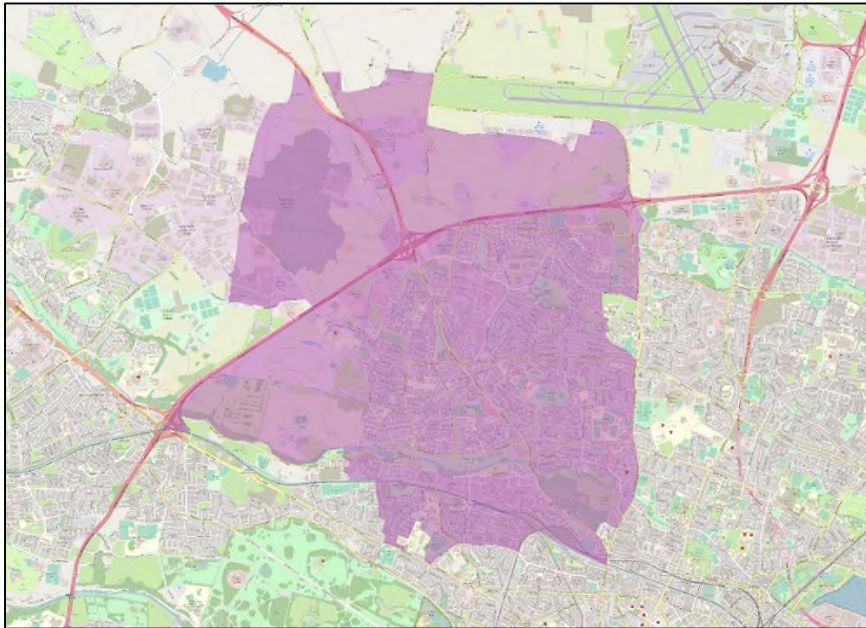


Figure 6-2: LAM Area

6.3.2 Model Time Periods

The analysis of existing traffic data allowed the identification of the typical profile of traffic demand within the study area throughout an average weekday. The results follow a typical trend with peaks in traffic volumes in the morning and evening. The ATC data suggests that the hours experiencing the highest levels of traffic are from 08:00-09:00 in the AM, and 17:00-18:00 in the PM.

Therefore, the LAM was developed, calibrated and validated to represent the following time periods:

- AM Morning peak : 08:00 to 09:00
- PM Evening peak: 17:00 to 18:00

6.3.3 Demand Segmentation

The prior travel demand for the LAM was derived from the NTA's ERM. The ERM assignment matrices contain the following ten user classes:

- Car Employer's Business (in work time)
- Car Commute (travel to/from work);
- Car Other (other non-work purposes such as shopping, visiting friends, etc);
- Car Education (travel to/from school);
- Car Retired;
- Taxi;
- Light Goods Vehicles (LGV);
- Other Goods Vehicles (OGV) 1;
- OGV2 Permit Holder (5 or more axles and allowed drive in Dublin city centre); and
- OGV2 (5 or more axles and not allowed drive in Dublin city centre).

Each user class has its own defined set of generalised cost parameters based on a price per kilometre and a price per minute. To ensure consistency with the larger strategic ERM, the ten user classes and their associated generalised cost parameters were retained for the LAM.

The ten assigned user classes were then grouped in to three broader vehicle classes, based on the availability of disaggregated survey data. The three vehicle classes represented are:

- Car;
- LGV; and
- All other Goods Vehicles.

6.3.4 Model Software

The model software used to develop the LAM is the SATURN (Simulation Assignment of Traffic to Urban Road Networks) suite of transportation modelling programs.

SATURN has 6 basic functions:

1. As a combined traffic simulation and assignment model for the analysis of road-investment schemes ranging from traffic management schemes over relatively localised networks (typically of the order of 100 to 200 nodes) through to major infrastructure improvements where models with over 1,000 junctions are not infrequent;
2. As a “conventional” traffic assignment model for the analysis of much larger networks (e.g., up to 6,000 links in the standard PC version, 37,500 in the largest);
3. As a simulation model of individual junctions;
4. As a network editor, database and analysis system;
5. As a matrix manipulation package for the production of, for example, trip matrices; and
6. As a trip matrix demand model covering the basic elements of trip distribution, modal split, etc.

6.3.5 Assignment Parameters

The LAM was developed in SATURN and the model was calibrated and validated using release version 11.4.07H MC of the software. The SATURN application SATNET was used to build the various data files in to an assignable road network (UFN) file.

Matrices were then assigned to the network using the SATALL application, where it iterates through assignment and simulation loops until the user defined levels of convergence are reached (RSTOP and STPGAP), or the model reaches the user defined maximum number of assignment and simulation loops (MASL). SATALL uses a converged equilibrium assignment method to assign the traffic to the road network over successive iterations, until user defined convergence criteria are achieved.

The key convergence criteria are presented in Table 6-1.

Table 6-1: SATURN Convergence Criteria

VARIABLE	DESCRIPTION	VALUE
MASL	Maximum number of assignment / simulation loops.	150
PCNEAR	Percentage change in flows judged to be “near” in successive assignments	1%
RSTOP	The assignment / simulation loops stop if RSTOP % of link flows change by less than PCNEAR % in successive assignments	98%
NISTOP	Number of successive loops which must satisfy the RSTOP criteria for convergence	4
STPGAP	Critical gap value (%) used to terminate assignment / simulation loops	0.05

6.4 Traffic Data

This section provides an overview of the traffic count and journey time data used to facilitate calibration and validation of the LAM. Existing data sources were reviewed to identify available counts and locate gaps in observed information across the model area. This review was used to define a specification for additional counts which were commissioned for the area. The combination of new commissioned counts, and existing available information, provided a comprehensive dataset for calibration and validation.

6.4.1 Existing Data Review (Gap Analysis)

A review of existing traffic survey data available for the model area was undertaken from the following sources:

- NTA count database: A mixture of Automatic Traffic Counts (ATC) and Junction Turning Counts (JTC) from previous studies covering a range of years; and
- TII Counters: Permanent TII ATCs located on national strategic roads across the network with data publicly available online.

Figure 6-3 illustrates the location and spread of the most recent (2019/2020) available data across the model area from the NTA count database. Other datasets were too old to be considered for this project. The data review indicated that additional information was required to robustly calibrate and validate a LAM for the area as limited observations are available within the Finglas urban area along the proposed Luas route.

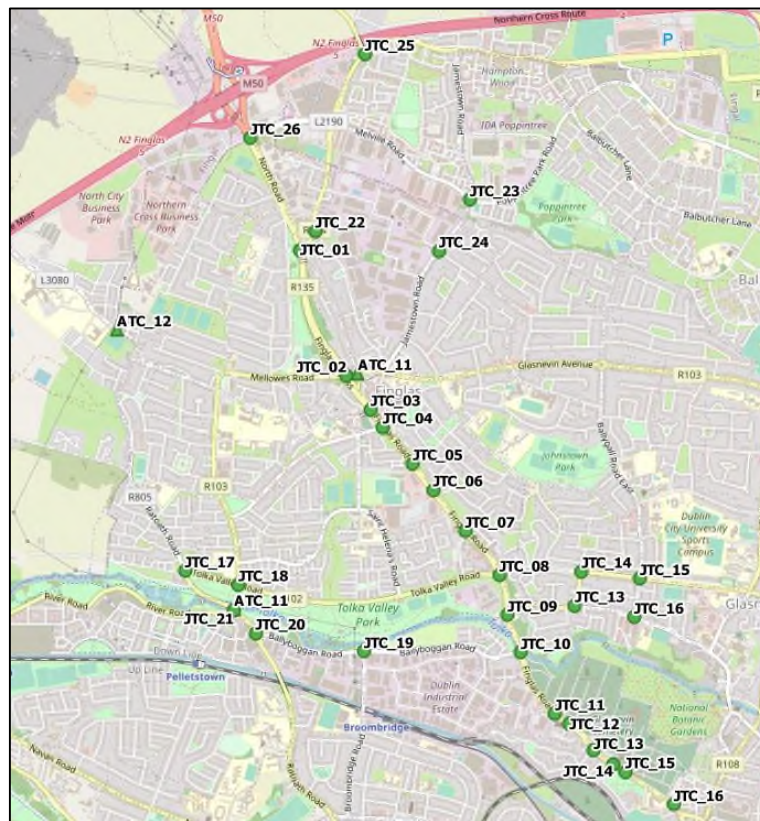


Figure 6-3: Location of existing traffic count sites

On foot of the above review, a data collection exercise was commissioned to supplement existing traffic counts and provide sufficient information to robustly calibrate and validate a LAM for the area.

6.4.2 Commissioned Traffic Survey Data

TRACSIS were commissioned to undertake a programme of traffic surveys to bridge the identified gaps. In particular, the following surveys were required:

- ATCs at key locations to complement the ATC data available from the 2019/2020 survey campaign;
- JTCs at all the main junctions within the model area to capture movement of vehicles during the peak periods.

6.4.2.1 Automatic Traffic Counts (ATCs)

ATC's were undertaken at 6 locations across the network, as illustrated in Figure 6-4, over a one week period from Monday 29th November to Sunday 5th December 2021. The ATC data provides information on:

- The daily and weekly profile of traffic within the study area;
- Busiest time periods and locations of highest traffic demand on the network;
- Any issues on the network during the survey period e.g. accidents, road closures etc.; and
- Typical speed of traffic on the network.



Figure 6-4: Location of the ATC counts

6.4.2.2 Junction Turning Counts (JTCs)

JTC’s were undertaken at 14 locations across the network, illustrated in Figure 6-5, during the AM and PM peak periods (07:00 – 10:00 and 16:00 – 19:00) on Tuesday 30th November 2021.

Combined with the existing 2019/2020 traffic data, all the main junctions within the study area have been included and provide information on the volume, and types of vehicles, making turning movements at each location. This data is utilised within the LAM calibration to ensure that the flow of vehicles through the main junctions on the network is being represented accurately.

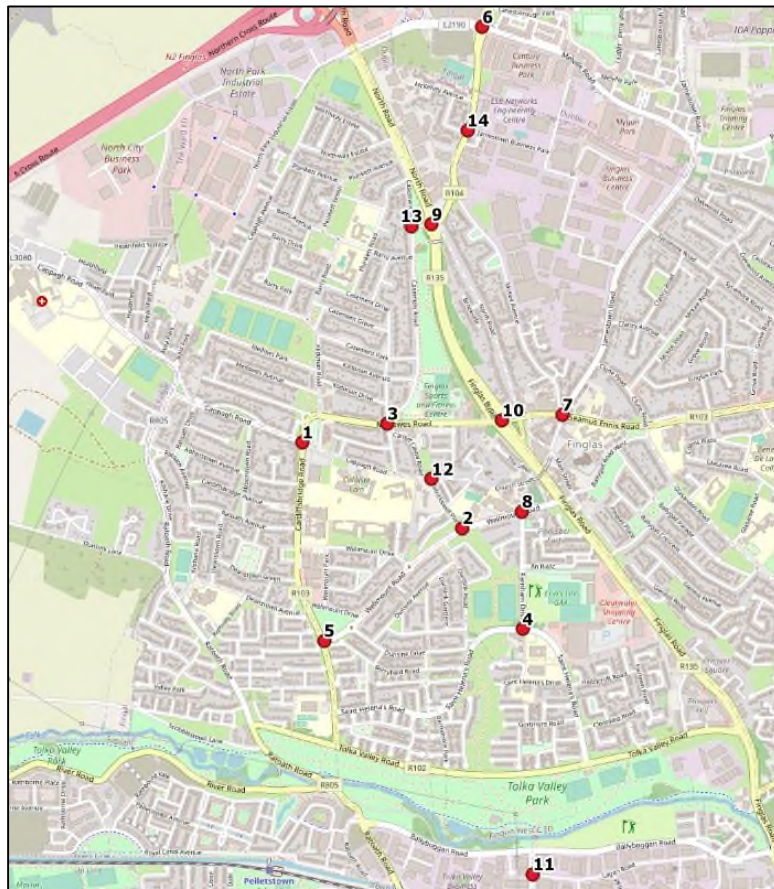


Figure 6-5: Location of the commissioned JTC counts

6.4.3 TomTom Road Journey Time Data

Road journey time data for the proposed scheme models has been sourced from TomTom, who calculate journey times using vehicle position data from GPS-enabled devices and provide this on a commercial basis to a number of different users. The NTA purchased a license to access the anonymised Custom Area Analysis dataset through the TomTom TrafficStats portal. The NTA has an agreement with TomTom to provide travel time information covering six areas of Ireland and for certain categories of road.

The data is provided in the form of a GIS shapefile and accompanying travel time database file. The shapefile contains topographical details for each road segment, which is linked to the travel time database via a unique link ID. The database file then contains average and median travel time, average and median speed, the standard deviation for speed, the number of observations and percentile speeds ranging from 5 to 95 for each link. Figure 6-6 shows the routes for which Journey Times have been analysed.

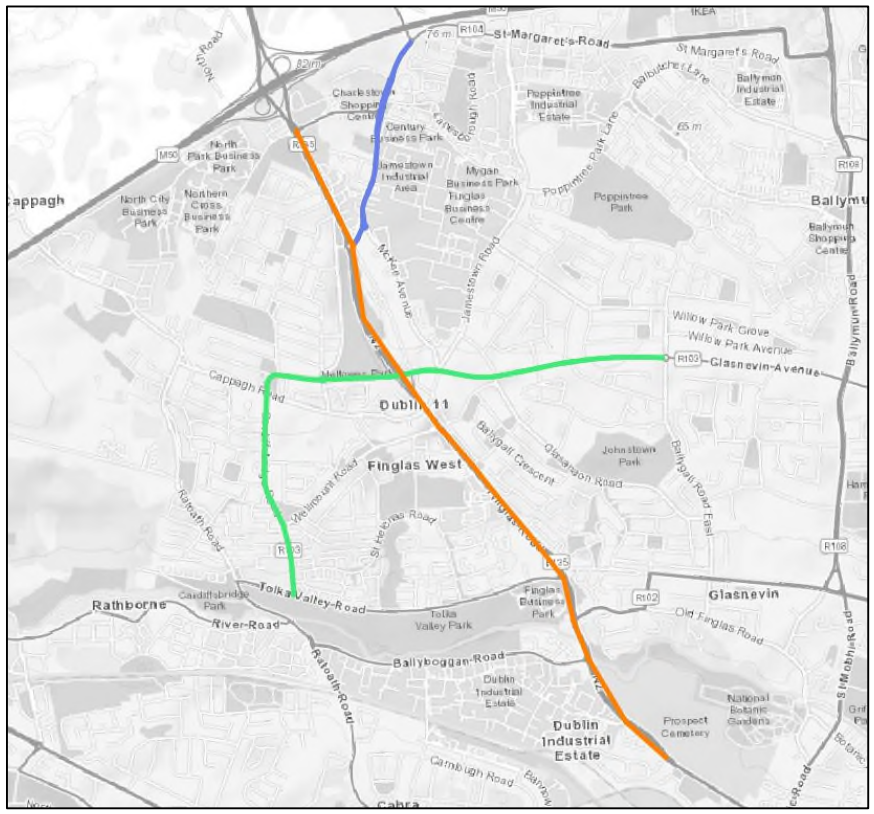


Figure 6-6: Routes for the journey time used for validation

This journey time data was used to validate the LAM to ensure that it is providing a robust representation of current levels of delay on the network at the correct locations (see section 6.7 for further details).

6.5 Road Network and Zone System Development

6.5.1 Network Development

The Dublin Local Area Model (DLAM)¹⁴ was used as a starting point in developing the Finglas LAM network. DLAM itself is an extraction from the ERM road model, but with the addition of extra road network and zoning details. The original base ERM network was developed from the HERE mapping layer which provides a detailed representation of all National Primary, Secondary, Regional and local roads in Ireland.

The Saturn highway network for the Finglas area was extracted from the DLAM using a cordoning process and then additional detail was added to this network to ensure that all necessary junctions and links are included in the Finglas LAM and that the network is representative of the base year conditions.

¹⁴ https://clongriffinsscheme.ie/wp-content/uploads/sites/2/2022/03/06.-A6.2_Transport-Modelling-Report.pdf

The LAM road network is illustrated in Figure 6-7. A detailed review was undertaken of all model coding in the study area using digital mapping systems such as Google Earth to ensure it represented, as accurately as possible, the existing road network. This included aspects such as network speed limits, availability of bus lanes, junction layouts, pedestrian crossing points etc.

Junction capacities and saturation flows were adopted from the Network Coding Guidelines developed for the NTA as part of the RMS development, and were further reviewed during the calibration process. Where required, additional detail was added to ensure that traffic was loading onto the road network at the correct locations.

As illustrated in Figure 6-7, the LAM provides a detailed representation of all significant roads within the study area. To ensure full network coverage and route choice, all roads have been considered, from the national primary routes to minor residential streets. The short dead-end links in Figure 6-7 are “spigots” used to load traffic from the zones accurately onto the network, and reflect the further developed zone system that is outlined in section 6.5.2 below.

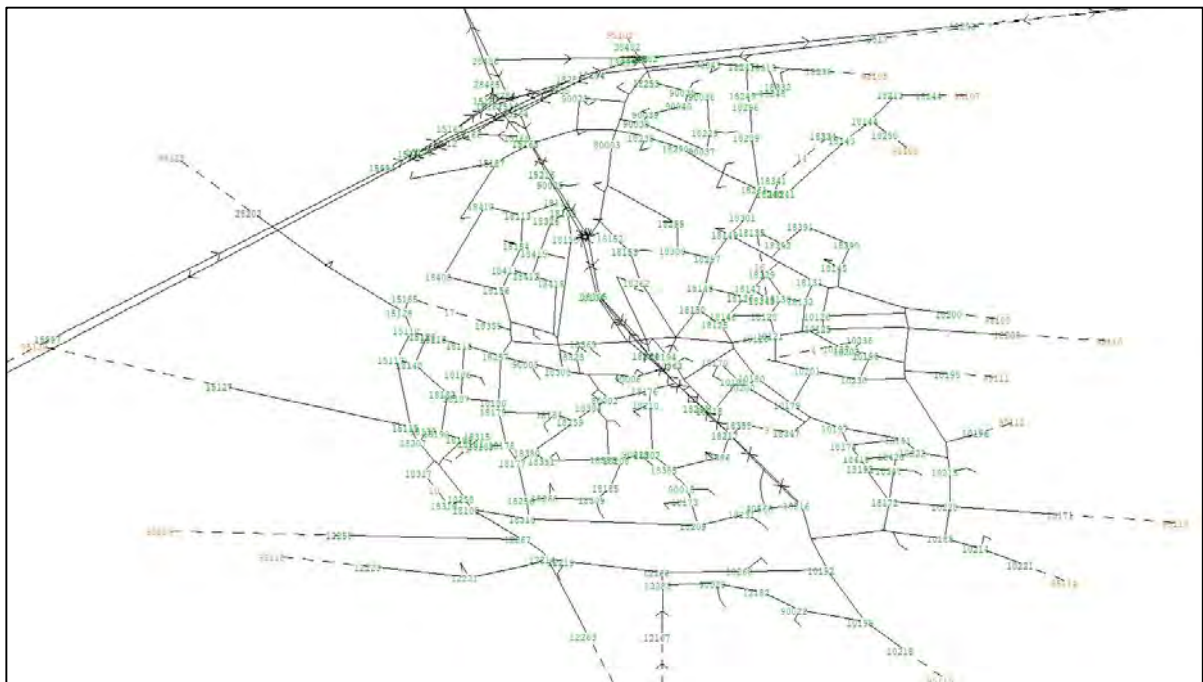


Figure 6-7: Finglas LAM highway network

6.5.2 Zone System Development

The base LAM zone system was adopted from the ERM, which was developed using the Census Small Area Population Statistics (SAPS) and Place of Work, School or College Census of Anonymised Records (POWSCAR) to get detailed information on population, employment and education centres across the model area. Other data sources such as MyPlan and Geo Directory were also used to obtain information on specified land-use zoning and location of commercial development. The following rules were then applied to generate the zone system:

- **Population, Employment and Education** – the number of zones with values of population, number of jobs and persons in education above a certain threshold should be minimised;
- **Activity Levels** – the number of zones with activity levels that have very low or very high levels of trips should be minimised;
- **Intra-zonal Trips** – threshold values should be applied to the proportion of intra-zonal trips within each zone, to avoid an underestimation of flow, congestion and delay on the network;
- **Land Use** – zones should be created with homogeneous land use and socio-economic characteristics where possible;
- **Zone Size/Shape** – zone size and the regularity of zone shape should be considered in order to avoid issues with inaccurate representation of route choice;
- **Political Geography** – it should be possible to aggregate all zones to ED level i.e. zone boundaries do not intersect ED boundaries; and
- **Special Generators/Attractors** – large generators/attractors of traffic such as Airports, Hospitals, shopping centres etc. should be allocated to separate zones.

Figure 6-8 illustrates the base ERM zone system within the study area. As the area of interest is relatively close to Dublin City Centre, the zones are represented in quite a high level of detail. The ERM zones become larger and more aggregate in nature away from the city centre primarily due to the lower levels of activity (population and employment) in these areas.

A detailed review was undertaken of all ERM zoning and centroid connectors in the study area. On foot of this review a number of edits, illustrated in red in Figure 6-8, were applied to the ERM zone system in order to provide a more accurate representation of traffic loading onto the road network. These mainly involved splitting ERM zones into smaller LAM zones with each LAM zone having a separate “spigot” onto the network.

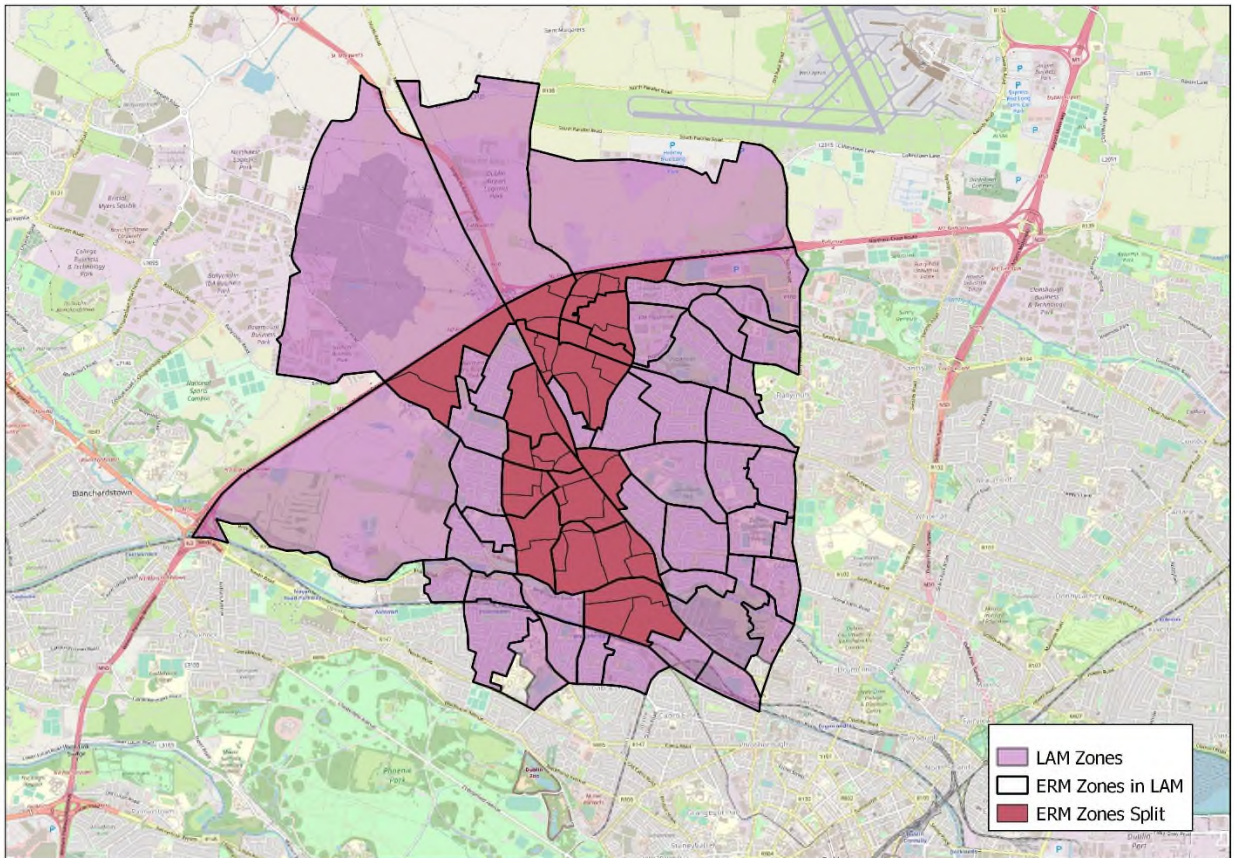


Figure 6-8: LAM zones derived from the ERM

6.6 Model Calibration Process and Results

6.6.1 Introduction

Calibration is the process of adjusting the LAM network and demand to ensure that it provides a robust estimate of assignment when compared to observed traffic characteristics. Generally, the components of the model that may be adjusted on the demand side are trip distribution and trip production/generation levels, and this usually involves trip ‘Matrix Estimation’.

On the supply side (network), modelled junction and link characteristics may be altered if sufficient new information is available to justify changes to the existing network.

The Finglas LAM was calibrated and validated in accordance with Transport Infrastructure Ireland’s (TII) *Project Appraisal Guidelines (PAG) for National Roads Unit 5.1 – Construction of Transport Models (October 2016)*. This is a widely accepted standard in Ireland that provides robust calibration and validation criteria to which certain types of highway models should adhere.

The method for the calibration of the LAM is illustrated in Figure 6-9 overleaf, and comprises of the following key elements:

- **Network and Zone System Development:** As outlined in section 6.5, the initial LAM network and zone system is derived from the ERM with further detail added where necessary to provide an accurate representation of existing conditions;
- **Network Adjustments:** A detailed review is undertaken of the road network coding taking cognisance of surveyed traffic volumes and network speeds with adjustments made where necessary;
- **Prior Matrix:** The initial prior matrix is extracted from a cordon of the ERM;
- **Calibration Criteria Check:** The LAM is then assessed against guideline calibration criteria in terms of modelled versus observed traffic volumes;
- **Matrix Estimation:** If the model is not passing the initial calibration check, a process known as ‘Matrix Estimation’ is undertaken to adjust the trip demand in order to provide an improved correlation between counts and modelled flows;
- **Post-Estimation Calibration Check:** The model is then re-tested against the calibration criteria with a focus on correlation between modelled and observed flows, along with an analysis of the demand changes introduced by ‘Matrix Estimation’; and
- **Validation:** Once all the calibration criteria have been achieved, the model is passed forward to validation.

The following sections of this Chapter provide an overview of the steps outlined above along with the calibration guidelines for LAM development.

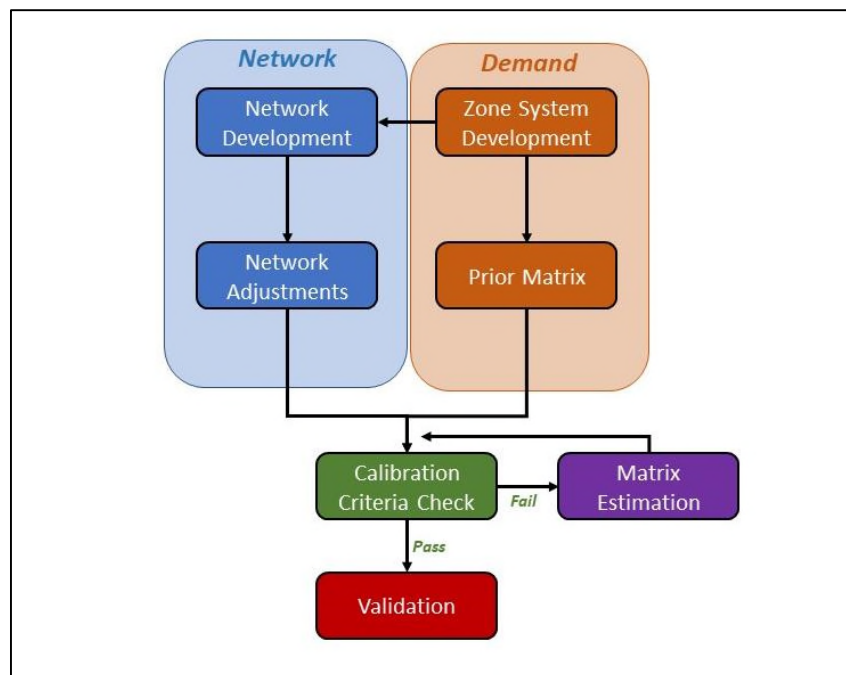


Figure 6-9: LAM calibration process

6.6.2 Calibration Criteria

The guidelines for the calibration of a LAM are contained in the following documents:

- Transport Infrastructure Ireland’s (TII) Project Appraisal Guidelines (PAG) for National Roads Unit 5.1 - Construction of Transport Models;
- UK Department for Transport (DfT) TAG Unit M3.1 Highway Assignment Modelling; and
- NTA guidance on LAM development from Regional Models.

The TII guidelines are a widely accepted standard in Ireland and have been developed in cognisance with the UK DfT TAG guidance. They focus on correlations between modelled and observed traffic flows at an individual count level along with monitoring of demand changes introduced by ‘Matrix Estimation’.

6.6.2.1 Traffic Flow Calibration

The TII PAG criteria for permissible differences between observed and modelled traffic flows makes use of the Geoffrey E. Havers (GEH) statistic.

The GEH statistic is a measure that considers both absolute and proportional differences in flows. Thus, for high levels of traffic volumes a low GEH may only be achieved if the percentage difference in flow is small. For lower flows, a low GEH may be achieved even if the percentage difference is relatively large. GEH is formulated as:

$$GEH = \sqrt{\frac{(Observed - Modelled)^2}{0.5 \times (Observed + Modelled)}}$$

The reason for introducing such a statistic is the inability of either the absolute difference or the relative difference to cope over a wide range of flows. For example, an absolute difference of 100 passenger car units per hour (pcu/h) may be considered a big difference if the flows are of the order of 100 pcu/h, but would be unimportant for flows in the order of several thousand pcu/h. Equally a 10% error in 100 pcu/h would not be important, whereas a 10% error in, say, 3000 pcu/h might mean the difference between adding capacity to a road or not.

As a rule of thumb in comparing assigned volumes with observed flows, a GEH parameter of 5 or less would be an acceptable fit, while GEH parameters greater than 10 would require closer attention. TII guidelines stipulate that at least 85% of count sites must have a GEH of less than 5.

6.6.2.2 Analysis of Trip Matrix Changes

Trip Length Distribution Analysis

A further calibration step recommended by TII guidance is to compare trip length distributions for the prior and post calibrated matrices to ensure they have not been overly distorted by the ‘Matrix Estimation’ process.

‘Matrix Estimation’ can sometimes generate increased short distance trips to match count information, thus distorting the profile of trip making on the network. PAG suggests that the coincidence ratio¹⁵ should be used to compare trip length distributions before and after estimation, with a desirable range between 0.7 and 1.0

A coincidence ratio can be used to compare two distributions by examining the ratio of the total area of those distributions that coincide. The coincidence ratio is defined as:

$$CR = \frac{\sum\{\text{Min (TLDs, TLDf)}\}}{\sum\{\text{Max (TLDs, TLDf)}\}}$$

Where TLDs is the source trip length frequency and TLDf is the final trip length frequency. A desirable range for the coincidence ratio is between 0.7 and 1.0 where a ratio of 1.0 suggests an identical distribution.

Figure 6-10: Coincidence Ratio Calculation – TII PAG Page 20

6.6.3 Network Adjustments

The Finglas LAM was coded based on best practice approaches developed during the NTA Regional Model Scoping Process, and as such, the model provided an accurate and up-to date representation of the existing road network.

When the traffic survey data was processed and analysed, the network coding was re-checked with the following edits undertaken where there was a clear justification for doing so:

- **Junction Capacity:** The SATURN software flags an error where a junction has insufficient modelled capacity to achieve the observed traffic flow. All these instances were reviewed in detail and remedial action was taken where required. This included:
 - Adjusting Signal Timings (mostly synthesised within the model area);
 - Adding/removing flared lanes;
 - Adding/removing approach lanes; and
 - Adjusting saturation flows through junctions.
- **Network Speeds:** The capacity and speeds of modelled links were checked to ensure they were broadly in line with survey information;
- **Zone Connectors:** A review was undertaken on the location of zone connectors in close proximity to count sites to ensure they were providing an accurate representation of traffic loading onto the road network.

6.6.4 Prior Matrix Development

As noted previously in Chapter 2, the Full Demand Model carries out mode and trip destination choice for all zones within the ERM. The FDM has been calibrated using Census data, and hence, provides a robust and accurate representation of trip distributions across the model network. In order to generate

¹⁵ The coincidence ratio is a calculation used to examine the how the total area under different distributions coincide, with a value of 1 representing an identical distribution.

prior matrices for the LAM, a cordon was extracted from a run of the ERM, which has been updated to include 2020 planning data. The cordon function within SATURN, facilitates the extraction of trip matrices for a subset area of the ERM whilst still maintaining route and destination choice from the full model.

A bespoke Excel spreadsheet tool was created to disaggregate the cordoned ERM matrices to each of the Finglas LAM zones. This tool used available data on population, employment, and education places by Census small area, to split trips to/from each ERM zone between the more detailed LAM zoning system. This allowed for a consistent split of demand within the study area, whilst maintaining consistency with the ERM matrix.

Figure 6-11 provides an indicative example of how the disaggregation process is undertaken in the Excel Spreadsheet tool for the Commute user class in the AM peak.

The overall commute trips between Zone 1 and Zone 2 is extracted from a cordon of the ERM. Zone 1 is disaggregated into two LAM zones, namely Zone A and Zone B. Whilst Zone 2 is also disaggregated into two LAM zones, Zone C and Zone D.

Commute trips in the AM are assumed to be travelling from home to work. As such, the origin trips for ERM Zone 1 are split between the LAM zones based on the population numbers in each zone. Likewise, the destination trips to ERM Zone 2 are split between their LAM zones based on the level of employment in each zone. As mentioned previously, Census 2016 data was used to identify the level of population and employment in each LAM zone.

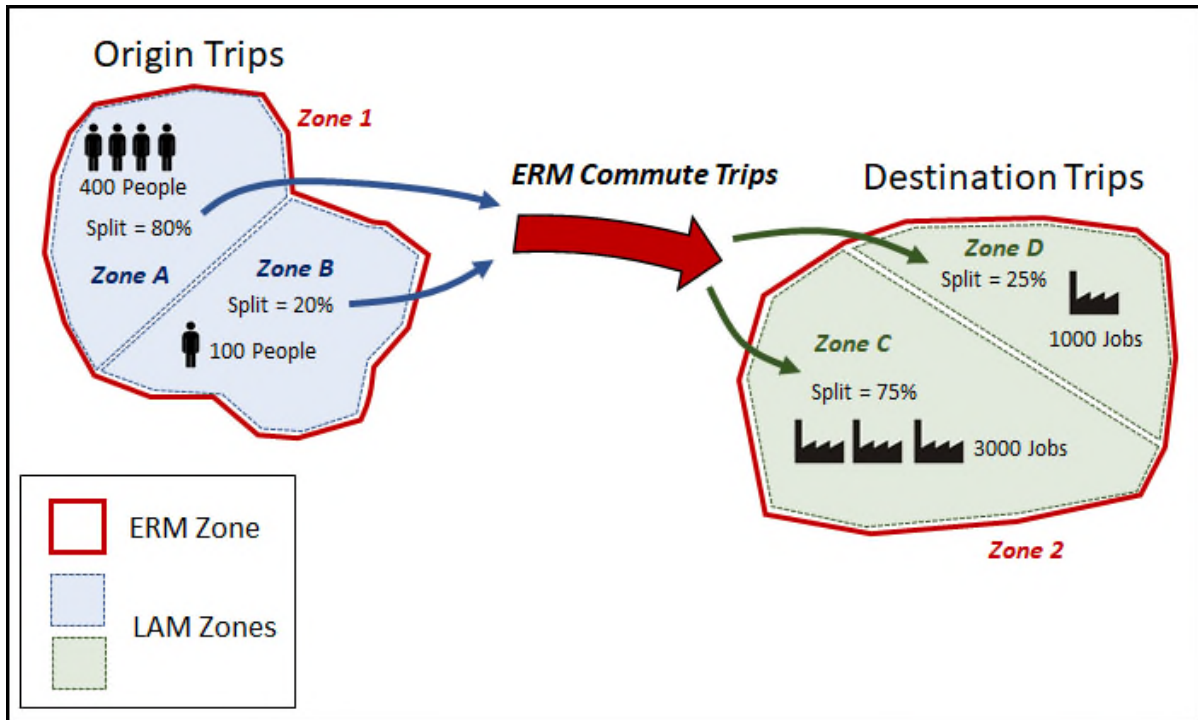


Figure 6-11 LAM Disaggregation Example – AM Peak Commute Trips

Detailed checks were undertaken at various stages to ensure that no demand from the ERM was lost throughout the disaggregation process. Table 6-2 and Table 6-3 below outline the matrix totals by user class before and after the disaggregation process, and indicate that all ERM cordoned demand is represented in the LAM matrices for the AM and PM peaks.

Table 6-2 AM Matrix Total Comparison

USER CLASS	ERM CORDON	LAM MATRIX	% DIFFERENCE
Employers Business	5,183	5,183	0%
Commuter	8,314	8,314	0%
Other	4,774	4,774	0%

Education	59	59	0%
Retire	215	215	0%
Taxi	595	595	0%
LGV	2,347	2,347	0%
OGV1	3,116	3,116	0%
OGV2	0	0	0%
OGV2_NP	106	106	0%

Table 6-3 PM Matrix Total Comparison

USER CLASS	ERM CORDON	LAM MATRIX	% DIFFERENCE
Employers Business	5,523	5,523	0%
Commuter	7,506	7,506	0%
Other	5,650	5,650	0%
Education	95	95	0%
Retire	450	450	0%
Taxi	591	591	0%
LGV	1,958	1,958	0%
OGV1	1,827	1,827	0%
OGV2	1	1	0%
OGV2_NP	60	60	0%

6.6.5 Matrix Estimation

‘Matrix Estimation’ is a process used to adjust trip demand so that there is an improved correlation between counts and modelled flows. The base prior matrix is fed into a SATURN programme called SATME2. SATME2 then adjusts origin-destination patterns to produce a trip demand matrix that better replicates traffic counts when assigned to the network.

The prior matrix is adjusted only after all options for improving the network are exhausted. Any matrix adjustment must significantly improve the match between observed and modelled flows, and not introduce more trips into a zone than could realistically be expected. Controls are placed on zones to

ensure that the trip demand generated is sensible and in line with census population and employment statistics.

The algorithm driving the SATME2 estimation process tends to reduce long trips in place of chains of short trips, especially when counts are spread over the entire area, which may not fully reflect reality. Constraints are therefore placed on the adjustment process to protect the number of movements and distribution of the through trips contained within the original car trip matrix. By restricting such long through trips, the matrix adjustment algorithm is forced to create or re-distribute short trips.

6.6.6 Post-Estimation Calibration

The post ‘Matrix Estimation’ model was then re-tested against the TII and TAG calibration criteria to assess performance. This was undertaken in an iterative process, with adjustments made to the road network where necessary to facilitate a better correspondence between model and observed flows e.g. altering junction capacity to facilitate count demand, fixing routing issues and rat-running etc.

A calibration and validation dashboard was created to identify areas of the network requiring adjustment/improvement and not meeting the calibration guidelines. Once all options for network improvement were exhausted, ‘Matrix Estimation’ was re-run to try and achieve a better match between modelled and observed flows. The iteration between network alterations and ‘Matrix Estimation’ was carried out until the calibration criteria had been achieved.

6.6.6.1 GEH Calibration Results

Table 6-4 summarises the GEH calibration results for the Finglas LAM after the matrix estimation process, for each of the modelled time periods.

Table 6-4: Finglas LAM – Model Calibration Summary

GEH	AM Counts	AM % Counts	PM Counts	PM % Counts
<5	260	86%	265	87%
5-10	38	13%	36	12%
>10	6	2%	3	1%
Total	304	100%	304	100%

The results in Table 6-4 demonstrate that a satisfactory calibration has been achieved in the model for the AM and PM peak periods, with GEH values falling within TII standards (more than 85% of counts to be modelled with GEH less than 5).

The full list of flow calibration results for each traffic count location are presented in Appendix B.

6.6.6.2 Analysis of Trip Matrix Changes – Trip Length Distribution

TII guidance recommends comparing trip length distributions for the prior and post calibrated matrices to ensure they have not been overly distorted by the ‘Matrix Estimation’ process.

The ‘Matrix Estimation’ programme SATME2 can sometimes generate increased short distance trips to match count information, thus distorting the profile of trip making on the network. PAG suggests that the coincidence ratio should be used to compare trip length distributions before and after estimation, with a desirable range between 0.7 and 1.0.

Table 6-5 below outlines the coincidence ratios for each of the calibrated LAM time periods. The coincidence ratios suggest that there has been some minor distortion of trip lengths but that it is within acceptable bounds.

Table 6-5: Trip Length Analysis - Coincidence Ratios

MEASURE	SIGNIFICANCE CRITERIA	AM	PM
Coincidence Ratio	Between 0.7 and 1.0	0.88	0.87

The trip length distributions illustrated in Figure 6-12 and Figure 6-13 below display the proportion of trips travelling various distances for both the pre and post estimation matrices. The results indicate that there have been some changes, however, the general shape of the distributions are similar. The changes overall are not large, and therefore, it is considered that ‘Matrix Estimation’ has not overly distorted the overall trip length distribution inherited from the ERM.

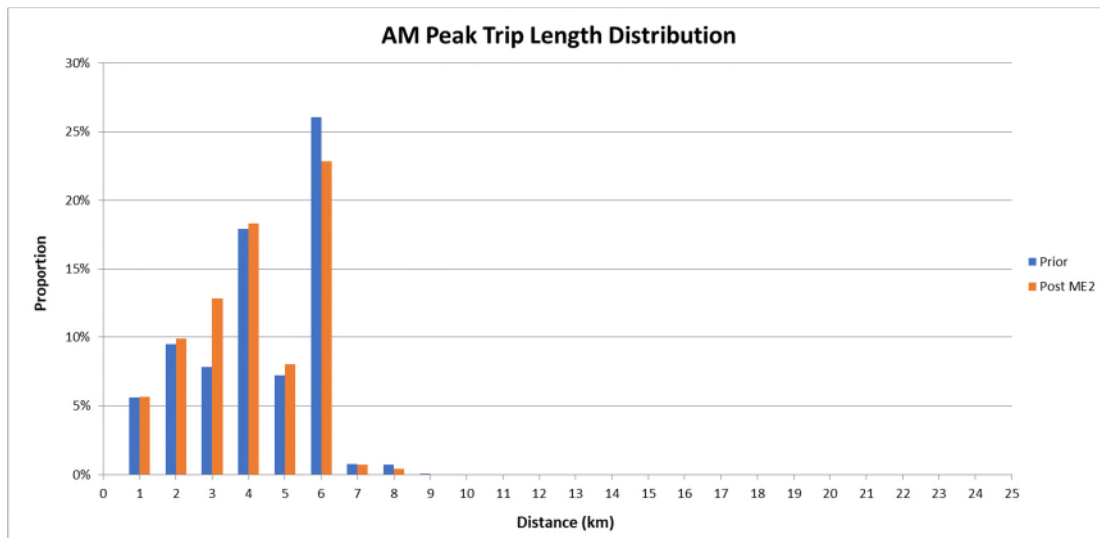


Figure 6-12: AM Peak Trip Length Distribution

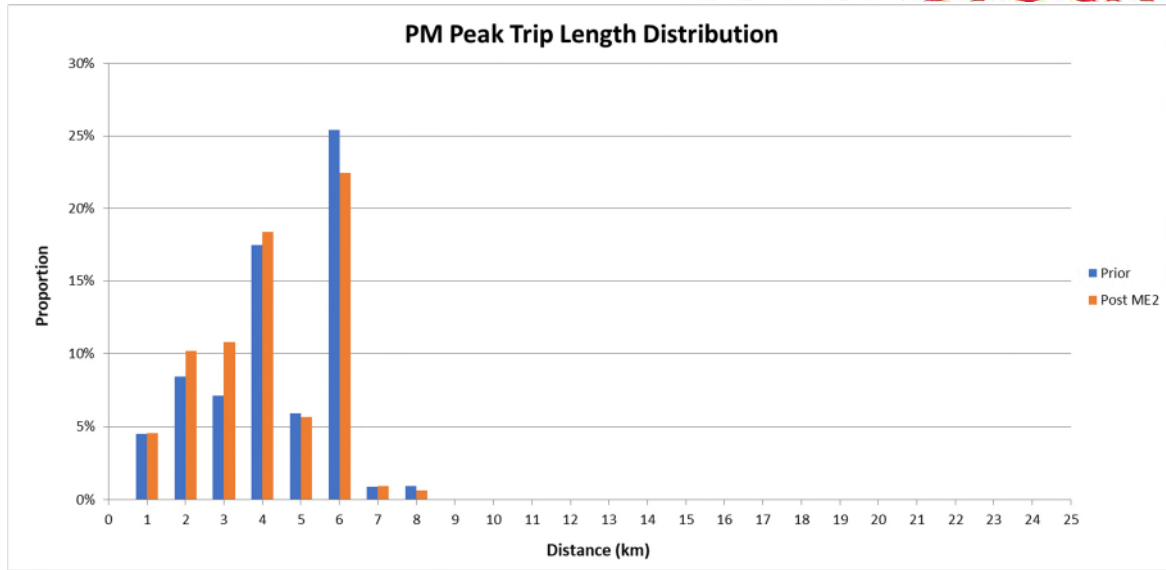


Figure 6-13: PM Peak Trip Length Distribution

6.6.7 Calibration Summary

The previous sections of this Chapter have outlined the methodology used to calibrate the Finglas LAM to better reflect observed traffic survey data. In summary:

- A combination of network edits and ‘Matrix Estimation’ have been used to provide a better correlation between modelled and observed traffic flows;
- The model meets a satisfactory level of calibration following the GEH criteria; and
- The coincidence ratio is well within TII guidelines and, as such, it is considered that ‘Matrix Estimation’ has not overly distorted the overall trip length distribution inherited from the ERM.

6.7 Model Validation

The validation of the model uses additional comparative measures against which the robustness of the calibrated model may be judged. Calibration and validation are separate concepts, however, in reality these two elements are part of an iterative process. If the results of the validation checks are not satisfactory, then the modeller will review the inputs and coding within the model and adjust as required in order to achieve a better representation of reality. The guidelines for model validation are outlined in Table 6-6.

Table 6-6: Validation Criteria

CRITERIA	ACCEPTABILITY GUIDELINE
<u>Modelled journey times compared with observed times</u>	
Times within 15% or 1 minute if higher	>85% of cases

As outlined in Table 6-6, TII guidelines recommend that modelled journey times should be within +/- 15% of the observed time, or 1 minute if higher, in more than 85% of cases. Journey Times have been validated comparing Joy Ride Journey Times extracted from Saturn with TomTom data on three different routes (in both directions):

- 1) R103 Glasnevin Avenue - Cardiffsbridge Road
- 2) Saint Margaret's Road
- 3) R135 Finglas Road - North Road

The routes are displayed in Figure 6-14 while Table 6-7 and Table 6-8 report the validation results.

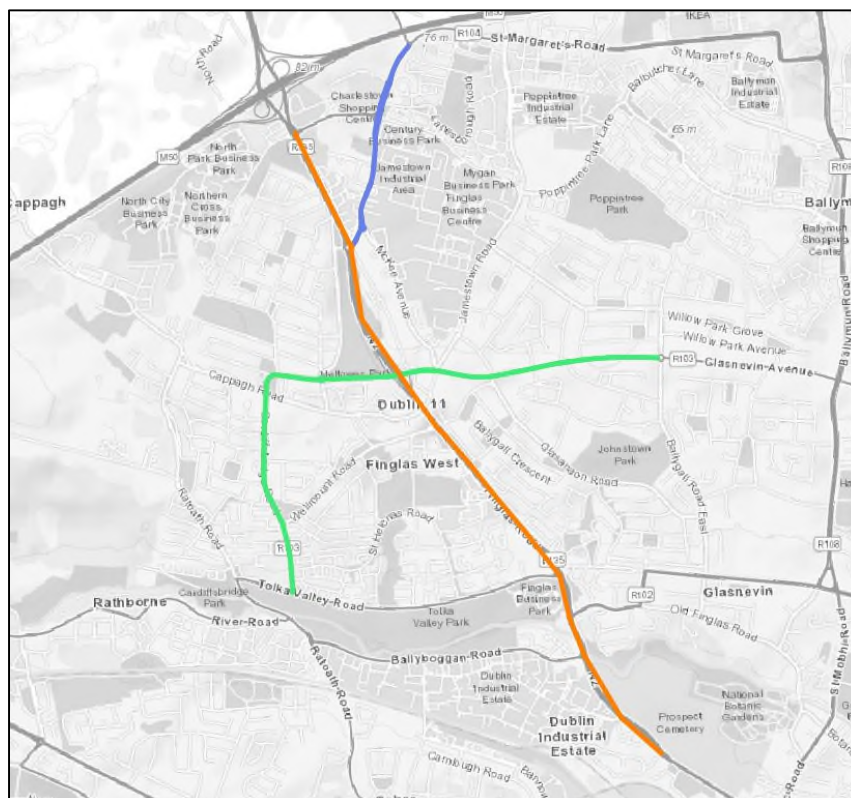


Figure 6-14: Routes used for Journey Time Validation

Table 6-7: validation results for the three routes in the AM peak

Route	Route Name	Direction	Obs.	Mod	Diff.	% Diff	Pass/Fail
1	R103 Glasnevin Avenue - Cardiffsbridge Road	NB	619	545	-74	-12%	Pass
		SB	526	533	7	1%	Pass
2	Saint Margaret's Road	NB	156	156	0	0%	Pass
		SB	190	202	12	6%	Pass
3	R135 Finglas Road - North Road	IB	363	345	-18	-5%	Pass
		OB	315	342	28	9%	Pass

Table 6-8: validation results for the three routes in the PM peak

Route	Route Name	Direction	Obs.	Mod.	Diff.	% Diff	Pass/Fail
1	R103 Glasnevin Avenue - Cardiffsbridge Road	NB	573	539	-34	-6%	Pass
		SB	558	533	-24	-4%	Pass
2	Saint Margaret's Road	NB	182	182	0	0%	Pass
		SB	219	192	-27	-12%	Pass
3	R135 Finglas Road - North Road	IB	283	326	43	15%	Pass
		OB	524	532	8	1%	Pass

The model meets the criteria for journey time validation (more than 85% of routes to be modelled within 15% or within 1 minute of the observed journey times). More details about validation results are shown in Appendix C.

In summary the Finglas LAM meets the required calibration and validation criteria and it is suitable for testing.

6.8 Future Year Scenarios

The previous sections outlined the calibration and validation of the LAM. This was then used to assess the local impact of Luas Finglas on traffic in the area. In order to test future scenarios two inputs are required:

- Future year demand; and
- Future year networks.

6.8.1 Future Year Demand – Furness Method

The Furness Method (also known as *Doubly Constrained Growth Factor Method* – or as *Fratar* in the US) is an iterative process typically used when the future number of trips originating and terminating in each zone is known. The method calculates “a set of intermediate correction factors which are then applied to cell entries in each row or column as appropriate. After applying these corrections to say, each row, the totals for each column are calculated and compared with the target values. If the differences are significant, new correction coefficients are calculated and applied as necessary” (Modelling Transport, Ortuzar, Willumsen, 2011).

Figure 6-15 provides an overview of the furness method applied to produce the future year LAM demand. The steps on the left side of the diagram represent the process of calibrating the base year LAM as reported in section 6.6. The first two rectangles on the right side of the diagram refer to the cordoning of the ERM forecast scenarios which results in a cordoned forecast demand matrix (forecast year LAM prior).

The procedure involves the calculation of growth factors at origin and destination level between the base and the forecast year prior. These factors are then applied to the calibrated base year LAM in an iterative process that “pivots” the base demand to match the growth trends observed between the

two prior matrices. This results in a final pivoted forecast year matrix that can then be assigned to the LAM network.

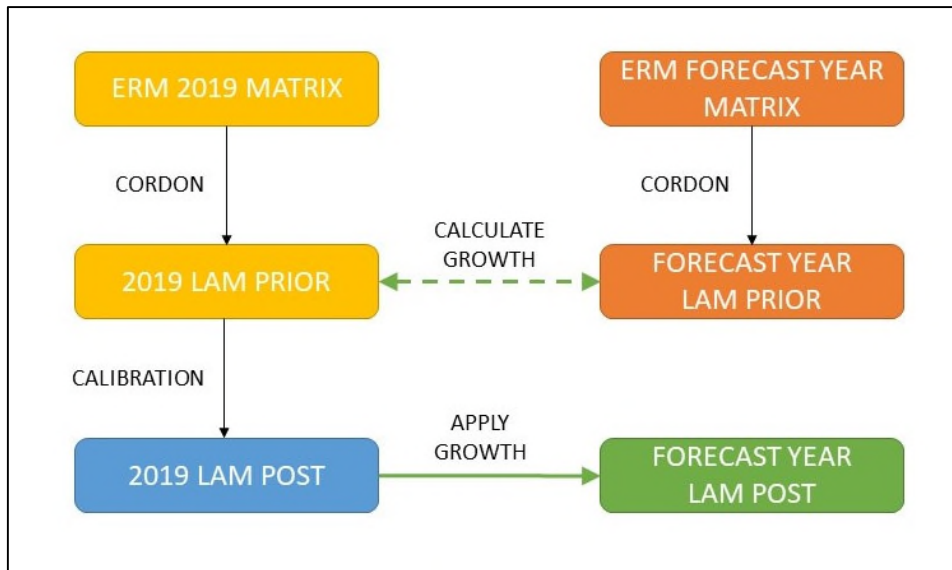


Figure 6-15: Overview of the Furnessing method for the Finglas LAM

Before assigning the forecast demand to the LAM network, a detailed analysis of the total Trip Ends was performed to ensure the growth trends of the demand remained consistent across all zones. Care was taken to ensure results were robust and outliers dealt with appropriately. For example where very large growth was to occur, e.g. at greenfield sites, the gross increase in demand was added to the base year rather than using a multiplication factor. This process was carried out for both 2035 and 2050.

6.8.2 Future Year Networks

The future Do Minimum network is based off the calibrated and validated base SATURN Network. This was then updated with schemes included in the ‘Core’ scenario (see Section 4.2). This mainly included updating the network along the Finglas Road (R135) to include proposed changes as a result of the BusConnects Core Bus Corridor.

The Do Something network was then built off the Do Minimum. As outlined previously, Luas Finglas will interact with the surrounding road network at a number of locations – new signalised junctions are proposed at Ballyboggan Rd, Tolka Valley Rd, St. Helena’s Rd, Wellmount Rd, Cappagh Rd, Mellowes Rd, North Rd (R135) and along St. Margaret’s Rd to the terminus at Charlestown.

The two most significant impacts will be at:

- **R135 / St Margaret’s Road Junction:** It is proposed that this junction will be altered from the existing roundabout to a signalised junction to facilitate through movements of Luas Finglas, along with improved safety for pedestrians and cyclists; and
- **St Margaret’s Road / Melville Road Junction:** It is proposed that this junction will be reconfigured to reduce crossing distances and improve safety for pedestrians and cyclists which includes the removal of existing left-turn filter lanes.



Figure 6-16: R135 / St Margaret's Road Junction Upgrade Proposals

The coding for these junction upgrades has been included in the Do Something networks based on the latest designs available at the time of modelling.

6.9 Results

The future year LAMs were run for 2035 and 2050 and the following sections outline the road network results focusing on:

- **Network Performance Indicators:** looking at queuing, journey times and speeds in the LAM; and
- **Journey times along the R135:** Assessing the impact of Luas Finglas on journey times along this key route into the city.

6.9.1 Network Performance Indicators

Network performance indicators for the LAM network were extracted for all modelled scenarios in the AM and PM peak hours and are presented in Table 6-9. For each scenario, the following network statistics are presented:

- **Transient Queues:** this is expressed in total pcu hours which is essentially the volume of vehicles on the network multiplied by the time spent in transient queues and it represents time spent in queues at junctions which are not over capacity (e.g. at a signalised junction where the queue is able to clear during a single cycle).

- Over-capacity queues: expressed in total pcu hours, this occurs where the volume of turning movements exceeds junction capacity, such that a permanent queue builds (e.g. at a signalised junction where a queue is unable to clear in a single cycle).
- Average Speed: represents the average speed of all vehicles travelling on the network within the modelled time period measured in km/h.
- Total Travel Distance: represents the total distance travelled by vehicles on the road network in the modelled period measured in pcu km.
- Total Travel Time: represents the total time travelled by vehicles on the road network in the modelled period measured in pcu hours.

Table 6-9: LAM network performance indicators

	Time Period	Transient Queues [pcu-hrs]	Over Capacity Queues [pcu-hrs]	Average Speed [km/h]	Total Travel Distance [pcu-km]	Total Travel Time [pcu-hrs]
2035 DO-MIN	AM	906	272	35	124,865	3,594
	PM	892	272	36	127,102	3,582
2035 DO-SOM	AM	1,007	260	34	124,875	3,689
	PM	1,023	239	35	126,860	3,657
2050 DO-MIN	AM	1,152	432	31	130,000	4,155
	PM	992	583	32	131,321	4,118
2050 DO SOM	AM	1,232	551	30	128,458	4,305
	PM	1,113	466	32	131,241	4,095

The results in Table 6-9 indicate that whilst the proposed changes to the junctions at the northern end of the alignment have an impact on road network capacity, the overall impact on the network is relatively minor.

Average speed decreases by only 1km/hr in all scenarios for both 2035 and 2050. This represents an approximately 3% decrease in average speed with the introduction of Luas Finglas. The minor overall impact is further shown by the impact on total travel time. Total travel time increases by between 2-3% in 2035 and between 1-4% in 2050.

While transient queues increase by roughly 10% in all scenarios, over-capacity queues are relatively stable across scenarios. This is true in both 2035 and 2050. While Luas Finglas results in some increased queuing, there is a very minor impact on travel times and speeds throughout the modelled area.

6.9.2 Journey Times

As part of the delivery of Luas Finglas, the roundabout at St. Margaret’s Road will be converted to a signalised junction. The R135 Finglas Road is one of the key radial vehicular routes into Dublin City, and as such, analysis was undertaken of journey time changes along this route in the Do Minimum and Do Something scenarios.

For the purpose of this analysis, the highest demand scenarios were assessed i.e. travel southbound towards Dublin City in AM, and travel northbound towards the M50 in the PM (the route assessed is outlined in Figure 6-17).

The results of the journey time assessment is illustrated in Figure 6-18 and Figure 6-19. The results indicate an increase in journey times along the R135 of just under 10% in both the AM and PM. This equates to an increase of an average of 54 seconds for AM inbound and 79 seconds for PM outbound towards the M50.

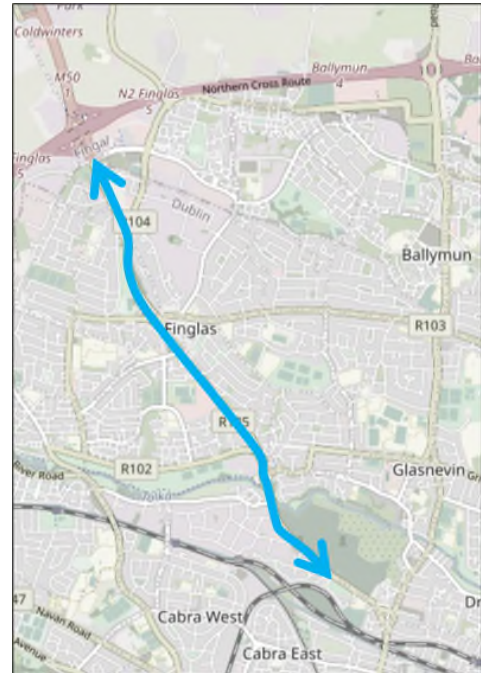


Figure 6-17 Journey Time Testing Route



Figure 6-18: R135 Journey Time Southbound Do Minimum and Do Something 2035 AM

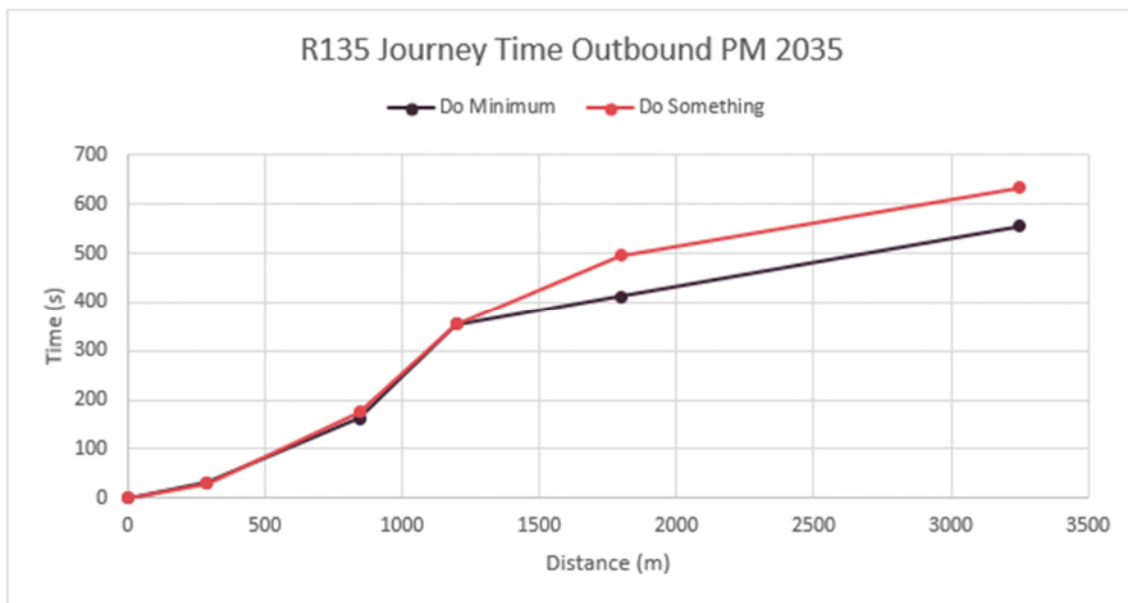


Figure 6-19: R135 Journey Time Northbound Do Minimum and Do Something 2035 AM

It is acknowledged that the proposed junction changes as a result of Luas Finglas may have an impact on road network capacity for vehicles as they provide greater priority to sustainable modes in terms of facilitating Luas crossings as well as safe pedestrian and cycle facilities. However, the modelled impacts are likely to be overestimated due to the following:

- Limitations of the modelling software:** The SATURN traffic modelling software package has limitations in its ability to model complex signalised junctions. For example, the proposed R135/St Margaret Roads signalised junction would likely be controlled via the Dublin SCATS system which allows signal timings and phasing to adapt to vehicle demand and delay. The impact of such a system cannot be replicated in the modelled road network assignment, and as such, the associated estimated delay due to the junction changes is likely to be overestimated; and
- Impact on Goods Vehicles:** The modelling also assumes that goods vehicles (HGVs and LGVs) continue to grow in line with forecasted economic activity with patterns of travel remaining the same. This is considered a conservative assumption. It should be noted, the 2023 Climate Action Plan (CAP) sets out the necessity to examine the feasibility of developing logistics hubs near urban centres to consolidate and rationalise freight transport. These measures may include the development of consolidation centres to limit the number of ‘last-mile’ trips made by larger goods vehicles with plans for higher use of smaller electric vans or cargo bikes for ‘last-mile’ deliveries in urban areas. As proposals for the above are at a pre-planning stage, it was not deemed appropriate to account for them in the assessments and a worst-case assessment has been undertaken based on continued growth in goods traffic.

At the time of writing this report, further detailed traffic modelling of the local impact of proposed junction changes is being undertaken to support the ongoing design of the scheme and the Environmental Impact Assessment Report (EIAR). It is envisaged that this report will be updated as additional modelling is completed, and will be included as part of a future EIAR submission.

7. SUMMARY

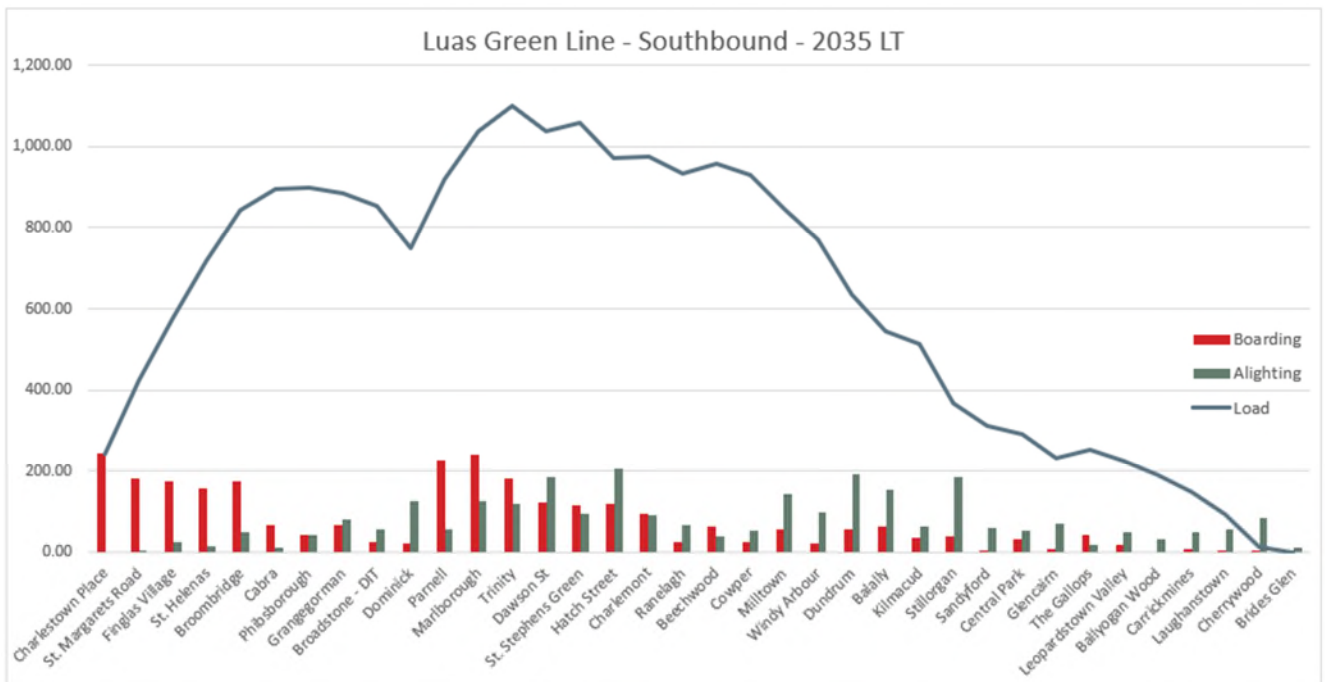
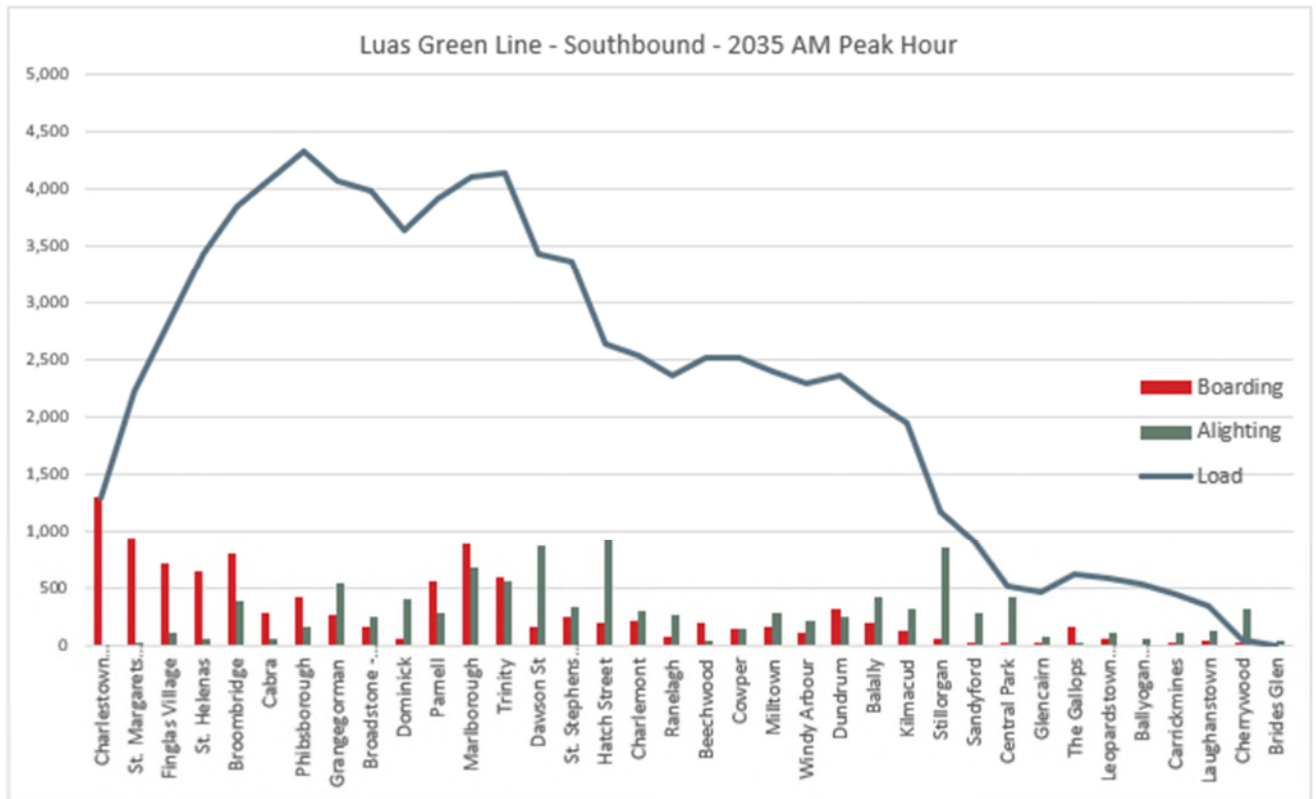
This report provides an overview of the modelling undertaken to support the Luas Finglas PBC. A detailed description is provided of the NTA's ERM, along with rationale as to why it is a suitable tool for assessing the effects of the proposed scheme.

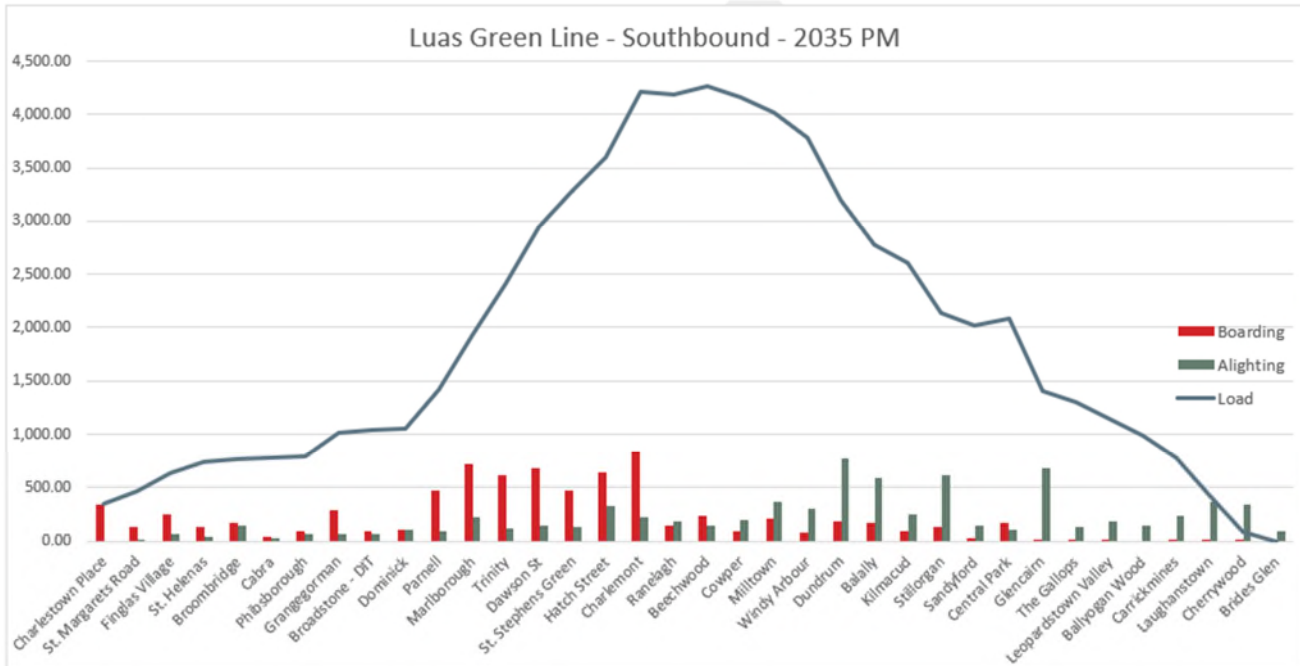
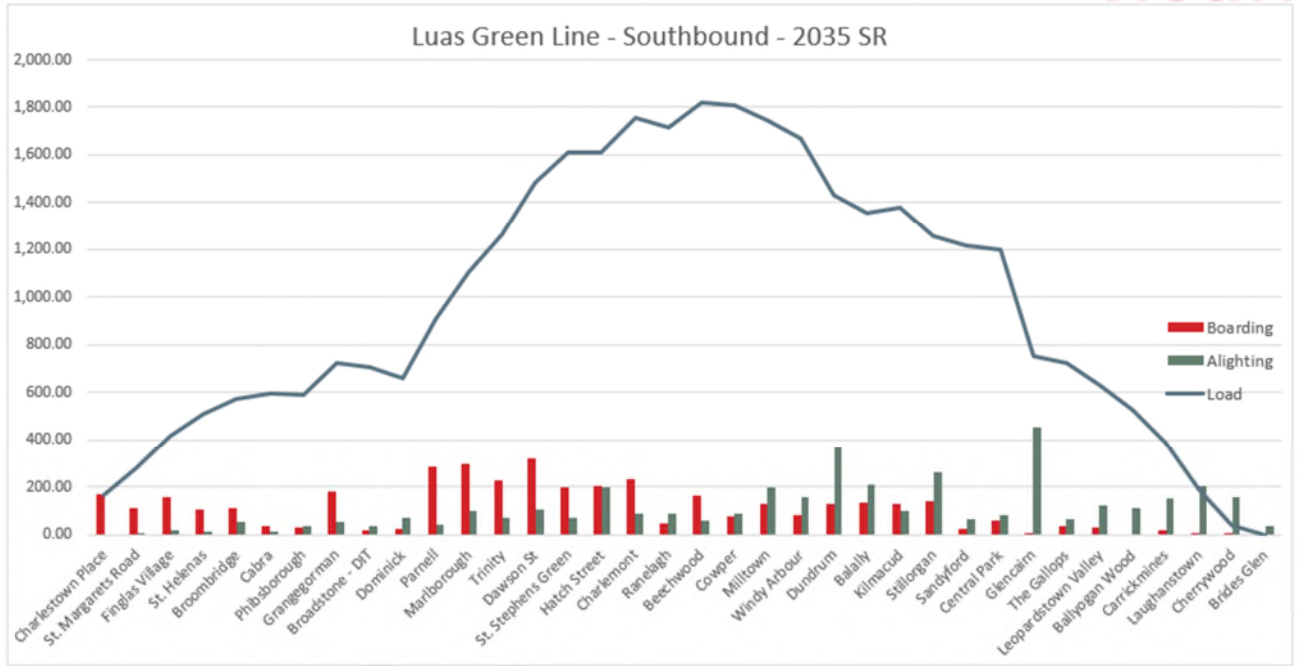
The report outlines the assumptions used to develop future year model scenarios to feed into the appraisal of Luas Finglas, including how they have been represented in the ERM. The results of modelling undertaken in the ERM to support the Luas Finglas PBC have been presented. In summary:

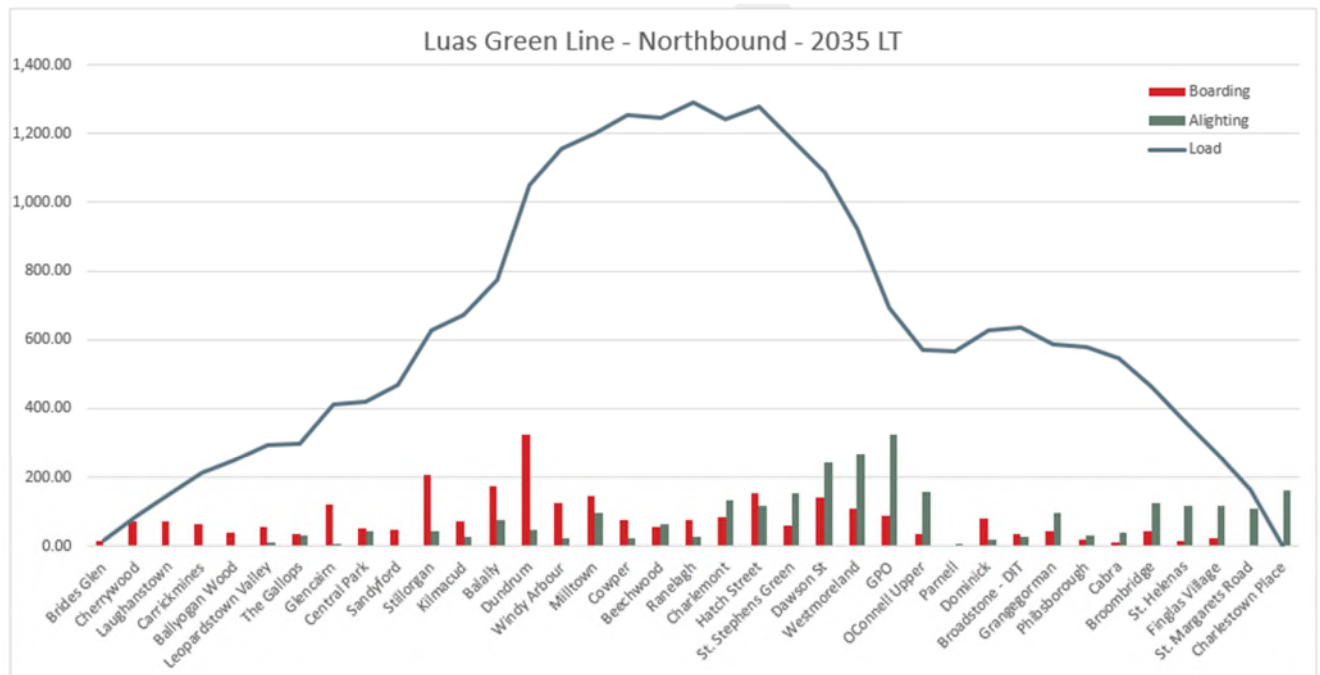
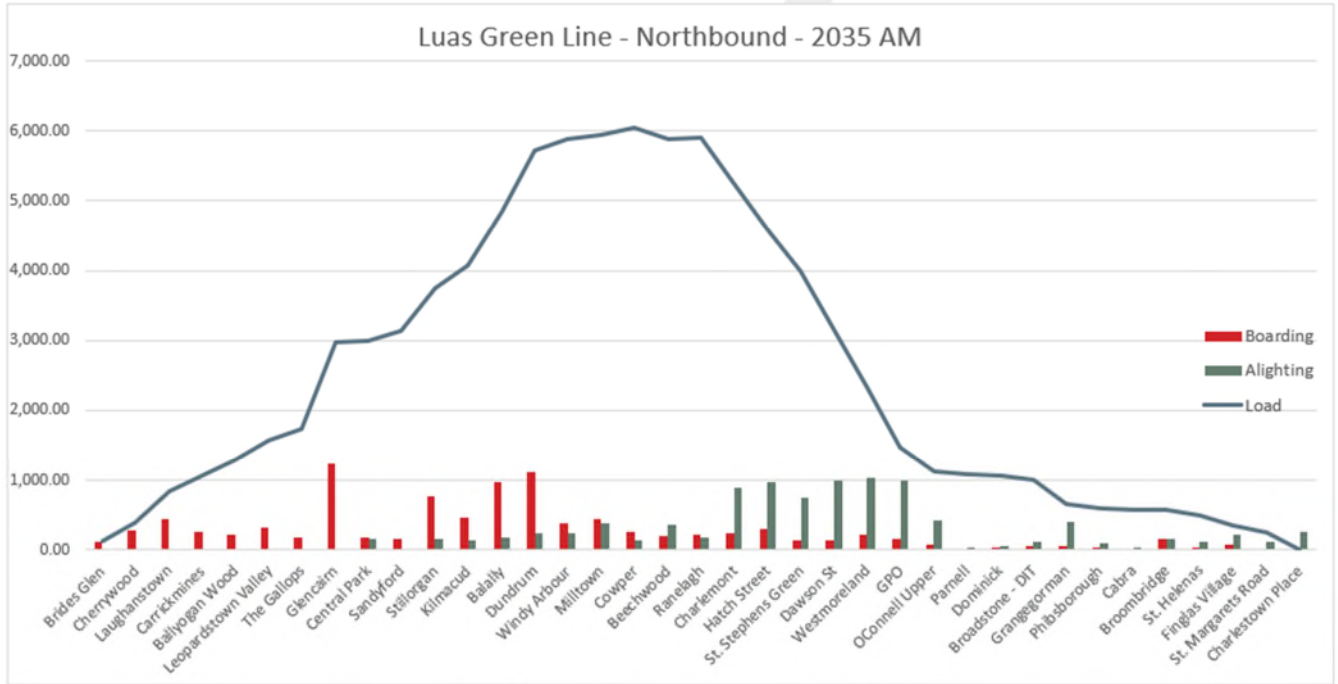
- Luas Finglas directly serves a number of large sites marked for high-density development. It is estimated that 73% of the new population expected in the Finglas area by 2035 will be within a 10-minute walk of one of the new Luas Finglas stops.
- Luas Finglas will attract high levels of boardings at all four of the stations along the proposed extension. In total, Luas Finglas will lead to an increase of 1.3 million low carbon public transport trips in 2035, increasing to 1.8 million in 2050.
- Luas Finglas delivers an improved public transport service directly to the city centre, but also to a range of other destinations along the network through integration with other high quality public transport services. Interchange points are provided with DART+ at Broombridge station as well as a number of BusConnects Network spines and orbital routes at Charlestown and Finglas Village.
- The large level of population growth planned for the study area strains the transport system in the Do Minimum scenario, resulting in a bottleneck for travel towards the city centre. Luas Finglas relieves this bottleneck and increases the overall carrying capacity of the transport network over the Royal Canal in this area by 50%.
- Luas Finglas will significantly reduce public transport journey times between the Finglas area and the city centre by an average of 12% during the AM peak hour. When compared to travel via private car, the delivery of Luas Finglas will lead to an average reduction in journey times to the city centre of 15 minutes (over 30%) during the congested peak periods.
- Overall, the impact of junction changes as a result of Luas Finglas leads to a relatively minor increase in travel time and delay on the road network. This is a localised impact, focused around the proposed changes along St. Margaret's Road and the junction with the R135. This has been reflected in the road user impacts derived from the ERM and TUBA for the Economic Appraisal of Luas Finglas – further details are provided in Appendix D of the PBC.

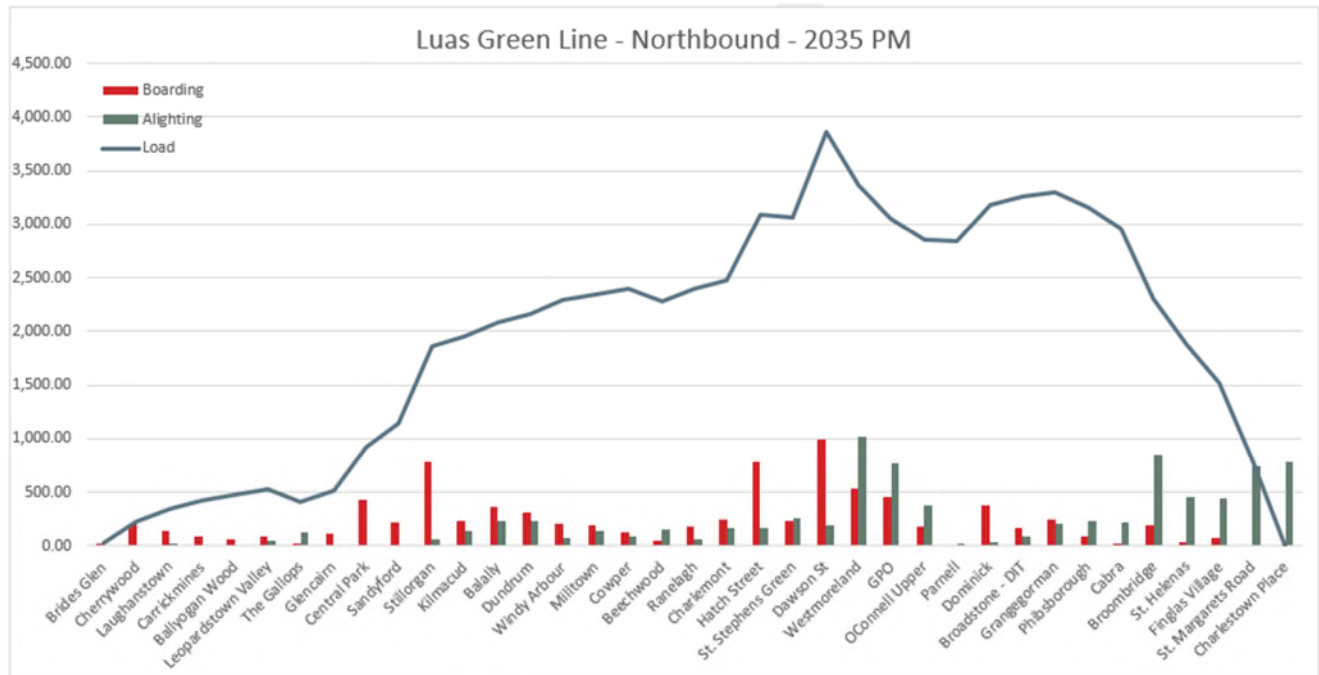
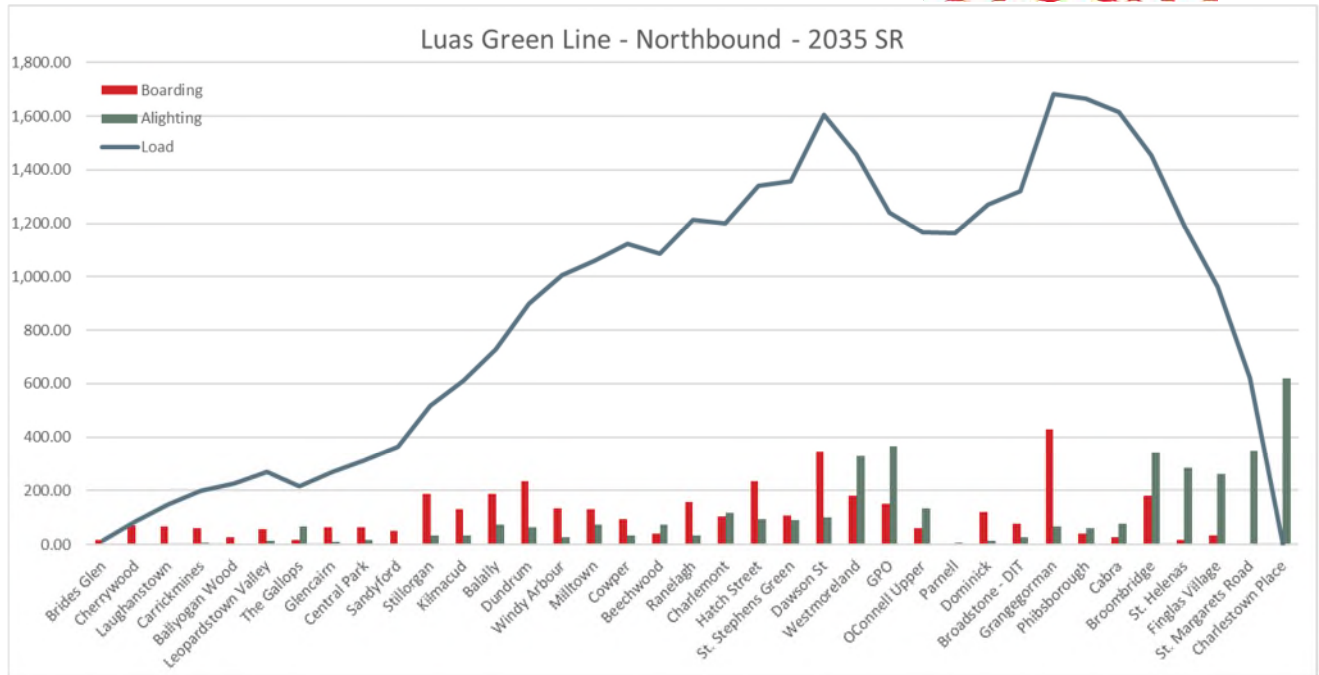
This report outlines the development of a LAM to support the ongoing design and EIAR process. It is envisaged that this report will be updated as additional traffic modelling is completed, and will be included as part of a future EIAR submission.

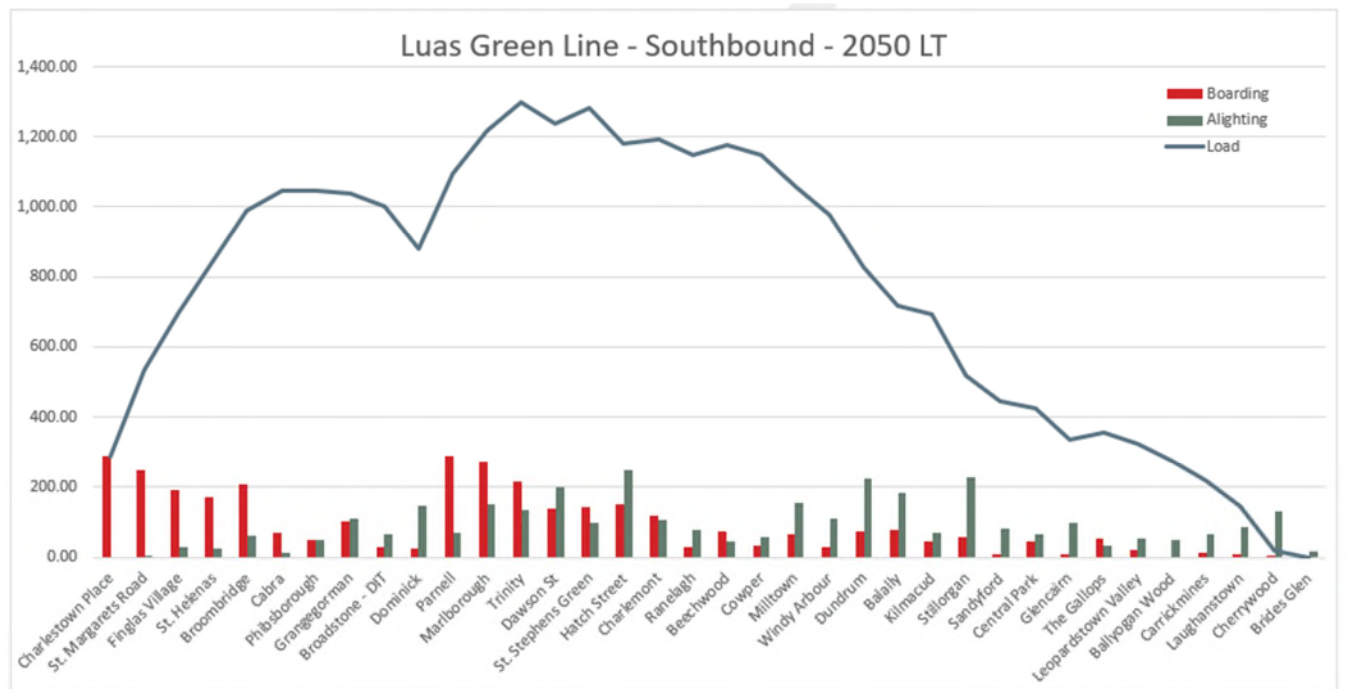
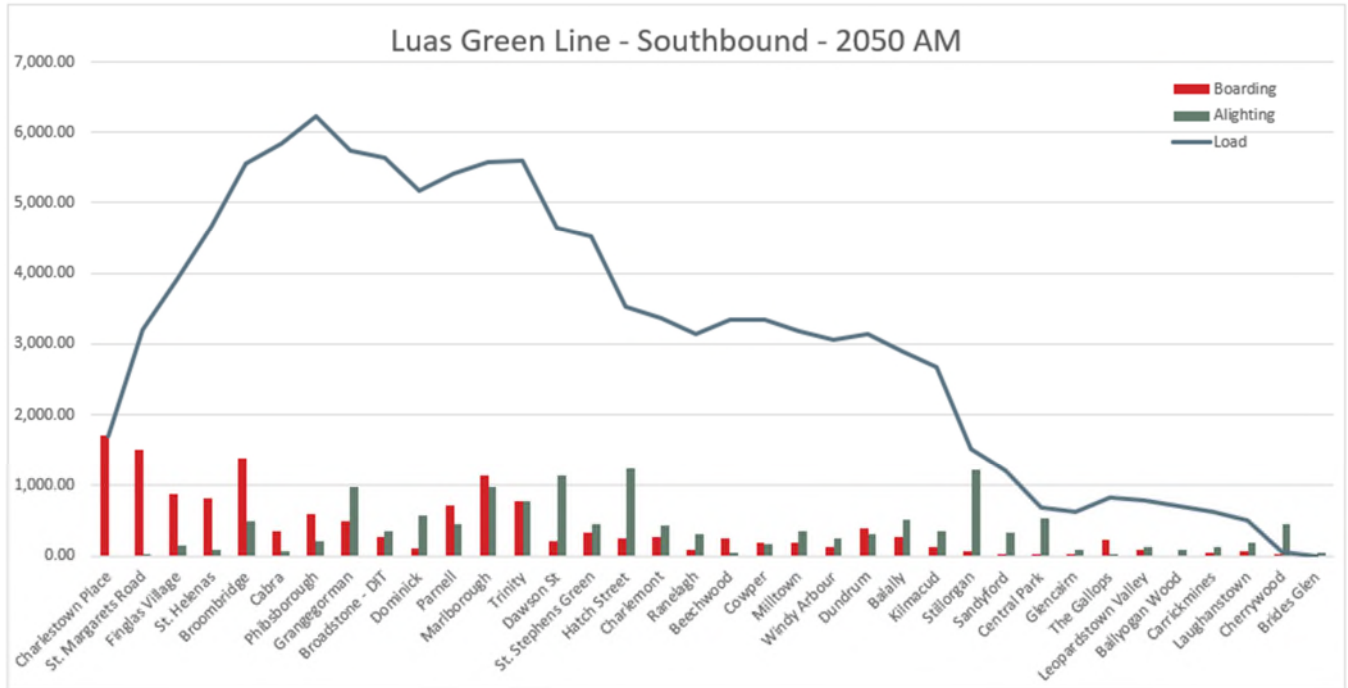
Appendix A Luas Line Flows Core Scenario

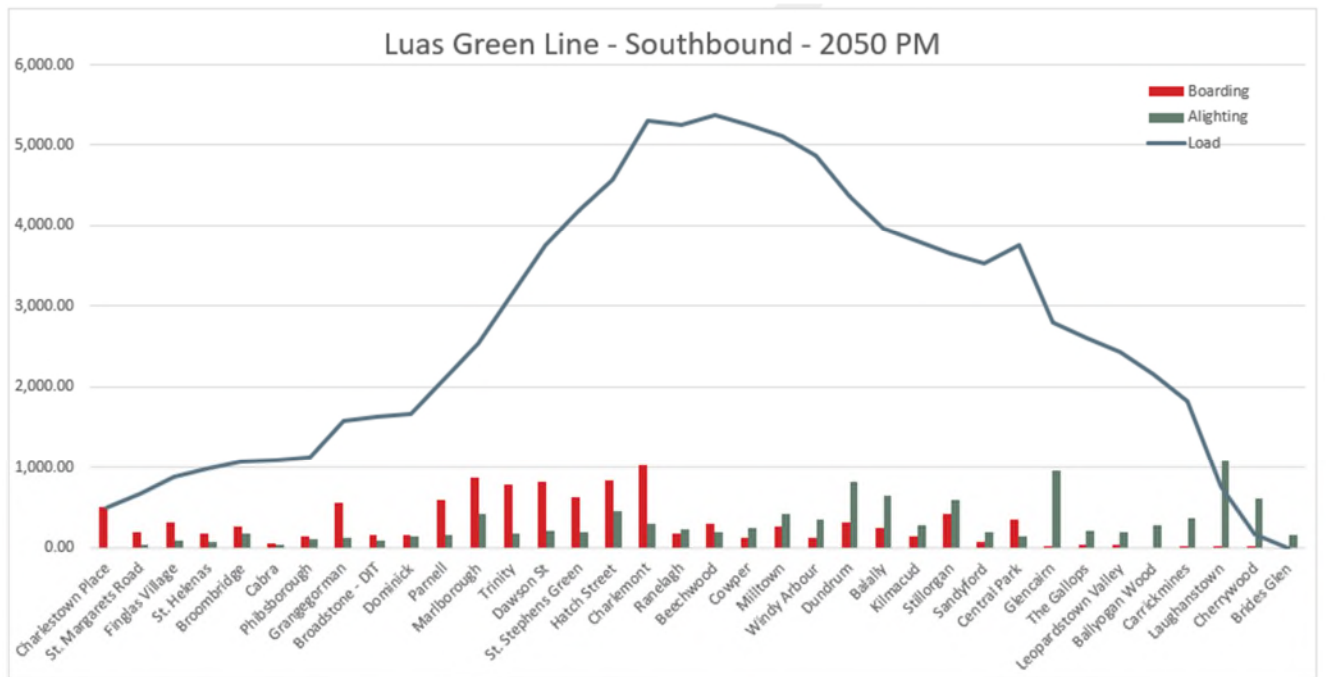
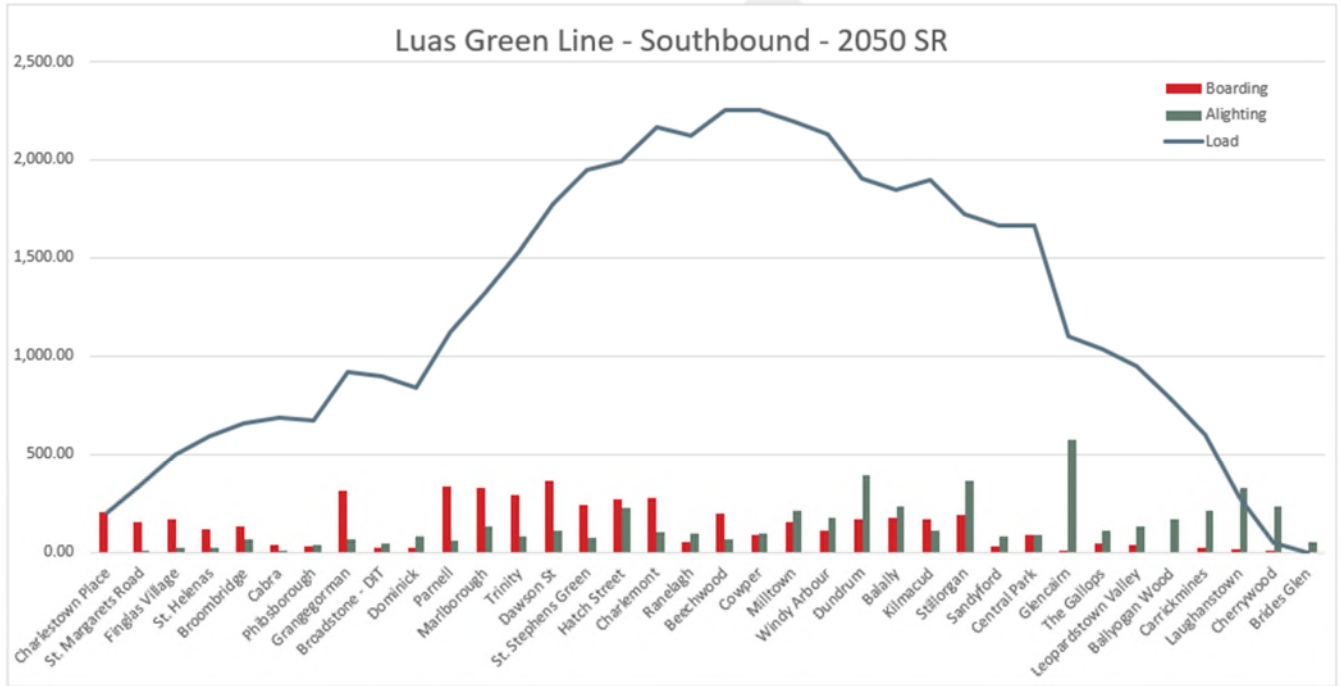


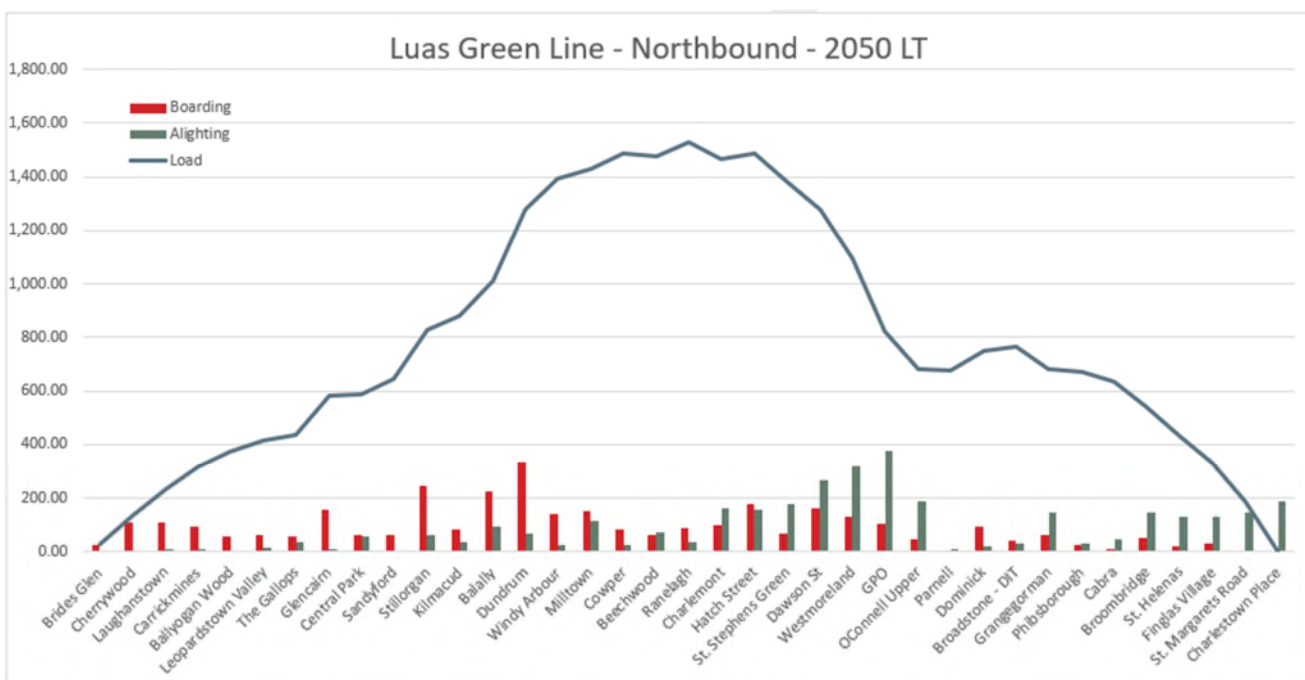
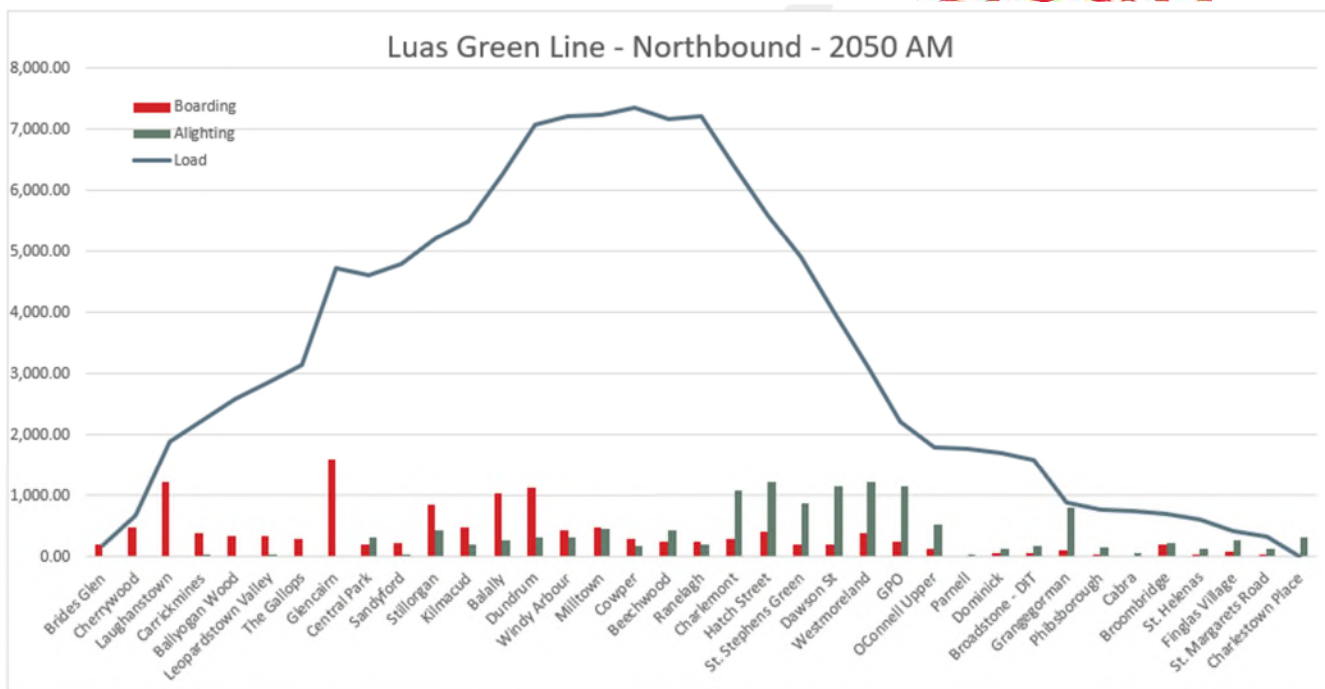


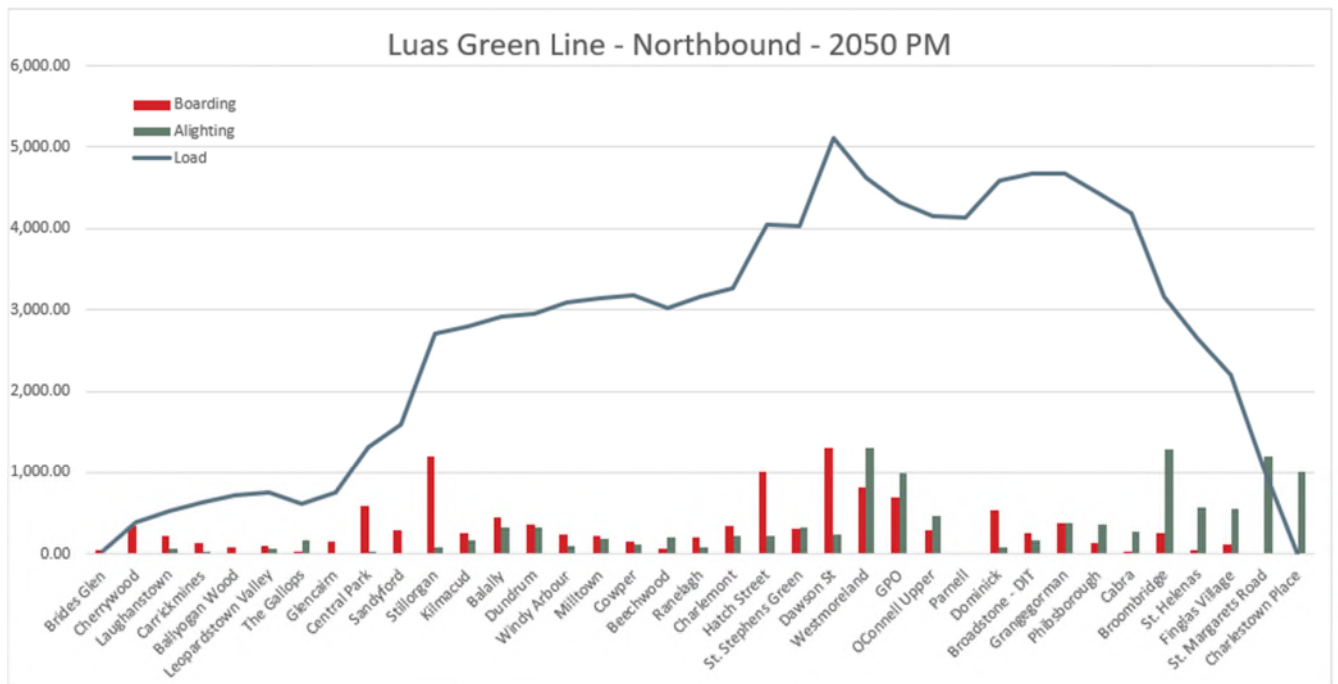
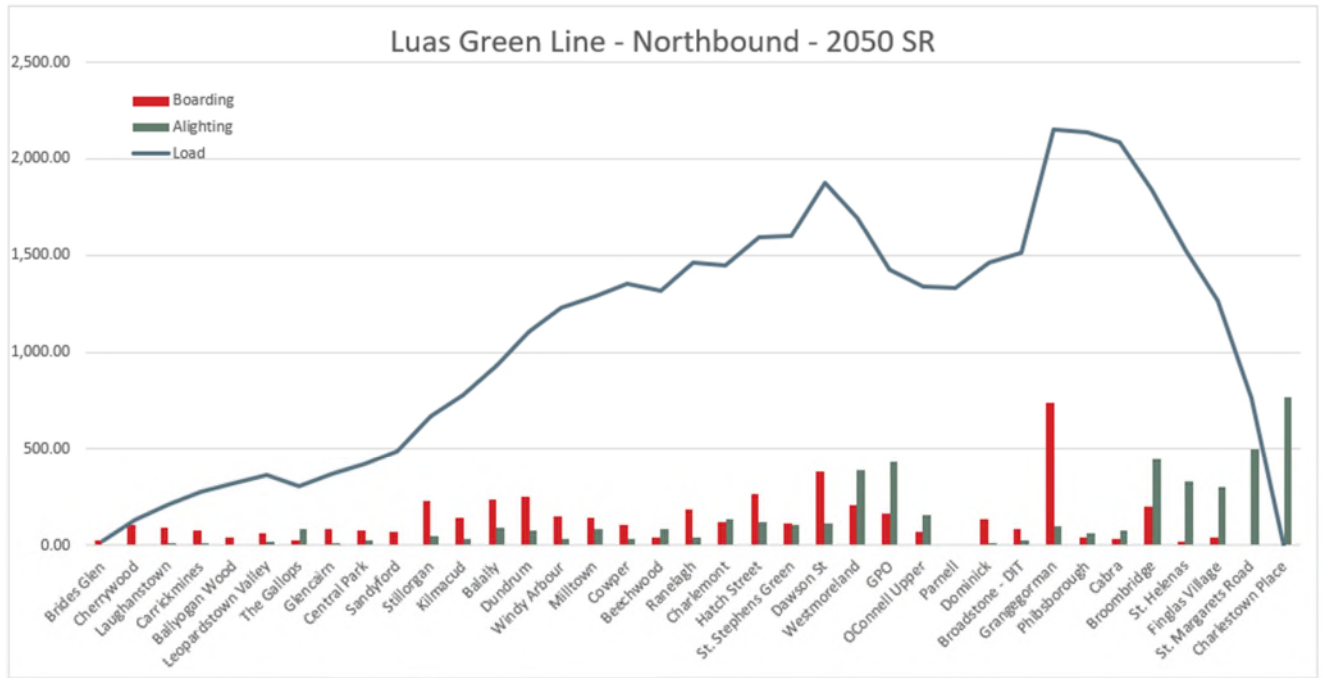












Appendix B Finglas LAM – Flow Calibration Results

Flow Calibration – AM and PM

Site	Movement (ABC nodes)	AM Obs.	AM Mod.	AM GEH	PM Obs.	PM Mod.	PM GEH
02	18105_18151_18102	189	187	0.1	106	95	1.1
02	18101_18102_18264	18	32	2.7	54	48	0.8
02	18102_18151_18103	292	369	4.3	336	455	6.0
02	18169_18103_18265	26	23	0.7	31	18	2.7
02	18169_18103_18151	40	33	1.1	26	55	4.5
03	18264_18219	887	895	0.3	936	953	0.5
03	18219_18195_90006	43	40	0.4	52	40	1.8
03	18219_18195_18169	774	771	0.1	923	888	1.2
03	90006_18195_18169	75	67	1.0	26	15	2.4
04	18264_18219_18191	735	719	0.6	661	662	0.1
04	18264_18219_18176	149	177	2.2	273	290	1.0
04	18292_18219_18176	203	140	4.8	170	124	3.8
04	18292_18219_18195	657	590	2.7	867	817	1.7
04	18176_18219_18195	158	221	4.6	121	111	0.9
04	18176_18219_18191	451	288	8.5	233	162	5.1
05	18191_18175_18218	289	305	0.9	87	90	0.3
05	18191_18175_18217	630	603	1.1	635	633	0.1
05	18218_18175_18217	169	160	0.7	159	117	3.6
05	18218_18175_18304	76	77	0.1	48	23	4.2
05	18217_18304_18291	640	638	0.1	823	826	0.1
05	18217_18304_18175	200	111	7.1	169	135	2.8
06	18175_18217_18358	25	25	0.0	50	98	5.5
06	18175_18217_18234	690	630	2.3	557	604	2.0
06	18358_18217_18234	18	99	10.6	18	26	1.6
06	18358_18217_18304	69	68	0.1	39	39	0.1
06	18280_18217_18304	645	633	0.5	786	810	0.8
06	18280_18217_18358	3	13	3.6	12	40	5.4
07	18217_18234_18216	753	741	0.5	635	637	0.1
07	18216_18280_18217	710	647	2.4	859	842	0.6
08	18234_18216_10118	771	664	4.0	608	601	0.3
08	18234_18216_40566	37	77	5.3	40	37	0.5
08	10118_18216_40566	178	170	0.6	269	269	0.0
08	10118_18216_18280	607	597	0.4	854	820	1.2
08	40566_18216_18280	49	50	0.1	35	21	2.5
08	40566_18216_10118	416	388	1.4	161	167	0.4
09	18216_10118_10198	391	346	2.3	342	323	1.0
09	18216_10118_10192	823	706	4.2	435	444	0.5
09	10198_10118_10192	265	261	0.2	187	191	0.3
09	10198_10118_18216	217	192	1.8	196	180	1.1
09	10192_10118_18216	588	576	0.5	919	909	0.3
09	10192_10118_10198	179	177	0.1	400	365	1.8
10	10118_10192_10199	549	523	1.1	410	405	0.3
10	10118_10192_10260	549	427	5.5	237	231	0.4

Site	Movement (ABC nodes)	AM Obs.	AM Mod.	AM GEH	PM Obs.	PM Mod.	PM GEH
10	10199_10192_10260	122	119	0.3	146	125	1.8
10	10199_10192_10118	482	471	0.5	940	936	0.1
10	10260_10192_10118	260	281	1.3	397	338	3.1
10	10260_10192_10199	19	21	0.5	63	56	0.9
11	10192_10199_10218	377	392	0.8	398	395	0.1
11	10192_10199_90022	158	152	0.5	74	65	1.0
11	10218_10199_90022	88	82	0.7	79	79	0.0
11	10218_10199_10192	568	553	0.6	881	877	0.1
11	90022_10199_10192	51	37	2.1	220	183	2.6
11	90022_10199_10218	43	19	4.4	80	79	0.1
12	10199_10218	403	411	0.4	479	475	0.2
12	10218_10199	638	635	0.1	963	956	0.2
59	18172_10209_10186	10	22	2.9	10	8	0.6
59	18172_10209_10198	131	143	1.0	131	131	0.0
59	10186_10209_18172	23	21	0.4	23	18	1.1
59	10186_10209_10198	339	310	1.6	339	240	5.8
59	10198_10209_18172	410	319	4.8	410	384	1.3
59	10198_10209_10186	296	196	6.4	296	304	0.5
60	18348_18172_10220	20	150	14.1	20	20	0.1
60	18348_18172_10209	61	56	0.7	61	56	0.6
60	18348_18172_18192	20	0	6.3	20	0	6.3
60	10220_18172_18348	34	55	3.1	34	56	3.3
60	10220_18172_10209	73	109	3.7	73	83	1.1
60	10220_18172_18192	11	0	4.7	11	0	4.7
60	10209_18172_18348	134	69	6.5	134	117	1.6
60	10209_18172_10220	265	272	0.4	265	285	1.2
60	10209_18172_18192	26	0	7.2	26	0	7.2
60	18192_18172_18348	11	0	4.7	11	0	4.7
60	18192_18172_10220	8	0	4.0	8	0	4.0
60	18192_18172_10209	7	0	3.7	7	0	3.7
61	10215_10220_10171	267	147	8.4	73	30	6.0
61	10215_10220_10185	321	290	1.8	197	169	2.1
61	10215_10220_18172	14	40	4.9	12	11	0.2
61	10171_10220_10215	95	42	6.4	132	101	2.9
61	10171_10220_10185	51	48	0.4	101	88	1.3
61	10171_10220_18172	186	120	5.4	99	102	0.3
61	10185_10220_10215	224	127	7.3	299	256	2.6
61	10185_10220_10171	47	43	0.6	38	34	0.7
61	10185_10220_18172	4	4	0.1	12	26	3.2
61	18172_10220_10215	32	19	2.5	44	38	0.9
61	18172_10220_10171	351	367	0.8	247	251	0.2
61	18172_10220_10185	28	36	1.3	16	16	0.1
62	10220_10185_10214	276	308	1.8	128	128	0.0
62	10220_10185_10186	93	66	3.1	163	146	1.4
62	10214_10185_10220	180	174	0.5	257	252	0.3
62	10214_10185_10186	138	128	0.9	192	182	0.8

Site	Movement (ABC nodes)	AM Obs.	AM Mod.	AM GEH	PM Obs.	PM Mod.	PM GEH
62	10186_10185_10220	38	0	8.7	90	63	3.0
62	10186_10185_10214	407	321	4.5	193	193	0.0
36	18258_18100_18310	156	155	0.1	150	151	0.1
36	18258_18100_12267	262	256	0.4	382	379	0.2
36	18310_18100_18258	86	61	2.9	78	69	1.0
36	18310_18100_12267	237	287	3.1	335	332	0.2
36	12267_18100_18258	425	429	0.2	621	616	0.2
36	12267_18100_18310	307	308	0.1	418	429	0.5
37	18256_18310_18209	143	142	0.1	27	26	0.1
37	18256_18310_18100	171	184	0.9	228	223	0.3
37	18209_18310_18256	62	62	0.0	70	66	0.5
37	18209_18310_18100	128	165	3.0	198	178	1.4
37	18100_18310_18256	244	245	0.1	340	350	0.6
37	18100_18310_18209	234	217	1.1	231	230	0.1
46	10260_12266_12282	128	103	2.3	20	19	0.2
46	10260_12266_12219	542	488	2.4	375	345	1.6
46	12282_12266_10260	159	159	0.0	226	177	3.5
46	12282_12266_12219	158	128	2.5	461	342	6.0
46	12219_12266_10260	151	157	0.5	192	188	0.3
46	12219_12266_12282	158	136	1.8	48	46	0.3
35	12213_12214_12219	119	133	1.3	119	119	0.0
35	12213_12214_12263	331	363	1.7	416	435	0.9
35	12213_12214_12217	19	17	0.5	88	85	0.3
35	12219_12214_12213	287	273	0.9	433	371	3.1
35	12219_12214_12263	298	262	2.2	233	217	1.0
35	12219_12214_12217	50	53	0.4	188	190	0.1
35	12263_12214_12213	336	333	0.1	510	508	0.1
35	12263_12214_12219	41	33	1.3	41	8	6.6
35	12263_12214_12217	27	27	0.0	77	77	0.0
35	12217_12214_12213	86	87	0.1	276	201	4.9
35	12217_12214_12219	150	164	1.1	38	62	3.4
35	12217_12214_12263	148	147	0.1	70	70	0.0
29	18100_12267_12212	357	409	2.7	594	590	0.1
29	18100_12267_12258	135	134	0.1	114	120	0.6
29	12212_12267_18100	568	579	0.5	917	949	1.0
29	12212_12267_12258	129	114	1.4	315	127	12.6
29	12258_12267_18100	154	159	0.4	98	96	0.2
29	12258_12267_12212	110	104	0.6	48	48	0.0
1	90032_18123_18152	140	70	6.8	102	76	2.7
1	90032_18123_18118	579	503	3.3	500	465	1.6
1	90032_18123_90028	23	14	2.1	38	38	0.0
1	18152_18123_90032	53	53	0.0	96	99	0.3
1	18152_18123_18118	65	68	0.4	101	153	4.7
1	18152_18123_90028	14	0	5.1	19	21	0.4
1	18118_18123_90032	339	348	0.5	419	436	0.8
1	18118_18123_18152	87	100	1.4	92	97	0.5

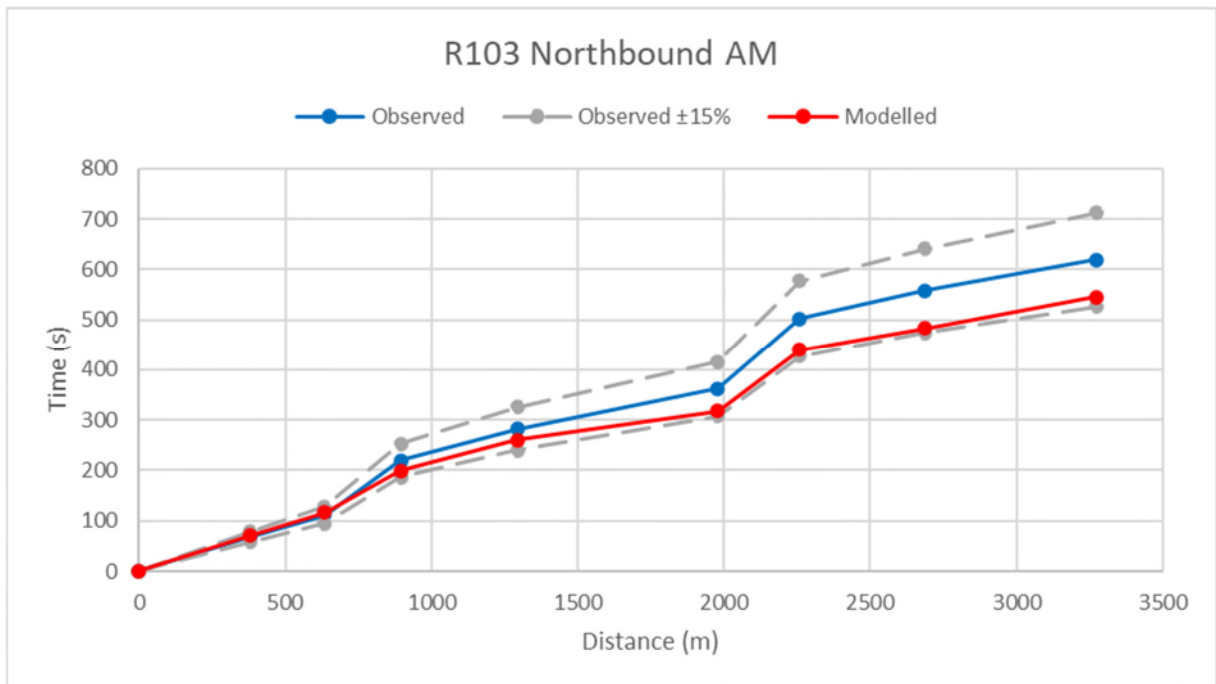
Site	Movement (ABC nodes)	AM Obs.	AM Mod.	AM GEH	PM Obs.	PM Mod.	PM GEH
1	18118_18123_90028	40	41	0.2	79	82	0.4
1	90028_18123_90032	27	28	0.2	45	45	0.0
1	90028_18123_18152	13	2	4.2	18	5	4.0
1	90028_18123_18118	29	40	1.9	63	70	0.9
2	18289_18261_18240	25	25	0.0	20	20	0.0
2	18289_18261_18301	178	178	0.0	87	69	2.1
2	18289_18261_18375	13	13	0.0	29	29	0.0
2	18240_18261_18289	21	21	0.0	38	35	0.5
2	18240_18261_18301	137	133	0.3	147	140	0.6
2	18240_18261_18375	210	207	0.2	241	159	5.8
2	18301_18261_18289	150	154	0.3	280	266	0.8
2	18301_18261_18240	183	185	0.1	185	185	0.0
2	18301_18261_18375	135	137	0.2	188	190	0.1
2	18375_18261_18289	36	36	0.0	57	57	0.0
2	18375_18261_18240	257	255	0.1	206	208	0.1
2	18375_18261_18301	269	248	1.3	227	220	0.5
3	18301_18149_18133	299	312	0.8	247	246	0.1
3	18301_18149_18297	210	201	0.6	196	156	3.0
3	18301_18149_90034	44	46	0.3	26	26	0.1
3	18133_18149_18301	205	203	0.1	219	169	3.6
3	18133_18149_18297	21	0	6.5	14	0	5.3
3	18133_18149_90034	9	9	0.0	5	3	1.0
3	18297_18149_18301	253	262	0.6	379	407	1.4
3	18297_18149_18133	18	1	5.4	23	9	3.5
3	18297_18149_90034	36	33	0.5	15	10	1.4
3	90034_18149_18301	11	11	0.0	54	65	1.4
3	90034_18149_18133	5	5	0.0	16	16	0.0
3	90034_18149_18297	9	4	2.0	30	19	2.2
371	18283_18214_90043	114	122	0.7	127	127	0.0
371	18283_18214_18253	6	6	0.0	22	22	0.0
371	18283_18214_18226	356	349	0.4	219	220	0.0
371	90043_18214_18283	137	137	0.0	196	196	0.0
371	90043_18214_18253	48	35	2.1	89	89	0.0
371	90043_18214_18226	399	403	0.2	187	205	1.3
371	18253_18214_18283	41	41	0.0	28	28	0.0
371	18253_18214_90043	88	88	0.0	36	36	0.0
371	18253_18214_18226	73	24	7.1	29	2	6.7
371	18226_18214_18283	151	151	0.0	310	311	0.1
371	18226_18214_90043	126	119	0.7	247	247	0.0
371	18226_18214_18253	31	31	0.0	95	95	0.0
361	15164_15165_18417	554	558	0.2	489	491	0.1
361	15164_15165_90029	1,057	1,140	2.5	927	946	0.6
361	15164_15165_15187	388	223	9.4	72	50	2.9
361	18417_15165_15168	287	298	0.6	290	315	1.4
361	18417_15165_15187	39	39	0.0	9	9	0.0
361	15216_15165_15168	920	890	1.0	1,514	1,368	3.9

Site	Movement (ABC nodes)	AM Obs.	AM Mod.	AM GEH	PM Obs.	PM Mod.	PM GEH
361	15216_15165_18417	66	64	0.3	103	69	3.6
361	15216_15165_15187	156	231	5.4	47	34	2.1
361	15187_15165_15168	132	94	3.5	337	286	2.9
361	15187_15165_18417	32	10	4.8	44	24	3.5
361	15187_15165_90029	54	52	0.3	114	114	0.0
Site 31	15196_15128	865	835	1.0	796	773	0.8
Site 31	15128_15196	674	665	0.3	824	871	1.6
1	18117_18257_90008	11	6	1.6	9	0	4.2
1	18117_18257_18180	259	229	1.9	253	225	1.8
1	18117_18257_18115	188	192	0.3	199	197	0.2
1	90008_18257_18117	8	0	4.0	8	3	2.3
1	90008_18257_18180	67	5	10.4	55	14	7.0
1	90008_18257_18115	114	114	0.0	131	64	6.7
1	18180_18257_18117	186	176	0.7	260	246	0.9
1	18180_18257_90008	42	25	3.0	32	3	6.9
1	18180_18257_18115	12	0	4.9	31	0	7.9
1	18115_18257_18117	218	215	0.2	265	265	0.0
1	18115_18257_90008	129	119	0.9	99	58	4.6
1	18115_18257_18180	20	0	6.2	21	0	6.5
2	90009_80002_18176	255	146	7.7	122	60	6.5
2	90009_80002_18384	110	98	1.2	68	68	0.0
2	18176_80002_90009	105	112	0.7	113	115	0.2
2	18176_80002_18384	175	199	1.8	285	260	1.5
2	18384_80002_90009	93	93	0.0	96	96	0.0
2	18384_80002_18176	348	333	0.8	241	220	1.4
3	18110_18211_18369	66	68	0.2	35	24	2.0
3	18110_18211_18183	194	214	1.4	69	69	0.1
3	18110_18211_18373	97	100	0.3	80	101	2.2
3	18369_18211_18110	28	2	6.8	50	46	0.6
3	18369_18211_18183	108	41	7.7	74	24	7.1
3	18369_18211_18373	293	272	1.3	332	266	3.8
3	18183_18211_18110	33	6	6.0	98	130	3.0
3	18183_18211_18369	57	67	1.3	64	62	0.3
3	18183_18211_18373	19	18	0.2	32	31	0.1
3	18373_18211_18110	33	0	8.1	50	60	1.4
3	18373_18211_18369	371	396	1.3	399	400	0.1
3	18373_18211_18183	35	31	0.7	37	37	0.0
4	18210_18307_18385	144	122	1.9	132	132	0.0
4	18210_18307_90018	39	40	0.1	63	51	1.6
4	18385_18307_18210	120	98	2.1	153	151	0.2
4	18385_18307_90018	83	86	0.3	99	99	0.0
4	90018_18307_18210	63	22	6.3	58	41	2.4
4	90018_18307_18385	125	50	8.0	81	32	6.5
5	18178_18177_18380	100	46	6.3	100	92	0.9
5	18178_18177_18256	266	58	16.3	162	45	11.5

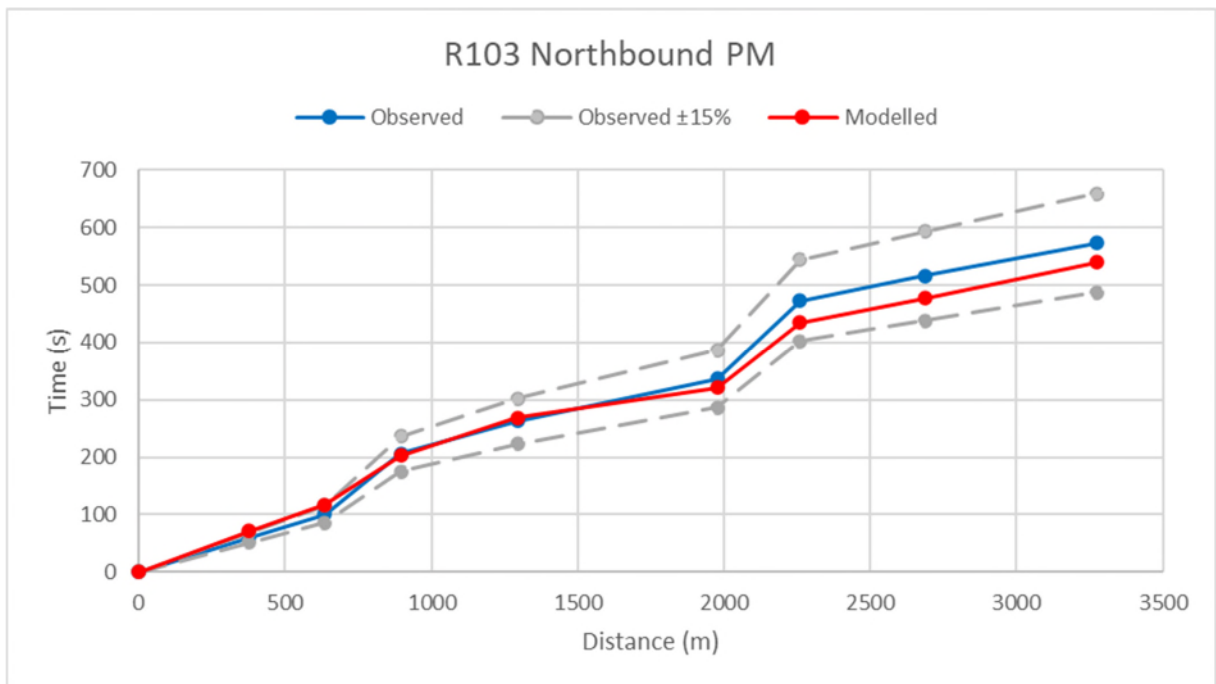
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5	18380_18177_18178	69	65	0.5	160	115	3.8
5	18380_18177_18256	119	164	3.8	100	172	6.2
5	18256_18177_18178	181	185	0.3	234	217	1.1
5	18256_18177_18380	145	137	0.7	178	177	0.1
6	18303_18228_18230	167	173	0.5	139	120	1.7
6	18303_18228_80003	484	475	0.4	344	344	0.0
6	18303_18228_18287	155	156	0.1	142	78	6.1
6	18230_18228_18303	37	37	0.0	82	82	0.0
6	18230_18228_80003	96	101	0.5	112	139	2.4
6	18230_18228_18287	184	186	0.2	260	216	2.9
6	80003_18228_18303	224	217	0.5	387	398	0.6
6	80003_18228_18230	77	76	0.1	115	117	0.2
6	80003_18228_18287	59	57	0.3	104	36	8.1
6	18287_18228_18303	46	83	4.6	89	119	2.9
6	18287_18228_18230	206	276	4.5	248	248	0.0
6	18287_18228_80003	80	0	12.6	53	0	10.3
7	18263_18124_10223	13	0	5.1	12	0	4.9
7	18263_18124_18101	90	110	2.0	118	104	1.3
7	18263_18124_18262	33	10	5.0	38	6	6.9
7	10223_18124_18263	6	0	3.4	6	0	3.4
7	10223_18124_18101	232	226	0.4	215	131	6.4
7	10223_18124_18262	25	25	0.0	45	87	5.1
7	18194_18124_18263	65	74	1.1	51	55	0.6
7	18194_18124_10223	90	1	13.2	79	60	2.2
7	18194_18124_18101	11	0	4.7	39	0	8.8
7	18194_18124_18262	25	10	3.6	59	77	2.2
7	18101_18124_18263	63	145	8.1	135	206	5.5
7	18101_18124_10223	204	341	8.3	164	222	4.2
7	18101_18124_18262	18	17	0.2	47	47	0.0
7	18262_18124_18263	23	8	3.9	40	36	0.6
7	18262_18124_10223	138	72	6.5	103	41	7.3
7	18262_18124_18101	47	44	0.5	52	20	5.4
8	18219_18176_18210	68	70	0.2	169	158	0.9
8	18219_18176_80002	223	244	1.4	293	256	2.2
8	18210_18176_18219	140	140	0.0	119	73	4.7
8	18210_18176_80002	67	67	0.0	102	119	1.6
8	80002_18176_18219	453	370	4.1	290	200	5.8
8	80002_18176_18210	115	109	0.6	80	81	0.1
11	12266_12282_90020	204	239	2.4	69	65	0.5
11	90020_12282_12266	80	74	0.7	221	117	8.0
11	12167_12282_12266	235	213	1.5	325	409	4.4
11	12167_12282_90020	55	47	1.1	33	66	4.7
12	90013_80001_90009	22	22	0.0	29	30	0.1
12	90013_80001_80000	42	37	0.8	57	57	0.0
12	90009_80001_90013	38	38	0.0	27	27	0.1
12	90009_80001_80000	168	170	0.2	182	184	0.2

Site	Movement (ABC nodes)	AM Obs.	AM Mod.	AM GEH	PM Obs.	PM Mod.	PM GEH
12	80000_80001_90013	48	65	2.2	43	43	0.0
12	80000_80001_90009	348	192	9.5	158	125	2.8
13	18109_18155_18108	98	118	1.9	135	135	0.0
13	18109_18155_18110	9	0	4.2	2	0	2.0
13	18108_18155_18109	69	64	0.7	130	130	0.0
13	18108_18155_18110	341	361	1.1	264	175	6.0
13	18110_18155_18109	2	0	2.0	5	0	3.2
13	18110_18155_18108	123	101	2.1	203	229	1.7
14	80003_18298_18299	101	35	8.1	31	3	6.7
14	80003_18298_90032	546	541	0.2	467	479	0.6
14	18299_18298_80003	12	13	0.2	32	28	0.7
14	18299_18298_90032	36	19	3.3	84	68	1.8
14	90032_18298_80003	347	337	0.6	576	523	2.3
14	90032_18298_18299	65	72	0.9	42	43	0.1
9	18118_18121_18122	554	606	2.2	607	686	3.1
9	18119_18120_18118	508	489	0.9	638	615	0.9
9	18104_18266_18108	1,025	1,026	0.0	1,238	1,094	4.2
9	18121_18122_18105	1,126	1,106	0.6	1,010	943	2.2
9	18155_18108_18215	220	219	0.1	337	363	1.4
9	18266_18108_18155	407	425	0.9	395	305	4.8
9	90029_18119_18120	1,299	1,354	1.5	1,246	1,253	0.2
9	18108_18215_15216	1,057	1,184	3.8	1,385	1,470	2.3
10	18105_18151	454	304	7.7	207	107	7.9
10	18265_18104	255	245	0.7	284	263	1.3
10	90002_18102	55	50	0.7	50	45	0.7
10	18102_90002	37	27	1.8	76	70	0.7
10	18101_18102	381	370	0.6	444	467	1.1
10	18102_18101	632	584	2.0	472	486	0.6
10	18169_18103	49	56	1.0	100	72	3.0
10	18102_18264	29	93	8.2	70	117	4.9
10	18103_18151	471	466	0.2	540	522	0.8
10	18151_18103	457	486	1.4	439	468	1.4

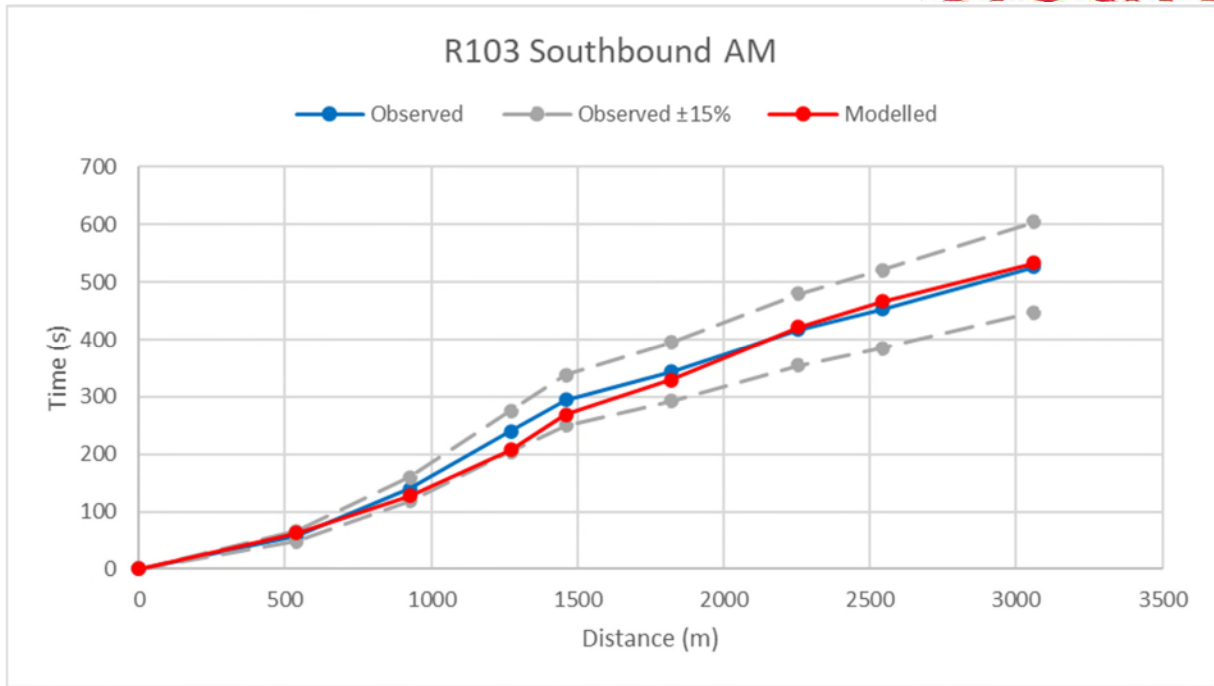
Appendix C Finglas LAM – Journey Time Validation Results



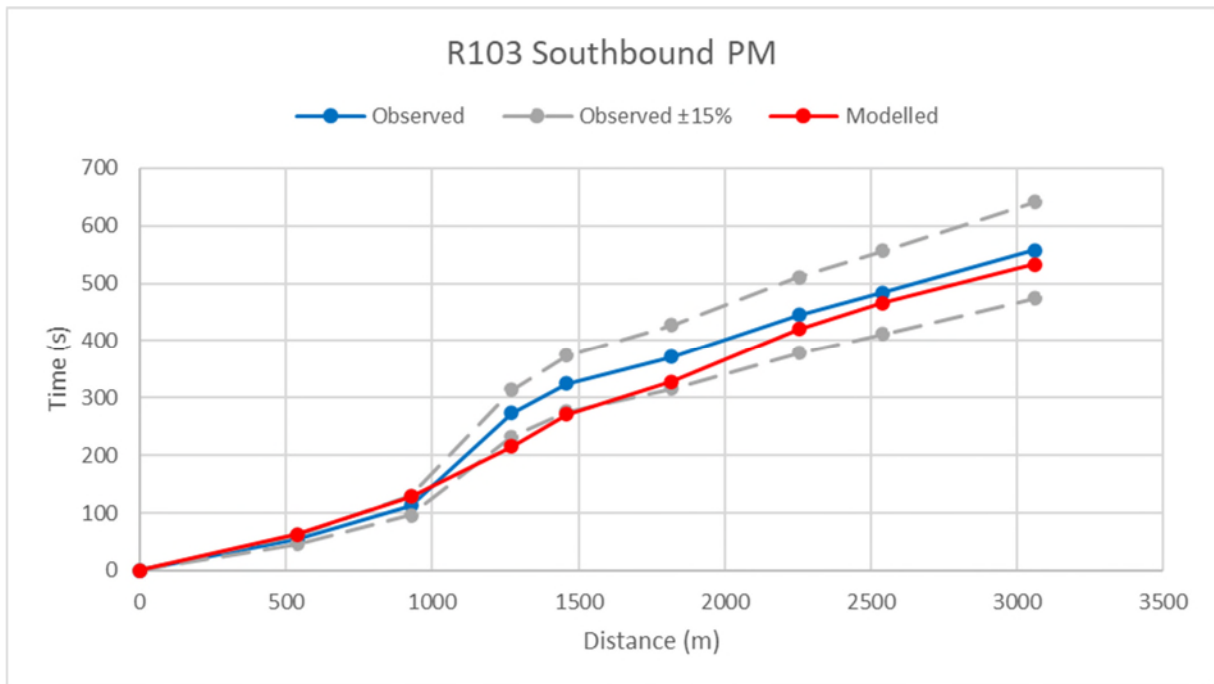
Journey Time Validation – R103 Northbound AM



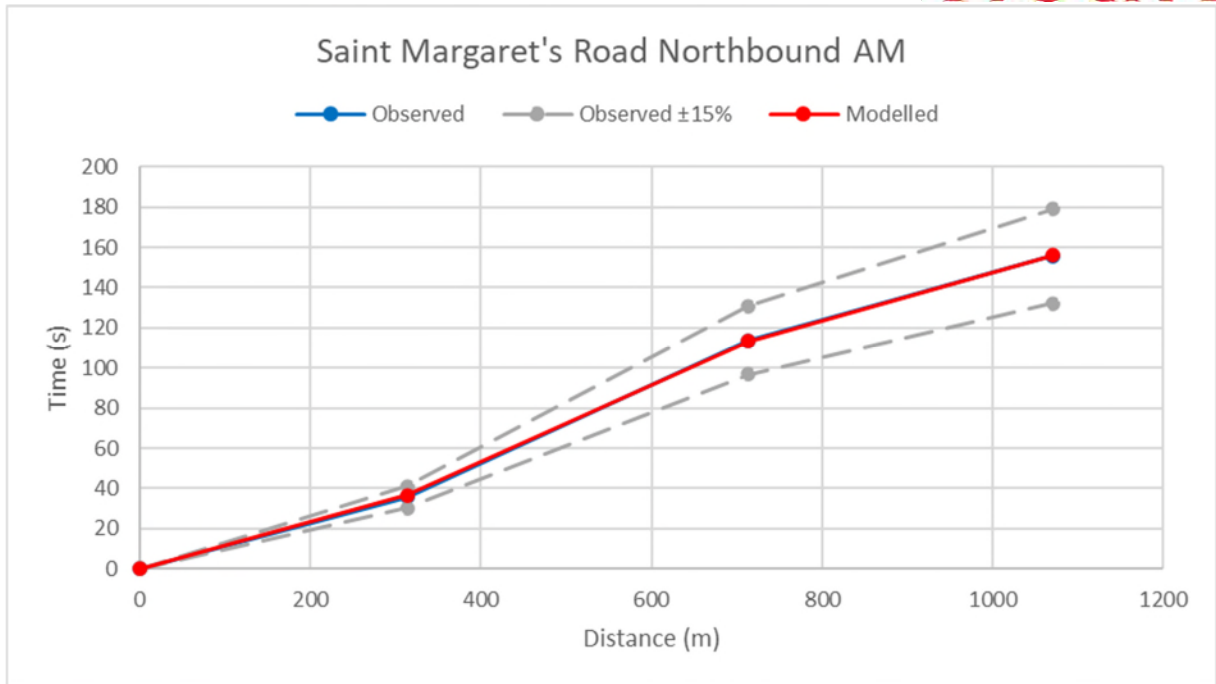
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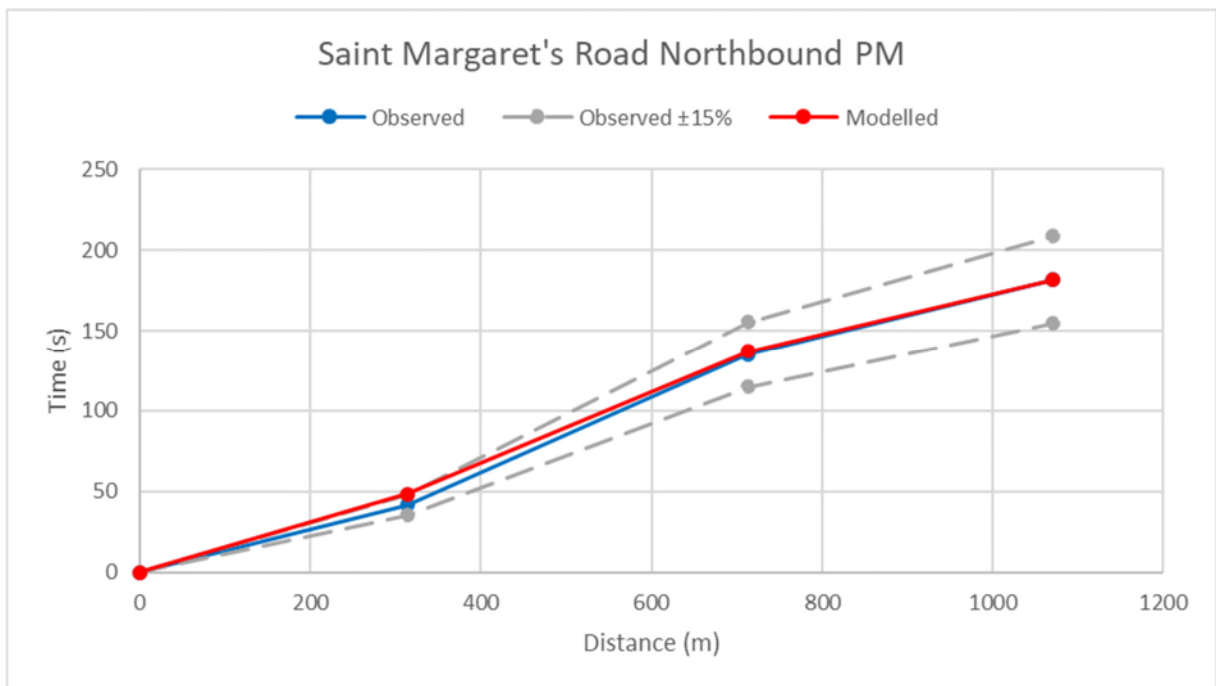
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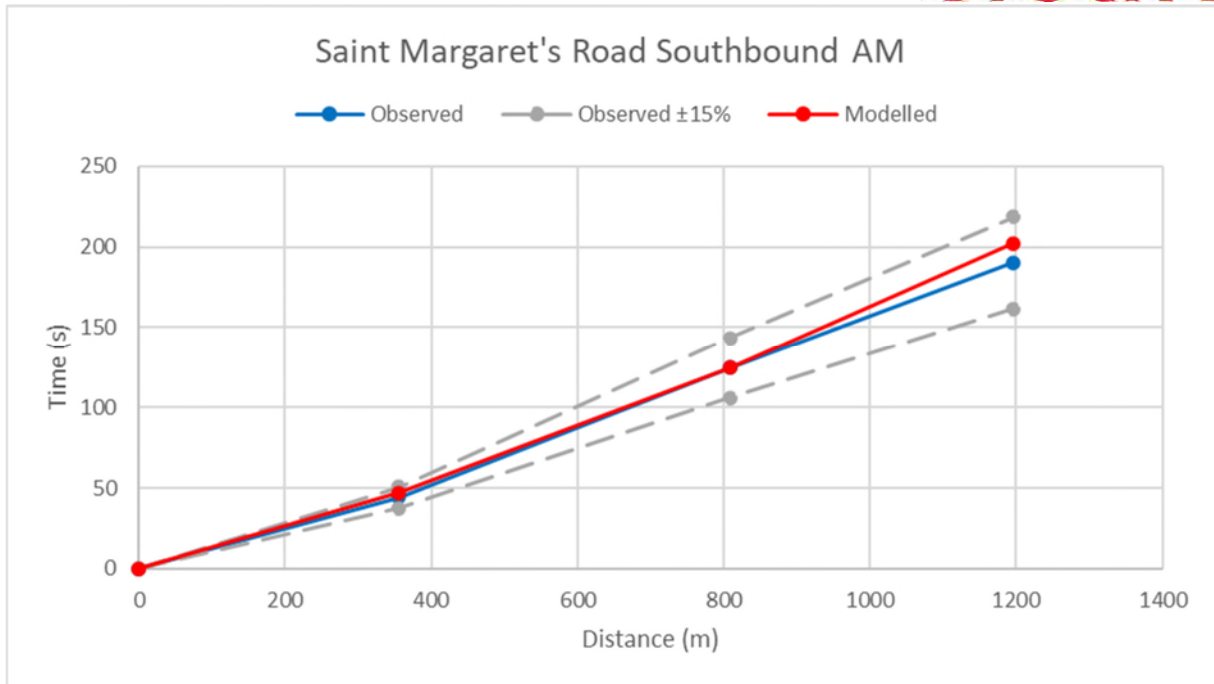
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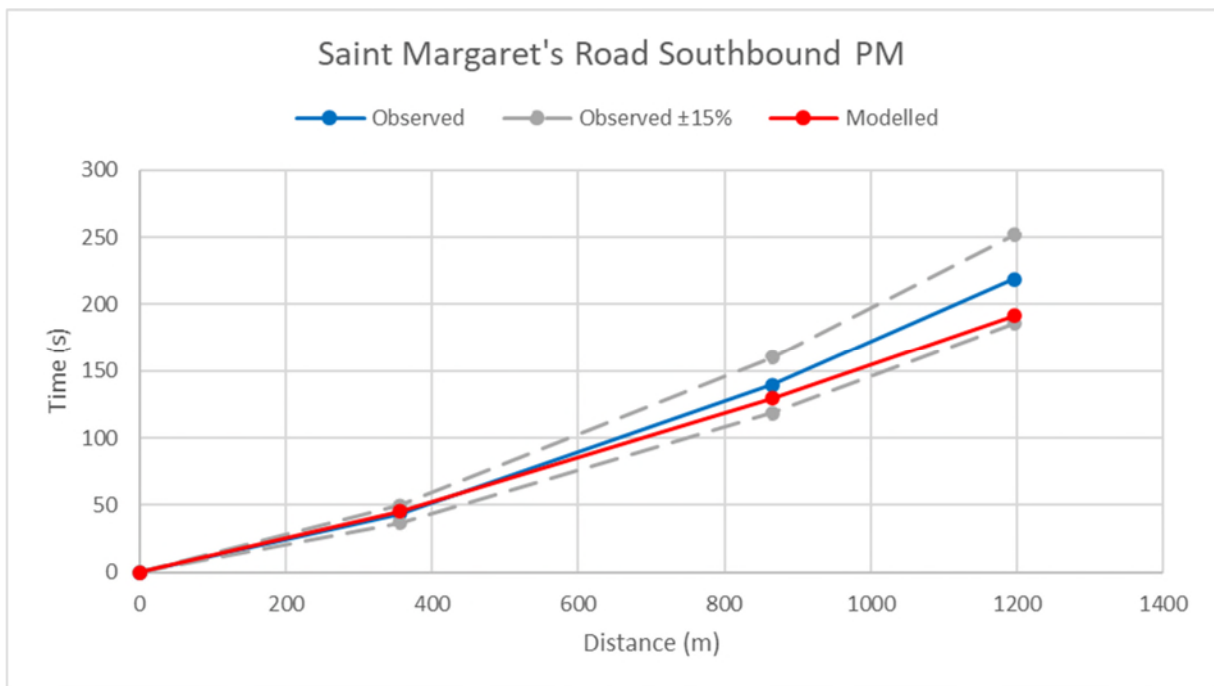
Journey Time Validation – Saint Margaret's Road Northbound AM



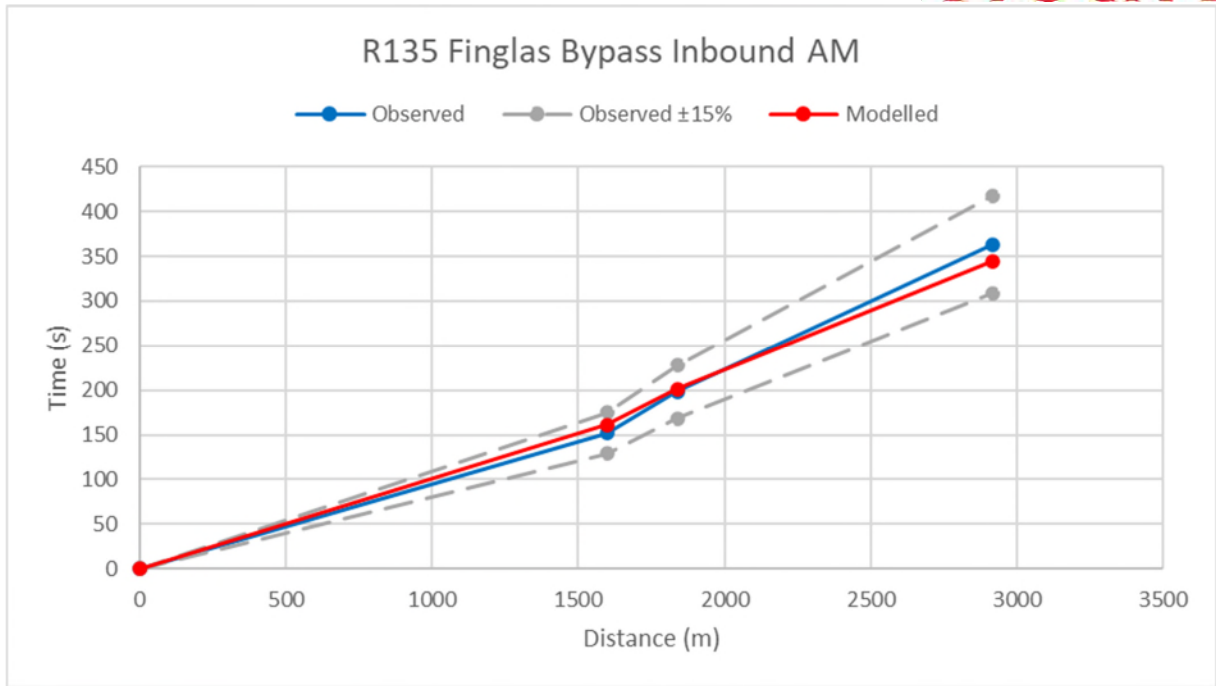
Journey Time Validation – Saint Margaret's Road Northbound PM



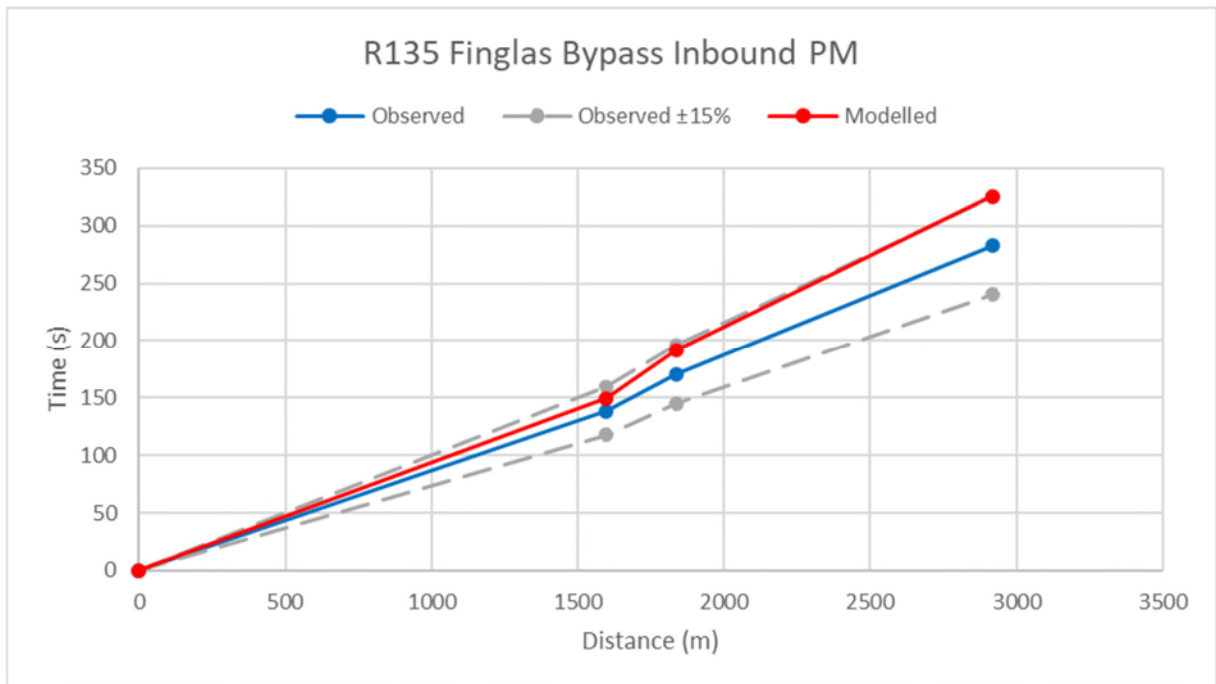
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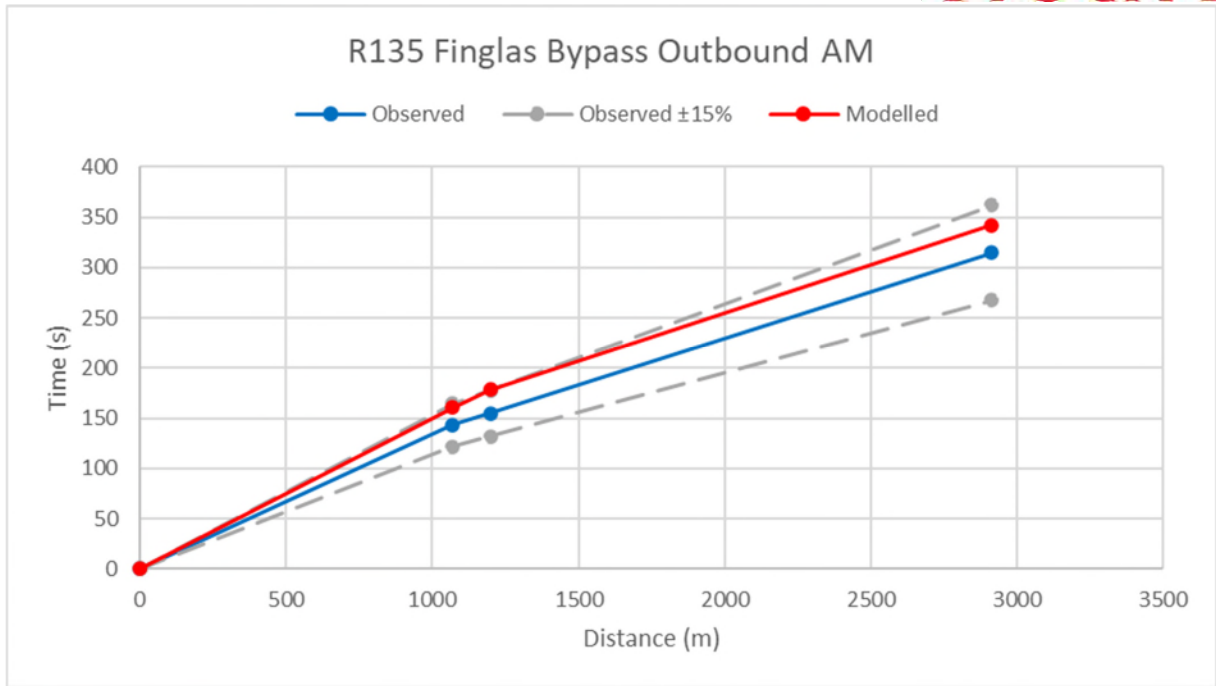
Journey Time Validation – Saint Margaret's Road Southbound PM



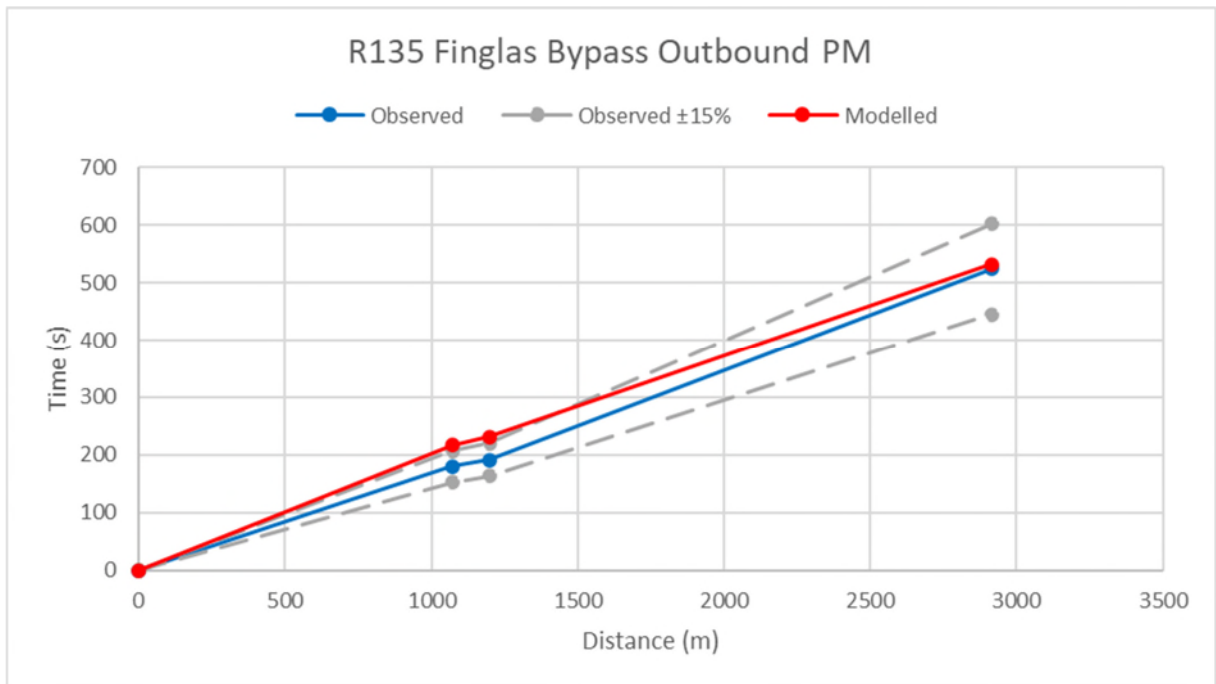
Journey Time Validation – R135 Finglas Bypass Inbound AM



Journey Time Validation – R135 Finglas Bypass Inbound PM



Journey Time Validation – R135 Finglas Bypass Outbound AM



Journey Time Validation – R135 Finglas Bypass Outbound PM

Appendix | D

Economic Appraisal

Luas Finglas Preliminary Business Case



Appendix D Economic Appraisal

30/05/2023



Document Control Sheet

Client:	Transport Infrastructure Ireland
Project Title:	Luas Finglas Preliminary Business Case
Document Title:	Appendix D Economic Appraisal
File Name:	230530-Appendix D Economic Appraisal v1.4

Table of Contents <i>(incl. Y/N)</i>	List of Tables <i>(incl. Y/N)</i>	List of Figures <i>(incl. Y/N)</i>	Pages of Text <i>(No.)</i>	Appendices <i>(No.)</i>
N	N	N	21	0

Document Revision				Document Verification			
Issue Date <i>(DD/MM/YY)</i>	Revision Code	Suitability Code	Author <i>(Initials)</i>	Checker <i>(Initials)</i>	Reviewer <i>As Per PMP (Initials)</i>	Approver <i>As Per PMP (Initials)</i>	Peer Review <i>(Initials or N/A)</i>
30/05/2022	1.4		DB	DB	SC	SC	

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SECTION 1: INTRODUCTION

1.1 Background

Luas Finglas is a 3.9km extension of the Luas Green Line from Broombridge to Charlestown via Finglas, with a 350-space Park & Ride facility located just off the M50 at St Margaret's Road. The alignment is primarily off-road and segregated from traffic providing a high quality public transport service. In the year of opening, Luas Finglas will provide for a tram in each direction every 7.5 minutes during peak times with an approximate journey time of 30 minutes from Charlestown to Trinity College.

The scheme is currently at **Phase 3: Preliminary Design** of the National Transport Authority's Project Approval Guidelines with the Preliminary Business Case (PBC) forming one of the key deliverables required for approval through Gateway 3. In-line with the Public Spending Code (PSC), a detailed economic appraisal of the Luas Finglas is required as part of the PBC to provide a basis for a decision on whether to proceed with the project in principle or not.

The appraisal of Luas Finglas has been prepared in compliance with the latest guidance, specifically:

- The Department of Public Expenditure and Reforms (DEPR) Public Spending Code (PSC) (2019)
- The Department of Transport (DoT) Common Appraisal Framework (CAF) (March 2016, updated October 2021)¹
- National Transport Authority Project Approval Guidelines (2020)
- Transport Infrastructure Ireland Project Appraisal Guidelines (PAG) (2016 plus various updates)

Where possible, and proportional to do so at this stage, scheme impacts have been monetised in accordance with the PSC and CAF. This report provides further information on the estimation of costs and benefits associated with the Luas Finglas scheme. This appendix should be read in conjunction with the PBC and its Appendix C Transport Modelling Report.

¹ CAF remains the applicable appraisal guidance at the time of PBC preparation

SECTION 2: MONETISING SCHEME IMPACTS

2.1 Introduction

The following sections provide further details on the methodology used to monetise the impacts associated with Luas Finglas focusing on the 'Core' scenario. As outlined in the PBC, the 'Core' Scenario assumes that all committed projects are implemented along with the delivery of DART+ West and the BusConnects Core Bus Corridor infrastructure that have planning applications submitted and directly serve Broombridge and the Finglas corridor.

In-line with CAF, all monetised impacts have been discounted to 2011 prices and values. The impacts have also been calculated over a 60-year period to account for the residual value. For major transport schemes, the residual value is a measure of the net present value of the infrastructure over a specified period beyond the 30-year appraisal period. For all major national transport projects, a residual value period of 30 years is commonly applied based on the guidance outlined in CAF.

2.2 Modelling Approach

The NTA's Regional Modelling System (RMS)² has been used to estimate the scheme impacts. It comprises a National Demand Forecasting Model (NDFM) and five Regional Multi-Modal Transport Models.

The NDFM takes input attributes such as land-use data, population etc., and estimates the total quantity of daily transport demand produced by, and attracted to, each of the 18,488 Census Small Areas in Ireland. Of the five regional models, the Finglas/North Dublin area is covered by the East Regional Model (ERM). The models capture all day transport demand, enabling more accurate modelling of mode choice behaviour and increasingly complex travel patterns.

The NTA's RMS is the most sophisticated modelling tool available for assessing complex multi-modal movements within an urban context. It is significantly more responsive to future changes in demographics, economic activity and planning interventions compared to more traditional models. Therefore, the ERM is the ideal tool to estimate the multi-modal impact of transport schemes such as the Luas Finglas extension.



Figure 2-1 NTA Regional Model Boundaries

The outputs of the ERM include estimated demand for four modes of transport (walking, cycling, public transport and private vehicles). It also includes a number of metrics on network performance including journey times, queuing, delay, passenger boardings, fare revenue etc. that can be extracted from the model runs. These have been combined with transport appraisal tools to monetise various impacts of the Luas Finglas scheme, including:

- User benefits;
- Park & Ride user benefits;
- Journey time reliability benefits;
- Active mode benefits; and
- Road safety benefits.

² Further details on the NTA RMS are available at: <https://www.nationaltransport.ie/planning-and-investment/transport-modelling/regional-modelling-system/>

2.3 User Benefits

2.3.1 Transport User Benefit Appraisal (TUBA) Software

As recommended within TII PAG, TUBA is the main software package used to estimate the user impacts associated with Luas Finglas. TUBA is a computer program, developed by the UK Department for Transport, for undertaking transport economic appraisals. It implements a 'willingness to pay' approach to economic appraisal for multi-modal schemes with fixed or variable demand.

TUBA takes demand, journey time and distance travelled information from the ERM for each future year, vehicle type and journey purpose; for each time period; and calculates travel time saving benefits. It does this by comparing the travel times in the 'Do-Minimum' scenario with those in the 'Do-Something' scenario. It then applies monetary values (known as Values of Time - VoT) to derive the monetary benefits of those time savings. These monetary values are standard for appraisals within Ireland and are provided by CAF. In addition to journey time savings, TUBA also calculates impacts on Vehicle Operating Costs (VOC), revenues (e.g. tolls, public transport fares and other charges) and tax revenues.

TUBA version 1.9.14 has been used for this assessment, and the economic parameter file has been updated in accordance with the latest PAG guidance. This ensures the assessment is using the latest version of the software with adjusted Irish guidance to incorporate Ireland specific operating costs and other TUBA elements. To align the appraisal with the modelling work undertaken, two additional modelled journey purposes (beyond the core model and appraisal purposes - Business, Commute, Other) have been included within the economic parameter file. These are Education and Retired, which are included within the ERM. For the purposes of this assessment, it is assumed that these two purposes have the same parameter characteristics as 'Other'.

2.3.2 Annualisation Factors

The outputs from the ERM are produced for different time periods throughout an average representative day. Therefore, within TUBA an annualisation factor is applied to convert these time period specific results to annual values. The annualisation factors used within the Luas Finglas appraisal were derived during the development of the ERM and are outlined in Table 2.1.

Table 2.1: Annualisation Factors

Modelled Time Period	Time	Appraisal Representative Period	Annualisation Factors
AM	07:00 – 10:00	AM	575
LT (Lunch Time)	10:00 – 13:00	LT, Evening Off-Peak, Weekend	3,164
SR (School Run)	13:00 – 16:00	SR	550
PM	16:00 – 19:00	PM	581

The NTA consider the LT period to be representative of the evening, off-peak and weekend periods in terms of traffic levels and provision of public transport services, and so it is used as a proxy for the impact of Luas Finglas in these periods. To achieve this the lunchtime annualisation factor is increased to incorporate the evening, off-peak, weekend and bank holiday periods. The other time periods (AM, LT and PM) only represent weekday movements, and so have much lower annualisation factors.

2.3.3 Sectoring Impacts

As illustrated in Figure 2-1, the ERM covers the entire eastern side of the country. A sector system (illustrated in Figure 2-2) was created in order to focus the analysis and capture impacts associated with

Luas Finglas. The sectors considered to be relevant for analysing Luas Finglas include areas to the north of the city and along catchments of the existing Green and Red Luas Lines. Only transport user impacts associated with travel to, from and between these sectors has been extracted from the TUBA analysis. This increases the likelihood that any potential over-estimation/under-estimation of impacts that is unlikely to be related to Luas Finglas, and may be associated model 'noise'³, is removed from the appraisal.

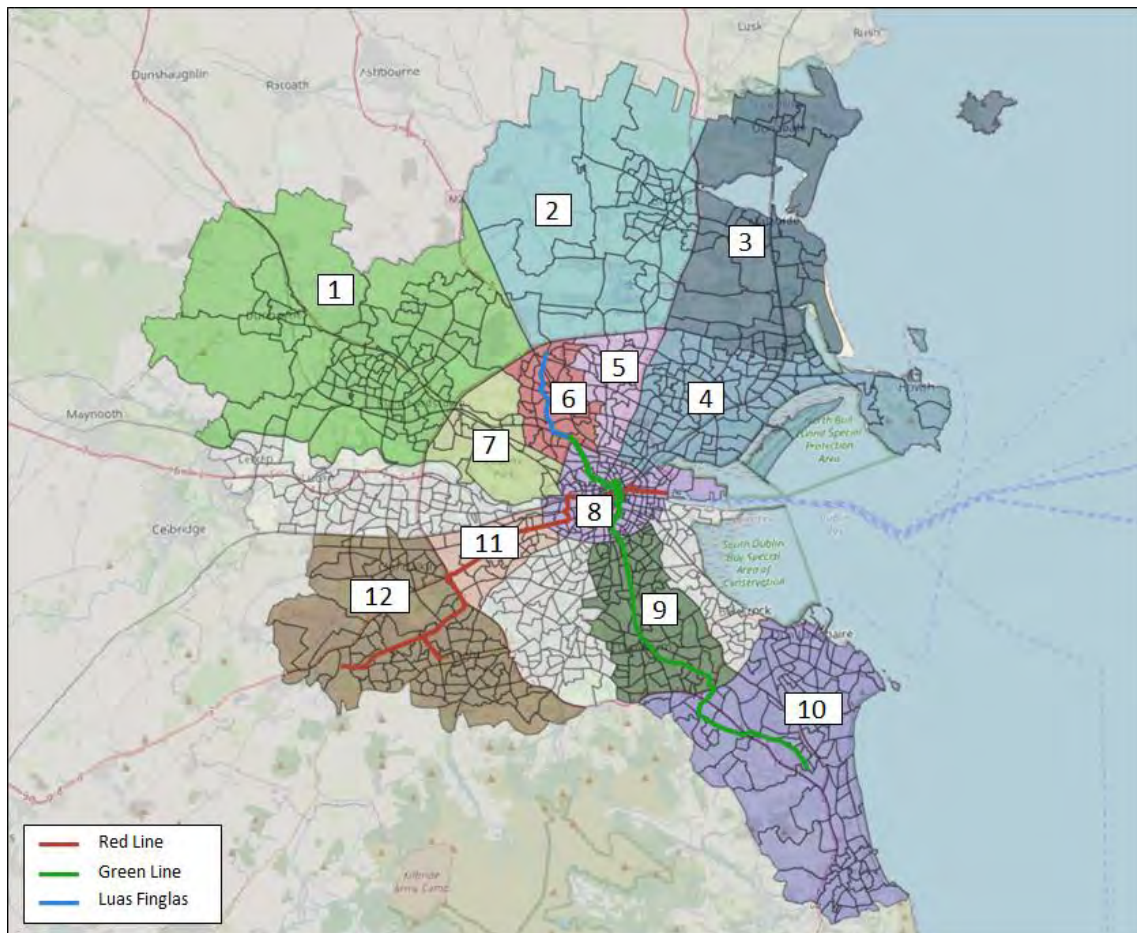


Figure 2-2 TUBA Sectors for Analysis

2.3.4 Public Transport User Impacts

Users of Luas Finglas will be the primary beneficiaries of the line's development. Luas Finglas will significantly reduce public transport journey times between the Finglas area and the city centre by an average of 12% during the AM peak hour. When compared to travel via private car, the delivery of Luas Finglas will lead to an average reduction in journey times to the city centre of 15 minutes (over 30%) during the congested peak periods in 2035. As an example, journey time by Luas Finglas from Charlestown to the city centre⁴ is expected to be around 30 minutes in the AM peak, whilst the equivalent trip by car in the opening year is estimated to take approx. 47 minutes.

The modelling analysis indicates that there will be substantial demand for Luas Finglas, leading to an increase of 1.3 million public transport trips in the opening year 2035. This will rise to 1.8 million additional trips by 2050 due to underlying development growth and modal shift from car. The overall benefits associated with Luas Finglas 'Core' scenario broken down by Sector are provided in Table 2.2.

³ Model 'noise' reflects small fluctuations in outputs between runs due to the significant size of the ERM and the level of convergence achieved.

⁴ For the purpose of this analysis, the 'city centre' has been defined as Trinity College

Table 2.2: TUBA Public Transport User Benefits ‘Core’ Scenario - (€000’s, 2011 values and prices)

Sector	Total Origin Benefits (€000’s)	% Total
Sector 1	17,169	5%
Sector 2	-8,088	-2%
Sector 3	-77	0%
Sector 4	1,435	0%
Sector 5	15,574	5%
Sector 6	153,609	46%
Sector 7	11,636	3%
Sector 8	87,621	26%
Sector 9	28,858	9%
Sector 10	28,898	9%
Sector 11	-358	0%
Sector 12	474	0%
Total	336,752	

The TUBA analysis indicates that Luas Finglas will deliver public transport user benefits of €336.8 million (2011 prices and values) over the 60 year period (this includes the 30 year appraisal period and an additional 30 years to reflect the residual value).

As expected, the majority of the benefits (72%) are associated with the Luas Finglas catchment (Sector 6) and the city centre (Sector 8). As noted above, Luas Finglas will significantly reduce travel times to the city centre when compared to car and other public transport alternatives in the ‘Do Minimum’ scenario. 89% of total benefits are generated along the Green Line corridor (Sectors 6, 8, 9 and 10) reflecting the benefit of Luas Finglas in facilitating onward travel beyond the city centre.

Sectors 5 and 7 experience benefits mainly due to the potential for interchange with Luas Finglas. There are number of orbital BusConnects services such as the N6, N4 and E2 that provide a connection for residents in these areas to Luas Finglas stops. The largest negative impact is associated with trips originating in Sector 2. This may be due to the impact of proposed junction changes along St Margaret’s Road on journey times for longer distance buses coming from outside the M50. However, it is felt that the impact may also be associated with some model ‘noise’ described previously and therefore potentially overstated. Either way, the impacts associated with Sector 2 have been retained in the overall public transport benefits for consistency and completeness.

2.3.5 Road User Impacts

The delivery of Luas Finglas will lead to a shift to sustainable modes and an estimated annual reduction of around 440,000 vehicle trips on the road network along the corridor in the opening year 2035. Luas Finglas will operate along a mainly off-road corridor, however, it will interact with the road network at certain locations particularly at the northern end of the alignment. The two most significant impacts will be at:

- **R135 / St Margaret’s Road Junction:** It is proposed that this junction will be altered from the existing roundabout to a signalised junction to facilitate through movements of Luas Finglas, along with improved safety for pedestrians and cyclists; and
- **St Margaret’s Road / Melville Road Junction:** It is proposed that this junction will be reconfigured to reduce crossing distances and improve safety for pedestrians and cyclists which includes the removal of existing left-turn filter lanes.



Figure 2-3 R135 / St Margaret's Road Junction Upgrade Proposals

The proposed junction upgrades have been included in the ERM SATURN networks to reflect the impact these changes could have on the road network performance. The TUBA road user results for the analysis sectors⁵ are outlined in Table 2.3 below.

Table 2.3: TUBA Road User Benefits 'Core' Scenario - (€000's, 2011 values and prices)

Sector	Total Car Benefits (€000's)	Total Goods Vehicle Benefits (€000's)	Total Benefits (€000's)	% Total
Sector 1	-4,550	-1,264	-5,814	12%
Sector 2	-1,782	-3,845	-5,626	12%
Sector 3	-942	-1,611	-2,553	5%
Sector 4	-1,126	-1,754	-2,879	6%
Sector 5	-1,571	-1,716	-3,287	7%
Sector 6	-7,611	-12,687	-20,298	43%
Sector 7	-1,195	-213	-1,408	3%
Sector 8	-1,394	-4,462	-5,856	12%
Total	-20,170	-27,551	-47,721	

⁵ Note: Analysis of the ERM results showed a negligible impact of Luas Finglas on car trips south of the city centre in Sectors 9, 10, 11 and 12. As such, they have been excluded from the final outputs.

Overall, the modelling estimates a negative impact for road users with approximately €47.7 million (2011 prices and values) in disbenefits over the 60 year period. This is primarily due to the proposed junction changes at the northern end of the alignment with the majority of disbenefits (43%) associated with trips originating in the Luas Finglas catchment area. The other largest disbenefits are associated with travel through the proposed junction changes, for example from the north of the M50 (Sectors 1 and 2) travelling to/from the city centre via the R135 / St Margaret's Road Junction.

The proposed junction changes are likely to have an impact on road network capacity for vehicles as they provide greater priority to sustainable modes in terms of facilitating Luas crossings as well as safe pedestrian and cycle facilities. However, the TUBA impacts are likely to be overestimated due to the following:

- **Limitations of the modelling software:** The road network assignment in the ERM uses the SATURN traffic modelling software package which has limitations in its ability to model complex signalised junctions. For example, the proposed R135/St Margaret Roads signalised junction would likely be controlled via the Dublin SCATS system which allows signal timings and phasing to adapt to vehicle demand and delay. The impact of such a system cannot be replicated in the ERM road network assignment, and as such, the associated estimated delay due to the junction changes is likely to be overestimated; and
- **Impact on Goods Vehicles:** The modelling also assumes that goods vehicles (HGVs and LGVs) continue to grow in line with forecasted economic activity with patterns of travel remaining the same. This is considered a conservative assumption. It should be noted, the 2023 Climate Action Plan (CAP) sets out the necessity to examine the feasibility of developing logistics hubs near urban centres to consolidate and rationalise freight transport. These measures may include the development of consolidation centres to limit the number of 'last-mile' trips made by larger goods vehicles with plans for higher use of smaller electric vans or cargo bikes for 'last-mile' deliveries in urban areas. As proposals for the above are at a pre-planning stage, it was not deemed appropriate to account for them in the assessments and a worst-case assessment has been undertaken based on continued growth in goods traffic.

2.3.6 Economic Efficiency of the Transport System (TEE) Table

The Economic Efficiency of the Transport System (TEE) Table is one of the main outputs from TUBA and outlines the overall impacts of the scheme across road and public transport in terms of travel time, VOC, user charges and revenues. Table 2.4 outlines the full TEE table for the 'Core' scenario with the Present Value of Transport Economic Efficiency Benefits of €360.8 million (2011 prices and values) with fare revenue included. For the Luas Finglas Appraisal, fare revenue has been used to offset against operational costs of the scheme (further details provided in Section 3.2). As such, with fare revenue removed the Present Value of Transport Economic Efficiency Benefits for the 'Core Scenario' is €289.0 million.

Table 2.4: 'Core' Scenario TEE Table - (€000's, 2011 values and prices)

Consumer - Commuting User Benefits	All Modes	Highway	Public Transport
Travel Time	109,413	-2,172	111,585
Vehicle Operating Costs	53	53	-
User Charges	878	-	878
During Construction & Maintenance	-	-	-
NET CONSUMER - COMMUTING Benefits	110,344	-2,119	112,463

Consumer - Other User Benefits	All Modes	Highway	Public Transport
Travel Time	172,202	-10,575	182,777
Vehicle Operating Costs	531	531	-
User Charges	-61	-	-61
During Construction & Maintenance	-	-	-
NET CONSUMER - OTHER Benefits	172,672	-10,044	182,716

Business User Benefits	Highway			Public Transport
	All Modes	Personal	Freight	
Travel Time	5,881	-7,832	-26,506	40,218
Vehicle Operating Costs	-1,220	-175	-1,045	0
User Charges	1,355	-	-	1,355
During Construction & Maintenance	-	-	-	-
Subtotal	6,015	-8,007	-27,551	41,573

Private Sector Provider Impacts	Highway			Public Transport
	All Modes	Personal	Freight	
Revenue	71,814	-	-	71,814
Operating Costs	-	-	-	-
Investment Costs	-	-	-	-
Grant/Subsidy	-	-	-	-
Subtotal	71,814	-	-	71,814

Other business Impacts	Highway			Public Transport
	All Modes	Personal	Freight	
Developer Contributions				
NET BUSINESS IMPACT	77,829	-8,007	-27,551	113,387

TOTAL	All Modes
Present Value of Transport Economic Efficiency Benefits (TEE)	360,844

2.4 Park & Ride User Benefits

The provision of a 350-space Park & Ride beside the St Margaret's Road Luas stop will provide a number of benefits. It will support the removal of vehicular traffic from the road network, thus contributing to the decarbonisation of travel. For users of the Park & Ride, there will also be significant journey time savings when using Luas Finglas which have been captured separately from the TUBA analysis.

A bespoke tool was created to estimate the potential journey time benefits for Park & Ride users. Select Link Analysis was used to determine the likely destination for people using the Park & Ride. This investigated where cars in the 'Do Minimum' scenario were travelling to as they pass the Park & Ride site, along with their likelihood to benefit based on their travel time by car and the distance of their destination from a Luas stop. Figure 2-4 illustrates the estimated distribution pattern of trips using the Park & Ride site, with darker green areas indicating higher demand.

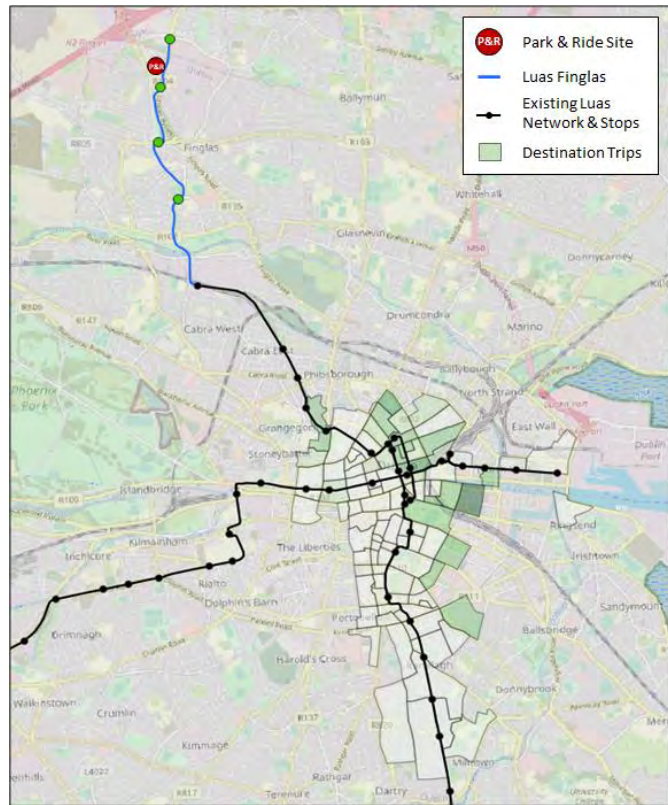


Figure 2-4: Luas Finglas Park & Ride Destinations

The tool uses outputs from the ERM to calculate the time saving by parking at the Park & Ride and taking the Luas when compared to completing the full journey by car.

- Car Journey Time = car travel times from the zone containing the Park & Ride site at St Margaret's Road to the proposed destinations from the ERM; and
- Park & Ride Travel Time = Wait Time + In-Vehicle Time + Walk Time

Where:

- Wait Time = the time spent waiting for the Luas to arrive at the Park and Ride site. This is assumed to be half the headway of the Luas Finglas service;
- In-Vehicle Time = the time spent on Luas travelling to the destination; and
- Walk Time = the time spent walking from the Luas stop to the eventual destination.

Vehicle occupancy surveys from existing Luas Park & Ride sites were used in combination with modelling data to estimate the likely occupancy rate for the St Margaret's Road site. The overall time saving benefit for the Park and Ride user is calculated as:

Benefit

$$= \text{Park \& Ride Demand} \times \text{Weighted Average Journey Time Saving} \times \text{Value of Time} \times \text{Annualisation Factor}$$

The tool uses the standard CAF value of time parameters to monetise the time savings for the Park & Ride users over a 60-year period (to include for the residual value) with discounting to 2011 prices and values in-line with CAF guidance. The annualisation factors used are the same as those applied in the TUBA analysis and outlined in Table 2.1. Overall, it is estimated that the Park & Ride will generate approximately **€14.6 million** (2011 prices and values) in journey time benefits for its users over the 60 year period.

2.5 Journey Time Reliability Benefits

Luas Finglas will deliver a level of segregation and priority for trams that will reduce the variability in journey times currently being experienced by public transport users (bus) and private vehicle users travelling along the corridor. Reliability benefits are those attributable to the improved confidence in arrival time at users' destinations. Improving the reliability of journey times allows users to better plan and make use of their time, for example, providing more consistent travel times to work, or for better use of time before leaving one's home.

The monetisation of reliability benefits is a relatively new component of economic appraisal and whilst there are draft guidelines in place from DoT they are not yet included in the current CAF guidelines. Reliability benefits are separate from journey time savings. They capture the perceived benefit associated with reduced uncertainty and stress users experience when the variation in their journey times is reduced. Improvements in the variability of a service do not necessarily result in journey time savings. It is therefore appropriate that the appraisal of Luas Finglas captures both the journey time savings (due to reduced headways, improved speeds and more direct journeys) and reliability savings (through segregation and priority infrastructure reducing the likelihood of delays and protecting Luas passengers from the impact of congestion).

A bespoke tool was developed for the appraisal of reliability impacts, which aligns with draft guidance set out by the DoT. The monetised value of these reliability benefits is calculated based on the formula below:

$$\textit{Benefit} = \textit{Reliability Ratio} \times \textit{Value of Time} \times \textit{Reduction in Variability} \times \textit{Demand} \times \textit{Correction Factor}^6$$

Travel time variation is expressed as the standard deviation of travel time, and the following sources were used to estimate this change in variability:

- Observed TomTom journey time information for the Finglas corridor on access to the city centre for road users;
- Bus AVL data for the route 140 travelling along the Finglas corridor; and
- Luas AVL data for a section of the existing Green Line.

Outputs from the NTA ERM were used to quantify the number of unique passengers travelling along the corridor and who will therefore gain the most benefit from the reliability improvements. For the 'Core' scenario, it is assumed Luas Finglas will not have any additional journey time reliability benefits over the provision of the Finglas Core Bus Corridor, which will provide priority for bus services along the route. Therefore, in this scenario the reliability benefits have only been derived from Luas users who have transferred from car.

The reliability benefit for Luas Finglas has been calculated over a 60 year period with discounting to 2011 prices and values in-line with CAF guidance. The overall total benefit for the 'Core' scenario is approximately **€43.3 million** (2011 prices and values).

It should be noted that the change in variability has been calculated based on observed information, with the same values applied to the future opening year (2035) and design year (2050) for the purpose of estimating the reliability benefits. However, it is likely that as travel demand continues to grow, without an intervention such as Luas Finglas, congestion will worsen along the corridor leading to a greater chance of variability in car travel times. As such, it is felt that the reliability benefits presented here represent a conservative estimate.

⁶ Where reduction in variability is the difference between the sums of the variability of travel time for Do Minimum and Do Something scenarios, Reliability Ratio is 0.8 based on CAF and Correction Factor used is 1.0

2.6 Active Mode Benefits

Luas Finglas will include the delivery of walking and cycling infrastructure along the majority of its route. The TII Tool for Economic appraisal of Active Modes (TEAM) has been used to estimate the monetised benefits associated with delivery of walking and cycling infrastructure, including health, mode shift, journey time, journey quality and recreation benefits.

TEAM is an Excel-based tool developed by TII for undertaking a Cost Benefit Analysis (CBA) of active mode schemes. It can quickly estimate the main benefits associated with increased levels of walking and cycling or improved infrastructural quality. It can be used to carry out a full CBA for an active mode scheme, as it provides a summary of the benefits and economic outputs required by the PAG and PSC. It can also be used to simply calculate the active modes benefits for inclusion in another economic appraisal. Further details on TEAM can be found in TII PAG Unit 13.0⁷.

Demand analysis was undertaken using the ERM to identify the potential usage of the proposed Luas Finglas walking and cycling infrastructure which was fed into the TEAM tool to monetise the benefits. The overall benefits associated with the proposed walking and cycling infrastructure are outlined in Table 2.5 and Figure 2-5.

Table 2.5: Team Benefits 'Core Scenario'
- (€000's, 2011 values and prices)

Benefit	Present Value Benefit
Mode Shift	€ 968
Health	€ 5,107
Journey Quality	€ 4,109
Recreation	€ 1,299
Present Value of Benefits	€ 11,483

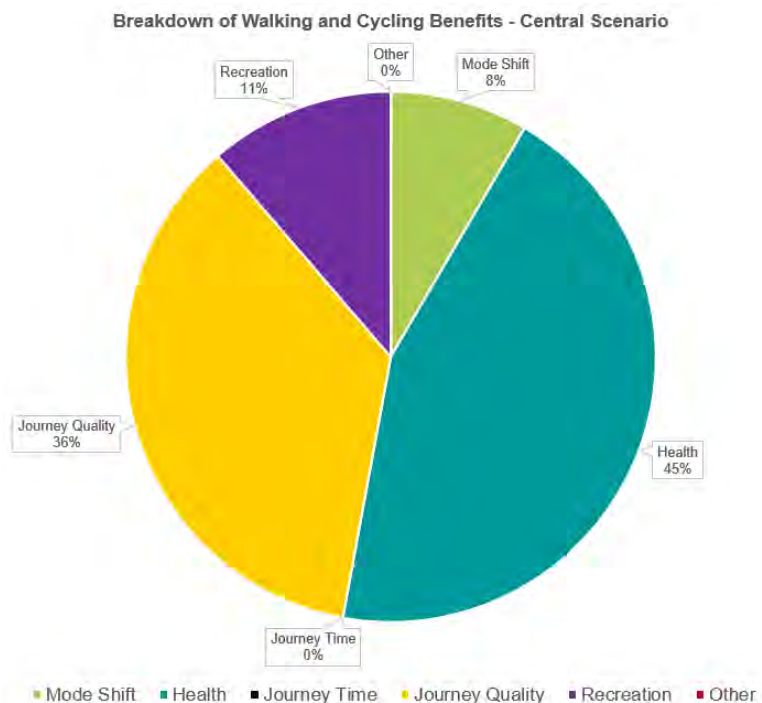


Figure 2-5: Team Benefits 'Core' Scenario Breakdown

For the purpose of appraising the active travel facilities associated with Luas Finglas, it was assumed that the new walking and cycling routes would not significantly improve journey times. There are a number of existing and parallel route options for pedestrians and cyclists along the corridor. As such, the majority of benefits are associated with improved journey quality due to the upgraded walk and cycle facilities, and associated health and recreational benefits from encouraging additional active travel along the route.

The proposed off-road walk and cycle infrastructure will link a number of residential areas, local schools, parks and recreational facilities along the route encouraging sustainable travel, in particular for vulnerable road users and unconfident cyclists. There are 11 primary and 3 secondary schools within approximately 1km of the Luas Finglas alignment. In total about 3,000 primary school children and 1,500 secondary school pupils attend these schools. The new active travel facilities delivered as part of Luas Finglas will also provide a connection to the Royal Canal Way which offers a mainly off-road link towards Dublin city and is also a great local amenity for recreational trips along with the Tolka Valley Greenway.

⁷ <https://www.tiipublications.ie/library/PE-PAG-02036-02.pdf>

2.7 Road Safety Benefits

As the delivery of Luas Finglas will encourage a shift away from private car use, the reduction in vehicles will produce safety benefits associated with collisions on the network. The NTA's Safety Appraisal Tool was used to analyse the impact of Luas Finglas on road safety. It uses TII's Irish specific version of the COBA-LT (Cost and Benefit to Accidents – Light Touch) programme.

COBA-LT is a computer program developed by the UK Department for Transport (DfT) to assess and quantify the change in the number of collisions and casualties between two model scenarios. Within COBA-LT, the predicted numbers of accidents with and without a scheme are compared and converted into monetary values by multiplying the numbers of accidents by their average monetised costs. The benefits for each year are discounted to 2011 prices and summed over the 60-year assessment period. COBA-LT calculates the number of accidents over the 60-year period from either default (national average) or observed (local) accident rates. For the purposes of this assessment, default values based on the link characteristics have been used. The traffic flows used for accident analysis were calculated from the ERM flows. They are consistent with flows used in other elements of the economic analysis including the TUBA assessment. Table 2.6, provides a summary of the key assumptions used for the analysis.

Table 2.6: Accident Impact – assumptions and source information

Item	Assumptions/Notes
Software	COBA-LT-Ireland Version 2015.1 (current version)
Parameters File	COBA-LT-Ireland Parameters file Version 2019.10.03
Appraisal Period	60 years
Accident Data	Set out in PAG Unit 6.11: National Parameter Values Sheet
Traffic Data	Base Year AADTs taken from ERM SATURN model. DM and DS AADTs for 2035 and 2050 taken from ERM model assignments
Geometric parameters	Speed limits, distances, carriageway standard, junction type etc. extracted from ERM SATURN models
Price basing and discounting	To ensure consistency with all other scheme impacts, the accident monetary impacts were calculated in 2011 prices and discounted to 2011.

The overall monetary benefit of the reduction in the number of accidents over the 60-year assessment period equates to **€547,000** as shown in Table 2.7.

Table 2.7: Summary of Safety Benefits

Scheme	Collision Costs (€000's, 2011 values and prices)
Total Without-Scheme	411,574
Total With-Scheme	411,027
Total Collision Benefits	547

The results from the road safety appraisal indicate very minor benefits. Luas Finglas will contribute to a shift in mode share, and a reduction in vehicles on the road network. However, these reductions are occurring on urban streets with lower speeds, which in the COBA-LT software have reduced accident rates (particularly serious and fatal collisions) when compared to more rural roads.

SECTION 3: COST BENEFIT ANALYSIS RESULTS

3.1 Introduction

The CBA of Luas Finglas has been undertaken in line with the PSC and CAF guidance. Individual economic parameters, such as Value of Time, have been based on industry-standard variables extracted from DoT CAF and TII PAG. Core assumptions used in the economic appraisal are:

- **Price Base Year:** Price base year and present value year of 2011 as defined in the DoT CAF;
- **Residual Value:** Standard appraisal period of 30 years with a residual value period of a further 30 years;
- **Discount Rate:** Discount rate of 4.0% for 30 years from current year, 3.5% for years 31-60 and 3.0% thereafter;
- **Shadow Price of Public Funds:** When the government raises funds through taxation, it can introduce economic distortions: taxes such as VAT or income tax raising the price paid for goods and services, which can discourage economic activity that would have otherwise occurred. In-line with the PSC and CAF, a shadow price factor of 1.3 has been applied for public funds in the Luas Finglas appraisal.
- **Shadow Price of Labour:** Spending on some projects, particularly when they are located in an area with high rates of unemployment, can have a stimulus effect; creating jobs and reducing the number of people claiming social welfare payments. As of October 2021, PSC and CAF guidance indicate that those involved in the preparation of economic appraisals in the transport sector should use 100% as the shadow price of labour. As such, a shadow price factor of 1 has been applied for labour in the Luas Finglas appraisal.

3.2 Scheme Costs

The overall estimated costs of Luas Finglas are outlined in the PBC and the *Luas Finglas Consolidated Preliminary Cost Estimate Report*. These costs have been adjusted in-line with CAF guidance for economic appraisal including the discounting to 2011 prices and values, and the exclusion of projected inflation and VAT.

In addition to this, passenger fare revenue resulting from the scheme is assumed to partly offset operational costs. This essentially reduces the funds that need to be raised by Government to construct and operate Luas Finglas.

TII has produced a range of cost estimates for delivery of Luas Finglas across varying risk assumptions. For the purpose of economic appraisal at this PBC stage, the Reference Class Forecasting (RCF) P80 allowance was used as the core cost scenario. This helps ensure a conservative appraisal is undertaken within the PBC and the assessment takes appropriate account of the potential for risk events to arise during forthcoming project phases. Costs under the 'Management Stretch Target' (P30), 'Management Base Target' (P50) and 'High Risk' (P90) scenarios have been included as sensitivity tests. Table 3.1 outlines the overall costs to construct, operate and maintain Luas Finglas over the 60 year period at the various risk levels.

Table 3.1. Luas Finglas Economic Appraisal Costs (2011 Prices and Values)

Scenario	Risk	Present Value Costs 2011 Prices & Values (€ 'm)
Management Stretch Target	P30	€170.98
Management Base Target	P50	€205.19
Prudent Client Appraisal Value	P80	€240.85
High Risk Sensitivity	P90	€308.25

3.3 Sensitivity Scenarios

Standard practice in undertaking assessments of transport projects requires that a number of demand and network configuration scenarios are generated to provide a range of appraisal results. Each scenario is offering a different assessment of the future by comparing a “Do Minimum” development scenario with a “Do Minimum plus Luas Finglas” (also known as “Do Something”) scenario. This allows for a more robust understanding of the likely impacts of Luas Finglas across a range of potential future “Do Minimum” states, as well as gaining more appreciation for the potential trade-offs and behaviours that underpin the demand modelling results.

Table 3.2 summarises the alternative sensitivity scenarios that have been evaluated as part of the Luas Finglas Economic Appraisal in the preparation of the PBC.

Table 3.2. Economic Appraisal Sensitivity Scenarios

Scenario	Do Minimum Scenario Description
1. Alternative Growth Future	Assumes delivery of the ‘Core’ scenario projects and demand patterns aligned with the NTA’s ‘Alternative Future Scenario for Travel Demand’. This aims to reflect changes in transport demand e.g. increased working from home.
2. Core + MetroLink	Assumes that all the projects of the ‘Core’ scenario are delivered along with MetroLink.
3. Core + MetroLink + Alternative Growth Future	Assumes that all the projects of the ‘Core + MetroLink’ scenario are delivered, along with demand patterns aligned with the NTA’s ‘Alternative Future Scenario for Travel Demand’

As outlined in the PBC and associated Transport Modelling Report, the various scenarios have different impacts on demand for Luas Finglas and associated user benefits. Each of the scenarios were modelled in the ERM and the results were passed through TUBA to inform the CBA.

3.4 CBA Results

Table 3.3 outlines the results of the Luas Finglas CBA across the core scenario and sensitivity tests. Further analysis of the results is provided in Chapter 5 of the PBC. In summary:

Core Scenario

- The incremental cost and benefit of Luas Finglas in the Core Future scenario generates a Benefit to Cost Ratio (BCR) of 1.4, and a Net Present Value (NPV) of €108 million.
- This means that for every €1 of incremental economic cost, Luas Finglas delivers €1.40 of incremental economic benefit to the Irish economy.
- Luas will deliver significant monetised benefits, valued at €349.2 million in the Core Future scenario.

Alternative Future Scenario

- Overall, the alternative future scenario results in a decrease in the total number of trips on the transport network, leading to a reduction in passenger demand and associated journey time savings from Luas Finglas (when compared to the ‘Core’ scenario).
- In this scenario Luas Finglas is estimated to deliver around €286 million Present Value Benefits and a positive BCR of 1.1

Table 3.3. Luas Finglas CBA Results

All Values Presented in 2011 Prices & Values (€ 'm)				
Scenario	Core	Alt Future Scenario	Core + MetroLink	Core + MetroLink + Alt Future
Public Transport Users	336.8	278.6	233.6	202.2
Road Network Users	-47.7	-47.7	-34.8	-34.8
Active Mode Users	11.5 ⁸	11.5	11.5	11.5
Indirect Tax Revenue	-9.7	-8.8	-3.9	-6.8
Reliability	43.3	37.6	37.6	37.6
Park & Ride Users	14.6 ⁹	14.6	14.6	14.6
Road Safety	0.5 ¹⁰	0.5	0.5	0.5
PV Benefits	349.2	286.2	259.1	224.8
PV Costs (P80)	240.8	251.0 ¹¹	263.1	269.3
BCR (P80)	1.4	1.1	1.0	0.8
PV Costs (P50)	205.2	215.4	227.5	233.6
BCR (P50)	1.7	1.3	1.1	1.0
Sensitivities:				
P30 Costs	2.0			
P90 Costs	1.1			
Benefits (-20%)	1.2			

⁸ Users benefiting from active mode improvements have been derived from ERM and catchment analysis based on future population levels and the potential for use of the new infrastructure. The new walk and cycle links will connect communities to local schools, recreational facilities and services. For the purpose of economic appraisal, it is assumed that the usage of the new infrastructure, and associated benefits are the same across all scenarios.

⁹ It is estimated that the 350 space Park & Ride site will be well utilised in all scenarios tested. As such the associated journey time benefits are assumed to be the same for the purpose of economic appraisal.

¹⁰ Road safety benefits represent a very minor proportion of overall scheme benefits (<1%). As such, the impacts are assumed to be equal across all scenarios for the purpose of calculating a BCR.

¹¹ Note: Costs vary between scenarios due to the impact of fare revenue which is offset against operational and maintenance costs. Each scenario has different levels of Luas Finglas boardings, and associated fare revenue.

Core + MetroLink Scenario

- The modelling within the ERM indicates that the introduction of MetroLink leads to a reduction in patronage on Luas Finglas and associated user benefits resulting in a BCR of 1.0 in the P80 cost scenario.
- The modelling analysis likely overestimates this response due to the simplified nature of the residential zone system and access roads in the ERM. The model choices are also based on mathematical calculations without full consideration of local conditions.
- Demand for Luas Finglas in the 'Core+ MetroLink' scenario is still strong with around 2,900 passengers boarding across the four new stations in the 2035 AM peak hour.
- The modelling analysis also illustrates the synergies that could arise from the delivery of both services and the positive impact this would have on public transport usage. Within the Luas Finglas 20-minute walk catchment, the public transport demand is significantly higher with both Luas Finglas and MetroLink in operation, than when either scheme is delivered in isolation.
- The costs used in the PBC economic appraisal represent a conservative estimate with a large value associated with future risk and contingency (P80). When a lower risk value is applied in-line with the 'Management Base Target' (P50), the BCR in the 'Core + MetroLink' scenario increases to 1.14.

Core + MetroLink + Alternative Future Scenario

In order to present a robust assessment of the Luas Finglas scheme, a sensitivity test was undertaken combining scenarios which impact on Luas Finglas patronage and associated benefits resulting in a BCR of 0.8. However, it is unlikely that the conditions represented in this sensitivity test will come about in reality as:

- It represents an accelerated reduction in overall trip making predominantly as a result of Covid-19. It is impossible to predict what the long term impact will be on trip making and trip patterns. Recent data suggests that whilst trip patterns are currently different to pre-Covid there has been a strong bounce back in public transport travel with patronage returning above pre-Covid levels at the end of 2022¹².
- Since the modelling for the Economic Appraisal was undertaken, development planning in the areas has progressed. At the time of writing this PBC, the draft Jamestown SDRA Masterplan includes for 3,500 – 3,800 new homes which is significantly higher than was originally proposed. Further work is also ongoing for the redevelopment of the Dublin Industrial Estate lands with a Local Area Plan being developed to regenerate the area. These areas will be directly served by Luas Finglas and are conservatively represented in the modelling analysis.
- The modelling analysis doesn't include for any demand management measures which support a reduction in vehicle kilometres travelled and a shift to sustainable modes. Significant work is ongoing currently to develop a National Demand Management Strategy and Demand Management is an element of the Greater Dublin Area Transport Strategy. The reallocation of road space from private car use to accommodate better public transport and active travel will likely be a key element of any Demand Management Strategy.
- The Reference Class Forecast (Outline Business Case) P80 cost estimate includes a large value associated with future risk and contingency. When a lower risk value is applied in-line with the 'Management Base Target' (RCF - P50), the BCR in the 'Core + MetroLink + Alt Future' scenario increases to around 1.0. If the 'Management Stretch Target' (RCF - P30) is used, the BCR rises just above 1.1.

¹² <https://www.transportforireland.ie/news/bus-passenger-numbers-return-to-pre-pandemic-levels-nla/>

Sensitivity Tests

Three separate sensitivity tests have been considered on the 'Core' future scenario as follows:

- Increasing the project costs by applying the P90 risk, while holding all other things equal, would result in a BCR of 1.1. Given the economic appraisal utilises the already conservative P80 cost estimate, this sensitivity is considered unlikely;
- Decreasing the project costs by applying the P30 risk, while holding all other things equal, would result in a BCR of 2.0; and
- Accounting for the risk associated with the calculation and monetisation of Luas Finglas benefits by applying a 20% reduction in their value, would result in a BCR of 1.2.

On the whole, the sensitivity tests indicate the scheme is robust even if current assumptions change. However, it is recommended that additional sensitivity testing is undertaken at Final Business Case (FBC) Stage to examine assumptions and uncertainties again.

SECTION 4: SUMMARY & CONCLUSIONS

This report provides further details on the estimation of costs and benefits associated with Luas Finglas under a number of different scenarios to support the PBC. Economically, Luas Finglas will provide a positive Benefit-Cost Ratio (BCR) of 1.4 in the expected core scenario and between 1.0 to 2.0 over a range of scenarios comprising variations in costs, demand and changes in the wider transport network. As a sensitivity test, cost, demand and transport network scenarios that individually have lower benefit to cost ratios have been combined. In the unlikely event that the conditions underpinning this sensitivity test arise, the resulting BCR will reduce to 0.8. Overall, it is expected that Luas Finglas will deliver a positive BCR and will deliver good value for money.

However, it should be noted that whilst the Net Present Value (benefits minus costs) and BCR are relevant indicators, they do not provide information on benefits and costs not directly monetisable such as enhancements or negative effects on the natural or built environment. In other words, although an important input, the economic analysis should not be used as the sole basis for decisions.

Further Appraisal

Further appraisal work will be undertaken for the FBC, so that this can inform the development of the scheme taken forward. This preliminary business case sets out a justification for the investment that is required. The resources put into developing a preliminary business case should be proportionate to the scale of the proposal. Therefore, a high-level view of some of the benefits that Luas Finglas may deliver has been provided. Further areas of work to be undertaken at FBC include quantifying potential agglomeration, employment and Land Value Uplift impacts.

Appendix | E

Luas Finglas MetroLink Analysis Technical Note

Transport Infrastructure Ireland



Luas Finglas Preliminary Design & Statutory Process



MetroLink Analysis Technical Note

31/05/2023



Document Control Sheet

Client:	Transport Infrastructure Ireland
Project Title:	Luas Finglas Preliminary Design & Statutory Process
Document Title:	Luas Finglas MetroLink Analysis Technical Note
File Name:	230530-Luas Finglas MetroLink Analysis Tech Note v2.1

Table of Contents <i>(incl. Y/N)</i>	List of Tables <i>(incl. Y/N)</i>	List of Figures <i>(incl. Y/N)</i>	Pages of Text <i>(No.)</i>	Appendices <i>(No.)</i>
Y	N	N	26	

Document Revision				Document Verification			
Issue Date <i>(DD/MM/YY)</i>	Revision Code	Suitability Code	Author <i>(Initials)</i>	Checker <i>(Initials)</i>	Reviewer <i>As Per PMP (Initials)</i>	Approver <i>As Per PMP (Initials)</i>	Peer Review <i>(Initials or N/A)</i>
20/04/2023	v1.0		DB	SC	SC	SC	
31/05/2023	v2.1		DB	SC	SC	SC	

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SECTION 1: INTRODUCTION

1.1 Introduction

Luas Finglas is a proposed 4km extension of the Luas Green Line which will provide a safe, frequent, reliable and efficient public transport connection from Charlestown just south of the M50 to the city centre, via Finglas and Broombridge.

Barry Transportation, EGIS and SYSTRA Ltd. have been commissioned to carry out Phases 3 and 4 of National Transport Authority's (NTA) Project Approval Guidelines (Design and Statutory Process) for the Luas Finglas extension project.

The Preliminary Business Case (PBC) is one of the key deliverables within Phase 3, and describes the process followed in order to appraise the Luas Finglas scheme, and confirm it is a good use of public money. It explains the strategic fit of the scheme; how it aligns with Government policy; the options considered and the investment required. The benefits, impacts and affordability of the proposed intervention are appraised, along with identifying a plan for implementation.

1.2 Purpose of this Note

The Luas Finglas PBC outlines the Economic Appraisal of the scheme with, and without, the delivery of MetroLink as a sensitivity test. The results indicate that the delivery of MetroLink has an impact on the Benefit to Cost Ratio (BCR) of the Luas Finglas scheme resulting in a BCR of 1.0 compared to 1.4 in the core scenario. The purpose of this note is to investigate the sensitivity test with MetroLink in further detail to supplement the PBC Economic Appraisal. It looks at Luas Finglas and MetroLink together from a first principles approach to allow for an informed interpretation of the transport modelling results, and includes the following:

- **Section 2: Scenarios Tested** provides an overview of the modelling undertaken to assess Luas Finglas with MetroLink including information on the NTA's Regional Modelling System along with key parameters used to reflect each service in the model.
- **Section 3: Catchment analysis** outlines the potential catchments for both Luas Finglas and MetroLink from a pure walkability perspective on the existing network along with what's represented in the NTA's East Regional Model (ERM).
- **Section 4: Modelling Results** provides further detail on the modelled impact of MetroLink on Luas Finglas including changes in demand and boardings on Luas. It also outlines potential synergies that could arise from the delivery of both schemes including overall increases in public transport usage and reduced journey times.
- **Section 5: Wider Considerations** looks at other elements which should be considered when assessing Luas Finglas and MetroLink. In particular, it focuses on significant proposed development sites and identified 'disadvantaged' areas along the Finglas corridor which will not be served by MetroLink.
- Finally, **Section 6: Summary and Conclusions** provides an overview of information provided within this technical note along with a presentation of the main conclusions from the analysis undertaken.

SECTION 2: SCENARIOS TESTED

2.1 Introduction

Standard practice¹ in undertaking assessments of transport projects requires that a number of demand and network configuration scenarios are generated to provide a range of appraisal results. Each scenario is offering a different assessment of the future by comparing a “Do Minimum” development scenario with a “Do Minimum plus Luas Finglas” (also known as “Do Something”) scenario. This allows for a more robust understanding of the likely impacts of Luas Finglas across a range of potential future “Do Minimum” states, as well as gaining more appreciation for the potential trade-offs and behaviours that underpin the demand modelling results.

Table 2.1 summarises scenarios that have been evaluated using the ERM as part of the Luas Finglas PBC, and are analysed in further detail within this technical note.

Table 2.1. MetroLink Analysis Scenarios

Scenario	Committed Projects ²	DART+ West	BusConnects Core Bus Corridors	Luas Finglas	MetroLink
1. Core Do Minimum	✓	✓	✓	✗	✗
2. Core Do Something	✓	✓	✓	✓	✗
3. Core + MetroLink Do Minimum	✓	✓	✓	✗	✓
4. Core + MetroLink Do Something	✓	✓	✓	✓	✓

2.2 Regional Modelling System

The NTA’s Regional Modelling System (RMS)³ has been used to estimate the impacts of Luas Finglas across a variety of scenarios. It comprises a National Demand Forecasting Model (NDFM) and five Regional Multi-Modal Transport Models.

The NDFM takes input attributes such as land-use data, population etc., and estimates the total quantity of daily transport demand produced by, and attracted to, each of the 18,488 Census Small Areas in Ireland. Of the five regional models, the Finglas/North Dublin area is covered by the East Regional Model (“ERM”).

¹ Source: The Department of Transport (DoT) Common Appraisal Framework (CAF) (March 2016, updated October 2021)

² The full list of schemes included in the ‘Core’ Do Minimum scenario is provided in the Luas Finglas Transport Modelling Report

³ Further details on the NTA RMS are available at: <https://www.nationaltransport.ie/planning-and-investment/transport-modelling/regional-modelling-system/>

The models capture all day transport demand, enabling more accurate modelling of mode choice behaviour and increasingly complex travel patterns.

The NTA’s RMS is the most sophisticated modelling tool available for assessing complex multi-modal movements within an urban context. It is significantly more responsive to future changes in demographics, economic activity and planning interventions compared to more traditional models.

The outputs of the ERM include estimated demand for four modes of transport (walking, cycling, public transport and private vehicles). It also includes a number of metrics on network performance including journey times, queuing, delay, passenger boardings, fare revenue etc. that can be extracted from the model runs. These have been used to assess the impact of Luas Finglas and feed into the appraisal of the proposed scheme as part of the PBC.



Figure 2.1 NTA Regional Model Boundaries

2.3 Luas Finglas Coding

2.3.1 Characteristics

Table 2.2 outlines some of the key characteristics which have been used to model the Luas Finglas extension. For tram capacity, it has been assumed that the longer trams introduced as part of the Luas Green Line Capacity Enhancement Project will operate on the extension to Finglas. These are 55m trams with a seat capacity of 96 and overall passenger capacity of 408⁴.

It has been assumed that the service pattern for the Finglas Extension will include trams operating between Charlestown and Brides Glen with an average headway of 7.5 minutes in all modelled time periods for the Core Scenario in 2035. This headway has been reduced to 5 minutes in the design year 2050.

Table 2.2: Luas Finglas ERM Parameters in GDA Strategy Run

Parameter (Luas Finglas)	Value
Tram Seat Capacity	96
Overall Tram Passenger Capacity	408
Headway	7.5 mins (2035) / 5 mins (2050)

2.3.2 Alignment

Figure 2.2, overleaf, outlines the Preferred Luas Finglas route alignment which has been coded within the ERM Public Transport Model. It also illustrates the ERM zones in proximity to the Luas alignment, along with their connectors to the walk network facilitating access to the Luas stations.

Walk links have been generated in the ERM connecting the Luas stations to their nearest road network node, representing the station access points as accurately as possible. The ERM zone centroids have been calculated using GeoDirectory weightings to ensure their loading points are reflective of the average access to the network for each zone.

⁴ Details available at:

<https://www.nationaltransport.ie/planning-and-investment/transport-investment/projects/luas-green-line-capacity-enhancement/>

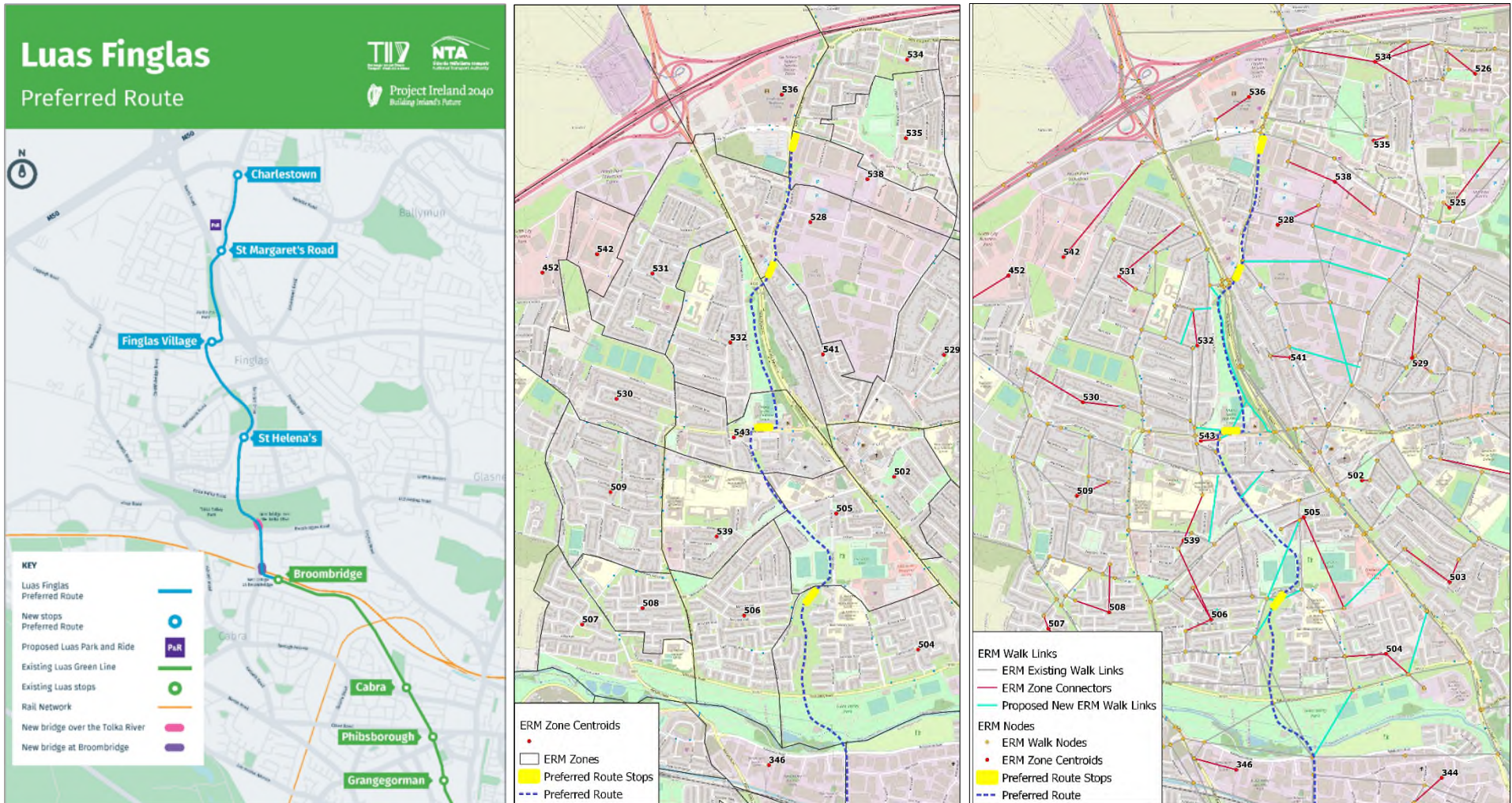


Figure 2.2: Preferred Luas Finglas Route Alignment and ERM Zone System

SYSTRA has undertaken a detailed review of the walk network along the Luas alignment to ensure that access is represented as accurately as possible. These new links, highlighted in Figure 2.2, represent walk access through housing estates, green areas, local streets etc. which may not have been included in the overall ERM road network. This ensures that walk access times to the Luas are represented as accurately as possible and that residents are loading on at the correct stations.

2.3.3 Run Time

Table 2.3 outlines the proposed distances between stations and overall travel time (including dwell time at stations) along the route. The proposed travel time has been taken from assumptions within the Operation Plan for the Luas Finglas Extension. In total, it is estimated that a journey from Charlestown to Broombridge will take 12.7 minutes.

Table 2.3: Luas Finglas ERM Run Time

Origin Station	Destination Station	Distance (km)	Total Time (sec)	Total Time (min)
Charlestown	St. Margaret's Road	0.682	100	1.67
St. Margaret's Road	Finglas Village	0.846	165	2.75
Finglas Village	St. Helena's	1.025	237	3.95
St. Helena's	Broombridge	1.433	260	4.33
Total		3.986	762	12.70

2.4 MetroLink Coding

The ERM coding for MetroLink has been taken from the latest model runs undertaken for the MetroLink Preliminary Business Case. This includes services with a seat capacity of 125, total capacity of 500 people operating at 2 minute headways in both directions throughout the day. The estimated journey times on MetroLink services are outlined in Table 2.4.

Table 2.4: MetroLink ERM Run Time (Estuary – Charlemont)

Origin Station	Destination Station	Section Travel Time (min)	Total Cumulative Time (min)
Estuary	Seatown	1.7	1.7
Seatown	Swords Central	1.55	3.25
Swords Central	Fosterstown	1.71	4.96
Fosterstown	Dublin Airport	2.65	7.61
Dublin Airport	Northwood	3.81	11.42
Northwood	Ballymun	1.49	12.91
Ballymun	Collins Avenue	1.43	14.34
Collins Avenue	Griffith Park	2.17	16.51
Griffith Park	Glasnevin	1.62	18.13
Glasnevin	Mater	1.54	19.67

Origin Station	Destination Station	Section Travel Time (min)	Total Cumulative Time (min)
Mater	O'Connell Street	1.58	21.25
O'Connell Street	Tara Metro	1.37	22.62
Tara Metro	St. Stephen's Green Metro	2	24.62
St. Stephen's Green Metro	Charlemont	1.43	26.05

The ERM zone and walk connectors at the MetroLink stations were also re-examined to ensure an accurate representation of loading onto MetroLink within the model.

2.5 ERM Assignment Parameters

The following sections provide an overview of the key parameters used within the ERM Public Transport Assignment model. These parameters have been calibrated as part of the 2016 NTA Regional Model System calibration, and as such, have been retained for the Luas Finglas Extension modelling.

2.5.1 Public Transport Generalised Cost

A person's choice of mode of travel is linked to the generalised costs associated each option available to them. In terms of public transport, the equation used to calculate the generalised cost for users is as follows:

Generalised cost = (A X Walk Time) + (B X Wait Time) + Boarding Penalty + Transfer Penalty + (C X In-Vehicle Time) + (Fare)

Where:

- Walk Time = time spent walking to access a public transport service
- Wait Time = time spent waiting at the station/stop for a service to arrive
- Boarding Penalty = penalty applied to represent the time associated with boarding a public transport service
- Transfer Penalty = penalty applied to represent the time and inconvenience associated with transferring between public transport services
- In-vehicle Time = time spent while travelling on a public transport service which may be factored to represent crowding impacts
- Fare = fare paid to undertake travel on public transport
- A = weighting applied to convert actual walk time into a perceived walk time for calculation of overall generalised cost. A value of 1.6 is included in the 2016 calibrated ERM
- B = weighting applied to convert actual wait time into perceived values for calculation of overall generalised cost. A value of 2 is included in the 2016 calibrated ERM; and
- C = Mode specific weight applied to the in-vehicle travel time to represent the perceived preference of one mode versus another. Values for these weightings have been derived for the ERM from stated preference research.

2.5.2 Calibrated Parameters

Table 2.5 outlines the ERM calibrated values for walk time factor, wait time factor, in-vehicle time factor and the boarding penalty. These values have been retained as part of the Luas Finglas ERM modelling.

Table 2.5: ERM PT Assignment Parameters (Calibrated Values)

Parameter	Value	Source
Walk Time Factor (A)	1.6	TAG ⁵ suggests values between 1.5 and 2.0. A walk time factor of 1.6 was calibrated in the ERM model, following stated preference study recommendations.
Wait Time Factor (B)	2.0	TAG suggests values between 1.5 and 2.5. A mid-range value of 2.0 was used for the ERM calibration.
In-Vehicle Time Factor (C)	Rail = 1.3 Bus = 1.5 LUAS = 1.0 Metro = 1.0	ERM calibration process started with initial values from BRT stated preference research, which were then refined to improve sub-mode share during model calibration.
Boarding Penalty	5 minutes	Derived during model calibration based on observed boarding data.

2.5.3 Transfer Penalty

The Transfer Penalty reflects the cost of interchanging from one mode to another and the quality of the waiting facilities (information, security etc.). Table 2.6 outlines the values for Transfer Penalty calibrated in the 2016 ERM to match observed data on levels of interchange between public transport modes within Dublin City. These values have been retained as part of the Luas Finglas ERM modelling.

Table 2.6: ERM PT Assignment Transfer Penalty (Calibrated Values)

Transfer	Time Penalty (mins)
All Modes to/from DART/Rail	15
Dublin City Bus to/from Dublin City Bus	15
Other Transfer (including to/from Luas and Metro)	5

2.5.4 Fares

The BusConnects 90-minute fare structure has been applied for the Luas Finglas ERM runs. The public transport assignment within the ERM includes a simplified representation of fare structure by operator, with an average fare applied which is representative of all ticket types available.

A key element of the BusConnects fare structure is the facility to accommodate 90 minutes of travel across Dublin City Bus, Luas and Irish Rail without penalising the passenger for making an interchange. The best methodology to implement this within the ERM is to specify a single fare structure that covers all travel across these modes.

The single 'Short Distance Fare' has been set at a Leap value of €1.60 and the 'Longer Distance Fare' at €2.50. Analysis was undertaken to determine the weighted average fare paid across all ticket types using available ticket sales data. This analysis was used to calculate the percentage discount applied to the Leap single fare to estimate the average fare across all ticket types to be applied in the ERM.

⁵ UK Department for Transport (DfT) Transport Analysis Guidance (TAG) provides information and guidelines for transport modelling and appraisal.

SECTION 3: CATCHMENT ANALYSIS

3.1 Introduction

Luas Finglas and MetroLink both serve different corridors on access to Dublin City Centre from the north. Luas Finglas is an extension to the Green Line travelling from Broombridge through Finglas and on to Charlestown. MetroLink will run from Swords and the Airport along the Ballymun Road through Glasnevin and Phibsborough.

Analysis was undertaken to understand the likely catchments for passengers using these services, along with potential overlap in catchment areas where residents would have a choice as to whether to travel by Luas or MetroLink if both were delivered. This Catchment Analysis was undertaken using two key sources:

- **GIS Accessibility:** Using Geographic Information System (GIS) software package to analyse access times based on the existing walking network; and
- **ERM Boarding Catchment:** Using outputs from the ERM to identify where passengers are travelling from to access Luas Finglas and MetroLink.

3.2 GIS Catchment

The Openroute Service (ORS) plugin for QGIS⁶ was used to identify the walk catchment to both Luas Finglas and MetroLink stations. It uses the latest Open Street Map network which contains a detailed representation of the road network including residential streets and walking paths. As such, the walk distance to stations is reflective of the available network including elements such as impermeable housing estate links, cul de sac roads etc.

The results of the GIS Catchment Analysis are illustrated in Figure 3.1, overleaf, which outlines the areas within a 20-minute walk (based on an average walk speed of 4.8km/hr) of the proposed Luas Finglas and MetroLink stations. The results suggest a very minor overlap in these catchments (areas highlighted in red in Figure 3.1) mainly to the north near Hampton Wood residential estate and along Glasnevin Avenue (R103). This would indicate that the two public transport routes predominantly serve different catchment areas.

There are a number of residential areas between the Finglas Road (R135) and Ballymun Road (R108) that could have a choice of service depending on their willingness to walk. For example, there may be residents willing to walk 25-minutes to MetroLink rather than 15-minute to Luas to avail of the shorter headways and quicker journey times to the city centre:

- **Luas Finglas:** 7.5 minute headway and journey time of 25 minutes from Charlestown to O'Connell Street;
- **MetroLink:** 2 minute headways and a journey time of under 10 minutes from Northwood to O'Connell Street.

This will depend on people's personal preferences, willingness to walk, mobility and external conditions such as weather and walking environment. Residents in this area will also be within a 5-10 minute cycle of either Luas Finglas or MetroLink stations, and as part of the BusConnects network, there will be a number of orbital services (such as the E2, N6 and N4) connecting to both lines.

However, the majority of the Luas Finglas demand is likely to be within a 10-15 minute walk of the stations which would be 25-30 minutes (and longer in some cases) from the nearest MetroLink station. This includes

⁶ © openrouteservice.org by HeiGIT | Map data © OpenStreetMap contributors

large development areas such as Charlestown and Jamestown Strategic Development and Regeneration Area (SDRA) (see Section 5.1 for further details). There are also large established residential areas to the west of the Finglas Road which will be directly served by Luas Finglas but would be outside of the MetroLink catchment.

Overall, the GIS analysis suggests that there is very limited overlap in areas served by both Luas Finglas and MetroLink, meaning for the most part these lines serve two different catchment areas. Luas Finglas will provide a high-capacity, reliable and fast public transport offering for existing residents and new development areas along the Finglas corridor which will not be directly served by MetroLink. It highlights the need for the delivery of both Luas Finglas and MetroLink, along with BusConnects to create an integrated public transport network covering the north of the city improving accessibility by public transport and supporting a shift to sustainable modes.

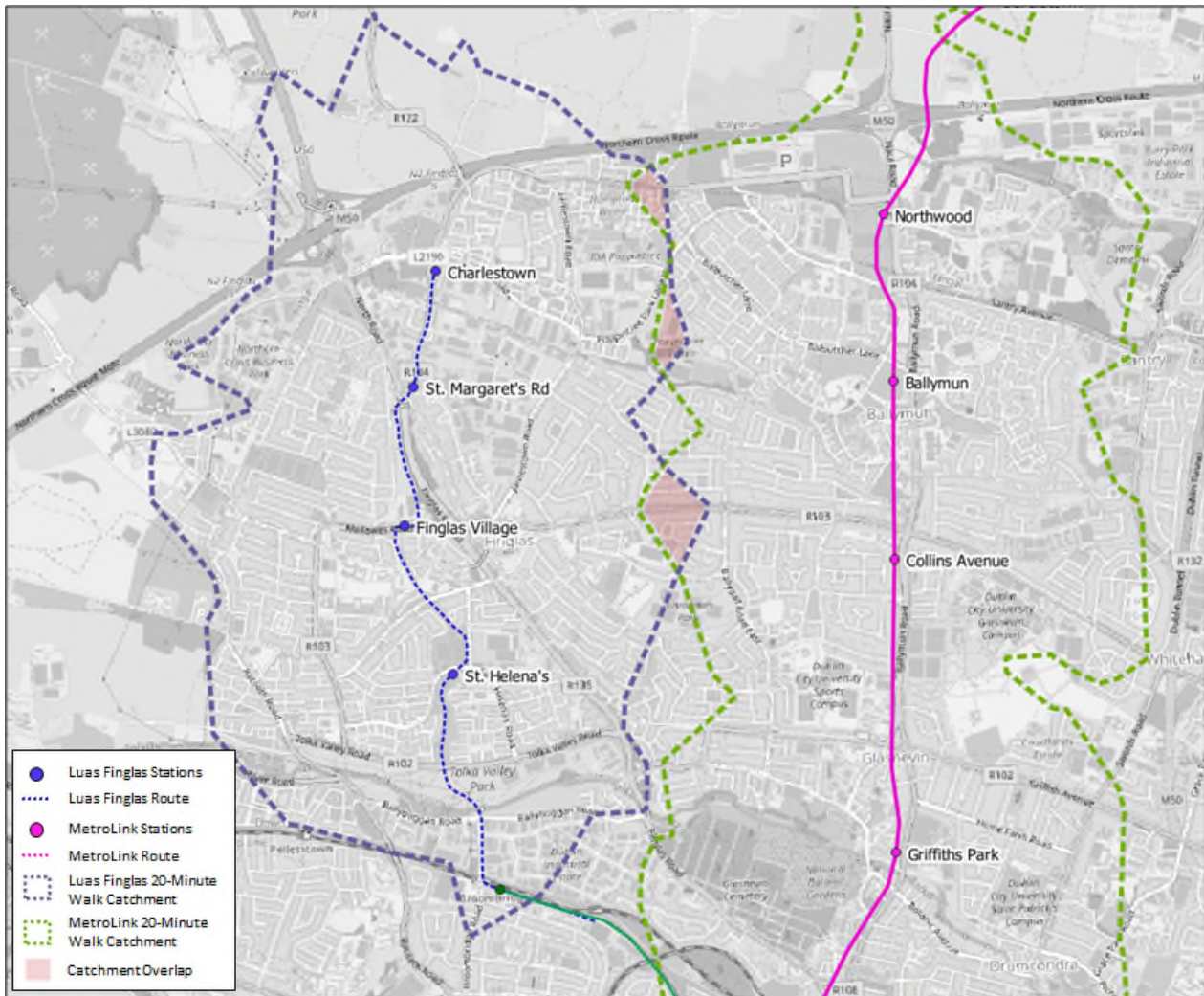


Figure 3.1: Luas Finglas and MetroLink 20-Minute Walk Catchment

3.3 ERM Boarding Catchment

In-light of the walkability GIS catchments outlined above, analysis was undertaken of ERM outputs to understand the model catchment for boarders of Luas Finglas and MetroLink. Figure 3.2, overleaf, illustrates the following:

- The left-hand image shows the number of Luas Finglas boarders in the 2035 AM peak by ERM zone in a scenario without MetroLink ('Core Do Minimum'); and
- The right-hand image shows the number of MetroLink boarders in the 2035 AM peak by ERM zone in a scenario without Luas Finglas ('Core+MetroLink Do Minimum').

The analysis indicates that, for the most part, the ERM boarding catchments align with the 20-minute walk catchments from the GIS analysis in Section 3.2. As outlined in Section 2.2 previously, the ERM is a large strategic model covering the majority of the eastern side of the country. Due to its strategic nature, it cannot reflect every individual house or every possible link on the network. As such, areas are grouped together into zones with connectors providing access to the surrounding road network.

As illustrated in Figure 3.2, there is an overlap in model catchment zones between the Finglas Road and Ballymun road along the 20-minute walk catchment boundary to both Luas Finglas and MetroLink. These zones are relatively aggregate in nature representing a number of residences and businesses. Without MetroLink, public transport users from these zones mainly walk to access Luas Finglas. However, with MetroLink, the modelling calculations estimate that some residents in these zones will use MetroLink availing of shorter headways and quicker journey times to the city centre. This contributes to a change in boardings on Luas Finglas in the 'Core+MetroLink Do Something' scenario (see Section 4.2 for further details).

Whilst some abstraction from Luas Finglas onto MetroLink is expected, the modelling analysis likely overestimates this response due to:

- The aggregate nature of model zones within the area between the proposed Luas Finglas and MetroLink network, along with the representation of zone access within the ERM reducing walk times to the road network particularly within housing estates with poor permeability. This may artificially reduce access times for some residents to MetroLink when compared to the existing available walk network.
- The ERM choice model is based on mathematical calculation of the lowest cost journey to the passenger. It doesn't take into consideration aspects such as weather conditions, pedestrian infrastructure, quality/safety of available routes etc. As such, the ERM is likely to overestimate the distance passengers will walk to MetroLink to avail of high frequencies and reduced journey times.
- The ERM doesn't explicitly reflect the time taken to access the MetroLink stations. There will be a delay accessing underground stations (particularly if requiring use of lifts in the case of mobility impaired or pushing a buggy) compared to the convenience of hopping on the tram at street level.

Overall, the ERM boarding catchments for Luas Finglas and MetroLink are sensible with the majority of demand for each service within a 20-minute walk catchment. However, it is likely that the modelling slightly overestimates the number of people opting to use MetroLink as opposed to Luas Finglas due to the strategic nature of the ERM, along with the mathematical calculation of choice irrespective of local conditions.

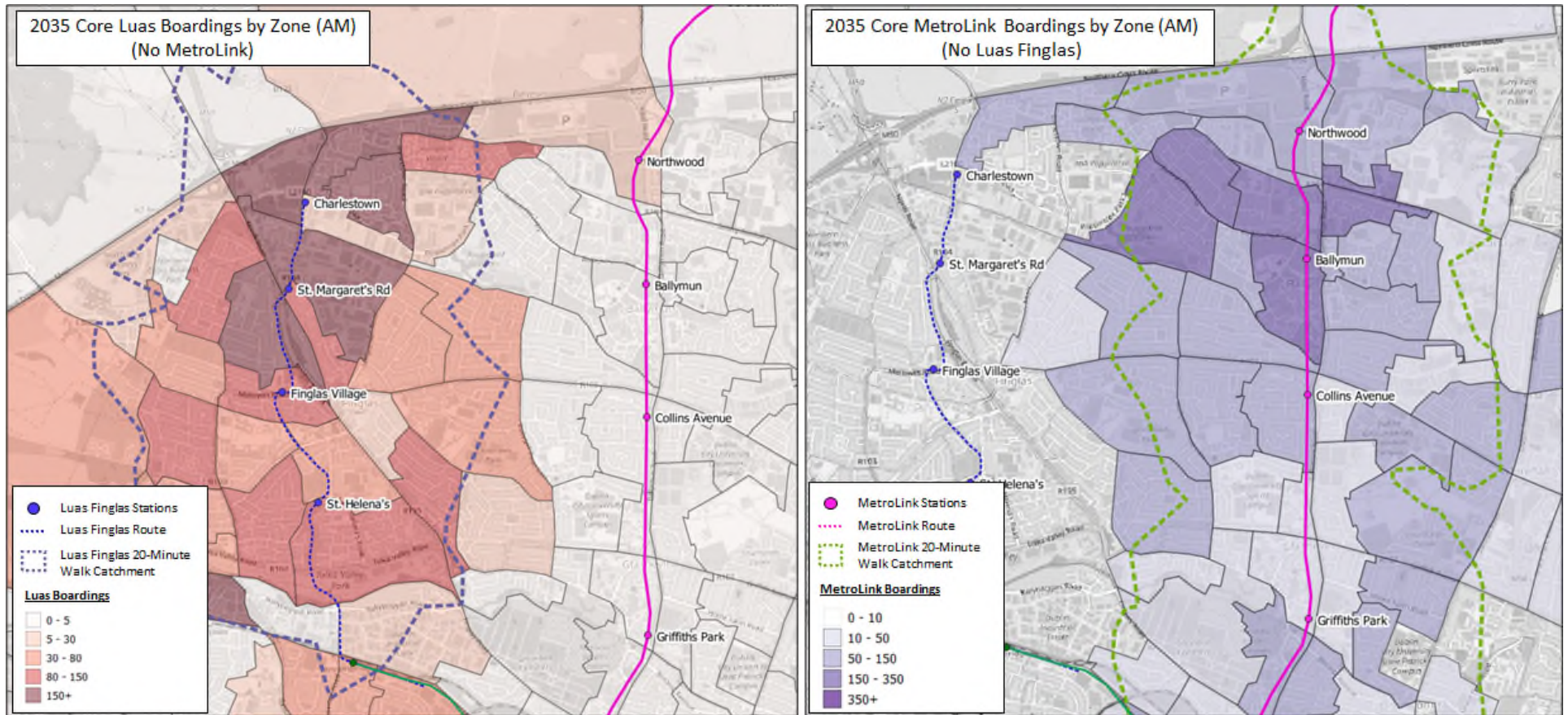


Figure 3.2: Luas Finglas and MetroLink Boarding Catchment (2035 AM)

SECTION 4: MODELLING RESULTS

4.1 Introduction

The following section provides further detail on the modelled results for the Luas Finglas and MetroLink scenarios focusing on boardings, overall public transport demand and changes in both travel time and generalised cost of travel by public transport. For the purpose of this technical note, the results in the following sections concentrate on the opening year (2035) AM peak hour.

4.2 Luas Finglas Boardings

Total 2035 AM peak hour (08:00-09:00) boardings at the four new Luas Finglas stations have been extracted for the 'Core' (without MetroLink) and 'Core+MetroLink' (with MetroLink) scenarios, and the results are illustrated in Figure 4.1 below.

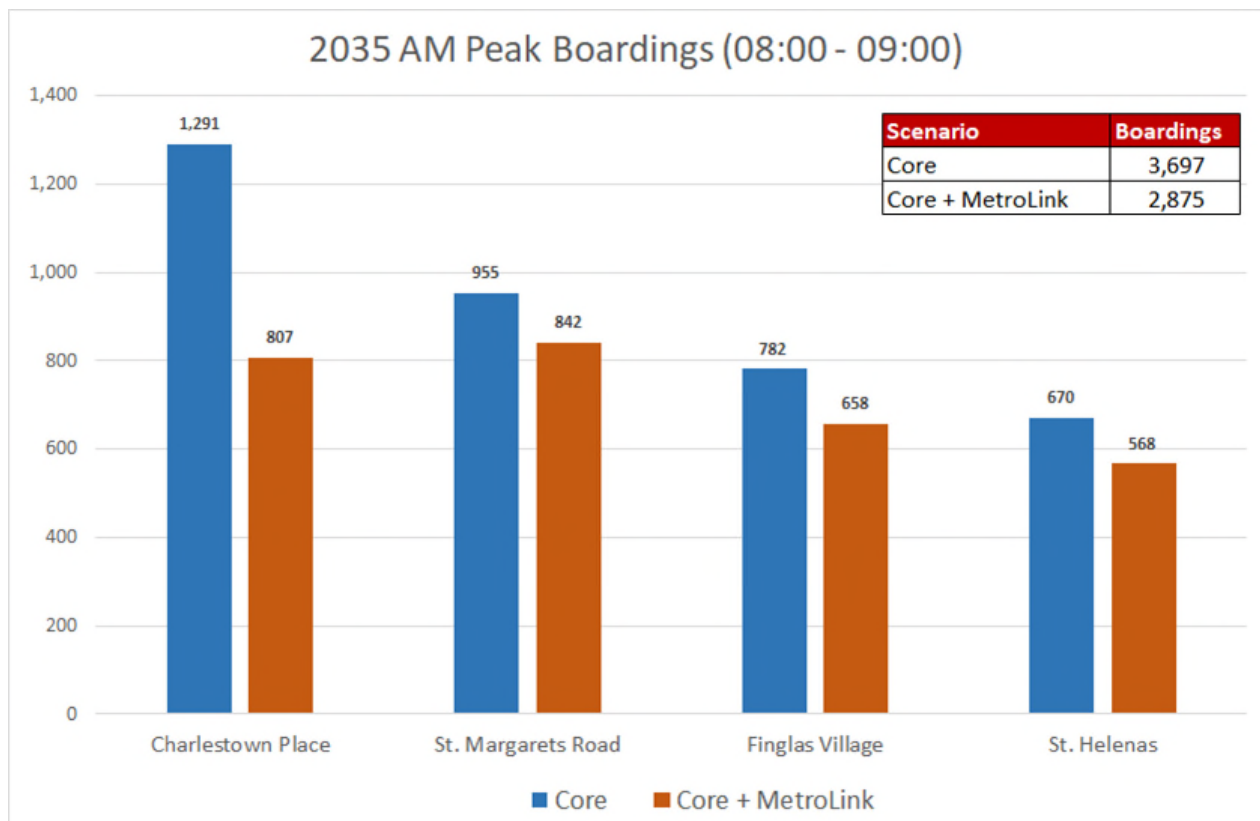


Figure 4.1: Luas Finglas and MetroLink Boarding Catchment (2035 AM)

The modelling results indicate that the scenario with MetroLink leads to a reduction of approximately 800 boardings on Luas Finglas in the AM peak. As outlined in Section 3.3 previously, there is an overlap in ERM model zone catchments for Luas Finglas and MetroLink between the R108 (Ballymun Road) and R135 (Finglas Road). The modelling results indicate that when MetroLink is delivered, some passengers who were using Luas Finglas in the 'Core' Scenario decide to use MetroLink instead to avail of the shorter headways (every 2 minutes versus every 7.5 minutes on Luas) and quicker journey times to the city. As outlined previously in Section 3.3, whilst some abstraction from Luas Finglas onto MetroLink is expected, the modelling analysis likely overestimates this response.

The Charlestown Place station experiences the largest reduction in boardings in the scenario with MetroLink. This represents the closest point between the new proposed Luas Finglas stations and the

MetroLink Stations, with a large bank of residential land just south of the M50 having a direct walk and cycle connection to the Northwood MetroLink station via St. Margaret's Road.

Another reason for the reduction in Luas boardings at Charlestown is due to a change in bus interchange patterns with MetroLink. As illustrated in 4.2, Charlestown is identified as an interchange hub in the BusConnects network allowing transfer between bus services and Luas Finglas. In line with the 'branch and spine' BusConnects network, the modelling results indicate a number of orbital passengers transferring from services such as the E2 and N6 onto Luas Finglas and travelling towards the city centre. These routes will have high frequencies of 8 minutes and 10 minutes respectively in the AM connecting large residential areas to the Finglas Road and Ballymun Road corridors.

In the scenario with MetroLink, the number of passengers interchanging at Charlestown reduces, with an associated increase at the MetroLink Ballymun station. This indicates that some passengers may choose to interchange with MetroLink availing of shorter headways and quicker journey times to the city centre.

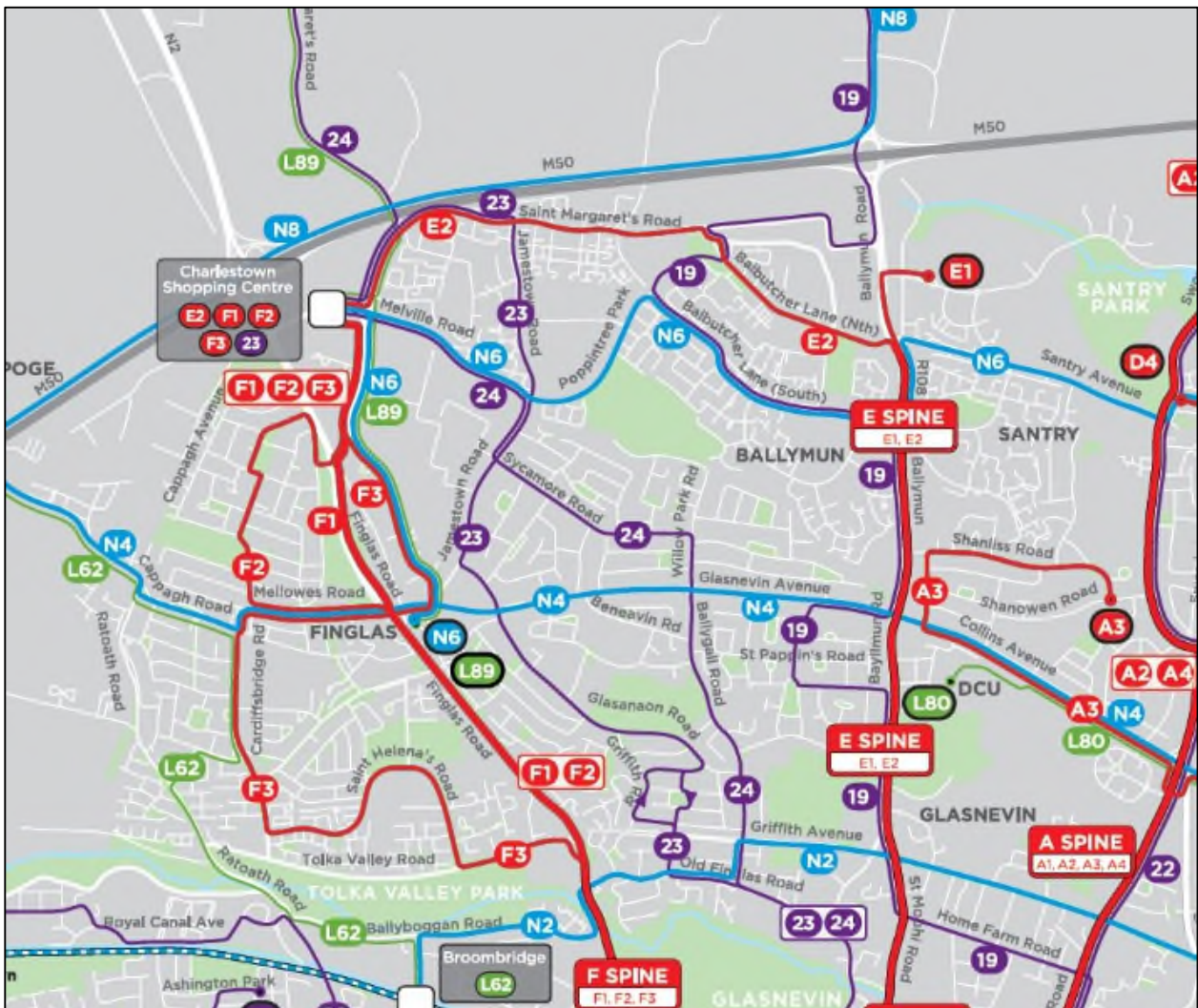


Figure 4.2: BusConnects Network Map

4.2.1 Boardings in Context

Analysis was undertaken of the 2019 Luas Census to understand the boarding levels on existing Luas stations in pre-Covid conditions. A selection of stations were taken along the Green Line from Charlemont to Sandyford and the total AM Peak hour (08:00 – 09:00) boardings are illustrated in Figure 4.3.

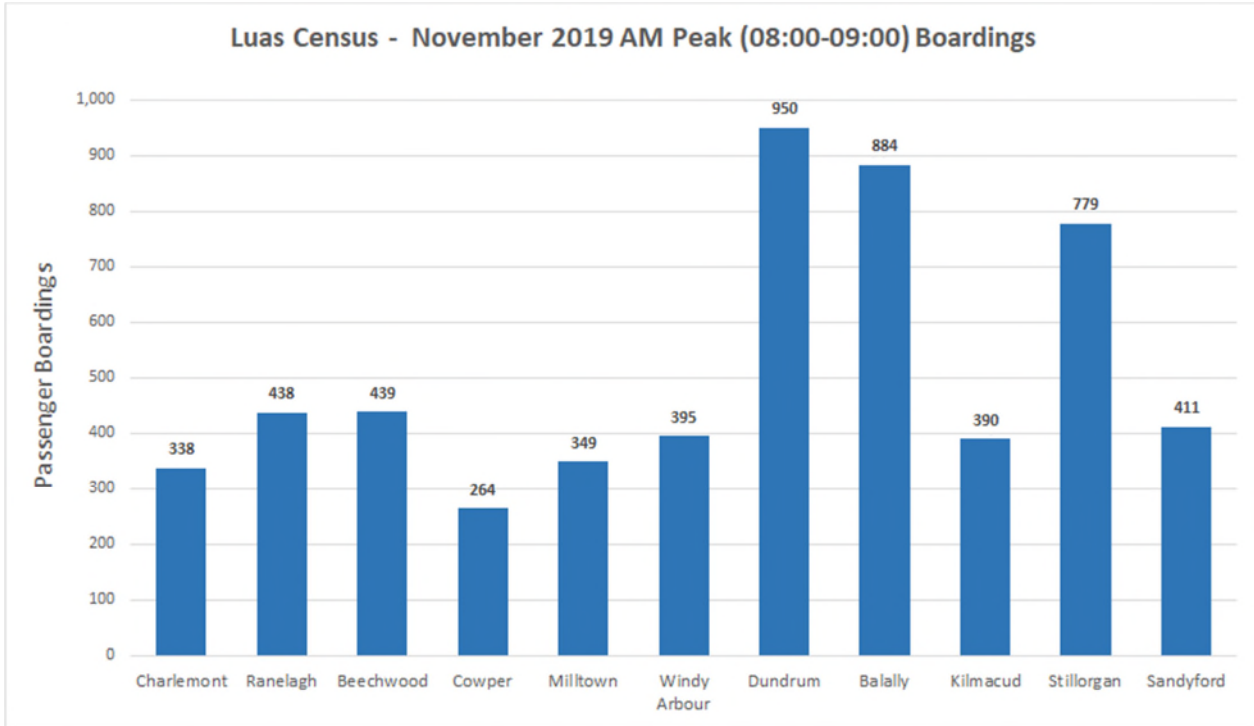


Figure 4.3: 2019 Luas Census Boardings – AM Peak (08:00 – 09:00)

The 2019 Census results have been compared to the modelled Luas Finglas boardings in the scenario where MetroLink is also delivered ('Core+MetroLink'). The modelling results indicate that St. Helena's station has the lowest boardings along the planned extension (568 passengers), however, this is higher than boarding numbers for the majority of stations along the existing Green Line as illustrated in Figure 4.3. Also, the higher demand stations of Charlestown Place (807 passengers) and St. Margaret's Road (842 passengers) rival some of the highest demand Green Line stations at Stillorgan, Balally and Dundrum.

It should be noted that this is not a direct comparison as the Luas Finglas boardings are taken from the 2035 demand which will include significant increases in population and employment from 2019. However, the results do indicate that demand for Luas Finglas in the 'Core+ MetroLink' scenario is still strong with boarding numbers matching and exceeding those experienced currently at existing Luas stations.

4.3 Public Transport Demand

In order to understand the impact of the delivery of Luas Finglas and MetroLink on public transport demand, origin public transport trips for the AM peak hour (08:00-09:00) were extracted for the ERM zones within a 20-minute walk catchment of the Luas Finglas stations. The analysis was undertaken for the four scenarios outlined in Table 2.1 previously, with the total public transport trips compared back to the 2035 'Core Do Minimum' scenario. The results of this analysis are outlined in Figure 4.4 and indicate the following:

- The delivery of Luas Finglas ('Core Do Something') leads to a 14% increase in public transport origins in the AM peak hour.
- The delivery of MetroLink without Luas Finglas ('Core+MetroLink Do Minimum') leads to a 10% increase in public transport origins. As outlined in Figure 3.2, there are a number of ERM zones to the eastern

edge of the Luas Finglas 20-minute walk catchment which are also within a 20-minute walk of MetroLink. The ERM analysis also suggests that there are passengers willing to walk longer distances to reach MetroLink in a scenario where Luas Finglas isn't available.

- The delivery of Luas Finglas and MetroLink ('Core+MetroLink Do Something') leads to a 20% increase in public transport origin trips when compared to the 'Core Do Minimum'. This illustrates the synergies that could arise from the delivery of both services and the positive impact this would have on public transport usage. Delivery of Luas Finglas in isolation provides a 14% increase in public transport trips, however, with the introduction of MetroLink in combination, this jumps to a 20% increase. The results highlight the fact that both MetroLink and Luas Finglas serve different catchment areas. There are some locations between the Ballymun Road and Finglas Road who will have a choice of service depending on their willingness to walk, however, there is a significant level of public transport demand in the Finglas area that will not be served by MetroLink.

It should be noted that all of the public transport trip increases outlined above are in addition to any modal shift achieved by the delivery of the BusConnects network redesign and infrastructure (included in all scenarios). This highlights the need for an integrated public transport solution to encourage a shift to sustainable modes and help achieve Climate Action targets.

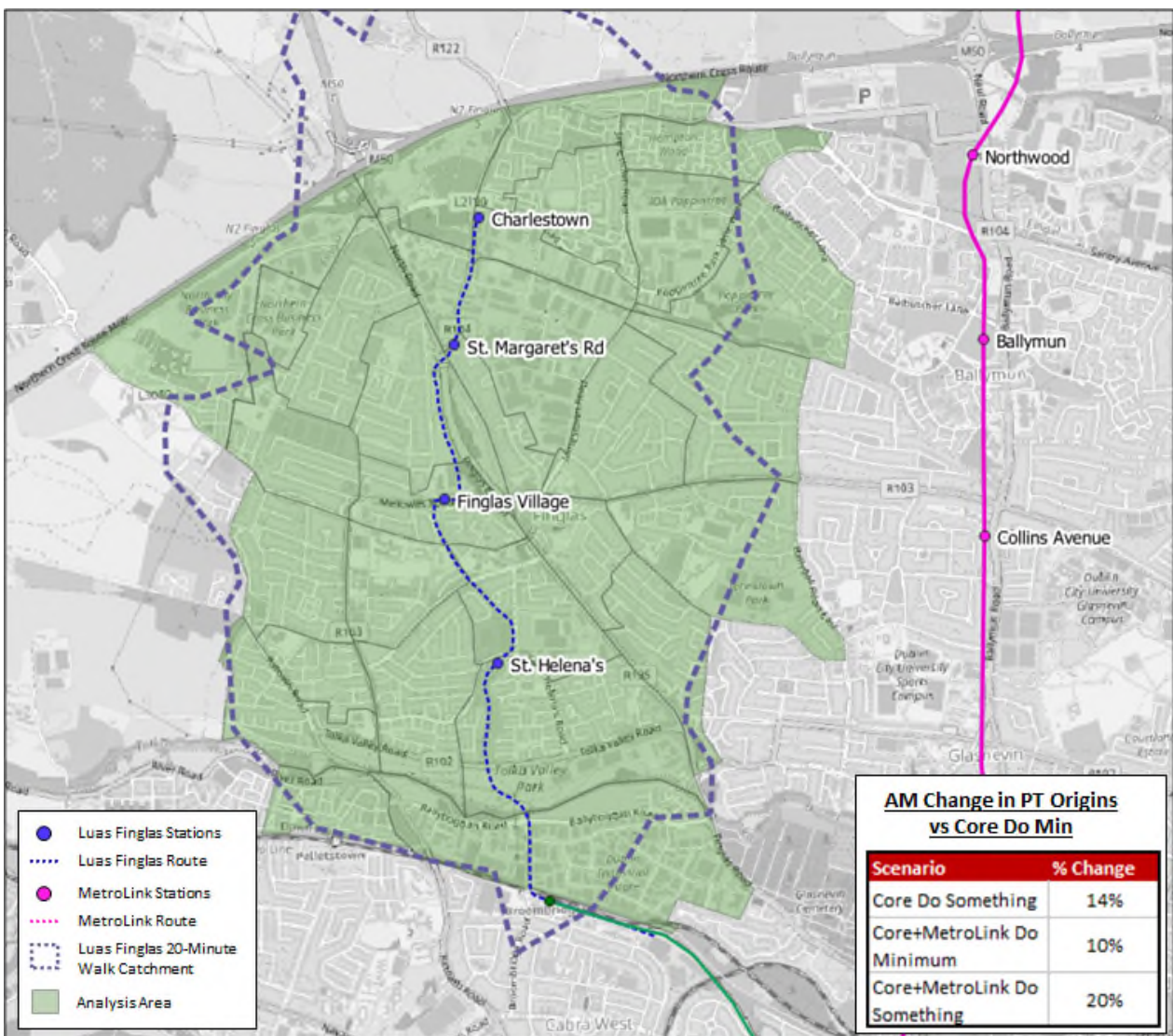


Figure 4.4: AM Peak Hour Public Transport Origin Trips Analysis

4.4 Public Transport Journey Times & Generalised Cost

Analysis was undertaken of the ERM modelling results to understand the impact of the delivery of Luas Finglas and MetroLink on journey times and overall cost of travel by public transport. As outlined in Section 2.5.1, the generalised cost of travel dictates a person’s choice of travel mode and destination in the ERM and consists of elements such as journey times, fares, walk access times and boarding penalties.

The public transport journey times and generalised cost of travel was extracted for all zones within the 20-minute walk catchment of Luas Finglas for trips to the city centre in the AM peak hour. For the purpose of this analysis, the city centre zone was chosen around D’Olier and Hawkins Street just north of Trinity College. The average journey time and cost changes across the catchment zones were extracted for the four model scenarios (Table 2.1), with the results compared back to the ‘Core Do Minimum’ in Table 4.1.

Table 4.1: ERM PT Journey Time & Generalised Cost Analysis (to City Centre in AM peak)

Scenario	Average Journey Time ⁷ (% Change)	Average Generalised Cost (% Change)
Core Do Something	-7%	-11%
Core + MetroLink Do Minimum	-5%	-5%
Core + MetroLink Do Something	-10%	-14%

The results indicate that the delivery of Luas Finglas will lead to a significant reduction in journey times and the overall cost of travel by public transport for the catchment area. This is the main source of transport user benefits included in the economic appraisal for Luas Finglas⁸, and as outlined in Section 4.3, leads to an increase in overall public transport demand.

The results in Table 4.1 also suggest that the delivery of MetroLink without Luas Finglas (‘Core+MetroLink Do Minimum’) will lead to a reduction in public transport journey times and costs for some areas within the 20-minute Luas Finglas walk catchment. There are a number of areas to the east of the alignment between the Finglas Road and Ballymun Road which will have access to MetroLink stations within a 20-25 minute walk. Without Luas, some residents in these areas may also be more willing to walk a little further to avail of the high frequency, fast MetroLink services to the city centre. This is illustrated in Figure 4.5 overleaf, which highlights the reduction in generalised cost of travel by public transport for zones to the east of the Luas Finglas alignment due to the delivery of MetroLink.

This has an impact on the economic appraisal of the ‘Core+MetroLink’ scenario. In-line with CAF guidance, this scenario has been appraised as a with (Do Something) and without (Do Minimum) Luas Finglas only. As such, this is not the same Do Minimum that the ‘Core’ scenario is assessed against. The ‘Core+MetroLink’ Do Minimum essentially represents a scenario where MetroLink is delivered before Luas Finglas. As outlined above, the introduction of MetroLink leads to reduction in journey times and costs for some zones in the Luas Finglas catchment. When Luas Finglas is delivered in the ‘Core+MetroLink Do Something’ scenario, the journey time benefits for some zones are diluted slightly as these areas will already have been receiving some benefits due to MetroLink. Therefore, within the Economic Appraisal, the public transport user benefits for the ‘Core+MetroLink’ scenario are reduced when compared to the ‘Core’ scenario.

However, the analysis in Table 4.1 indicates that the delivery of both Luas Finglas and MetroLink will lead to significant public transport journey time (-10%) and cost (-14%) savings when compared to a scenario where neither are constructed (‘Core Do Minimum’). As outlined in the demand analysis (Section 4.3), this

⁷ Note Journey Time includes both the in-vehicle time along with walk time to/from public transport.

⁸ Further details provided in the Luas Finglas Preliminary Business Case

highlights the benefits of providing both Luas Finglas and MetroLink in improving the attractiveness of public transport within the Finglas corridor and encouraging an increase in sustainable travel.

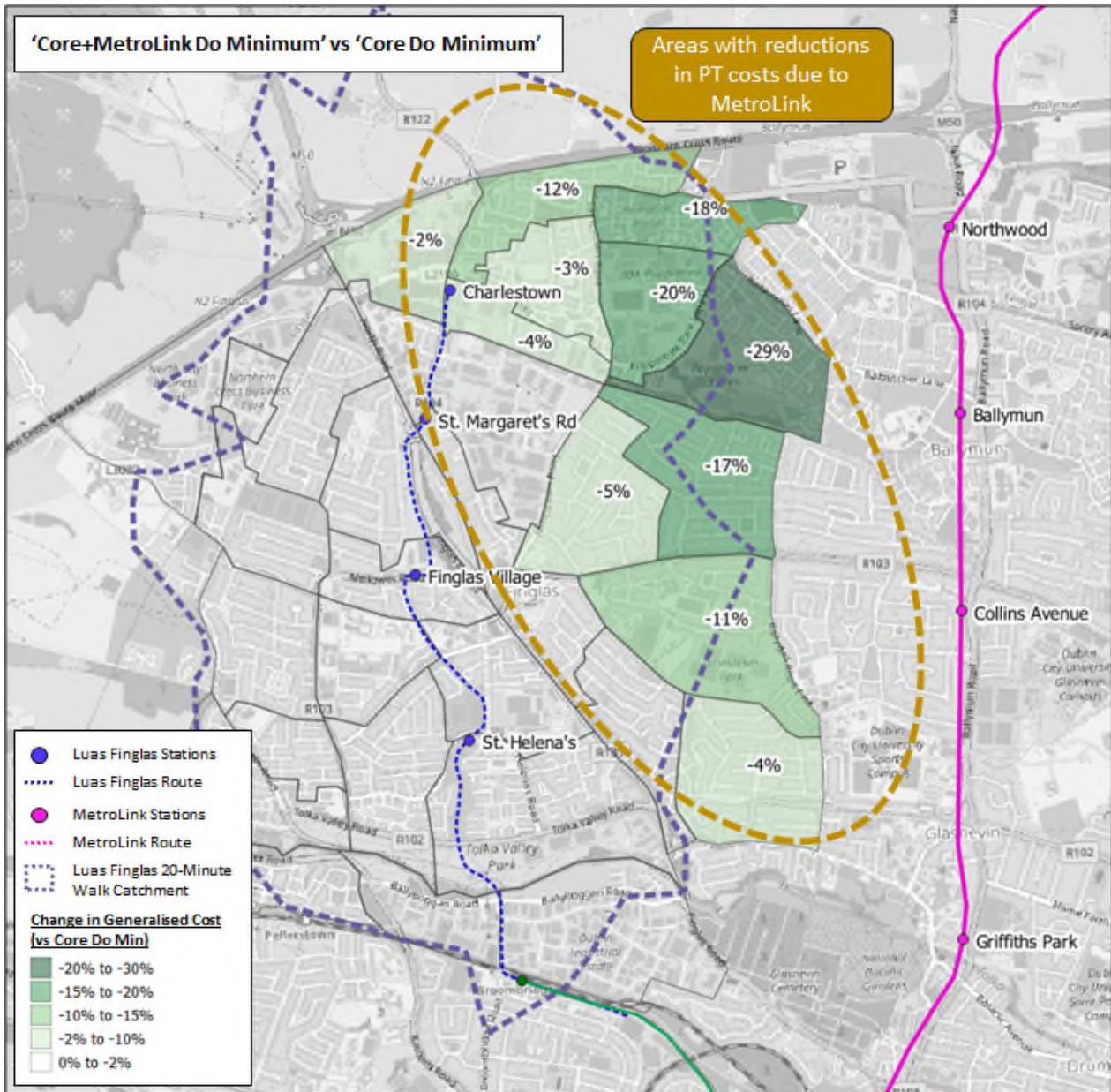


Figure 4.5: 2035 AM Peak Hour PT Generalised Cost to City Centre

SECTION 5: WIDER CONSIDERATIONS

5.1 Introduction

As outlined in the PBC, there a number of benefits associated with Luas Finglas which cannot be delivered by MetroLink but are not easily monetised. This section focuses on two of these key benefits, including:

- The significant forecast development proposed along the Finglas corridor and the need to support this with high capacity public transport to encourage compact, sustainable growth; and
- The potential to improve accessibility for residents in disadvantaged areas to employment and education and support the regeneration of the Finglas area.

5.2 Proposed Development Areas

A number of significant development areas have been identified along the proposed Luas Finglas alignment including:

- The Charlestown Centre Phase 2 and Charlestown Place SHD with planning permission granted for 967 residential units;
- The Jamestown Strategic Development and Regeneration Area⁹ (SDRA) with the draft Masterplan indicating delivery of 3,500 – 3,800 new homes; and
- The proposed regeneration of the Dublin Industrial Estate lands. At the time of writing this note, Dublin City Council (DCC) are preparing a Local Area Plan for these lands. Similar to the Jamestown SDRA, it is envisaged that the Dublin Industrial Estate lands will be redeveloped with more of a focus on residential use.

These development sites are illustrated in Figure 5.1, along with the 20 and 30 minute MetroLink walk catchments and boarding zones from the ERM. Figure 5.1 highlights the fact that these key development sites will not be served by MetroLink. Charlestown and Jamestown SDRA are both more than a 30-minute walk to the nearest MetroLink station. The Dublin Industrial Estate lands are more than a 20-minute walk and are located beside Broombridge station. As such, it is very unlikely that residents in this area will walk to access MetroLink. The ERM boarding analysis also doesn't suggest any demand for MetroLink from these zones, even in the scenario where Luas Finglas is not delivered.

As such, the delivery of Luas Finglas is key to support the sustainable development of these sites along the Finglas corridor. Through the substantial increase in public transport capacity and improvements to journey times and reliability due to the delivery of Luas Finglas, the scheme will have a significant economic impact, improving the attractiveness of the Finglas area supporting development investment, and providing capacity to enable medium and long-term compact and sustainable economic growth.

⁹ https://consultation.dublincity.ie/planning/draft-jamestown/supporting_documents/Draft_Jamestown_Masterplan_2023.pdf

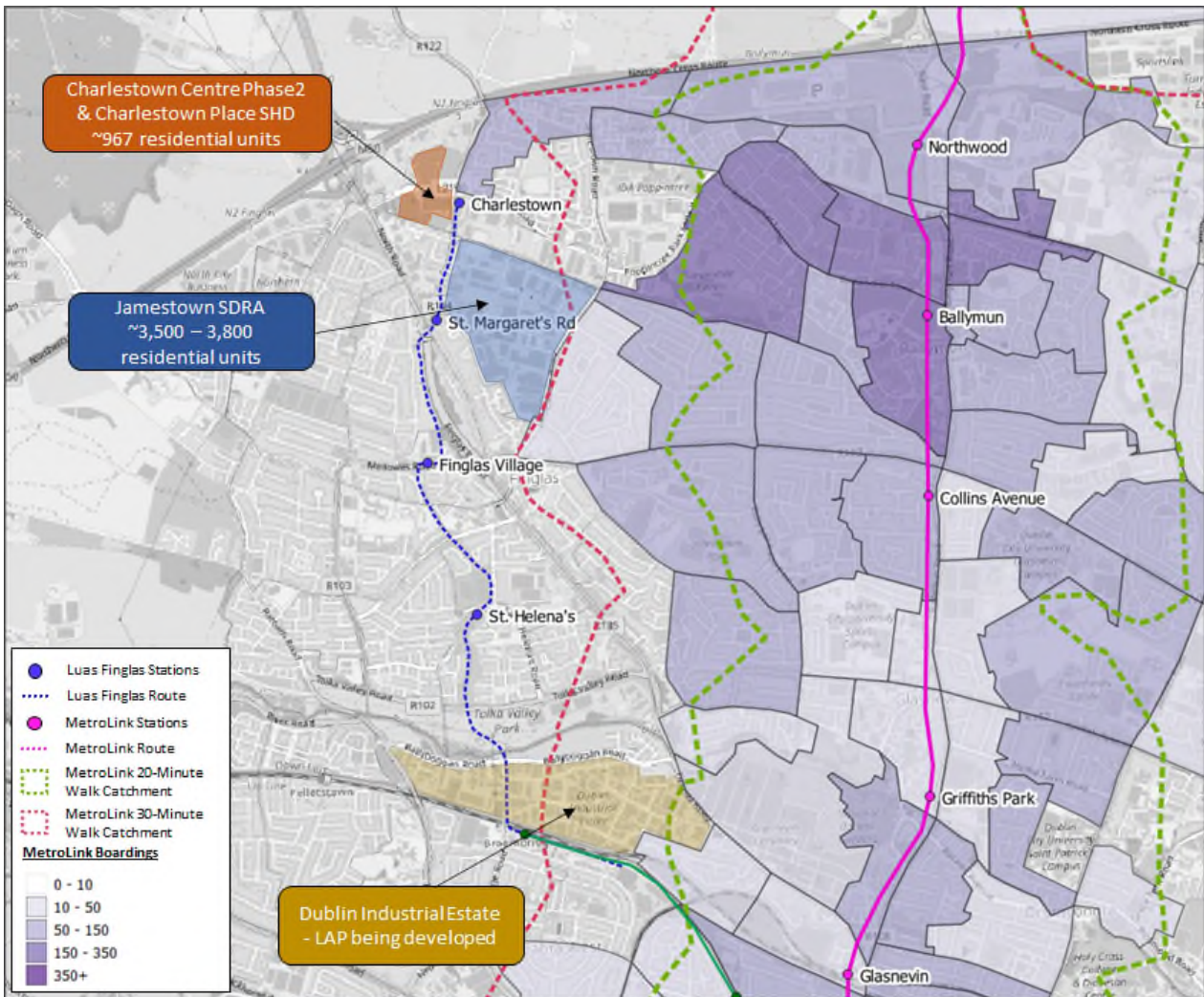


Figure 5.1: MetroLink Catchment and Proposed Development Areas

5.3 Impact on Areas of Social Deprivation

Figure 5.2, overleaf, illustrates the 2016 POBAL Deprivation Index along with the MetroLink 20 and 30-minute walk catchment. MetroLink will directly serve areas classed as disadvantaged around Ballymun, however, areas around Finglas West in particular will be well outside a 30-minute walk from the nearest MetroLink station.

In total, 10,212 people who are identified as ‘disadvantaged’ will live within a 10-minute straight-line catchment of a Luas Finglas station. All of these people will be more than a 20-minute walk from MetroLink. Developing and constructing Luas Finglas will support improvement through increased accessibility to work, education, health and community facilities. It will provide direct connectivity to TU Dublin and Trinity College, and in general bring education, jobs, and leisure activities to within greater reach of a significant number of currently disadvantaged residents which cannot be delivered by MetroLink in isolation.

Through an integrated public transport network, Luas Finglas will support accessibility to major destinations beyond the direct catchment of the extension. For example, St James’ Hospital and the new National Children’s Hospital will be accessible via Luas Finglas and a single transfer to the Red Luas Line. St Vincent’s Hospital can be accessed via interchange with the future DART at Broombridge or bus connections via transfer in the city centre.

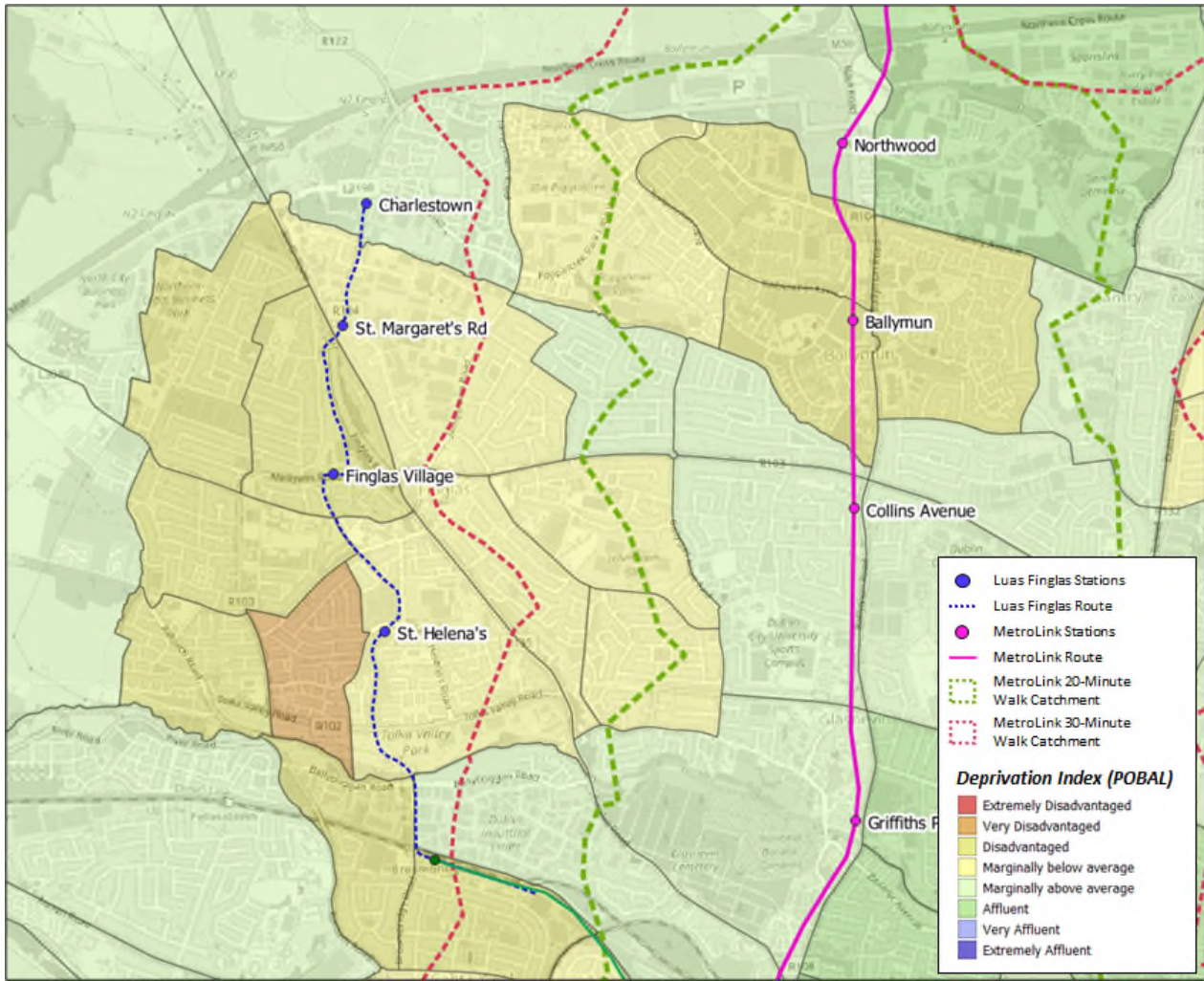


Figure 5.2: POBAL Deprivation Index and MetroLink Catchment

SECTION 6: SUMMARY AND CONCLUSIONS

6.1 Summary

This note provides further information on the with and without MetroLink scenarios reported in the Luas Finglas PBC. It presents the modelling scenarios tested, catchment analysis, ERM results and wider aspects for consideration. In summary, the following key points were noted:

6.1.1 Catchment Analysis

GIS Catchment

- The GIS analysis suggests that there is a small overlap in areas served by both Luas Finglas and MetroLink, however, for the most part these lines serve two different catchment areas.
- Luas Finglas will provide a high-capacity, reliable and fast public transport offering for existing residents and new development areas along the Finglas corridor (e.g. Jamestown SDRA) which will not be directly served by MetroLink.

ERM Boarding Catchment

- The ERM boarding catchments for Luas Finglas and MetroLink are sensible, with the majority of demand for each service aligning with the 20-minute GIS walk catchment. There is an overlap in model catchment zones between the Finglas Road and Ballymun road along the 20-minute walk catchment boundary to both Luas Finglas and MetroLink. These zones are relatively aggregate in nature representing a number of residences and businesses.
- Without MetroLink, public transport users from these zones mainly walk to access Luas Finglas. However, with MetroLink, the modelling calculations estimate that some residents in these zones will use MetroLink availing of shorter headways and quicker journey times to the city centre.

6.1.2 Modelling Results

Luas Finglas Boardings

- The modelling results indicate that the introduction of MetroLink leads to a reduction of approximately 800 boardings on Luas Finglas in the 2035 AM peak. This reduction is from two-main sources:
 - Some passengers from overlapping catchment zones between the Finglas Road and Ballymun Road switching to MetroLink when it is delivered; and
 - A change in bus interchange patterns when MetroLink is delivered. Passengers on orbital BusConnects routes such as the E2, N6 and N4 choosing to interchange with MetroLink rather than Luas Finglas to avail of shorter headways and quicker journey times.
- Whilst some abstraction from Luas Finglas onto MetroLink is expected, the modelling analysis likely overestimates this response due to the simplified nature of the residential zone system and access roads in the ERM. The model choices are also based on mathematical calculations without full consideration of local conditions. For example, aspects such as weather and quality/safety of available routes can impact on a person's choice to walk to a particular service.
- However, the results do indicate that demand for Luas Finglas in the 'Core+ MetroLink' scenario is strong with boarding numbers matching and exceeding those experienced currently at existing Green Line Luas stations.

Public Transport Demand

- The delivery of both Luas Finglas and MetroLink leads to an overall 20% increase in public transport origin demand in the AM peak within the Luas Finglas catchment which is higher than that achieved by delivering either scheme in isolation.

Public Transport Journey Time and Generalised Cost

- The results indicate that the delivery of Luas Finglas will lead to a significant reduction in average journey times¹⁰ (-7%) and the overall cost of travel by public transport (-11%) for the catchment area when compared to the 'Core Do Minimum' scenario. This would improve further with MetroLink.
- In the scenario where MetroLink is delivered in advance of Luas Finglas ('Core+MetroLink Do Minimum'), some zones to the eastern edge of the Luas Finglas catchment experience reductions in average journey times and public transport cost when compared to the 'Core Do Minimum' scenario.

6.1.3 Wider Considerations

- Key development sites within the Finglas corridor such as Charlestown, Jamestown SDRA and the Dublin Industrial Estate lands will not be served by MetroLink. As such, the delivery of Luas Finglas is key to encourage investment and support the sustainable development of these sites.
- MetroLink will directly serve areas classed as disadvantaged around Ballymun, however, areas around Finglas West in particular will be well outside a 30-minute walk from the nearest MetroLink station. Luas Finglas will bring education, jobs, and leisure activities to within greater reach of a significant number of currently disadvantaged residents which cannot be delivered by MetroLink in isolation.

6.2 Conclusions

The analysis within this Technical Note outlines the fact that both Luas Finglas and MetroLink serve predominantly different catchments, and there is requirements for both to support the sustainable growth of Dublin city and achieve Climate Action targets¹¹.

The impact of the MetroLink test on the Economic Appraisal and BCR comes from two main sources:

- There is some abstractions from Luas Finglas onto MetroLink at model zones along the 20-minute walk boundary of both services. This is likely to be somewhat overestimated in the ERM due to its strategic nature and representation of choice irrespective of local conditions. The modelling also suggest a change in bus interchange patterns with orbital passengers choosing to interchange with MetroLink to avail of shorter headways and quicker journey times; and
- The MetroLink scenarios are compared against a very different 'Do-Minimum' than the 'Core' scenario. For the MetroLink tests, it is assumed that MetroLink is delivered prior to Luas Finglas. As such, there are areas within the Luas Finglas catchment which will benefit in terms of reduced public transport journey times due to the delivery of MetroLink alone. Once Luas Finglas is then delivered, these areas receive a further benefit, however, this is diluted slightly due to the presence of MetroLink. Therefore, within the Economic Appraisal, the public transport user benefits for the 'Core+MetroLink' scenario are reduced when compared to the 'Core' scenario.

¹⁰ Includes walk time to access public transport along with the in-vehicle time

¹¹ Climate Action Plan 2023 (CAP23) implements the carbon budgets and sectoral emissions ceilings required to halve our emissions by 2030 and reach net zero no later than 2050. The Luas Finglas PBC provides further detail on how Luas Finglas supports the realisation of these targets.

The demand for Luas Finglas remains strong if MetroLink is also delivered with around 2,900 passengers boarding across the four new Luas stations in the AM peak hour, matching and exceeding those experienced at existing Luas stations (2019 Luas Census). The modelling analysis also illustrates the synergies that could arise from the delivery of both services and the positive impact this would have on public transport usage. Within the Luas Finglas 20-minute walk catchment, the public transport demand is significantly higher with both Luas Finglas and MetroLink in operation, than when either scheme is delivered in isolation. The overall journey times and cost of travel by public transport also significantly improves when both services are delivered. This indicates that the public transport user benefits for people within the Luas Finglas catchment would be greatly improved due to the delivery of both schemes when compared to a scenario where neither are delivered.

There are also a number of benefits associated with Luas Finglas that can't be delivered by MetroLink. Luas Finglas will help encourage investment in the Finglas corridor and support compact sustainable growth directly serving a number of key development sites. Luas Finglas will also provide significant accessibility improvements for residents in disadvantaged areas in Finglas who are outside of the MetroLink catchment to employment and education supporting the regeneration of the area.

Overall, this highlights the need to deliver an integrated public transport solution including Luas Finglas, MetroLink, BusConnects and DART+ to provide an attractive network improving accessibility, encouraging mode shift from the private car and supporting increased public transport usage.

Appendix | F

Monitoring and Evaluation Plan

Luas Finglas Preliminary Design & Statutory Process



Monitoring and Evaluation Plan

23/05/2023



Document Control Sheet

Client:	Transport Infrastructure Ireland
Project Title:	Luas Finglas Preliminary Design & Statutory Process
Document Title:	Monitoring and Evaluation Plan
File Name:	230523 Appendix F Monitoring and Evaluation Plan v1.0

Table of Contents <i>(incl. Y/N)</i>	List of Tables <i>(incl. Y/N)</i>	List of Figures <i>(incl. Y/N)</i>	Pages of Text <i>(No.)</i>	Appendices <i>(No.)</i>
Y	N	N	3	0

Document Revision				Document Verification			
Issue Date <i>(DD/MM/YY)</i>	Revision Code	Suitability Code	Author <i>(Initials)</i>	Checker <i>(Initials)</i>	Reviewer <i>As Per PMP (Initials)</i>	Approver <i>As Per PMP (Initials)</i>	Peer Review <i>(Initials or N/A)</i>
23/05/2023	P01	S3	ED	GD	JQ	ED	N/A

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SECTION 1: INTRODUCTION

1.1 Introduction

The proposed Luas Finglas is a major scheme and therefore a strong monitoring and evaluation plan is necessary to better ensure the project benefits are realised. A Post Project Review is also required.

The Post Project Review shall be undertaken 5 years after scheme opening to ensure that the project outturn costs are known and that experience of the operation of the Luas and impacts on traffic and active travel arising is available to inform the analysis. Some of the objectives for Luas Finglas (such as promoting economic growth for the residents and businesses of Charlestown, Finglas and the surrounding areas) will take several years to be apparent. To ensure that these are fully captured, a second evaluation may be carried out at the 10-year point to ensure that every benefit has been captured, even those which took many years to develop. If possible, this evaluation will be timed around the 5-yearly Census and associated release of anonymised Census data which can take up to 18 months. This anonymised data will be the primary source of data on population, employment, travel and other socio demographic indicators, which are intrinsically linked to the benefits of Luas Finglas and for which a longitudinal and comparable dataset exists. For this reason, the ex-post evaluation may not fall perfectly into five and ten year periods.

The Post Project Review shall evaluate the following four stages of the project:

- Project Conception,
- Project Planning,
- Project Implementation,
- Project Operational Performance, and
- Close out Cost Benefit Analysis.

1.2 Project Conception

This part of the review shall provide an account of the background to the project, how the project arose and reference relevant transport programmes or policies. It shall also consider the project appraisal and review its comprehensiveness and relevance. In particular, it shall assess whether the need for the project was soundly established and whether the objectives were clearly specified.

1.3 Project Planning

The review shall address the following aspects of project planning:

1.3.1 Transport Analysis and Projections

- Transport modelling approach was appropriate to the nature of the project;
- Projected transport growth rates were benchmarked against recent trends;
- Projected transport growth rates were compatible with TII / NTA guidelines or other planning documents; and
- The sensitivity of transport projections to relevant factors was considered.

1.3.2 Options Selection

- The review will address the Options Selection Process.

1.3.3 Project Appraisal

- Relevant appraisal techniques / software used (TUBA, COBALT or other TII/NTA accepted techniques);
- Appropriate application rules and parameter values as per DPER, DTTAS and TII guidelines were used, and
- Sensitivity testing was undertaken.

1.3.4 Planning and Design

- Tram operation, frequency and capacity had a sound basis;
- Road/ Junction capacity decisions had a sound basis;
- Park & Ride capacity decisions had a sound basis;
- The preliminary design proved to be a sound basis for project implementation; and
- Ad-hoc alterations to the design were necessary during the implementation phase and whether these reflected on the quality of the preliminary design process.

1.3.5 Procurement & Statutory Process

- EU and national rules were adhered to; and
- Compliance with procurement, planning and other statutory requirements.

1.3.6 Consultation

- Consultation processes were of good quality.

1.4 Project Implementation

The review shall address the following:

1.4.1 Project Management

- Project management was in line with the existing NTA guidance,
- Monitoring reports were timely and of good quality,
- The project remained within budget,
- The project met target costs,
- The project met the target schedule, and
- The project design requirements were fully met.

1.4.2 Project Scope, Value and Risk Management

- Active management of scope changes was undertaken,
- Risk management was actively pursued throughout the planning and implementation phases, and
- Opportunities for value management were identified and actively pursued.

1.4.3 Form of Contract

- Contract obligations were met, and
- Any contractual claims made.

1.5 Project Operational Performance

This section of the review shall consider:

1.5.1 Operational Performance

- The project objectives were met,
- Tram usage and frequency is in line with predictions,
- Any departure of tram frequency / passenger numbers from those predicted has implications for the predicted economic return to the project,
- Post opening traffic volumes / queuing are in line with those predicted and used in the project appraisal,
- Any departure of traffic volumes from those predicted has implications for the predicted economic return to the project,
- There are any problems with traffic operation on the road,
- There are any road safety problems emerging,
- The Active Travel usage,
- The Park & Ride usage is in line with those predicted, and
- There are any further actions necessary to secure the anticipated benefits of the project.

1.6 Close Out Cost Benefit Analysis

A Cost Benefit Analysis (CBA) shall be undertaken as part of the review. The closeout CBA shall concentrate on establishing whether the basis on which the costs and benefits attributed towards the scheme at the pre-tender stage was correct. The final outturn scheme costs must be established prior to undertaken this closeout CBA.

A comparison should be undertaken with Phase 3 Design and Environmental Evaluation CBA outputs (pre-Tender). The comparison should look at the overall economic indicators including Present Value of Benefits (PVB), Present Value of Costs (PVC), Net Present Value (NPV), and Benefit to Cost Ratio (BCR). A summary table shall be produced showing the values, at constant prices, for these indicators at each phase.

Appendix | G

Transport and Accessibility Appraisal

Luas Finglas Preliminary Design & Statutory Process



Transport and Accessibility Appraisal

16/07/2024



Document Control Sheet

Client:	Transport Infrastructure Ireland
Project Title:	Luas Finglas Preliminary Design & Statutory Process
Document Title:	Transport and Accessibility Appraisal
File Name:	240716 Appendix G Transport and Accessibility Appraisal

Table of Contents <i>(incl. Y/N)</i>	List of Tables <i>(incl. Y/N)</i>	List of Figures <i>(incl. Y/N)</i>	Pages of Text <i>(No.)</i>	Appendices <i>(No.)</i>
Y	N	N	14	0

Document Revision				Document Verification			
Issue Date <i>(DD/MM/YY)</i>	Revision Code	Suitability Code	Author <i>(Initials)</i>	Checker <i>(Initials)</i>	Reviewer <i>As Per PMP</i> <i>(Initials)</i>	Approver <i>As Per PMP</i> <i>(Initials)</i>	Peer Review <i>(Initials or N/A)</i>
16/07/2024	P01	S3	DB	SC	SC	ED	N/A

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SECTION 1: ACCESSIBILITY

Criteria	Sub-Criteria	Indicator to be measured	Impact included in TAA	Text Description of Impact	Indicator Score	Sub-Criteria Score	Criteria Score
Accessibility	Access to Services	Urban Centres	Yes	<p>Luas Finglas will operate a tram in each direction every 7.5 minutes during peak times with an approximate journey time of 30 minutes from Charlestown to Trinity College. It is envisaged that this will increase to a tram every 5 minutes by 2050. It will significantly reduce public transport journey times between the Finglas area and the city centre by an average of 12% during the AM peak hour. When compared to travel via private car, the delivery of Luas Finglas will lead to an average reduction in journey times to the city centre of 15 minutes (over 30%) during the congested peak periods. As an example, journey time by Luas Finglas from Charlestown to the city centre is expected to be around 30 minutes in the AM peak, whilst the equivalent trip by car in the opening year is estimated to take approx. 47 minutes.</p> <p>The delivery of Luas Finglas will help unlock potential capacity for people movements to and from the north-west corridor. Modelling analysis indicates that in the opening year 2035, Luas Finglas will lead to a 50% increase in transport capacity utilisation for trips travelling south towards the city centre in the AM peak. With the delivery of Luas Finglas, an additional 2,655 person trips are expected to cross the Royal Canal in the AM peak in 2035.</p> <p>Luas Finglas will create a largely off-road, protected rail-based corridor from the M50 to O'Connell Street that can deliver more reliable journey times. It is estimated that the delivery of Luas Finglas will lead to an effective saving in journey time variability of over 4 minutes in the AM and PM peaks, over and above the average journey time differential noted above. Knowing exactly how long a journey will take provides a greater level of confidence and assurance to passengers and allows them to plan their time more efficiently.</p> <p>Through the substantial increase in public transport capacity and improvements to journey times and reliability due to the delivery of Luas Finglas, the scheme will have a 'High Positive' impact on access to urban centres both along the alignment (such as Charlestown and Finglas Village) and also to Dublin city centre and beyond.</p>	High Positive	High Positive	High Positive

		Schools and educational institutions	Yes	<p>The Luas Finglas scheme includes active travel facilities along the corridor consisting of approximately 1.2km of segregated (off-road) two-way cycle track and approximately 1.8km of segregated and protected one-way cycle track on street. The proposed walk and cycle infrastructure will link a number of residential areas and local schools along the route encouraging sustainable travel, in particular for vulnerable road users and unconfident cyclists. There are 11 primary and 3 secondary schools within approximately 1km of the Luas Finglas alignment. In total about 3,000 primary school children and 1,500 secondary school pupils attend these schools. Luas Finglas will also extend direct high-capacity public transport connectivity to two of the largest 3rd level institutions in Ireland, namely Grangegorman TU Dublin and Trinity College Dublin.</p> <p>Overall, Luas Finglas will have a 'High Positive' impact on access to schools providing improved, safe and sustainable connections between schools and residential areas along the alignment. It will also provide increased wider accessibility to education within the city for residents in the Finglas corridor.</p>	High Positive		
		Hospitals and healthcare facilities	Yes	<p>The delivery of Luas Finglas will provide improved accessibility to Dublin city centre reducing journey times to the Rotunda Hospital along with a wide range of pharmacies, GPs, opticians and other healthcare facilities. Through an integrated public transport network, Luas Finglas will support accessibility to other major healthcare destinations beyond the direct catchment of the extension. For example, St James' Hospital and the new National Children's Hospital will be accessible via Luas Finglas and a single transfer to the Red Luas Line. St Vincent's Hospital can be accessed via interchange with the future DART at Broombridge or bus connections via transfer in the city centre. As a result, Luas Finglas will have a 'Slight Positive' impact on access to hospitals and healthcare facilities.</p>	Slight Positive		

		Major land transport hubs and interchange facilities such as rail and bus stations	Yes	<p>The provision of a 350-space Park & Ride site located just off the M50 at St Margaret's Road significantly extends the catchment area of Luas Finglas, connecting the N2/ M50 to the city centre and the entire Luas network. Integrating Luas Finglas with the road network at this location supports the reduction of vehicular traffic closer to the city centre, providing a viable public transport alternative for people living further away outside the M50. Modelling analysis indicates that during the AM peak hour in 2035, people using the Park & Ride and Luas Finglas will save 8.7 minutes on average when compared to completing their journey by car. This is also likely to be a conservative estimate, as it does not include the time taken searching for a parking space in the city centre when travelling by car. The journey time benefits provided by the Park & Ride will encourage its usage, thus increasing sustainable trips to the city centre and beyond.</p> <p>The integration of Luas Finglas into the city's public transport network offers new opportunities to make multi-leg journeys. It complements the existing transport interchange hub at Broombridge station, along with the delivery of other schemes in the area such as the roll-out of the BusConnects network and infrastructure, and the DART+ West Rail upgrades, to create an integrated public transport offering. The delivery of walking and cycling infrastructure, along with cycle parking at the new stations also supports the integration between active modes and public transport use.</p> <p>Modelling analysis indicates there will be 1,024 public transport interchanges in the AM peak hour within the north-west of the city during the opening year of Luas Finglas (2035). This is well over twice as many that would occur without the delivery of the scheme. This high number of public transport interchanges illustrates the integration of Luas Finglas with the wider network.</p> <p>Luas Finglas has been planned with an outlook on the future, and will have a 'High Positive' impact on accessibility and interchange given its connectivity with existing and planned public transport services in the area along with the provision of the Park & Ride site significantly extending the catchment area of the scheme.</p>	High Positive		
		Access to Recreational Facilities	Parks and playgrounds	Yes	<p>There are a number of parks and sports facilities connected by the Luas alignment and associated improved pedestrian and cycle facilities including Erins Isle GAA Club, Tolka Valley Park and playground, Farnham pitches, Finglas Community Centre and Mellows Park. The new active travel facilities delivered as part of Luas Finglas will also provide a connection to the Royal Canal Way which offers a mainly off-road link towards Dublin city and is also a great local amenity for recreational trips along with the Tolka Valley Greenway.</p>	Positive	Positive
			Sports clubs and facilities	Yes		Positive	

				The delivery of Luas Finglas and associated active travel infrastructure will also help open up and develop existing green space along the corridor. For example, the area south of the St Helena's stop is currently unmaintained grasslands, however, a strong pedestrian desire line is evident from the worn path through the area. Luas Finglas will deliver new accessible footpaths and a separate parallel cycleway opening up this greenspace for local residents and providing a connection to Tolka Valley Park. As such, Luas Finglas will have a 'Positive' impact on access to parks, playgrounds, sports clubs and other recreational facilities.			
	Access to jobs	Access to jobs	Yes	<p>Luas Finglas will benefit those living or working close to a stop, in addition to those travelling from further afield and accessing the line via bus or by car when they make use of the Park & Ride at St Margaret's Road. This enhanced mobility for people in Finglas, the rest of Dublin, and beyond, generates economic benefits by reducing barriers to travel and widening the catchment areas for access to jobs and services. Modelling analysis indicates a 13% increase in people commuting to work on public transport within the Luas Finglas catchment as a result of the scheme. This highlights the increased access to employment delivered by Luas Finglas.</p> <p>As outlined for 'Urban Centres' above, Luas Finglas will significantly reduce travel times to the city and improve reliability of service, thus making more jobs more accessible by public transport for residents within the northwest corridor. Therefore, Luas Finglas will have a 'High Positive' impact on improving access to jobs.</p>	High Positive	High Positive	
	Access to International Transport Gateways	Change in PT access	No	This indicator will not be scored as there is no direct impact on PT access to International Transport Gateways.	N/A	N/A	
		Change in HGV/LGV access	No	This indicator will not be scored as there is no impact on HGV/LGV.	N/A		
	Freight Access	Freight Facilities change	No	This indicator will not be scored as there is no impact on freight facilities.	N/A	N/A	
		LGV access to urban centres	No	This indicator will not be scored as there is no impact on LGV access to urban centres.	N/A		

SECTION 2: SOCIAL IMPACTS

Criteria	Sub-Criteria	Indicator to be measured	Impact included in TAA	Text Description of Impact	Indicator Score	Sub-Criteria Score	Criteria Score
Social Impacts	Impact on deprived groups	Access to urban centres	Yes	<p>Parts of Finglas are classified as disadvantaged by the Pobal HP deprivation index with approximately 10,200 people, equating to over one in five, currently living in deprived and disadvantaged areas within the catchment of Luas Finglas. Light rail is a proven driver of economic and social regeneration in previously under-served communities. The improved connectivity offered by the extension will widen employment opportunities and improve access to education and health facilities, leading to improved economic, health and social outcomes, reducing social exclusion and supporting improvement in the levels of affluence for residents in the area.</p> <p>Analysis of census data indicates that around one third of households within the Finglas area do not have access to a private car. The fast, frequent and reliable service delivered by Luas Finglas provides a viable alternative for residents who currently do not own a car, or cannot afford to due to increased operating and maintenance costs associated with car ownership.</p> <p>As such, Luas Finglas will have a 'High Positive' impact on accessibility for deprived groups.</p>	High Positive	High Positive	Positive
		Access to schools	Yes		High Positive		
		Access to healthcare facilities	Yes		High Positive		
	Transport users with different mobility needs	Scheme facilities	Yes		<p>With a strong emphasis on legible and physical accessibility to stops and level boarding to the Luas vehicles, Luas Finglas will have a 'Positive' impact on accessibility for all users, including those with mobility, visual, hearing and sensory impairments. The segregated off-road cycle infrastructure will be of benefit to cyclists with different mobility needs (e.g. young cyclists).</p>		

	Gender Impacts	Scheme facilities	Yes	<p>Luas Finglas will have a 'Slight Positive' gender impact. The delivery of segregated cycle infrastructure along the route will improve safety for cyclists. Research such as TII's "<i>Travelling in a Woman's Shoes</i>" has highlighted the fact that the lack of safe infrastructure can be a real barrier to cycling for women. The public realm enhancements delivered by Luas Finglas will also improve interchange quality, safety, lighting and stations' environment.</p> <p>Barry Transportation EGIS have undertaken a Public Life Assessment (March 2022 and January 2023) for the open spaces in the vicinity of the proposed route to measure certain aspects of public life to better understand what's already happening in existing spaces and what changes might provide public benefits.</p> <p>The aim of the Public Life surveys is to capture pedestrian, age, gender, and stationary activities for the existing public spaces and to get a better sense of who is using the existing open space around the proposed Luas Finglas scheme and opportunities for the project to improve the public spaces from a protection, comfort and enjoyment point of view.</p> <p>Following the findings of the surveys, (ie. green parks dominated by young males presence), the design has been carefully deliberated to provide equal equity to all cohorts in the community. For example, the pedestrian bridge at Finglas Bypass road is a barrier to female cyclists and the elderly who expressed to the project team that it was difficult to cross, so it has been removed and this junction has been reconfigured for crossing. The paths were also widened for slower walkers (elderly and women with children).</p> <p>At the Farnham pitches, a social pavillion for girls (as male dominated sports teams were a barrier for girls to use this space) is provided along with benches for older spectators.</p>	Slight Positive	Slight Positive	
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SECTION 3: LAND USE IMPACTS

Criteria	Sub-Criteria	Indicator to be measured	Impact included in TAA	Text Description of Impact	Indicator Score	Sub-Criteria Score	Criteria Score
Land Use Impact	Public Realm	Scheme details	Yes	<p>The Luas Finglas design incorporates a number of public realm enhancements along the alignment including those described below.</p> <p>Luas Finglas will in part be operated on grass track that, along with proposed tree planting, will integrate the scheme with the surrounding areas and improve the resulting visual impact.</p> <p>As part of the scheme design, Broombridge Road, will have extensive landscape changes including increases in tree planting along with widening of footpaths and segregated cycle facilities. This will help transform Broombridge Road into a more attractive environment to encourage walking and cycling connecting to the existing Royal Canal Greenway and Luas station.</p> <p>The new Luas Stations at St. Helena's, Finglas Village, St. Margaret's Road and Charlestown have been designed to provide an improved public realm and facilitate interchange with bus services.</p> <p>The stop at Finglas Village is on the northern side of Mellowes Road and is incorporated into a new civic plaza which will improve public realm and enhance access to the nearby community facilities.</p> <p>The stop at St Margaret's Road will be incorporated into a new public plaza with pedestrian connections to the 350-space multi-storey Park & Ride facility, built as part of the scheme. Increased landscape areas, footpath upgrades and segregated cycle facilities will be provided along St Margaret's Road.</p> <p>At the Charlestown terminus, works include a major reconfiguration to the Charlestown Place / Melville Road junction to provide better pedestrian and cycling infrastructure. This will provide a safer connection from Luas to the Charlestown Shopping Centre and residential areas.</p> <p>Overall, Luas Finglas will have a 'Positive' impact on public realm along the corridor raising the attractiveness of the local area and boosting civic pride.</p>	Positive	Positive	High Positive

	Connectivity with existing public transport facilities	Scheme details	Yes	<p>As an extension to the Luas network, Luas Finglas services will, to a significant extent, utilise existing infrastructure. Together with the current Luas infrastructure between Broombridge and the City Centre, Luas Finglas will operate within a 7.5km corridor between Charlestown and the City Centre that is largely segregated from traffic. Luas Finglas will result in more balanced passenger flows on the Green Luas Line north and south of the City Centre increasing the utilisation of available capacity on the network and leading to greater efficiency and productivity. As Luas Finglas is an extension of the existing Luas Green Line, it offers many more integration opportunities further south such as the Luas Red Line and city centre bus and rail services.</p> <p>Luas Finglas will also connect into the existing rail and Luas station at Broombridge. A new footbridge is proposed as part of the Luas Finglas scheme connecting directly to the platforms at Broombridge. This will integrate with future upgrades to the rail network including DART+ West.</p> <p>As such, Luas Finglas will make best use of existing infrastructure and will have a 'High Positive' impact in terms of connectivity with existing public transport facilities.</p>	High Positive	High Positive
	Connection to zoned lands as part of national and regional planning.	Scheme details	Yes	<p>Through the substantial increase in public transport capacity and improvements to journey times and reliability, Luas Finglas will have a significant economic impact, improving the attractiveness of the area it serves supporting the delivery of regeneration and development investment, and providing capacity to enable medium and long-term compact and sustainable growth.</p> <p>Luas Finglas will pass close to a number of significant development areas, including:</p> <ul style="list-style-type: none"> - 101 residential units in and around Charlestown - 69 residential units on Cappagh Road - the recently delivered 92 residential units in Hampton Wood - 70 residential units in Scribblestown - 46 residential units in Royal Canal Park <p>In addition, a 52 hectare site has been identified for redevelopment as part of the Jamestown Strategic Development and Regeneration Area with planning for 3,500 – 3,800 new homes. Further work is also ongoing for the redevelopment of the Dublin Industrial Estate lands with a Local Area Plan being developed to enable the compact and sustainable mixed-use regeneration and redevelopment of the area. It is expected that 73% of the forecasted population growth in Finglas will be within a 10-minute walk of a Luas stop. 55% will be within a short 5-minute walk. Luas Finglas will bring high-quality public transport mobility to more people and, in doing so,</p>	High Positive	High Positive

				support the sustainable growth of the city. Therefore, Luas Finglas will have a 'High Positive' impact in-terms of supporting integration between transport and land-use and providing sustainable connections to zoned lands.			
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SECTION 4: SAFETY IMPACTS

Criteria	Sub-Criteria	Indicator to be measured	Impact included in TAA	Text Description of Impact	Indicator Score	Sub-Criteria Score	Criteria Score
Safety Impact	Safety Impact	Safety assessment	Yes	<p>Light rail is an attractive form of travel and will reduce the number of private cars on the road network as motorists opt for the convenient, fast journeys Luas offers. For pedestrians and cyclists, the provision of new complementary infrastructure will allow these active journeys to be made away from busy roads resulting in a reduced chance of collision with motorised vehicles. The cycle and pedestrian components of the scheme are designed with everyone in mind, adopting principles of universal design to achieve the highest possible levels of accessibility for all and to mitigate any exposure to safety risks associated with Luas Finglas.</p> <p>In terms of improving highway safety, transport modelling using the NTA's ERM and COBALT (Cost and Benefit to Accidents – Light Touch) analysis tool has shown that, over the appraisal period, the scheme is forecast to deliver €547,000 of road safety benefits due to a reduction in the number and the severity of collisions. This is in part derived from the reduction in traffic volumes driven by modal shift from car to Luas leading to fewer collisions on the network. Whilst collisions are expected to reduce overall, it is acknowledged that the delivery of Luas Finglas may lead to more Luas based accidents particularly at junctions where the scheme interacts with vehicular traffic. However, given the largely off-road alignment, it is expected that the risk of additional Luas-based accidents is low.</p> <p>The scheme also delivers safety benefits for cyclists and pedestrians, with the dedicated infrastructure running parallel to Luas Finglas providing an active travel environment mostly away from motorised vehicles and, therefore, greatly reducing the likelihood of a collision. Active design measures will mitigate safety risks where pedestrians and cyclists interact with Luas, including at stops and in crossing the Luas route. The delivery of the active travel elements of the scheme will provide €5.4m in benefits over the 30-year appraisal period due to the improved quality and safety of the walking and cycling infrastructure. Overall, Luas Finglas will have a 'Slight Positive' safety impact.</p>	Slight Positive	Slight Positive	Slight Positive

SECTION 5: CLIMATE CHANGE

Criteria	Sub-Criteria	Indicator to be measured	Impact included in TAA	Text Description of Impact	Indicator Score	Sub-Criteria Score	Criteria Score
Climate Change	Climate Mitigation	Percentage change in mode share from private vehicles to public transport and active travel modes.	Yes	<p>Luas Finglas will provide a fast, reliable public transport alternative which will shift people onto sustainable modes. In its opening year (2035), it is estimated that Luas Finglas will contribute to an annual increase of around 3.7 million public transport boardings within its 1km catchment area. This is an increase of 46% when compared to a scenario without the delivery of Luas Finglas. Whilst some of these boardings will be interchanges from existing bus services, the Luas will support significantly higher levels of demand for public transport.</p> <p>It is estimated that Luas Finglas will lead to an overall decrease in car mode share of around 1% for the north-west of the city in its opening year. In percentage terms this might seem modest. In actual trip numbers it represents a significant increase in sustainable travel. In the opening year 2035, Luas Finglas will deliver an increase of 1.3 million low carbon public transport trips per annum. This increases to 1.8 million additional public transport trips in the design year 2050 due to underlying development growth and modal shift from car. Luas Finglas is estimated to lead to an annual reduction in around 440,000 vehicle trips on the road network along the corridor in the opening year 2035.</p>	Positive	Slight Positive	Slight Positive
		Percentage change in private car kilometres travelled.	Yes	<p>Luas Finglas includes the provision of pedestrian and cycling paths running parallel to the Luas line. These will be almost entirely separated from vehicular traffic and as such will provide a pleasant environment to walk and cycle. This will also raise the attractiveness of the local area and boost civic pride. Each Luas stop will include cycle parking facilities, making it even easier to undertake multimodal trips (i.e. Cycle+Ride) and support sustainable travel choices.</p> <p>Therefore, it is envisaged that Luas Finglas will have a 'Positive' impact on mode share, supporting an increase in walking, cycling and public transport and a decrease in private vehicle usage.</p> <p>The modelling analysis indicates a reduction in private car vehicle kilometres travelled along the corridor of approximately 0.4% as a result of Luas Finglas. As such, this has been scored as a 'Slight Positive' in-line with the TAA Climate Mitigation threshold guidance.</p>	Slight Positive		

		Percentage change in CO2 emissions	Yes	<p>Emissions analysis undertaken using ENEVAL indicate that in the opening year 2035, the delivery of Luas Finglas will lead to reductions in NO2, particulate matter (PM10 and PM2.5), CO2, and other emissions that harm the natural environment and human health. In total, it is estimated that Luas Finglas will deliver reductions in carbon emissions from transport of approximately 300 tonnes per annum (0.04% reduction in carbon emissions). Luas Finglas also provides significant environmental resilience on the network, removing a number of car-based trips and freeing up road space for buses and active travel modes along the Finglas corridor. One tram can carry the same number of passengers as around 370 cars with lower carbon emission and energy consumption per person. This aligns with the Climate Action Plan 2024, which aims to achieve a 51% reduction in greenhouse gas emissions by 2030, setting us on a path to reach net zero emissions by 2050.</p> <p>Whilst the impact of the proposed scheme on CO2 emissions is positive, the percentage change falls within the 'Neutral' score range as outlined in the Climate Mitigation Scorecard contained within the TAA guidance, and has been scored accordingly.</p>	Neutral		
	Climate Adaptation	Climate hazard assessment	Yes	<p>Reference to https://www.floodinfo.ie/map/floodmaps indicates that the area along the proposed Scheme is potentially prone to flooding from the Tolka River in the Tolka Valley Park. The proposed Scheme will cross the Tolka River approximately 50m north of Ballyboggan Road in the Tolka Valley Park. Good design will ensure that the potential for fluvial flooding and/or pluvial flooding due to occurrences of heavy rainfall will be minimised to a very low potential of occurrence.</p>	Neutral	Neutral	

SECTION 6: CLIMATE CHANGE

Criteria	Sub-Criteria	Indicator to be measured	Impact included in TAA	Text Description of Impact	Indicator Score	Sub-Criteria Score	Criteria Score
Local Environmental Impact	Air Quality	Air Quality Impact based on total score from Air Quality Scorecard Tab	Yes	In terms of background air quality, all monitored results are identified as being of a 'good' category. The air quality assessment undertaken as part of the Environmental Impact Assessment Report (EIAR) for the Luas Finglas scheme shows a negligible impact from the 'Do Something' scenario (i.e. with scheme), and as such, this is judged as neutral.	Neutral	Neutral	Neutral
	Noise and Vibration	Scheme details	Yes	A detailed noise impact assessment has been carried out as part of the EIAR for the Luas Finglas scheme. The assessment indicates that with mitigation Light Rail noise impacts are reduced to negative, slight and long term at all residential locations when assessed over the full day and night periods as well as during peak hour periods. A negative, slight to moderate but not significant and long-term impact is calculated at other non-residential locations adjacent to the proposed Scheme alignment, however, no mitigation is required as there are no significant impacts at these locations.	Slight Negative	Slight Negative	
	Biodiversity	Scheme details	Yes	A thorough biodiversity impact assessment has been conducted as part of the EIAR. The potential operational impacts anticipated from the proposed Scheme on the existing biodiversity / ecological features are mainly focused around the disturbance and potential displacement and injury of protected faunal species, e.g., bird species such as Light-Bellied Brent Goose and Mute Swan, as well as mammals such as Otter and local Bat species. While impacts such as temporary habitat loss and fragmentation are unavoidable due to the physical footprint of the proposed Scheme, the remainder of the potential impacts will be mitigated for through a series of highly detailed measures, which include but are not limited to surface water, groundwater, dust and invasive species management plans. When combined with the proposed landscape plan for the Scheme these mitigations will ensure that temporarily / short-term impacted ecological features will return to their original condition or an enhanced condition in some cases. Once the ecological lag of the newly landscaped features has passed and the habitats matured, with them offering a full range of ecosystem services for local fauna, the proposed Scheme will have resulted in a 'Slight Positive' impact on biodiversity present within and adjacent to the site.	Slight Positive	Slight Positive	

	Water Resources	Scheme details	Yes	A detailed water assessment has been carried out as part of the EIAR, as well as a hydrogeological assessment. No significant effects have been identified with the mitigation measures proposed. In some cases, the impacts are positive due to the amount of newly introduced SuDS and attenuation features along the scheme.	Neutral	Neutral	
	Landscape and Visual Quality	Scheme details	Yes	A detailed LVIA has been carried out as part of the EIAR. The key impacts are likely to be at Royal Canal, Tolka Valley Park and residential areas such as Raven's Court, Casement Road, Mckee Ave and St Margaret's Road with the proximity of new infrastructure to sensitive receptors. Significant improvements are also planned for Broombridge Road, St Helena's, Finglas Road, Charlestown / St Margaret's Road. However, there will be an overall slight residual negative impact, when considered in the round with some moderate, negative impacts in some specific locations.	Slight Negative	Slight Negative	

