



Project Ireland 2040  
Building Ireland's Future

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# LUAS LUCAN FEASIBILITY STUDY

AUGUST 2021



## Quality information

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## 1. Executive Summary

### Introduction

Luas Lucan consists of an extension of approximately 14-17km to the existing red line between the west city centre and the wider Lucan area. Luas Lucan has the potential to play a key role in transforming the public transport offer in the west city and wider Lucan areas. It represents a significant investment and expansion of the Luas network to provide access to high density residential areas, key employment hubs and areas designated for future expansion. It will enable direct travel to many city centre locations without interchange, while other key destinations will be served with one interchange, including Ballymount, Tallaght and wider city suburbs allowing 75% of resident's work destinations to be accessed within 1km of the Luas network.

It will build on the success of the Luas network, improve the attractiveness of light rail, support compact urban growth, encourage and enable modal shift to public transport, and reduce congestion and emissions.

In the context of the State's climate action plans, investment in transport infrastructure is vital. Luas Lucan will be essential to the reduction in transport emissions through the expansion of the zero 'tailpipe' emissions tram fleet and through the reduction emissions from road congestion by encouraging and enabling people to choose public transport.

### Purpose of this Report

This report sets out the findings of a feasibility study of Luas Lucan. The purpose of this feasibility study is to assess the feasibility of a Luas line extension between the west city centre and the wider Lucan area ('Luas Lucan') in the context of the current and planned transport network in the area. The purpose of the study is to investigate the viability of delivering Luas Lucan with particular reference to the strategic and economic need for the scheme, its retention in the updated Greater Dublin Area (GDA) Transport Strategy (expected end Q3 2021) and subsequently its progression to the route selection stage.

### Alignment with Policy

The assessment of Luas Lucan follows several previous studies and inclusion in strategic documents over a long period including:

- 'Line F' EPF (2008-line assessment)
- Inclusion in Transport 21 (capital investment programme)
- Western Corridor Study (informing the GDA Transport Strategy)
- Inclusion in the GDA Transport Strategy (2016-2035)
- 2017 Luas Line F (Outline assessment)

There is a strong strategic policy fit between Luas Lucan and European, national, regional and local policy objectives, relating to sustainable mobility, emissions reductions, compact land use development, and consolidation of population and employment growth along high-frequency transport corridors. Luas Lucan aligns with the following policies:

- Project Ireland 2040: National Planning Framework
- Project Ireland 2040 National Development Plan (NDP)
- Climate Action and Low Carbon Development (Amendment) Act 2021
- Draft Sustainable Mobility Policy
- Draft Future Land Transport Investment Framework (FLTIF) (2021)
- Five Cities Demand Management Study (2021)
- Regional Spatial and Economic Strategy for the Eastern and Midland Region (EMRA RSES) 2019-2031
- Transport Strategy for the Greater Dublin Area (GDA) 2016-2035
- NTA Integrated Implementation Plan 2019-2024

### Costs

AECOM undertook an independent feasibility costing exercise using various datasets, particulars and outline route corridors. This exercise arrived at a cost for each of the high-level corridor options and derived an overall cost range for the project. Across

the three plausible route corridor options, the forecast cost for Luas Lucan will be in the region of €0.9 billion to €1.6 billion, in 2021 prices. In addition, the annual O&M cost range for Luas Lucan is forecast as €18-25 million. In-line with national guidance, this range will be discounted and assessed in 2011 prices as part of any future economic appraisal.

## Benefits

This feasibility study used a range of three potential route corridors for the basis of the feasibility assessment. The assessment has been undertaken with the notable backdrop of several major projects being maintained as programmed, BusConnects Dublin, DART+ and Metrolink. This feasibility study does not therefore seek to undermine these projects but does recognise that optimisation will be needed to deliver a high-quality public transport services without an over-provision in specific areas.

Some key outcomes from the analysis are outlined below:

- Luas Lucan is being proposed at a vital time for population growth in Ireland. Project Ireland 2040 requires that much of the imminent growth of the population be accommodated in existing urban centres.
  - The area served by Luas Lucan is forecast to experience a 20%+ growth in population over the coming 20 years, 15%+ growth in jobs and an even greater (45%+) increase in the numbers living in the area who are employed.
  - The analysis of job destinations also points to around 75% of jobs being accessible with 1 km of the Luas network which could be increased further as part of the route corridor options assessment.

It is clear that Luas Lucan is planned to serve an area of significant recent and future planned growth.

- A screenline assessment suggests that by 2043 up to 10,000 AM trips will seek to travel eastbound towards the city centre from western suburbs on either public or private transport, and around 130,000 two-way movements across a 12-hr period by 2043. Of these ~35% are projected to use public transport but wider demand management and climate action policies, improvements to the public transport network and changing perceptions around sustainability and carbon footprint will likely push this demand for PT higher.
- In terms of modal shift – Currently 74% of people in the study area west of the M50 use car as their mode of travel to work which is very high for Dublin – modelling suggests that upon opening of Luas Lucan in circa 2031 there is the potential for ~4,000 new public transport trips from local zones on a daily basis equivalent to ~1.2 million trips per annum<sup>1</sup>.
- Line loadings, extracted from the ERM, indicated reasonable demand for Luas Lucan with AM Peak line loadings of up to 3,000 passengers by 2050. The findings also acknowledged that there is scope for route optimisation to reduce the competition between BusConnects (CBCs 6 and 7, notably) and Luas Lucan. A two-way AM line loading of up to 5,000 may therefore be reasonably achievable in the longer-term following optimisation of the alignment during the route selection process. These flows therefore maintain Luas as a viable, highly sustainable public transport option.
- Significant non-monetised benefits are expected in relation to positive network effects and high level of interchange, links to many schools, education institutes and healthcare facilities, improved recreation and leisure access and wider regional and national transport links.

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<sup>1</sup> Approximately bounded by the M4 to the north, Grand Canal to the south, Dodsborough Road / Adamstown Boulevard to the west and Kylesmore Road to the east

- In 2017, the transport sector accounted for approximately 20% of Ireland's greenhouse gas emissions. Within this, travel by car was responsible for 51.9% of all transport emissions, however, for the same period public transport accounted for just 4.4% of emissions. Modal shift from car to public transport will therefore play a key role in achieving emissions targets. Luas Lucan has the potential to increase PT modeshares in the area by 8%+ and will play an important role in this modal shift onto public transport.
- The outline economic assessment suggests that Luas Lucan has the potential to return a positive economic appraisal and that Luas Lucan be maintained as a viable transport project as part of the wider GDA transport network, and that further optioneering and analyses be conducted.
- Future economic appraisal will fully capture all benefits including journey time reliability, agglomeration, carbon and active travel time, health and quality benefits as appropriate,
- It is recognised that given the scale of investment and the potential for BusConnects to serve short to medium term demands in some areas there may be potential to deliver Luas Lucan in phases in line with demand. It is therefore advisable that Luas Lucan progress to a point west of the M50 as a minimum, where the greatest demand exists. This mirrors outcomes of the policy review which discusses the provision of Luas Lucan to the Liffey Valley Shopping Centre as a minimum extent.

## Summary

The outcome of the analyses is that whilst Luas Lucan attracts good passenger demand, a later optimisation exercise is necessary to ensure the overall public transport offer in the area best serves users. It is also reasoned that alternatives such as a shorter line (for example, to Liffey Valley Shopping Centre) may also be valid either as phases or long term with supporting 'feeder' services and links.

This feasibility study therefore points to the ongoing inclusion of Luas Lucan in the forthcoming GDA Transport Strategy, with an acknowledged need for more detailed analysis, optioneering and route assessment.

## 2. Introduction

### 2.1 Overview

AECOM have been commissioned by Transport Infrastructure Ireland (TII) to assess the feasibility of a Luas line extension between the west city centre and the wider Lucan area ('Luas Lucan') in the context of the current and planned transport network in the area. The purpose of the study is to investigate the viability of delivering Luas Lucan with particular reference to the strategic and economic need for the scheme, its retention in the updated Greater Dublin Area (GDA) Transport Strategy (expected end Q3 2021) and subsequently its progression to the route selection stage. To inform this recommendation the report will provide commentary on the potential impacts and benefits from several high-level scenarios and route corridors.

### 2.2 Background

Since the delivery of the first Luas line in 2004 demand for Luas has grown steadily and has experienced strong growth when compared to other modes, albeit attracting lower volumes than heavy rail or bus reflective of the scale of the respective transport networks.

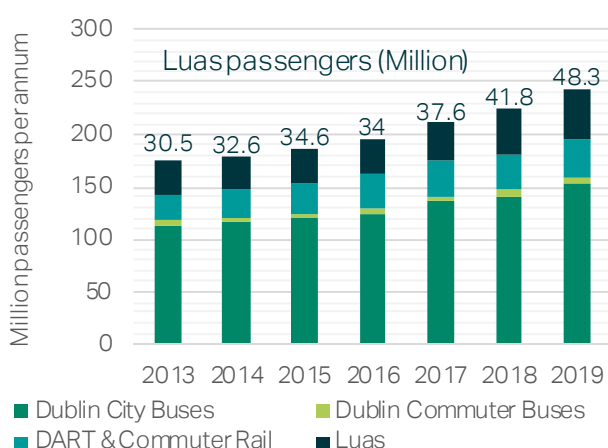


Figure 1.1 – Annual Passengers by mode in Dublin Region (Source: NTA)

The continuation of this success requires ongoing investment in the form of maintenance, renewals, enhancements to existing infrastructure and **expansion**. This investment is supported by national, regional and local policy.

Luas Lucan represents a key element of the expansion plans for the Luas network. It has been considered and developed over a long period. The selection of an emerging preferred route (EPR) for Luas Line F (as it was previously known) was first made in 2008, following consideration by the Railway Procurement Agency (RPA)<sup>2</sup>. The line was included in Transport 21, a capital investment programme for improved national transport, however, intervening events have delayed its progress.

The changing economic landscape experienced since 2008, notably a global economic downturn from 2008 onward and more recently the 2020 Covid-19 pandemic are significant events that have delayed the project. Furthermore, a number of studies, including this one, has sought to re-assess the need for the scheme at particular periods of its lifecycle.

In 2017, Luas Lucan ('Luas Line F') was the subject of an additional study which sought to address the question of whether a strategic need still existed. That study showed strong continued alignment of the scheme with policy and applicable strategies. It suggested the need for further optimisation to allow for development in the intervening period since 2009. This study, combined with the outcome of the NTA's Western Corridor Study which also supported Luas Lucan, resulted in Luas Lucan being included within the Transport Strategy for the Greater Dublin Area 2016-2035 ('GDA Transport Strategy'). Subsequently the need for Luas Lucan has been set out in the Project Ireland 2040: National Planning Framework and the associated National Development Plan 2018 - 2027.

This 2021 feasibility study analyses in greater detail the ongoing need for the scheme, with particular reference to the imminent update of the GDA

<sup>2</sup> The RPA has since been merged with the National Roads Authority (NRA, forming TII)

Transport Strategy. In the interim period, a number of other large-scale, major transport schemes are progressing through planning and design, notably BusConnects Dublin, DART+ and MetroLink – Luas Lucan will be assessed against the backdrop of these schemes being delivered prior to its delivery. Other updates for 2021 include the reassessment of the catchment potential using the more recent 2016 census and updated applicable policies and strategies.

### 2.3 Objective of the Study

AECOM, in coordination with relevant TII departments and NTA stakeholders, will use an evidence-based methodology to assess the ongoing feasibility of Luas Lucan and its inclusion in the GDA Transport Strategy.

### 2.4 Methodology

This 2021 study of Luas Lucan is being progressed as a review of its strategic context, impact assessment, costing and high-level appraisal to establish the validity of retaining Luas Lucan as a proposed scheme in the GDA Strategy. The analysis steps are presented below.

- Policy and strategic context review (Section 3)
- Approach (Section 4)
- Modelling and technical assessment (Section 5)
- Cost estimation (Section 6)
- Benefits Assessment (Chapter 7)
- Wider benefits (Section 8)
- Environmental assessment (Chapter 9)

The analysis will be undertaken with the aid of the NTA's Eastern Regional Model (ERM), supported by an assessment of the likely catchment, user base, origin-destinations of travellers, compatibility with other existing transport options (notably the Luas Red Line) and expected major projects (BusConnects Dublin, DART+ and Metrolink, for example).

Initially, a literature review will be undertaken on currently published transport related documents, following an assessment on their potential impact to the scheme. This will include local area plans, Project

Ireland 2040 (with specific focus on Luas' contribution towards achieving several of the National Strategic Objectives), NTA's GDA Transport Strategy and issues raised for its current review, the DoT's forthcoming land transport investment framework – Future Land Transport Investment Framework (FLTIF), DoT's forthcoming Sustainable Mobility policy which will replace the Smarter Travel policy, the Programme for Government 2020, the Climate Action Act 2021 and other applicable policies.

An assessment of travel patterns and conditions along the corridor will follow, aiming to understand any possible changes anticipated into the future. The travel patterns of residents will be mapped to better understand key desire lines. Particular consideration will be given to modal choice and public transport user trips along the corridor.

Using the ERM, a series of route corridors will be tested, particularly for later years with suitable reference cases (modelling years are 2035 and 2050, though some 2043 scenarios will be used for screenline analysis for reasons described in the specific section's text).

At this point the following modelling scenarios are envisaged.

- 2035 DoMin
- 2050 DoMin
- 2035 DoSmth – Route corridors 1,2,3
- 2050 DoSmth – Route corridors 1,2,3

### 2.5 Assessed Corridors

An Emerging Preferred Route (EPR) was identified for Luas Lucan in 2008, however, a great deal of land use, planning and demographic changes have taken place since its development. This report seeks only to assess whether Luas Lucan remains a viable scheme but does not seek to identify a renewed EPR. It is, however, necessary to assess an indicative alignment or set of alignments between the Lucan and Adamstown suburbs and the city centre. For this feasibility assessment three preliminary route corridors referred hereafter as



Options 1,2 and 3. These options, particularly in the western segments, were heavily influenced by the 2008 EPR which was established prior to BusConnects and assumed DART Underground was not in place. These options are subject to future review but were deemed reasonable for use at this feasibility assessment stage. These options will be assessed, costed and evaluated, and ranges of indicators produced. Later stages of study may propose taking forward all, some or none of the line sections tested in this feasibility study.

The three routes have been developed from a high-level, desktop sifting analysis. The rationale for identifying three unique route corridor options is for the purpose of giving ranges of potential impacts and will maintain high-level variability of cost and demand (where demand itself is based on pop/jobs within line catchments). The development of the

three route corridors was not supported by an alignment design, only for the purpose of modelling demand and benefits.

Subsequent analysis and study of the line should also seek to ensure compatibility with relevant strategic objectives, transport policies and environmental considerations and mitigation. It is prudent that the optioneering process assesses different benefit profiles of Luas Lucan with different BusConnects scenarios. It should be noted however that the feasibility level of analysis does **not** seek to make changes to bus services element of the BusConnects programme although it is considered likely that optimisation may occur once both schemes are in place. An overview of the three route corridors tested are shown in Figure 2.1 for reference.

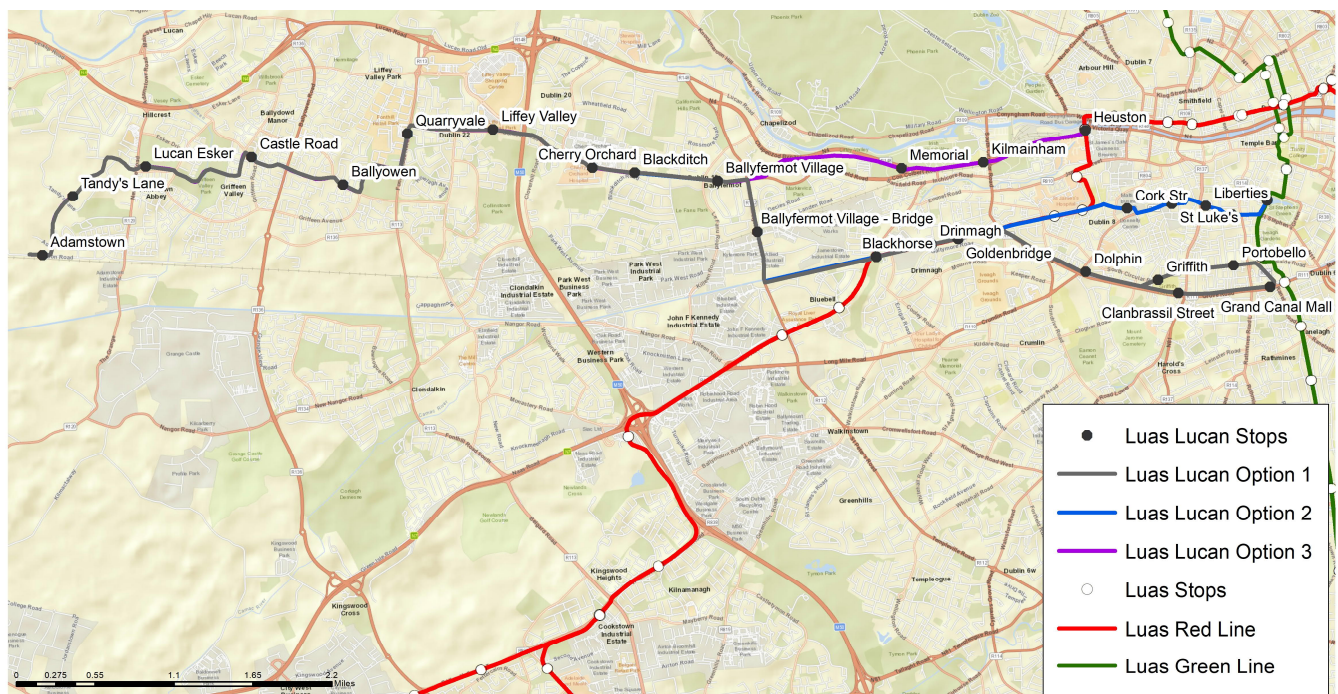


Figure 2.1 – Luas Lucan Feasibility Route Corridors

### 3. Policy

#### 3.1 Overview

A review of national, regional and county level policy was undertaken to establish the strategic context for the future development of the Luas Lucan line. Investment proposals related to the light rail network and associated time horizons where applicable were identified within each document. The review also documents the wider development context set out in policy documents focusing on how public transport investment generally, and specific light rail investments, can contribute to the achievement of shared goals and enable development. The review encompassed the following documents:

- Project Ireland 2040 National Planning Framework (NPF)
- Project Ireland 2040 National Development Plan (NDP)
- DoT's forthcoming land transport investment framework – Future Land Transport Investment Framework (FLTIF)
- Climate Action and Low Carbon Development (Amendment) Act 2021
- Regional Spatial and Economic Strategy for the Eastern and Midland Region (EMRA RSES) 2019–2031
- Transport Strategy for the Greater Dublin Area (GDA) 2016–2035
- NTA Integrated Implementation Plan 2019–2024
- Fingal County Council (FCC) Development Plan 2017–2023
- Dún Laoghaire Rathdown County Council (DLRCC) Development Plan 2016–2022
- Dublin City Council (DCC) Development Plan 2016–2022
- South Dublin County Council (SDCC) Development Plan 2016–2022
- Metrolink Preferred Route Design Development Report (March 2019)
- Luas Green Line - Peak hour capacity requirements south of Charlemont (TII, March 2019)

#### 3.2 Role of Luas in supporting policy

Investment in the public transport network through Luas is central to the delivery of public policy objectives at national, regional and local levels. The policy hierarchy and the relevant documents which reference, and support Luas are shown in Table 3.1.

Tier 1: National Planning	Tier 2: Regional Planning	Tier 3: Local Planning
Project Ireland 2040: NPF & NDP	RSEs	City & County Development Plans
Programme for Government Sustainable Mobility Policy (DoT)	Transport Strategy for the Greater Dublin Area 2016-2035	Local Area Plans
Draft 'FLTIF' Climate Action Act/ Plan 2021	Integrated Implementation Plans	Local Transport Plans

Table 3.1 - Policy Hierarchy

A brief overview of the key national policies focussing on elements relevant to the Luas system is provided below.

##### 3.2.1 Project Ireland 2040

Project Ireland 2040 was launched by the Government in February 2018 and comprises the NPF which sets out a spatial strategy for the period to 2040, and the NDP which sets out an investment strategy for the first 10 years of the NPF.

Project Ireland 2040 is the Government's plan for shaping the future growth and development of Ireland out to the year 2040. It is a framework to guide investment, to create and promote opportunities for the people of Ireland and to protect and enhance its environment. It sets out a single vision and shared set of goals for every community across the country. These are expressed as National Strategic Outcomes (see Figure 3.1).

Project Ireland 2040 is underpinned by the United Nations' 17 Sustainable Development Goals. It defines Sustainable Mobility as a National Strategic



Outcome (NSO4). NSO4 will be enabled by investment in the Luas network and other transport investments, all of which are specified in Project Ireland's NDP for the period 2018– 2027.

Investment in Luas will also play an important supporting role in the following NSOs:

- **NSO 1: Compact Growth**
- **NSO 8: Transition to a Low Carbon and Climate Resilient Society**
- **NSO 10: Access to Quality Childcare, Education and Health Services.**



Figure 3.1 – Project Ireland 2040: NSO's

Continued investment in the Luas system will contribute to achieving a number of The National Strategic Outcomes. The NDP sets out the need for the "appraisal, planning and design of Luas network expansion to Bray, Finglas, Lucan, Poolbeg and a light rail corridor for Cork". The below three NSOs in particular are linked to the rationale for investing in Luas.

**NSO 4: Sustainable Mobility** is one of the ten National Strategic Outcomes identified in the NPF. It is identified as being central to enhancing competitiveness, sustaining economic progress and enabling mobility choices for citizens. The aim is to expand the range of public transport services available and to reduce congestion and emissions.

**NSO 1 Compact Growth:** aims to deliver a greater proportion of residential development within existing built-up areas. High quality transport leads to high public transport mode shares which reduces the need for parking. The need for parking provision can reduce housing density and lead to viability issues with infill development which is key to compact growth in urban areas. It also highlights the role that an integrated transport network will play in the regeneration and revitalisation of urban areas.

**NSO 8 Transition to a Low Carbon and Climate Resilient Society:** will be supported by the electrification of transport fleets, reducing the use of carbon-intensive propulsion and benefitting from the decarbonisation of electricity production thereby lowering pollution.

**NSO 10 Access to Quality Childcare, Education and Health Services:** Luas Lucan has the potential to enhance connectivity to around 40 schools and Ballyfermot College of Further Education, wider third level institutes and St. James's Hospital among other healthcare facilities.

The NPF forecasts an increase in the population of Ireland by one million people by 2040, leading to a total population of 5.7 million. 2.85 million of the population will be located within the Eastern and Midlands region. Population growth will increase demand on our transport networks. Well-functioning integrated public transport systems will be essential to maintain economic development and enhance competitiveness.

A review of the NDP is due to be completed in 2021 which will lead to the publication of an updated 10-year plan for capital investment covering the period 2021 to 2030. It will take account of the altered environment that Ireland is now facing including the impacts of Covid-19 and will better reflect the major priorities set out in the current Programme for Government. Ensuring integration of climate change adaptation and mitigation imperatives will be central to the development of the updated plan.

### 3.2.2 Climate Action and Low Carbon Development (Amendment) Act 2021

The Climate Action and Low Carbon Development (Amendment) Act 2021 consists of a series of significant amendments to the Climate Act of 2015. The act commits Ireland to pursuing the transition to a climate resilient, biodiversity-rich, environmentally sustainable, and climate-neutral economy by 2050. It also commits to a 51% reduction in emissions by 2030 compared to 2018 levels, which was a key commitment in the Programme for Government agreed in 2020.

Luas as a low carbon emitting mode of transport will deliver very positively on the acknowledged need to reduce carbon emissions derived from transport. Luas Lucan will support many new trips and those derived from modal shift for western and central areas of Dublin City, as well as providing low-carbon interchange options for users of other modes.

### 3.2.3 Future Land Transport Investment Framework (FLTIF)

The Department of Transport's forthcoming framework for transport in Ireland has been developed to prioritise future investment in the land transport network and support the delivery of the National Strategic Outcomes outlined in Project Ireland. It will replace the Strategic Investment Framework for Land Transport (SIFLT) which was adopted in 2015. A public consultation process on the draft document concluded at the end of May. The document will now be finalised with publication expected to take place in Quarter 3 of 2021.

The framework document defines ten key transport challenges and establishes four investment priorities to address these, including: Decarbonisation, Protection and Renewal, Mobility of People and Goods in Urban Areas, and Enhanced Regional and Rural Connectivity.

Luas Lucan will deliver comprehensively across several of the elements, notably for:

- The very positive steps in **decarbonisation** which will result from Luas Lucan

- Enabling high levels of interchange across the Luas network and other modes, and therefore improving the **Mobility of People and Goods in Urban Areas**. Due to its tie-in with other modes (notable heavy rail stops), Luas Lucan will also deliver good improvements in **Enhanced Regional and Rural Connectivity**.



Figure 3.2 – FLTIF Investment Priorities

Future transport projects will need to align with these priorities to be considered for funding. To cater for rising travel demand while decarbonising the transport sector, there is a commitment to invest significantly in sustainable mobility. This will include major public transport schemes in cities as well as improved access to sustainable mobility in towns and rural areas and major investment in cycling and walking nationwide. These priorities are reflected in the modal hierarchy (shown in Figure 3.3).

Luas Lucan will deliver positively in relation to the 'Public Transport' element of the Modal Hierarchy, enabling many work, education and recreational trips to be undertaken in a timely manner across a widespread area. Additionally, Luas Lucan will tie-in well with active mode facilities as part of its development.

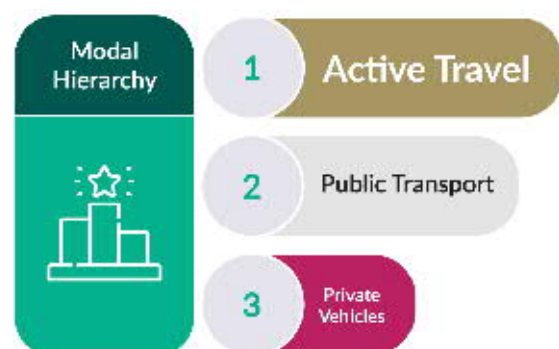


Figure 3.3 – FLTIF Modal Hierarchy

FLTIF also sets out an Intervention Hierarchy which sets out a commitment to maintain, optimise and improve existing transport assets to safeguard past investment and ensure the network is resilient to the impacts of climate change and evolving uses and travel patterns.

Luas Lucan will optimise and improve the existing transport network. Some new infrastructure will be necessary to deliver benefits however it will lead to an optimised and more efficient Luas network especially in the city. As the Luas network is expanded greater the cumulative benefits will be expected as peoples transport accessibility improves.

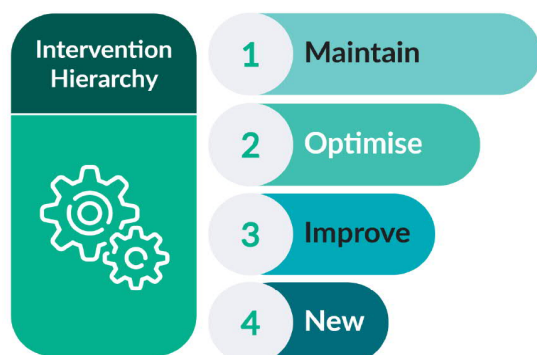


Figure 3.4 – FLTIF Intervention Hierarchy

### 3.2.4 Sustainable Mobility Policy Review

'Sustainable mobility' encompasses active travel and public transport. The DoT is currently conducting a review of a Sustainable Mobility policy in parallel with the department's infrastructure framework for national infrastructure. The new policy will replace existing documents published in 2009 and define priorities at a more granular, sectoral level. It will consider all aspects of active travel and public policy and define objectives in areas such as accessibility, affordability, modal shift and emissions reductions. A public consultation process was held between November 2019 and February 2020 and the submissions received will feed into the new policy. The new policy will be closely aligned with the NSOs and will support the Climate Action and Low Carbon Development (Amendment) Act 2021, to reduce emissions in the transport sector.

It is anticipated that Luas Lucan will have an important role to play in the region's and state's changing transport landscape towards sustainable travel, notably for enabling increasingly sustainable connections between homes, workplaces, education and community facilities and places of recreation (for example, sports, arts, retail etc.)

### 3.2.5 Greater Dublin Area Transport Strategy 2016 – 2035

The Greater Dublin Area Transport Strategy 2016–2035 examined strategic options for the Dublin area as a whole and on a corridor-by-corridor basis. Investment in the Luas system is core to providing a high-quality public transport network with expansion to Bray, Finglas, Lucan and Poolbeg planned for Dublin in addition to a line in Cork. The need for action is now set against a background of a growing population and economy in Dublin City, as forecast in Project Ireland 2040.

In summary, there is an imperative to upgrade the public transport system in the Eastern region with an integrated approach across all modes. The existing Luas network must be invested in to maintain, expand and optimise the system to meet a growing demand and heightened focus on sustainable travel. The strategy is currently being reviewed and will be published in Q3 2021.

## 4. Assessment approach

Luas Lucan was initially proposed as part of the Greater Dublin Area Transport Strategy 2016 – 2035. Prior assessment<sup>3</sup> indicated that there was sufficient demand for light rail to be progressed within the ‘western corridor’ of Lucan and Ballyfermot. The study pointed to the need for a comprehensive light rail solution in the area, ‘Western Luas’, initially to Liffey Valley Shopping Centre, supported by two quality bus corridor (QBCs) and various accompanying rail and feeder bus services.

The aim of the Luas Lucan line is to serve the existing and future demand and provide a safe, frequent, reliable, efficient and sustainable public transport connection from the wider Lucan area to the city centre, via Ballyfermot.

Spatial analysis will be undertaken to identify the demographic trends in the area by using a variety of demographic and development datasets.

Finally, to deliver the feasibility assessment a number of additional datasets and tools were developed to provide input to the analysis as outlined below.

- **Spatial analysis** - AECOM undertook a spatial analysis using a variety of demographic and development datasets. The analysis focused on the identification of commute, workplace and residential trends.
- **Transport modelling** - The NTA’s ERM was used to understand the anticipated Luas Lucan patronage, and benefits, and consequently the changes in travel times, road congestion and emissions.

- **Costing** – AECOM undertook an independent feasibility costing exercise using various datasets, particulars and outline route corridors. This exercise arrived at a cost for each of the high-level corridor options and derived an overall cost range for the line.
- **High-level environmental assessment** – An assessment of key environmental factors and considerations has been undertaken for the line. The assessment seeks to give an outline and context to the benefits of Luas (light rail system) and ongoing need to decarbonise transport, as well as some localised considerations around the three tested route corridors.

The purpose of this report is to draw a conclusion regarding the progression of Luas Lucan, and secondly outline the need for retention in the imminent update to the GDA Transport Strategy.

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<sup>3</sup> West Corridor Study, undertaken to inform the GDA Transport Strategy 2016-2035



## 5. Modelling and technical assessment

### 5.1 Spatial Analysis

This section presents the spatial analysis for Luas Lucan which looked at a variety of demographic and development datasets. The assessment is primarily focused on the Ballyfermot-Adamstown section of Luas Lucan, but some analyses also reference possible sections of Luas Lucan between Ballyfermot and the city centre.

A full spatial analysis of the catchment area, including POWSCAR trip analysis is available in Appendix A, though key highlights are provided in the following sections.

#### 5.1.1.1 Study Area Definition

The key area for catchment analysis is adjacent to the indicative Luas Lucan route corridors in the city's outer suburbs centred on the 2008 EPR alignment. The western sections of the route are better defined than some sections to the east of Ballyfermot. For comparative purposes a split of the catchment is made at the M50 where some differentiation may be expected – east of the M50 is characterised by long established residential areas, while the west is characterised by newer residential developments. The catchment assessment was undertaken for the area shown in Figure 5.1.

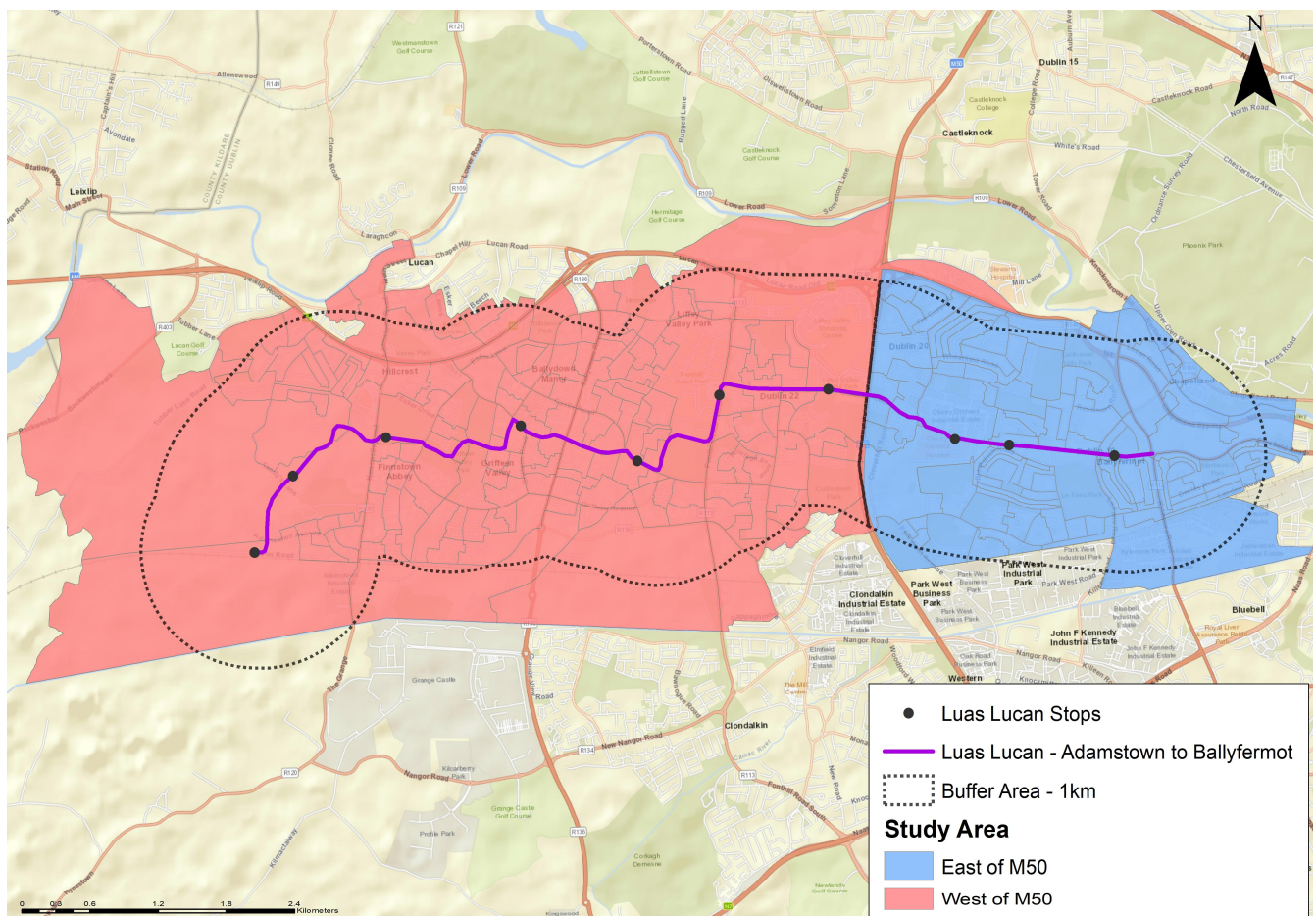


Figure 5.1 Luas Lucan, Ballyfermot-Adamstown Study Area (CSO Small Areas)

### 5.1.1.2 Overview

The analysis showed an increase on the population, increasing the demand for transportation. The main mode for trips to work is private vehicles due to lack of strong public transport services and for trips to education is walking. In addition, the work trips mainly follow the line's routing towards the city centre, thus a future Luas service would help to cater for this demand. Within the western catchment of the Luas Lucan line, there are approximately 40 schools, therefore it is proposed that the line will serve many trips for education. Active transport modes, such as cycling, could benefit from the proposed line, by easily connecting the cycle routes between the suburbs and the city centre. Further detail is included in the following sections.

### 5.1.1.3 Population characteristics

The population of the catchment in the outer suburbs (red and blue areas of Figure 5.1) is circa. 87,000 people, with an approximate 2/3 of the population being west of the M50.

A breakdown of the employment status of the two areas is provided in Table 5.1, indicating a higher proportion of working population and students in the western extents, and higher proportion of retired individuals in the eastern areas. The employment status provides an approximate reflection of the age profiles on each side of the M50. A total of 36,000 people are 'At Work' across the two areas, indicating a high potential commuter and/or business demand for new Luas Lucan services.

Table 5.1 - Census 2016 - % of Population aged 15 years and over by principal economic status

	At work	Looking for first regular job	Unemployed having lost or given up previous job	Student	Looking after home/family	Retired	Unable to work due to permanent sickness or disability	Other
East of M50	48.1%	1.0%	10.8%	9.6%	7.8%	13.7%	7.2%	1.8%
West of M50	58.6%	1.2%	8.6%	12.5%	8.2%	7.0%	3.7%	0.3%

Across the study area approx. 12,000 people are recorded as having a disability. Luas Lucan, with its accessible stops and trams, may provide increased levels of transport accessibility for this group to new areas of the city.

### 5.1.1.4 Changes in population and housing densities

Luas Lucan is being proposed at a vital time for population growth in Ireland. Project Ireland 2040 requires that much of the imminent growth of the population be accommodated in existing urban centres, where there is suitable existing infrastructure and services (water, electricity, gas and communications, for example), as well as community and social services, jobs and high performing public transport options. It is therefore prudent that population growth of areas is monitored

and accommodated in the urban areas specified in Project Ireland 2040.

Reviewing the population change in the area from 2011 to 2016 (census years), there has been substantial growth in the Lucan and Adamstown areas. The km<sup>2</sup> grid of Figure 5.2 indicates where this growth has taken place, noting that particular growth has been observed between the Grand Canal (on the study area's southern interface) and M4 along the northern areas. **It is clear that Luas Lucan is planned to serve an area of significant recent and future planned growth.** Slight decreases are noted in the mid to eastern areas of the catchment, possibly through 'empty nesting'.

The growth of population which has taken place in the 5-year analysis period, alongside the expected rapid population growth linked to the continued development of the Adamstown and Clonburris

SDZs, provide a strong incentive to progress Luas Lucan in the areas.

Regarding housing densities, there is a general range of around 11-50 units/hectare in the existing catchment, as observed in Figure 5.3. As the aforementioned SDZs develop, it would be expected that medium to high unit densities would develop, reportedly in the region of 30-90 units/hectare.

These higher densities would increase the demand for trips along the Luas Lucan corridor. Furthermore, with Luas Lucan in place it may be reasonably expected that redevelopment and infill development will take place around the line and stops as has been the case on other Luas and DART lines – as such, the higher densities would provide a further impetus for Luas Lucan to progress.

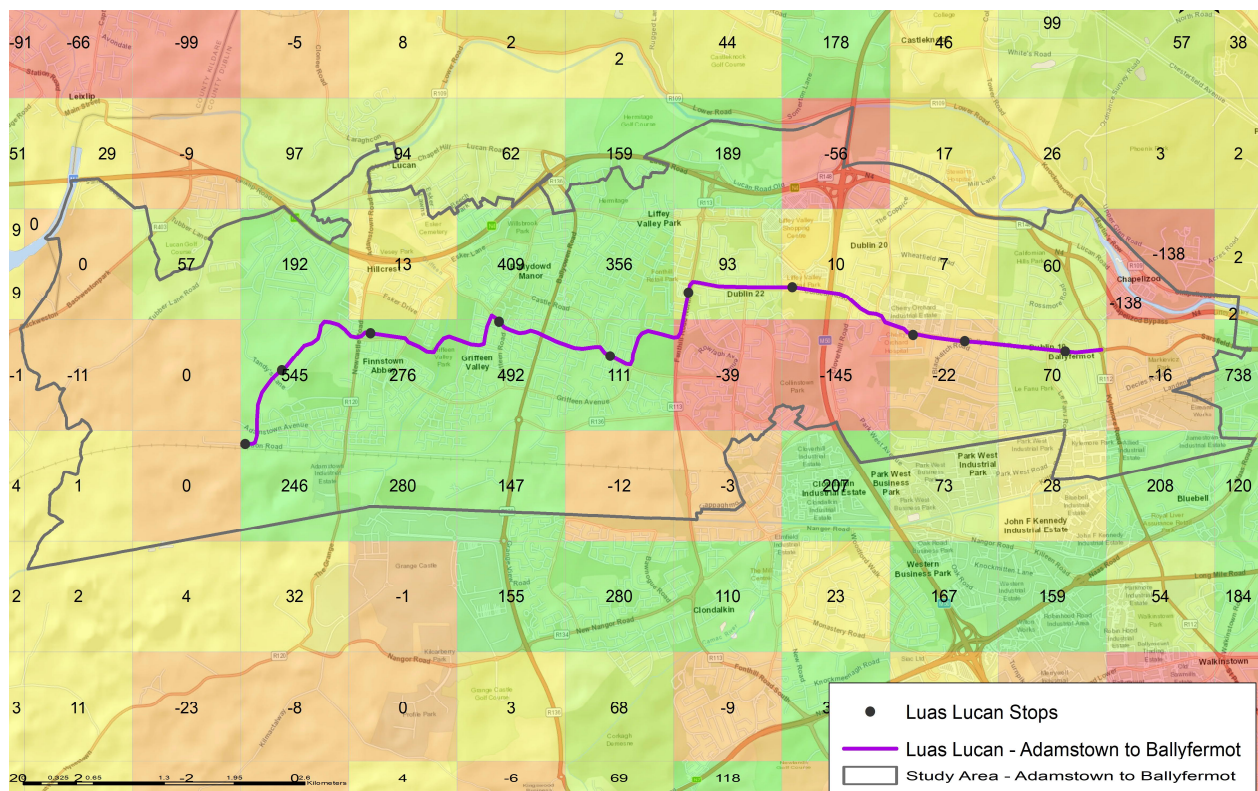


Figure 5.2 Census 2011-2016 population change on a kilometre square grid



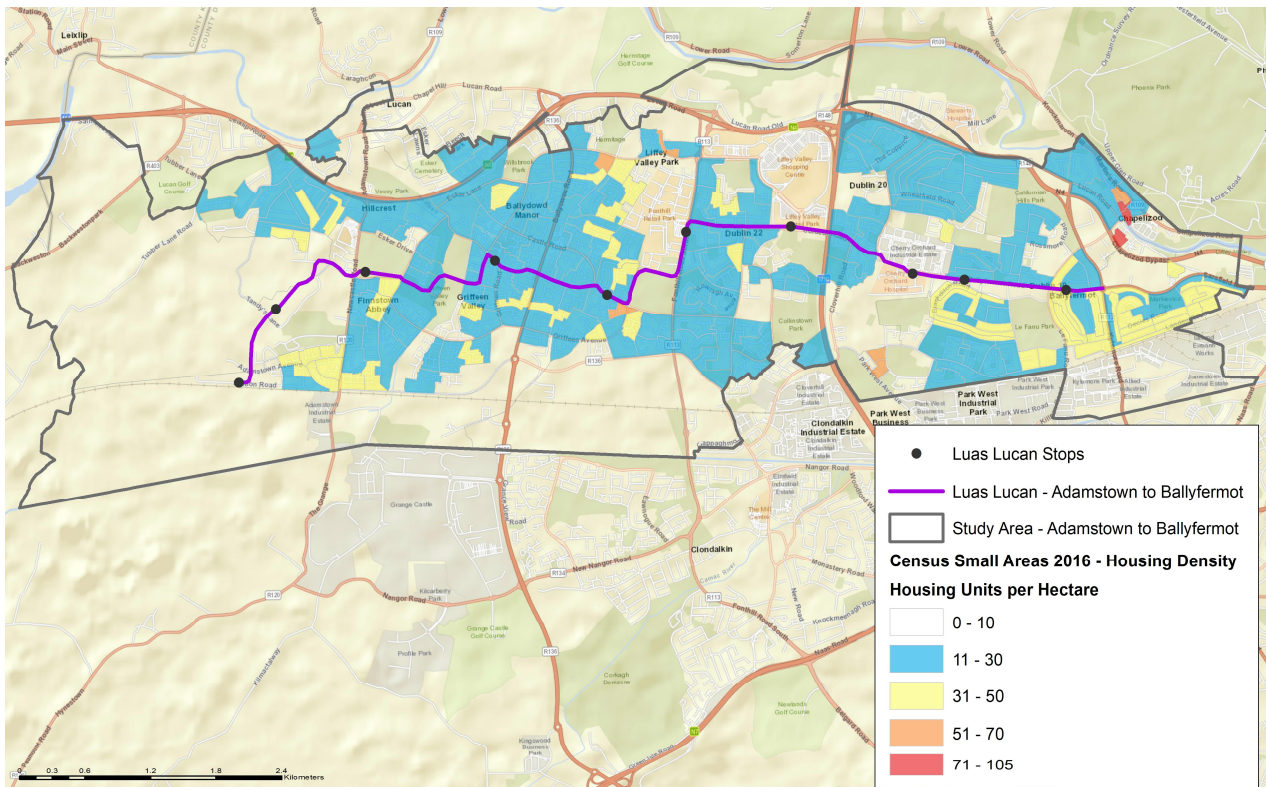


Figure 5.3 Census 2016 – Housing Density per Small Area (Units Per Hectare)

#### 5.1.1.5 Workplace locations and job desire lines

Two analyses are presented in this section based on POWSCAR data, firstly identifying areas of employment (jobs located in the area) within the study area and secondly assessing the location of the jobs for those living in the study area.

Figure 5.4 presents the location of jobs within the study area on a grid. Along the indicative Luas Lucan line, several key employment areas are present, namely Liffey Valley Shopping Centre, Fonthill Business Park, the Hermitage Hospital, Cloverhill Prison and Cherry Orchard Hospital. The high concentration of jobs is promising not only for the expected improvement in travel options for the workforces within them, but also for customers, patrons and visitors.

Using POWSCAR the desire lines of those travelling for work have also been assessed and are shown in Figure 5.5, alongside a table of accessible locations from the Luas network. Key destinations for work include Dublin City, Ballymount, Tallaght and Saggart, to name a few. All of these areas are highly accessible with either no change or a single interchange.

The analysis of job destinations also points to around 75% of jobs being accessible with 1 km of the Luas network which could be increased further as part of the route corridor options assessment. With Luas Lucan in place it is therefore likely that many work trips may be undertaken by a short walk to the nearest Luas stop, a possible change of Luas line (or to a different branch) and a short walk to the employee's place of work.



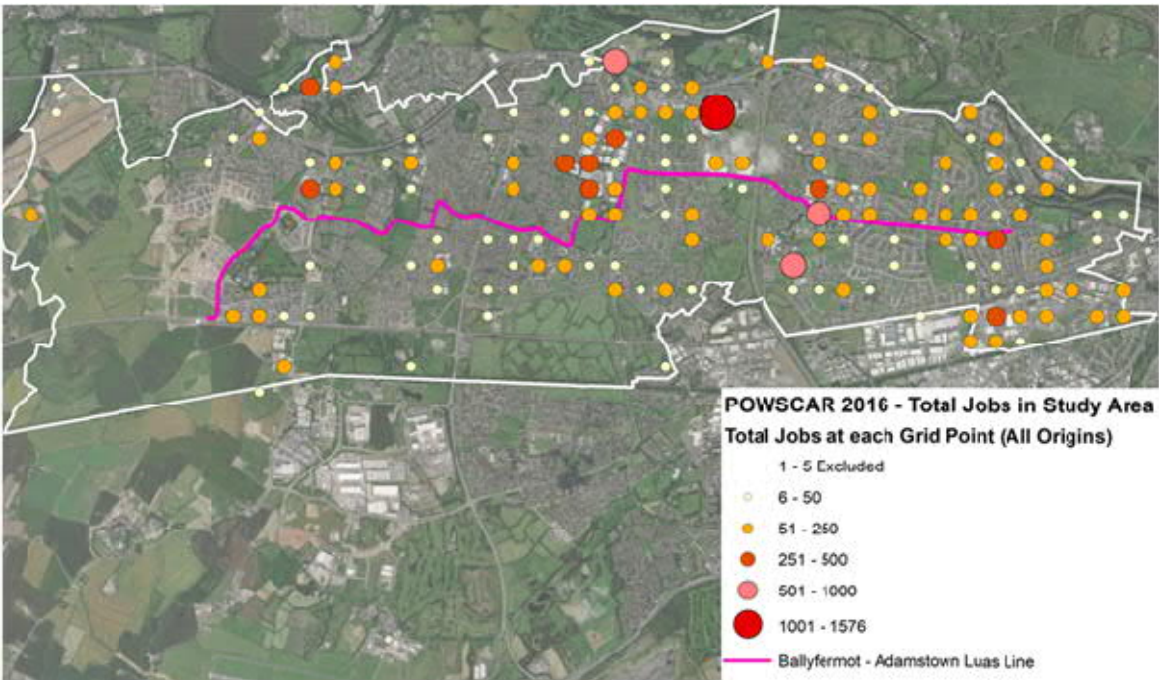


Figure 5.4 POWSCAR 2016 –Location of job destinations in Ballyfermot-Adamstown study area

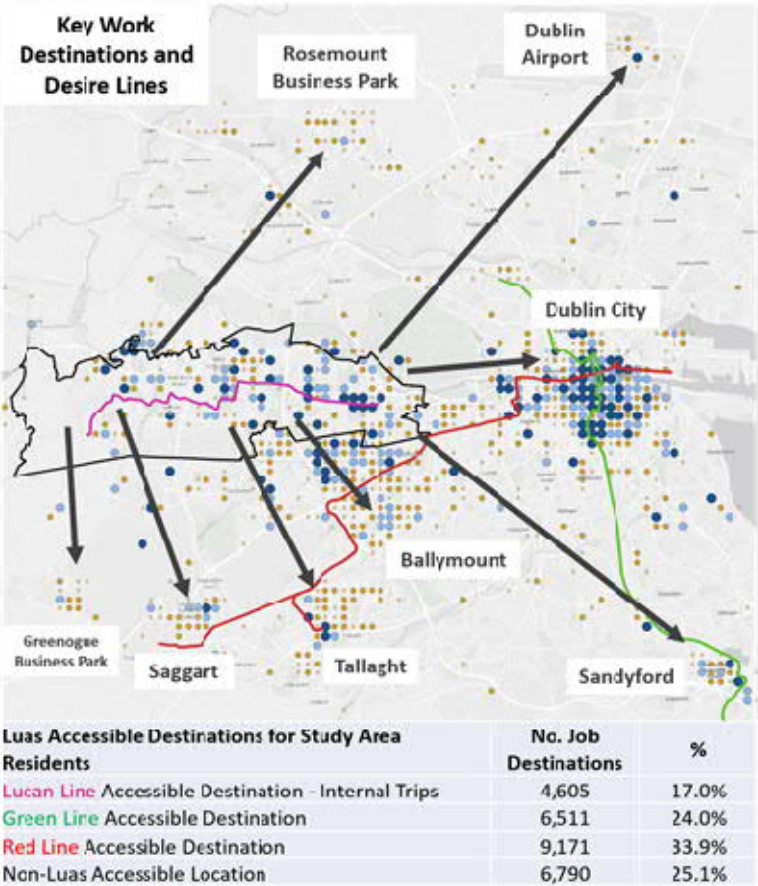


Figure 5.5 POWSCAR 2016 – Work destination desire lines from study area

### 5.1.2 Ballyfermot-City Centre Luas Route Corridors

This section outlines key findings and outcomes for the corridor sections east of Ballyfermot, where the three feasibility route corridors diverge towards different areas of Dublin City Centre<sup>4</sup>.

Route corridors 1 and 2 continue southward from Ballyfermot to connect with the Red Luas line at

Blackhorse. Route corridor 1 diverges from the Red Line east of Suir Road and continues towards the Charlemont stop of the Luas Green Line. Route corridor 2 follows a more direct path towards the St. Stephen's Green stop of Luas Green Line. Finally, Luas Lucan route corridor 3 continues eastward from Ballyfermot terminating at Heuston Station. The three Luas Lucan route corridors are presented in Figure 5.6.

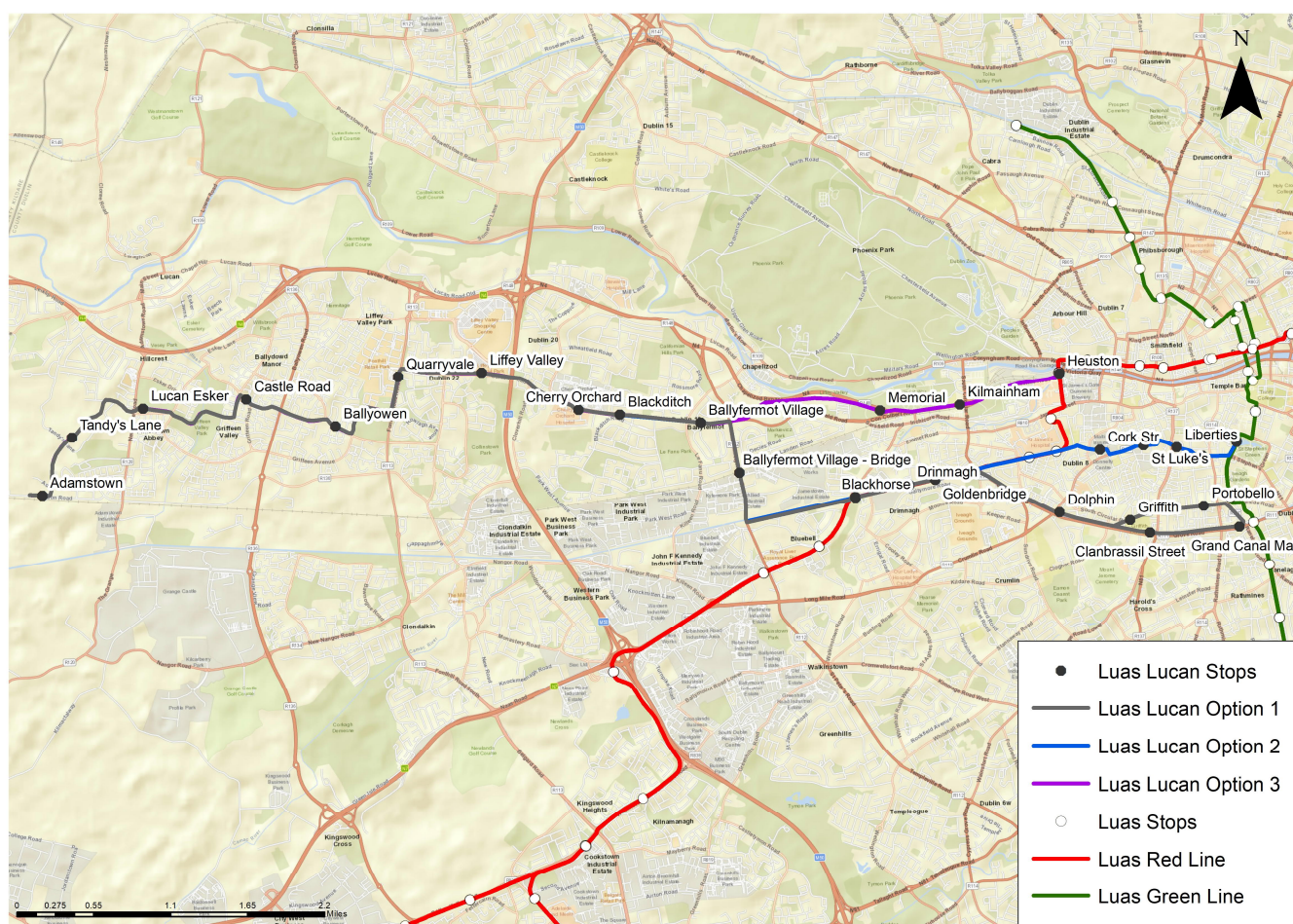


Figure 5.6 – Luas Lucan feasibility route corridors

The Luas Lucan route corridors were analysed for job densities, based on CSO Workplace zones. To achieve this, a 1km buffer was applied to the Luas route corridors and relevant zones assessed. An

example of the workplace zone job density analysis is shown for route corridor 1, full analyses of all route corridors are provided in Appendix A.

<sup>4</sup> Only one route corridor into the city will be progressed, noting that the determination of an EPR will be undertaken at a later stage.



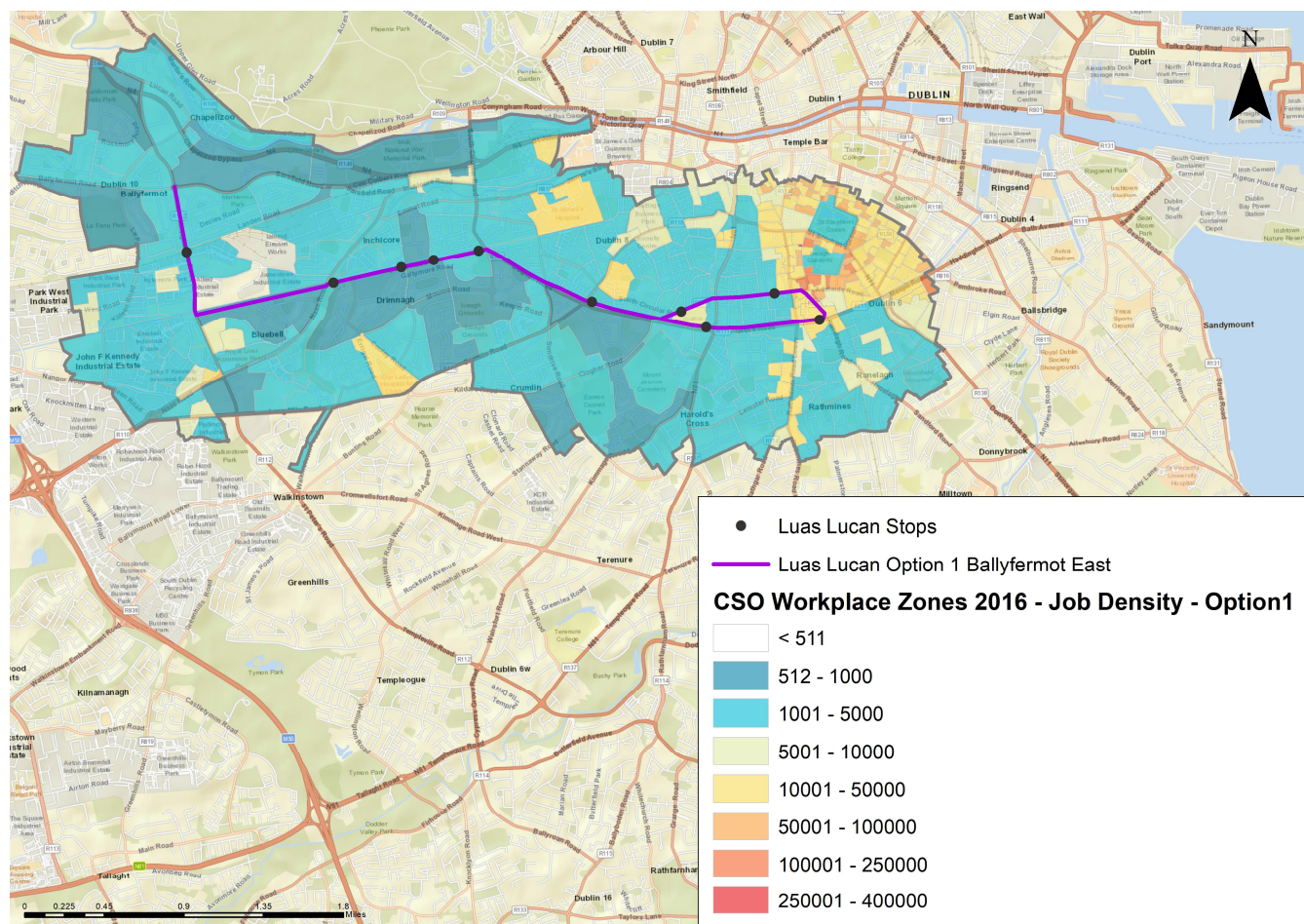


Figure 5.7 – CSO workplace zones job density– route corridor 1

## 5.2 Potential impact of investment in parallel active mode facilities

### 5.2.1 Health and safety impacts

Luas Lucan has the potential to reduce the frequency and severity of road collisions through a decrease in road traffic and improvement of junction accessibility. TII's PAG<sup>5</sup> sets out the means and variables for quantifying health and safety benefits. These benefits have not been quantified at this stage, however, given the intention to provide segregated cycling facilities along the alignment and improvements to pedestrian/cyclist facilities at junctions the following benefits are expected;

- Safety improvement due to removal of cyclists from general traffic lanes
- Health benefits based on reduction of overall health related risks, due to the increasing number of new cyclists along the corridors encouraged by the improved infrastructure
- Socio-economic benefits in the form of improved journey quality & ambience leading to reduced stress and decreased absenteeism due to improved cycle trip quality of the proposed offline cycle lanes.

<sup>5</sup> Transport Infrastructure Ireland, TII Project Appraisal Guidelines, Unit 13: Walking and Cycling Facilities, 2016

### 5.2.1.1 Collision reduction

A key goal of new transport infrastructure is to reduce the risk of fatalities and serious injuries due to collisions. Where there is a reduction in interaction between cyclists and general traffic, a lower collision risk would be expected. The collision reduction benefit is estimated from the number of incidents related to insurance, damage to property, Garda costs, and the number of casualties (including severities of injury).

**Whilst a decision on whether to allow for parallel cycle facilities has not been made,** previous Luas extensions have allowed for them. The development of a new segregated cycle route would provide a safer environment for the existing users and an attractive transport mode for new users. Consequently, a reduction in the number of collisions, particularly involving cyclists, would be expected.

### 5.2.1.2 Health

Health and physical activity are highly related. Specifically, regular physical activity such as cycling helps to reduce the risk of various illnesses, such as diabetes, cardiovascular diseases, and depression, while riding a bicycle to work every day reduces the risk of premature death by 41% (Netherlands Institute for Transport Policy Analysis, 2018). Conversely, physical inactivity contributes to numerous chronic diseases and high obesity levels.

## 5.2.2 Socio-Economic

### 5.2.2.1 Journey Quality

Journey quality (or ambience) is a measure of the real and perceived physical and social environment experienced while travelling. In cyclist terms the benefits are as a result of the users' perception of reduced danger (a reduced fear of potential collisions/incidents) and improved quality of journey.

Improved infrastructure and targeted interventions improve the quality of a transport mode, making it

more appealing in attracting new users. Segregated cycle facilities reduce the conflict between cyclists and other road users and significantly improves the travel experience and ambience for the user making cycling a more attractive travel option.

Assessing the journey quality benefit is challenging as different users will have different sensitivities to danger and environmental quality. However, the benefit is potentially large, especially for cyclists, because surveys suggest that existing and potential cyclist users attach great importance to the perceived safety and quality benefits of improved facilities (in particular, facilities segregated from motorised traffic).<sup>6</sup>

In a scenario where the Luas Lucan scheme delivered high quality offline cycle facilities through initiatives such as Cycle+Ride these could have positive impacts in the form of improved journey quality and associated improvements in users' perceptions of danger (a reduced perception of potential collisions or incidents) and improved journey quality.

### 5.2.2.2 Absenteeism

Introducing cycling into the everyday movements of people results in reductions of short-term absence from work due to improvements in the physical health of the users.

## 5.3 Growth in Demand

The wider Lucan area is earmarked as an area for significant growth in terms of both population and jobs. The area is forecast to experience a 20%+ growth in population over the coming 20 years, 15%+ growth in jobs and an even greater (45%+) increase in the numbers living in the area who are employed. This growth, alongside a trend away from private vehicle ownership and usage, will lead to pressure on the public transport system and supports the need for significant investment in the area.

<sup>6</sup> Source: Wardman et al, 2007

The projected growth in the area by 2040 is listed below and colour coded to match the map below.

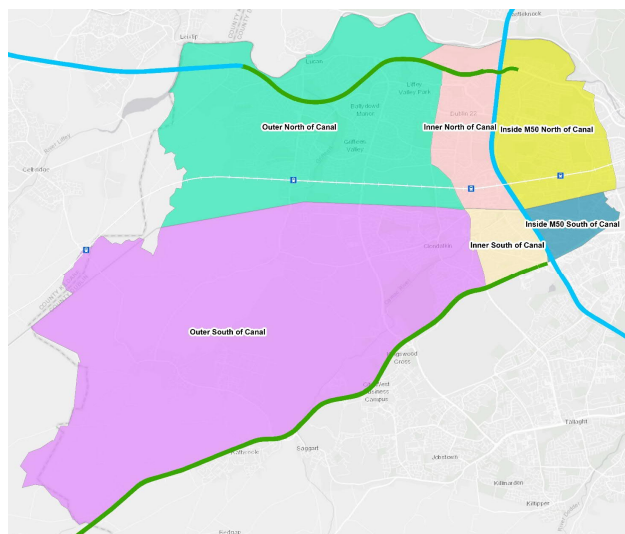


Figure 5.8 – Growth Areas in wider Lucan area

Table 5.2 – Growth by area in wider Lucan area

Area	Population (2040)	Change 2016 to 2040 (%)	Employment (2040)	Change 2016 to 2040 (%)	Jobs (2040)	Change 2016 to 2040 (%)
Outer North of Canal	66,621	31%	35,143	56%	13,343	37%
Inner North of Canal	15,671	14%	7,367	41%	7,230	30%
Inside M50 North of Canal	28,773	16%	12,282	32%	17,511	28%
Outer South of Canal	28,408	15%	14,467	36%	13,930	0%
Inner South of Canal	6,824	16%	3,774	36%	4,246	-4%
Inside M50 South of Canal	6,346	16%	3,509	36%	3,948	-4%

The capacity of the existing Luas red line is constrained due to the presence of major road junctions along the route in the west city centre. Investment in the line as part of Luas Lucan would increase the capacity of the Luas in the area, support

planned development of housing along the corridor and improve the resilience of the network.

## 5.4 Transport Modelling

This section presents the results of the transport modelling analysis for the Luas route corridor options. The ERM is one of five models in the NTA's Regional Modelling System and focuses on the Eastern Region including Dublin. The ERM is represented by 1,854 zones (1,844 internal zones, 7 external zones and 3 special zones) and includes all land transport modes for personal travel and goods vehicles, including private vehicles (taxis and cars), public transport (bus, rail, Luas, bus rapid transit (BRT), Metro), active modes (walking and cycling) and goods vehicles (light goods vehicles and heavy goods vehicles). The ERM is a multi-modal model and consists of four input elements, as follows:

- Public Transport (PT) Model (e.g. rail/bus/Luas services)
- Walking and Cycling Model
- Highway Model (e.g. road links/junctions)
- Demand Model

The ERM is a tool to assess the impact of interventions on people's travel choices in relation to time of travel, mode of travel and route of travel. In the context of the Luas Lucan scheme, the ERM will provide information on the total generalised cost of travel (made up of travel time, waiting times, fares, parking charges, tolls and fuel) for all trips in the Eastern Region both without and with Luas Lucan in place. These outputs then feed into the economic appraisal and allow us to capture and monetise the impacts of the scheme.



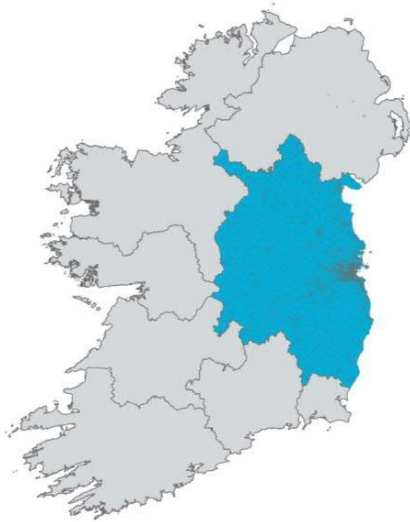


Figure 5.9 – Extent of ERM

ERM projections take account of future employment, population and education projections at Small Area level (in line with Project Ireland 2040). The projections are developed using the National Demand Forecasting Model (NDFM) which outputs travel demand to the ERM for iteration through the choice and assignment modules. The demand in the NDFM is built up based on Central Statistics Office Place of Work, School or College – Census of Anonymised Records (CSO POWSCAR), NTA Household Travel Surveys, Transport Surveys and other transport related datasets. During the model run, mode choice is undertaken based on current costs for each mode for each origin and destination pair.

The 2035 and 2050 reference case ERM models were updated in-line with NTA modelling guidelines to include the Luas Lucan scheme with an outline opening year of 2032.

#### 5.4.1 Scenario definition

The following ERM modelling scenarios have been assessed in the development of Luas Lucan:

- Do-Minimum - without the proposed Luas Lucan options in place. See list below.
- Do-Something 1 - with the proposed Luas route corridor 1 in place. A nominal route without DART

Underground or any amendments to the planned BusConnects routes in the vicinity

- Do-Something 2 - with the proposed Luas route corridor 2 in place. A nominal route without DART Underground or any amendments to the planned BusConnects routes in the vicinity
- Do-Something 3 - with the proposed Luas route corridor 3 in place. A nominal route **with** DART Underground in place but no amendments to the planned BusConnects routes in the vicinity. It should be noted that **impacts presented in this chapter under this scenario are accountable to both DS3 Luas Lucan and DART Underground.**

In the case of Luas Lucan, a Do-Minimum is used (instead of a 'Do-Nothing' model). The Do-Minimum is most appropriate as it takes account of the committed schemes which will be in place by 2031 but in this instance schemes still in the planning process such as DART+ Programme and BusConnects have also been included given their presence in the Luas Lucan area, the schemes in the DoMin are listed below.

- Phoenix Park Tunnel (Increased service plan)
- DART Frequency of 10mins
- Variable Speed Limits & a proxy for distance-based tolling on M50
- City Centre Traffic Management Plan
- M7 Naas Bypass
- Luas Green Line Capacity Enhancements
- Updated Irish Rail Service Plans accounting for committed additional fleet
- BusConnects Dublin
- DART+ Programme (without DART Underground element unless included in DoSmth as per DS3)

It is likely that the resultant performance of the Luas Lucan options is pessimistic as it is likely that bus routes (existing and proposed updates as part of

BusConnects) would be optimised to reflect the presence of Luas Lucan.

#### 5.4.2 Screenline Analysis

Given that there are number of potential major transport projects being delivered in the Lucan and Ballyfermot areas, it was necessary to understand the total potential public transport demand to identify the optimum long-term transport infrastructure for the area.

Total public transport demand is understood through a screenline analysis of the area and will include any movements undertaken on light rail and bus modes - to ensure that only local public transport trips (with the potential to be served by Luas Lucan) are included in the analysis, longer

distance heavy rail trips were excluded from the assessment and tables below<sup>7</sup>.

Two screenlines were set up in the ERM as indicated in Figure 5.10. These divide the area along the M50 (yellow screenline) and Kylemore Road (red screenline).

To gauge the passenger impacts in a future year without significant influence from major transport projects an ERM year 2043 has been used – this modelled case has only DART+ in place, and therefore provides a better future 'base' case to understand the scale of the need without BusConnects or Metrolink.

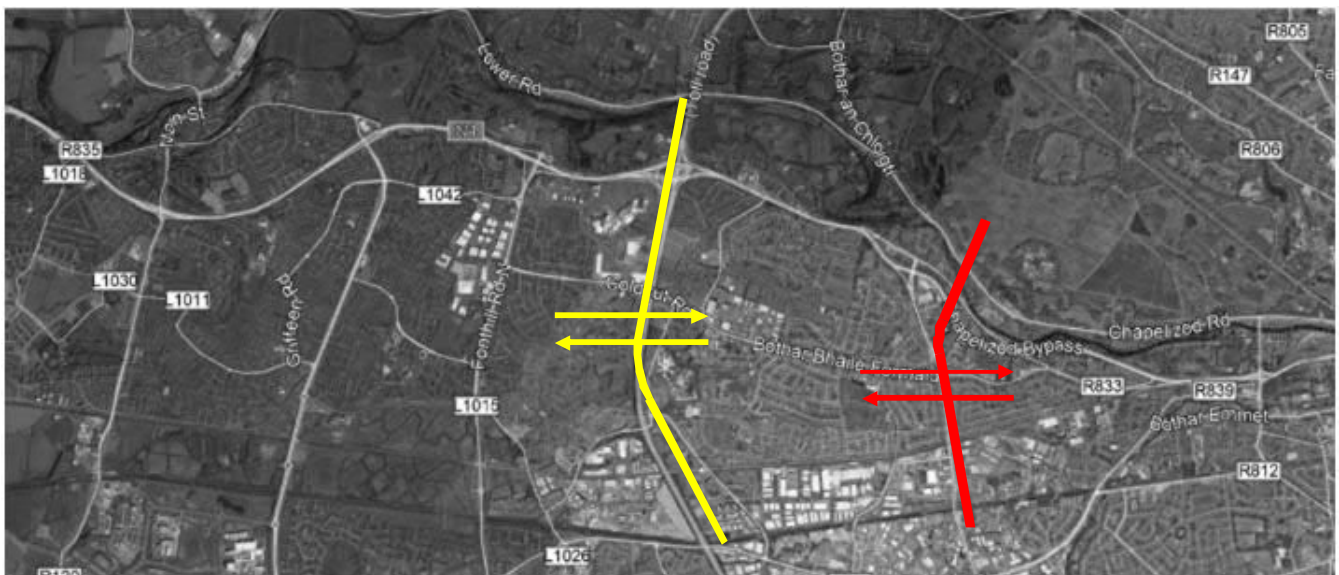


Figure 5.10 - Screenlines in the vicinity of the scheme

<sup>7</sup> Early analysis was dominated by heavy rail movements from the influence of the Kildare Line, with many trips coming from Kildare or

further afield. As a result, trips on heavy rail were excluded from the screenline analysis.

The outcomes of the screenline analysis for the AM Peak hour and 12h period (7am-7pm) and shown in Table 5.3 and Table 5.4 respectively.

*Table 5.3 - AM Peak hour screenline movements (2043, rounded)*

	Yellow eastbound (Inbound)	Yellow westbound (Outbound)	Red eastbound (Inbound)	Red westbound (Outbound)
PT	4,500	1,000	5,000	1,400
Private	5,000	4,000	4,300	4,100

*Table 5.4 – 12h (7am-7pm) screenline movements (2043, rounded)*

	Yellow eastbound (Inbound)	Yellow westbound (Outbound)	Red eastbound (Inbound)	Red westbound (Outbound)
PT	17,500	19,700	21,100	22,900
Private	40,400	52,600	37,000	48,500

The screenline assessment outlines a number of key observations:

#### In the AM:

- Around 4,500 to 5,000 eastbound trips at yellow and red screenlines respectively will take place on public transport modes.
- As would be expected there is a strong bias to inbound trips (towards the city centre) on public transport, primarily for employment in the AM period.
- Among private vehicle trips there is a greater balance of east and westbound trips, likely due to school drop-offs and local AM trips.

#### 12h (7am-7pm)

- Across the 12-hr period there are approximately 21,000 eastbound public transport trips expected (red screenline eastbound).
- Up to 100,000 private vehicle trips are expected to cross the screenlines daily (two-way

screenline crossings). While some trips may need to continue by private vehicle, many of these may be accommodated on public transport such as Luas Lucan in the future as a result of wider policies and changes in people's perceptions.

- Improved sustainability and wellbeing would be expected where private vehicle trips may transfer to public transport. Accompanying active mode facilities (such as any local cycle facility improvements and Cycle+Ride with Luas Lucan) will aid this change to sustainable travel.

#### Both Periods

- The area to the west of the yellow screenline (west of the M50), represents around 85% of demand. Approximately 15% of demand originates from between the screenlines. It is therefore advisable that Luas Lucan progress to a point west of the M50 as a minimum, where the greatest demand exists. This mirrors outcomes of the policy review which discusses the provision of Luas Lucan to the Liffey Valley Shopping Centre as a minimum extent.

#### 5.4.2.1 Outcomes of Screenline Analysis

The screenline analysis indicates that by 2043 **up to 10,000 AM trips will seek to travel eastbound towards the city centre from western suburbs on either public or private transport**, and around 130,000 two-way movements across a 12-hr period by 2043. Of these ~35% are projected to use public transport but wider demand management and climate action policies, improvements to the public transport network and changing perceptions around sustainability and carbon footprint will likely push this demand for PT higher. A two-way AM line loading of up to 5,000 may therefore be reasonably achievable in the longer term<sup>8</sup> following optimisation of the alignment during the route selection process and given the scale of demand it is suggested that **Luas**

<sup>8</sup> While the number of public transport trips does not exactly correlate with line loadings, many of the 5,000 AM trips will remain on board to central city stops.



### Lucan should be maintained as part of the plans for the future public transport network serving the area.

As set out above, over time, the changing habits and transport trends towards sustainable modes, and areas of development, will increase the likely ridership of Luas Lucan.

While outside the specific scope of this feasibility study, it may be appropriate to later consider feeder services west of the screenlines (from the wider Lucan and Adamstown areas, as well as future connections to Clonburris SDZ) to make most use of any infrastructure such as Luas Lucan.

From the screenline analysis there is suitable demand in future years for investing in a network of high-quality public transport in the study area. As increasingly sustainable travel becomes the norm (to achieve national and international climate change obligations), Luas and other forms of public transport should see enhanced passenger numbers.

#### 5.4.3 Passenger impacts

This section outlines the impact of Luas Lucan in terms of its impact on public transport passenger

trips. Extracts from ERM modelling provide details on the number of trips, modal splits, and % of public transport shares. These performance indicators provide insight into the potential impact of the scheme and how it will change travel behaviours acknowledging that the alignments are indicative and actual impacts will differ slightly as a result.

The impacts of the scheme, as forecast using the ERM, are summarised for passengers, businesses, cyclists and visitors, but are aggregated for presentation.

Reviewing the ERM year of 2035 as an approximation of the opening year of Luas Lucan, a comparable number of public transport trips are expected from the local area. Table 5.5 provides the model's mode shares and indicates that **upon opening in circa 2031 there is the potential for ~4,000 new public transport trips from local zones on a daily basis equivalent to ~1.2 million trips per annum<sup>9</sup>**. In percentage terms, 4,000-5,000 new public transport trips represent a 7-9% increase on top of the forecast 57,500 trips in 2035.

Table 5.5 - Mode shares – daily trips (2035)

Route corridor	Private Vehicles	Public Transport
Do Min	183,737	57,527
Do Something - 1	183,376	61,516
Do Something - 2	183,511	61,192
Do Something – 3	185,248	62,863
Change – 1	-361	3,990
Change – 2	-226	3,666
Change – 3	1,511	5,336
% Change – 1	-0.2%	6.9%
% Change – 2	-0.1%	6.4%
% Change – 3	0.8%	9.3%

<sup>9</sup> Approximately bounded by the M4 to the north, Grand Canal to the south, Dodsborough Road / Adamstown Boulevard to the west and Kylemore Road to the east

Mode shares in 2050, as set out in Table 5.6, demonstrate similar patterns as those observed in 2035. Overall, the mode share of public transport increases in all scenarios in both 2035 and 2050. This translates to an increase of over 5,000 daily

trips in either maxima. Given that route corridors are not optimised, future design iterations should seek to deliver assets and facilities which encourage active mode travel and to maintain the high mode shares for active modes.

*Table 5.6 - Mode shares – daily trips (2050)*

Scenario	Private Vehicles	Public Transport
Do Min	209,546	66,637
Do Something - 1	209,001	71,916
Do Something - 2	209,005	71,172
Do Something - 3	209,845	71,486
Change - 1	-545	5,279
Change - 2	-541	4,535
Change - 3	299	4,849
% Change - 1	-0.3%	7.9%
% Change - 2	-0.3%	6.8%
% Change - 3	0.1%	7.3%

Table 5.7 and Table 5.8 shows the impact of Luas Lucan on each public transport system in the ERM<sup>10</sup>.

The tables indicate that with Luas Lucan in place there will be a positive shift to light rail as a highly sustainable transport mode – some of these decreases (in both 2035 and 2050), are notably coming from Dublin Bus and DART trips. All scenarios result in an increase in the overall number of trips by public transport.

Luas Lucan will deliver a high-quality, competitive public transport service from western suburbs to the

city, linking in with the Luas network. Luas patronage is indicated to increase by up to 20% (DS1, 2050), with DS2 delivering an approximate 10% increase in Light Rail trips.

DS3 includes DART Underground which overlaps with Luas Lucan at some points along its alignment. The DS3 also does not connect to other components of the Luas network and takes a route through fewer residential areas towards Heuston Station, it therefore delivers a negligible change in Light Rail trips.

*Table 5.7 - Daily passenger boardings by public transport system<sup>10</sup>*

Year	Mode	Do Minimum	DS - 1	DS - 2	DS - 3
Passenger Boardings					
2035	DART	129,024	126,091	126,167	189,720
	Other Rail	145,893	143,992	143,765	150,827
	Light Rail	215,779	251,488	237,228	215,987
	Dublin Bus	642,418	627,409	631,153	612,569

<sup>10</sup> Metro excluded from mode list for comparability.

Year	Mode	DoMinimum	DS - 1	DS - 2	DS - 3
Passenger Boardings					
	Other Bus	106,173	106,281	106,189	105,196
	DART	158,355	153,808	155,326	233,922
	Other Rail	180,402	178,870	179,474	184,986
2050	Light Rail	255,722	304,765	283,164	255,711
	Dublin Bus	737,929	717,836	724,531	705,745
	Other Bus	124,972	124,651	124,462	123,727

Table 5.8 - Change in daily passenger boardings by public transport system

Year	Mode	Difference - 1		Difference - 2		Difference - 3	
		Relative	%	Relative	%	Relative	%
	DART	-2,932	-2.3%	-2,857	-2.2%	60,696	47.0%
	Other Rail	-1,901	-1.3%	-2,128	-1.5%	4,934	3.4%
2035	Light Rail	<b>35,709</b>	<b>16.5%</b>	<b>21,449</b>	<b>9.9%</b>	<b>208</b>	<b>0.1%</b>
	Dublin Bus	-15,009	-2.3%	-11,265	-1.8%	-29,849	-4.6%
	Other Bus	108	0.1%	16	0.0%	-977	-0.9%
	DART	-4,547	-2.9%	-3,028	-1.9%	75,567	47.7%
	Other Rail	-1,533	-0.8%	-928	-0.5%	4,584	2.5%
2050	Light Rail	<b>49,043</b>	<b>19.2%</b>	<b>27,442</b>	<b>10.7%</b>	<b>-11</b>	<b>0.0%</b>
	Dublin Bus	-20,093	-2.7%	-13,398	-1.8%	-32,184	-4.4%
	Other Bus	-321	-0.3%	-511	-0.4%	-1,246	-1.0%

#### 5.4.4 Line loadings

An assessment of line loadings (DS1 only for indicative purposes) has been presented as part of the feasibility assessment, and the changes are presented for the AM EB in Figure 5.11 – this represents morning peak journeys towards Dublin City. Over time, line loadings for the route corridor increase from around 2,000 in 2035 to nearly 3,000 by 2050, however, it is vital to acknowledge that the presented line loadings are without any optimisation of other major projects along the corridor and as such the major projects provide excessive public transport choice to local residents and businesses – the overprovision may undermine each other. It is also important to note that the line loadings presented here are based on one potential future in

terms of people's behaviours, car ownership rates etc. This scenario is closely linked to existing behaviours so it is increasingly likely that this represents an underestimate of likely public transport network and that all public transport options may be required to adequately serve future demand in the area. It does also not allow for any demand management or change in policy which may result in people reconsidering their mode choice in favour of more sustainable modes. **It is important to recognise that an optimisation process should occur after the feasibility stage of Luas Lucan testing,** in order deliver the right public transport services to the Lucan and Adamstown areas. Positively, the network effect of Luas Lucan provides benefits to existing Luas stops even though they are

not directly served. The analysis shows that a combination of enhanced bus and Luas will reduce the risk of overreliance on Luas especially along the potential shared section between the Drimnagh and

Suir Road stops which currently have Luas service frequency constraints due to the presence of busy junctions with road traffic.

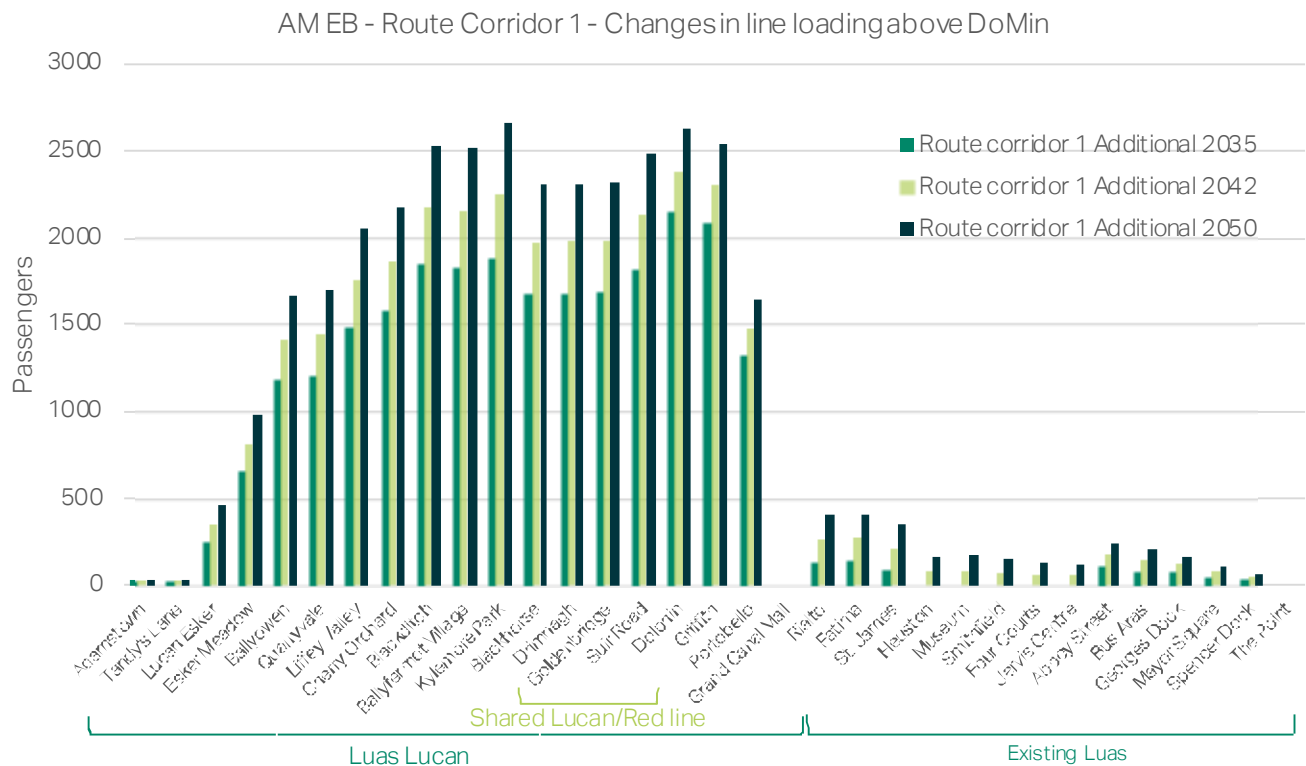


Figure 5.11 - Luas Lucan – Change in line loadings above the DoMin (DS1 - AM EB for 2035, 2042 and 2050)

## 5.5 Long term impact of COVID-19

No one knows how COVID-19 will affect long term travel behaviour. Anecdotal evidence has shown that flexible work location and hours can result in fewer trips at peak times, and greater off-peak travel. Historically, public transport revenue is reliant on peak commuting, but work-related travel changes could warrant higher frequencies outside peak times to capture this demand, help maintain revenue and facilitate social distancing. At present, public transport patronage is 15-50% of normal levels.

Recent research undertaken by AECOM on behalf of TII suggests that daily trip demand may reduce by 5% whilst similar NTA research<sup>11</sup> predicts a reduction in daily demand of up to 8%. In some respects, COVID-19 has accelerated existing trends towards flexible working arrangements.

COVID-19 also does not alter the requirement to encourage and enable modal shift from the private car and the need to address carbon emissions. It is therefore deemed not to be material to the need for the investment in Luas Lucan.

<sup>11</sup>[https://www.nationaltransport.ie/wp-content/uploads/2021/03/Alternative-Scenario-Development-Note-v-6.1\\_Final.pdf](https://www.nationaltransport.ie/wp-content/uploads/2021/03/Alternative-Scenario-Development-Note-v-6.1_Final.pdf)

Government restrictions to control Covid-19 have suppressed travel demand by requiring employees to work from home where possible, reducing public transport capacity, introducing remote learning and restricting travel to local areas for non-essential trips. Furthermore, people are avoiding crowded, enclosed spaces due to the risk of infection and this has reduced demand for public transport and pushed people towards greater car use. This has significantly reduced the number of people using buses to travel into the city centre or across the

urban region, but it is important to acknowledge that these are temporary impacts which will shift again once the pandemic has ended.

In the long term, once restrictions are lifted, it is likely that travel demand will return to similar trends observed prior to the pandemic because demand has been artificially suppressed by Government restrictions and public health issues.

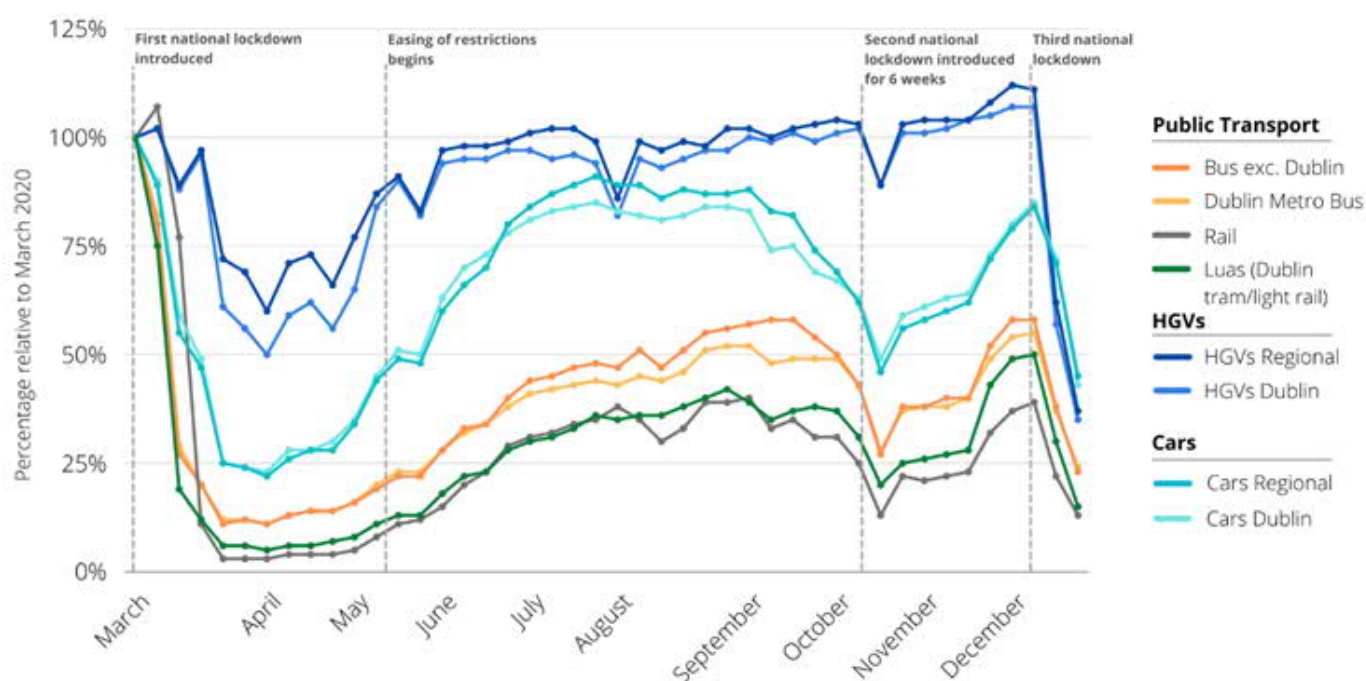


Figure 5.12 - Proportion of journeys made by public transport throughout 2020<sup>12</sup>

Figure 5.12 shows that demand for public transport recovered quickly in June-September and again in December when COVID-19 restrictions were eased, indicating that demand for public transport remains strong.

Yet, it is also important to acknowledge that some more permanent changes to travel behaviour have taken place, such as the accelerated acceptance of

home working, teleconferencing for services and home delivery of retail goods which could cause fluctuation in trip volumes and peak times. While these changes may affect the demand profile across different times of day and areas of the city, it is unlikely they will substantially reduce the overall demand for public transport usage particularly as the Irish economy is expected to return to growth quickly after the distribution of vaccines. The

<sup>12</sup> Sources: Public Transport - National Transport Authority (passenger journeys by public transport); HGVs - TII (Average weekly volume of heavy goods vehicles for selected traffic count sites); Cars - TII (Average weekly volume of cars for selected traffic count sites).

NB: Rail data includes passenger journeys on Intercity and DART services.

Economic & Social Research Institute's Quarterly Economic Commentary for Winter 2020 reports Ireland's economy to be one of few in the world to have grown in 2020, and Irish households experienced the fastest growth in disposable income in the European Union in 2020, with household savings increasing by €13 billion in 2020, according to the Central Bank. Future participation in the economy will depend on public transport to support a rapid economic, social and cultural recovery of the sectors hit hardest by the pandemic. In light of this, continued investment in the Luas network is justified to improve conditions for existing

rail users, and to increase the appeal of rail travel to attract mode transfer from car users to achieve sustainability policy goals in the years following the pandemic.

In the short term, the Government's five-level Living With COVID-19 plan includes restrictions on public transport load factors, with Levels 4 and 5 capping occupancy at 25% of capacity and Levels 2 and 3 capping occupancy at 50% of capacity. This means that service frequency and train lengths may remain unchanged to provide enough capacity for essential travel.

## 6. Cost Estimation

As part of the feasibility analysis of Luas Lucan, a high-level cost estimation exercise has been undertaken based on the three indicative alignments used for the purposes of this study. These provide initial estimates of the cost to delivery all aspects of Luas Lucan, notably:

- Line infrastructure, including junctions and operational features such as signalling
- Professional fees and utility costs
- Land acquisition costs
- Trams and fitout (initially expected as 30-34 vehicles)
- Construction of a suburban depot for stabling new trams
- Ongoing operations and maintenance.

The process of cost estimation has been undertaken by AECOM's cost management team with prior experience in light rail cost estimation across the GDA and internationally.

### 6.1 Considerations and assumptions

Costing has been undertaken for the indicative Luas Lucan lines at this feasibility stage. This early stage of development lends itself to only high-level costing, and therefore broad ranges are presented to maintain a robustness. Later costing exercises will seek to hone the cost estimates as the level of design increases.

Several key outcomes of Luas Lucan's cost exercise are as follows:

- The assumed construction commencement date is Jan 2028, with completion in December 2032. These dates may fluctuate pending design iterations, contractor engagement and on-site construction progress.
- The level of detail is such that land acquisition costs are indicative for the areas of the city which Luas Lucan will transit. Historically, land costs have fluctuated for Dublin City

depending on economic conditions – this level of variability is particularly relevant in the context of Covid-19 and Dublin's commercial space rates.

- Items such as demolition, retaining walls, utility diversions and traffic management are based upon high-level assumptions and unit rates in many cases, noting that increasing levels of costing detail will be provided for these aspects as designs progress.
- Full depth carriage reconstruction has not been accounted for at this stage of assessment, given that designs will evolve.
- To accommodate the new fleet of 30-34 Luas trams a new depot would be required towards the western extent of the Luas Lucan line where there is suitable land availability.

High levels of contingency are included in the initial cost estimates which are in-line with NTA's contingency calculator. Also, escalation/ inflation of costs has been included for in the high-level cost estimation and will account for the likes of material and labour cost increases.

In closing, costing has been deemed suitable for the level of feasibility design at this time. The routes will undoubtedly go through a number of stages of iteration, including route selection and the identification of an EPR, costs will be updated as appropriate for the stage of Luas Lucan's development. Finalisation of the costs for this stage has taken place following a review with TII counterparts, ensuring that Luas Lucan is costed on the same basis as other large-scale infrastructure projects and that it represents a robust forecast at the time of writing.

### 6.2 Capital Costs

Capital cost estimates are based on a build-up of 'line items', and therefore consider all manner of categorised costs. Categorised costs include items such as clearance, construction of Luas stops (by number), Red Line upgrade (by unit length), bridge costs (by deck area), depot, traffic management as



well as the many other elements required to deliver Luas Lucan.

Suitable consideration of risk has been included in the estimate, with moderate levels of cost contingencies included to account for the feasibility level of design. The levels of cost contingency are derived from appropriate NTA contingency level calculators, as is appropriate for this early design stage.

The cost estimates (ranges in current year, 2021 prices) are as shown in Figure 6.1.

Across the three plausible route corridor options, **the forecast cost for Luas Lucan will be in the region of €0.9 billion to €1.6 billion**, in 2021 prices. In-line with national guidance, this range will be discounted and assessed in 2011 prices.

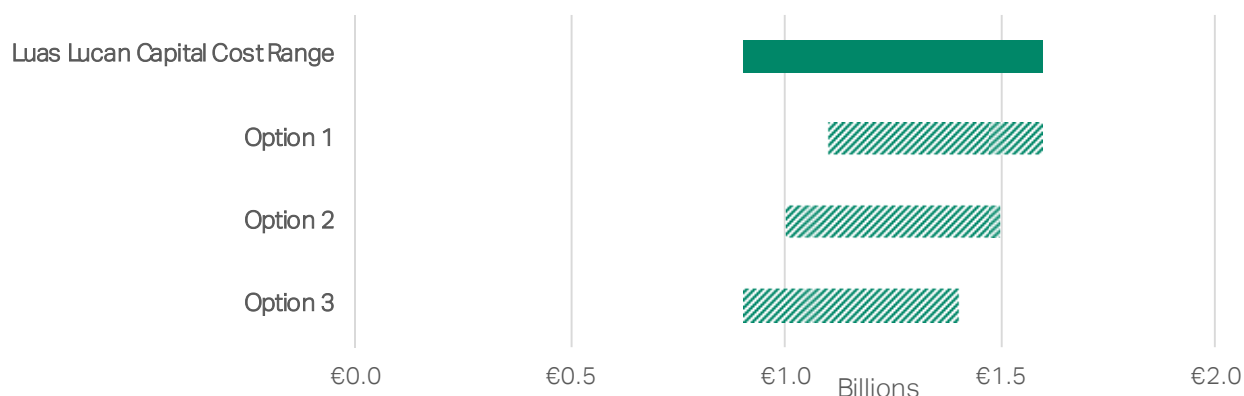


Figure 6.1 - Feasibility Capital Cost Estimate for Luas Lucan (2019 prices)

The cost range represents a best estimate for delivering a line from Adamstown to the City Centre, noting that an EPR is yet to be assessed and may form a combination of route sections from the three assessed options and / or new sections in the west of the city.

### 6.2.1 Assessment of several route corridor options in developing a range

Three indicative routes have been used to provide a range of capital costs at this feasibility stage of assessment. Though providing a useful comparison between 'costly, intermediate and economical' options for Luas Lucan, **the three route corridors were selected for the purposes of route selection and are subject to a route selection process. The cost estimates are therefore only provided to derive an overall range for Luas Lucan costs of delivery.**

- Route corridor 1 is forecast as being the costliest of the three, this is primarily due to the fact it is the longest (at 17km), and also

acknowledging an expected higher allowance for land acquisition adjacent to the Grand Canal

- Route corridor 2 indicates a route with short relative length (14km), requiring some land acquisition, but otherwise using a majority of existing street cross-sections approaching the southern central areas of the city
- The lowest cost corridor is that of route corridor 3, taking a northerly route approximately from western suburbs to Heuston Station via Kilmainham. At 15km, the intermediate length route may require less costs for land acquisition but would support more frequency services (avoiding the existing red line section) and would therefore have higher fleet costs

Later considerations in developing an EPR, other than costs, may include forecast number of trips, accessibility and onward connectivity, detailed



environmental assessment, physical activity, and other such factors<sup>14</sup>.

### 6.3 Operations and Maintenance (O&M) Costs

Luas Lucan will have ongoing costs to operate and maintain (O&M) the line, for example, electricity, staffing (drivers, security, cleaning, workshop staff and others), consumables replacement (brakes, interiors), and a host of other ancillary costs.

To gauge an appropriate level of ongoing O&M costs, historic rates have been used for the Luas network. These historic costs provide the actual costs to run the Luas network and are considered appropriate to base feasibility forecast costs upon.

The three tested route corridors are different lengths and will require a different number of trams to deliver a reliable, frequent service. On the basis of the number of annual tram-km to service the line, O&M costs for Luas Lucan are presented in Table 6.1. **The annual O&M cost range for Luas Lucan is forecast as €18-25 million.**

Like capital costs, the key outcome from the assessment of O&M costs is a range of plausible costs. An EPR should not be selected on the basis of each route corridor's forecast O&M costs, rather, other important factors should be considered in subsequent detailed assessments of Luas Lucan.

Table 6.1- Luas Lucan O&M cost estimate

	Annual O&M Costs	60-year O&M Costs (discounted, 2011 prices)
Luas Lucan Option 1	€25 million	€600 million
Luas Lucan Option 2	€22 million	€500 million
Luas Lucan Option 3	€18 million	€400 million
<b>Luas Lucan O&amp;M Cost Range</b>	<b>€18-25 million</b>	<b>€400-€600 million</b>

<sup>14</sup> The six CAF criteria may act as a starting point for assessment of line options to be undertaken at the next stage of assessment.

## 7. Potential Benefits Assessment

### 7.1 Scale of likely benefits

Given that Luas Lucan is in the early stages of planning, it is likely that the alignment will change from historical alignments as part of any new route corridor options assessment. Additionally, there will be a need to optimise the wider transport network to complement Luas Lucan. The monetised benefits assessment has therefore been undertaken as a comparative assessment with a significantly further progressed light rail scheme in Dublin, Luas Finglas, which was recently subject to a detailed economic appraisal. This will provide some insight into the likely economic performance of Luas Lucan.

For comparative purposes, Luas Finglas is a 4km line extension from Broombridge to Charlestown with an opening year expected around 2031. Luas Lucan is approximately four times the length of Luas Finglas and passes through a similar environment (types and densities of suburbs) and will deliver benefits such as those in Table 7.1. It should also be noted that other benefits such as improved journey time reliability and benefits associated with improved active mode facilities and increased active mode usage would further increase benefits.

Table 7.1 – Quantifiable benefit streams

User benefits
Journey time
Vehicle operating costs
CO <sub>2</sub>
Indirect taxation

When developing the monetised benefit any influence of Luas Finglas' P&R facility has been deducted, so as to compare 'like for like'. The future annual passenger demand on Luas Lucan is forecast

to be ~11 million by 2035 rising to ~15 million by 2050. This equates to a demand approx. 3-4 times greater than forecast for Luas Finglas.

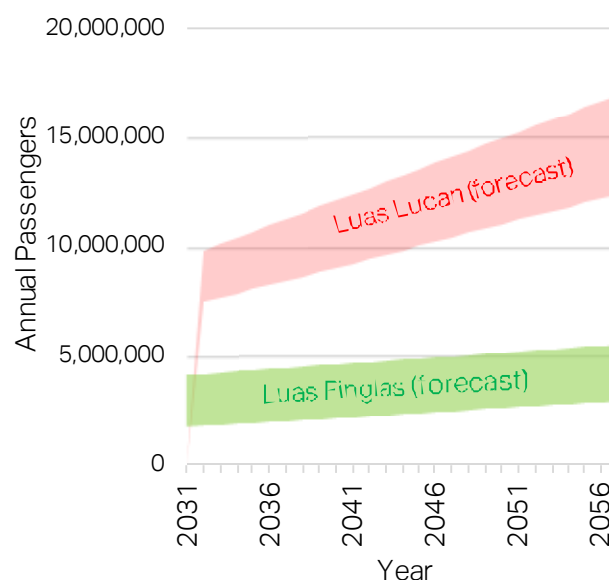


Figure 7.1 - Annual passengers of Luas Lucan and Luas Finglas

At a high level, Luas Lucan is around four times the length of Luas Finglas, with the opportunity to serve around four times the number of passengers. Indicative line loading based on ERM outputs is shown prior in Section 5.4.

With the expectation of approximately a similar public transport offering and demand response of the two Luas lines, it would be anticipated that economic benefits per km have the potential to be of a similar scale whilst acknowledging that Luas Lucan may offer higher benefits due to longer distance journeys and the scale of growth planned for the area. Based on the economic appraisal undertaken for Luas Finglas this suggests that €100million/km would be derived (2011 prices) from Luas Lucan<sup>15</sup>.

As such, the 14 to 17km Luas Lucan indicative route corridor tested at this feasibility stage may deliver

<sup>15</sup> Excluding any benefits of Luas Finglas' P&R facility.

benefits in the region of €1-1.5 billion however this is indicative and subject to detailed modelling and appraisal.

## 7.2 Other considerations

The outline benefit value of €100 million in benefits per km are dependent on many factors and can change. Some aspects influencing benefits may include the following, all of which are subject to revision:

- Increased route alignment detail, and the resultant running speeds and runtimes.
- The location of stops

- Determination of termini locations and feeder services, if applicable
- The opening years of Luas Lucan and other major projects
- The routing and service provision of other major projects
- Wider economic factors including peoples' need to travel, working habits (notably the changing proportion of home workers), users' propensity to walk, cycle or use other sustainable modes.

Given the feasibility level of assessment and the use of Luas Lucan's outline route corridors it will be necessary to revise the economic indicators as the level of detail improves.

### Overview of Findings - Western Corridor Study Benefits Assessment

The 2015 Western Corridor study, which informed the GDA Transport Strategy 2016-2035, indicated a strong need for improved public transport in the Adamstown, Lucan and Ballyfermot area, with notable reference to the provision of a new Luas line. It recommended that Luas Lucan be progressed alongside investment in the bus and rail networks.

The Study concluded that the development and implementation of the Western Corridor and the Luas Lucan would have the following benefits:

- Deliver a strong projected growth in demand to 2035 (and beyond).
- Public transport mode share to the city centre was 50% (at the time of writing). Implementation of Luas Lucan would capture the significant growth in travel demand in the served (western) area and would enable the delivery of a 68% public transport mode share to the city.
- It is complementary to the delivery of DART Underground and the benefits to the Kildare Rail Line, meaning that the modes do not undermine one another
- Provide public transport connections with Metrolink (Metro North at the time of writing), allowing trips to the airport from the West of Dublin
- Support a further concentration of development along the Western Luas Line and the Kildare Rail line
- Provides interchange with inner and outer orbital movements extending the effective catchment of all public transport with the study area.

Upon review there is a high level of agreement between the anticipated benefits of the 2015 Western Corridor Study and this 2021 Luas Lucan Feasibility Study.

### 7.3 Outline economic assessment

An outline economic assessment is set out below with detail and accuracy reflective of the early stages of the appraisal process.

The economic assessment is recognised as being only one measure of expected outcome performance, other wider economic benefits (non-monetised) are assessed and documented in Chapter 8.

At the feasibility level of assessment, such as is the case for Luas Lucan in 2021, the economic assessment must be considered indicative and subject to revision in later iterations.

Future iterations may employ Transport Users Benefit Appraisal (TUBA) software to fully assess line options as they become developed – current route corridors do not benefit from a highly detailed analysis.

Capital costs range between €0.9 billion to €1.6 billion and O&M costs range between €400-€600

million. Discounted and expressed in 2011 values results in combined costs over the 60-year period of approx. €600 million to €1 billion. Given benefits are in the region of €1.5 billion (2011), **it is anticipated that Luas Lucan will deliver a positive return on investment** when all costs are discounted to 2011 in line with benefits.

Future economic analyses will ensure discounting is appropriate for the expected construction years, opening years and lifecycle of the line.

Future economic appraisal will fully capture all benefits including journey time reliability, agglomeration, carbon and active travel time, health and quality benefits as appropriate.

The outline economic assessment suggests that Luas Lucan has the potential to return a positive economic appraisal and that **Luas Lucan be maintained as a viable transport project as part of the wider GDA transport network, and that further optioneering and analyses be conducted.**

## 8. Wider Economic Benefits (Non-monetised)

Further to the demonstrated monetised benefits of the outline economic analysis (Chapter 0), Luas Lucan offers a broad range of wider economic benefits, i.e. those which are not readily monetisable. Residents and businesses will experience improved quality of life delivered by the improved connectivity of the Luas Lucan line.

### 8.1 *Transport connectivity to employment, education, recreation, leisure and tourism*

The existing 87,000 residents of west Dublin (within the Adamstown to Ballyfermot 1km catchment), will gain substantially improved connectivity within their communities, and for onward connections to Dublin City, the Iarnród Éireann / Irish Rail network, Luas networks, as well as to employment opportunities, tourist hubs and entertainment destinations.

#### 8.1.1 *Agglomeration*

Agglomeration is a spatial effect where firms derive a productivity benefit from locating in close proximity to individuals and other firms. The benefits are the product of increased labour market, knowledge spill overs and strengthened linkages between suppliers.



Outputs from the transport model in the form of travel cost and demand skims can be used to ascertain the potential scale of agglomeration benefits. The process would make use of a similar approach taken by AECOM in developing an agglomeration tool for TII and based on extensive agglomeration parameters concerning productivity, density, job type, elasticities and distance decay. At this feasibility stage the potential agglomeration impacts have not been quantified however previous experience on rail projects should suggest that agglomeration would increase monetised economic benefits by between 8-10%.

#### 8.1.2 *Access to employment*

Of the 87,000 residents in the Adamstown to Ballyfermot catchment, around 35,000 people are in employment. There is a bias towards a working place population west of the M50 (likely due to newer housing developments), and therefore Luas may often deliver a simpler, lower-stress commute for those travelling eastward over a longer distance. East of the M50 there is a higher proportion of retired people. POWSCAR analysis indicates that 17% of Luas Lucan residents (within 1km of the Adamstown to Ballyfermot section), also have a job in the area. A further 34% of employment destinations may be accessed from the existing Red Line, with a requirement for either no or one interchange (where operationally it may be possible to access existing stops of the Red Line towards The Point). Lastly, a further 24% of jobs are accessible from 1km of the Green Line requiring one interchange between Luas lines.



A key employer along the proposed outer sections of the Luas Lucan line is the Liffey Valley Shopping Centre – supporting around 1500 employees in the immediate vicinity. In addition to Luas Lucan serving 'outbound trips' towards the city in the morning, it will also accommodate the travel needs of many employees at the shopping centre. Several other retail and light industrial areas would gain benefits for their workforces.

Summarising the improved access to employment, **with Luas Lucan in place around 75% of people in the catchment will be able to travel to their place of work using the Luas network and a short walk at either end.** In addition to personal wellbeing benefits of all employees, the high level of connection to workplaces would have a very positive impact in the reduction of GHG emissions from transport, where currently up to 74% of residents use a private motorised vehicle for trips to work.

### 8.1.3 Access to education

Approximately 46 schools are located within the Adamstown-Ballyfermot catchment (34 primary and 12 secondary), as well as a third level institute, the Ballyfermot College of Further Education.



Luas Lucan will provide enhanced access to many of the schools, particularly among older students and those of the Ballyfermot College of Further Education. This has multi-faceted benefits such that parents or caregivers may not need to own a car to take children to school, particularly where older students would be able to travel unaccompanied, traffic congestion would be reduced around school opening and end times, and that subsequent levels of road-based congestion would be reduced. Furthermore, Luas Lucan will enable increased cycling accessibility in the vicinity of the line encouraging cycling to schools.

**With the close proximity of 46 schools and the Ballyfermot College of Further Education to Luas Lucan, there is a strong future potential to decrease carbon emissions resulting from localised school travel.** Increased levels of walking, cycling and public transport use will reduce overall emissions for education travel purposed.

### 8.1.4 Access to Recreation, Leisure and Tourism

In addition to accommodating work and education trips, Luas Lucan will for a key link to recreation and leisure services.



Day-to-day activities such as shopping and retail will be well accommodated by both the lines Liffey Valley Shopping Centre stop and its

accessibility to shops across the city centre. Additionally, the network effect (joining with the existing Luas Red and Green Lines), also allows access to wider retail areas across the city, including Grafton Street, Jervis, St. Stephen's Green and Tallaght.

Access to tourism and community facilities will be greatly enhanced with Luas Lucan. Some key sites which would benefit include (depending on the eventual route), St. Patrick's Cathedral, Phoenix Park and Kilmainham Gaol, as well as several vibrant areas of Dublin's south city. Several healthcare facilities will also gain accessibility improvements such as, St. James's Hospital and Royal Victoria in the city centre, Cherry Orchard Hospital in Dublin's west and Our Lady's Children's Hospital, Crumlin a short distance away.

### 8.1.5 Build-out and densification of Strategic Development Zones

Over the coming years two Strategic Development Zones (SDZs) will continue to be built-out in the vicinity of Luas Lucan, namely Clonburris and Adamstown. Such SDZs are of strategic economic and social importance to the state, ensuring the efficient and accelerated provision of suitable housing, schools, mixed-use developments and community facilities.



#### Clonburris SDZ

In the case of Clonburris SDZ, a land parcel measuring 280 hectares was identified west of the city centre, between Lucan, Clondalkin and Liffey Valley.<sup>16</sup>

<sup>16</sup> Clonburris Draft Plan <http://www.clonburris.ie/stages/draft-plan/draft-planning-scheme/>





Figure 8.1 - Clonburris SDZ<sup>16</sup>

As part of the Clonburris SDZ, suitably dense housing should be provided. Targets of between 44 and 78 units/hectare are sought, which would significantly exceed those already present in the study area (Adamstown to Ballyfermot section catchment).

Transport links for Clonburris will focus on sustainable travel, with two train stations within or in close proximity to the SDZ and many walking and cycling connections planned.

Luas Lucan could be located approximately 500m from the SDZ's northern boundary (pending development of the EPR) and would provide direct links to the central city.

### Adamstown SDZ

Adamstown is the second SDZ in the vicinity of the scheme and will guide the development of medium to high density housing and mixed-use facilities around the western extent of Luas Lucan.



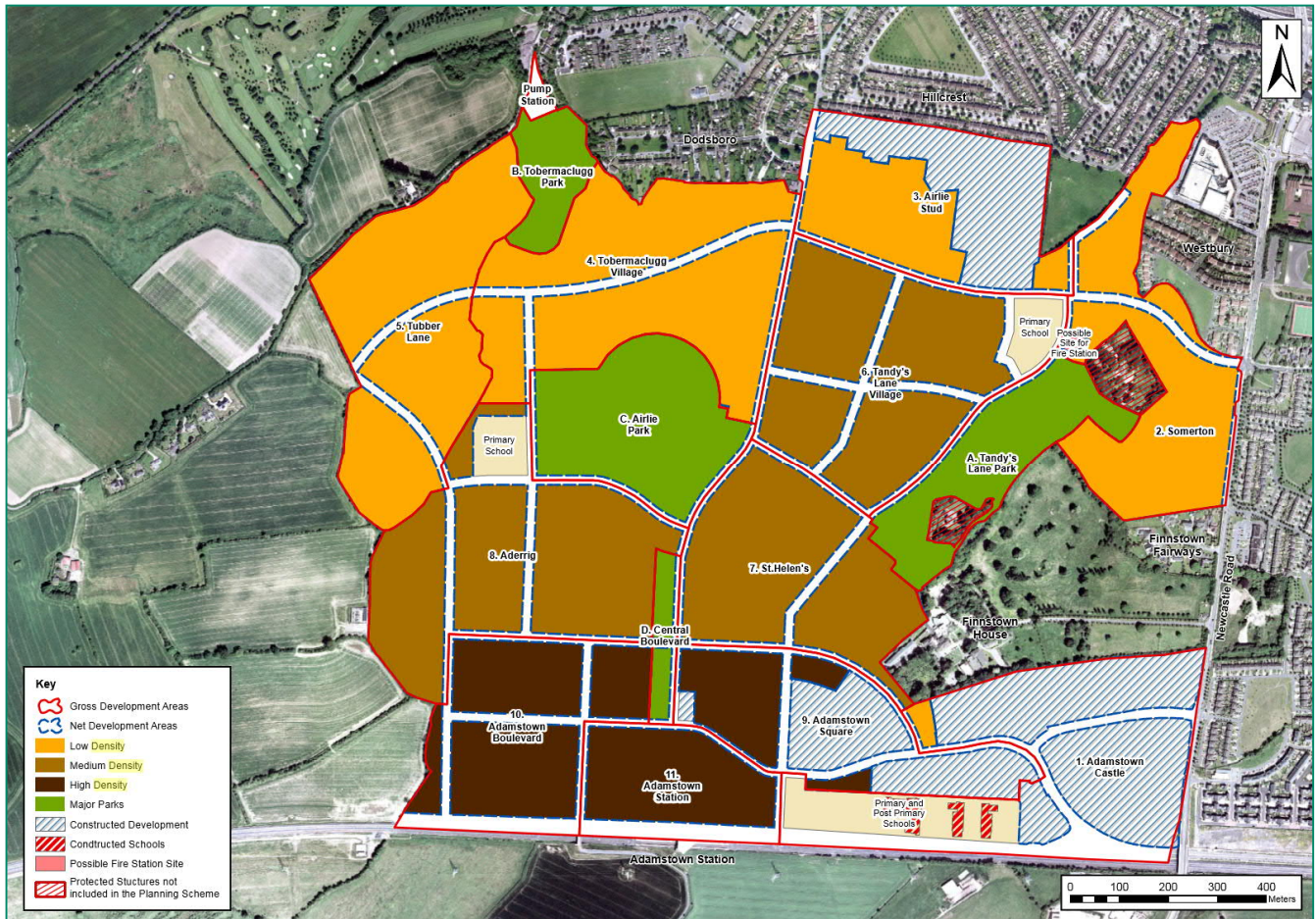


Figure 8.2 - Adamstown SDZ Outline

Approximately 9,000<sup>17</sup> dwellings are proposed in the development, alongside various commercial, retail and education facilities. The highest dwelling densities are expected in the southern areas of the SDZ where higher density mixed – dwelling densities are planned to be in the region of 50 to 90 dwellings per hectare. Progressing northward the densities will decrease to the region of 30 to 50 dwellings per hectare.

Luas Lucan has the potential to interchange with the Adamstown Railway Station in the future, enabling simple interchange and connectivity to different parts of west Dublin and the city centre, via the various branches and lines of both the heavy rail and Luas networks. Enhancing the level of walking and cycling will also be fundamental to the build-out of

the Adamstown SDZ, as well as connecting in with walking and cycling networks adjacent to Luas Lucan.

Both Clonburris and Adamstown SDZs will bring new vitality to the areas, promoting the use of sustainable modes for travel to work, education and other leisure activities. The condensed, moderate to high density housing expected of the SDZs will increase ridership of Luas Lucan considerably, particularly where residents may be travelling to the city (as evidenced in the existing catchment of Luas Lucan). There will be a mutual benefit to both the SDZs development and Luas Lucan – each will support the development and construction of the other and will result in

<sup>17</sup> Adamstown SDZ Planning Scheme 2014 – Section 2.0 Proposals for Development

improved land-use and expected levels of sustainable travel.

## 8.2 Sustainability

Luas Lucan provides a means of significantly lowering carbon emissions in transport. Transport has represented the Ireland's second highest sector of CO<sub>2</sub>



emissions since 2017 and is exhibiting a concerning upward trend as indicated in Figure 8.3.

Since the early '90s high levels of population growth, urbanisation and economic growth has taken place, primarily through increased levels of road transport. A second period of significant CO<sub>2</sub> emissions has taken place from 2012, during the recovery of Ireland's economy.

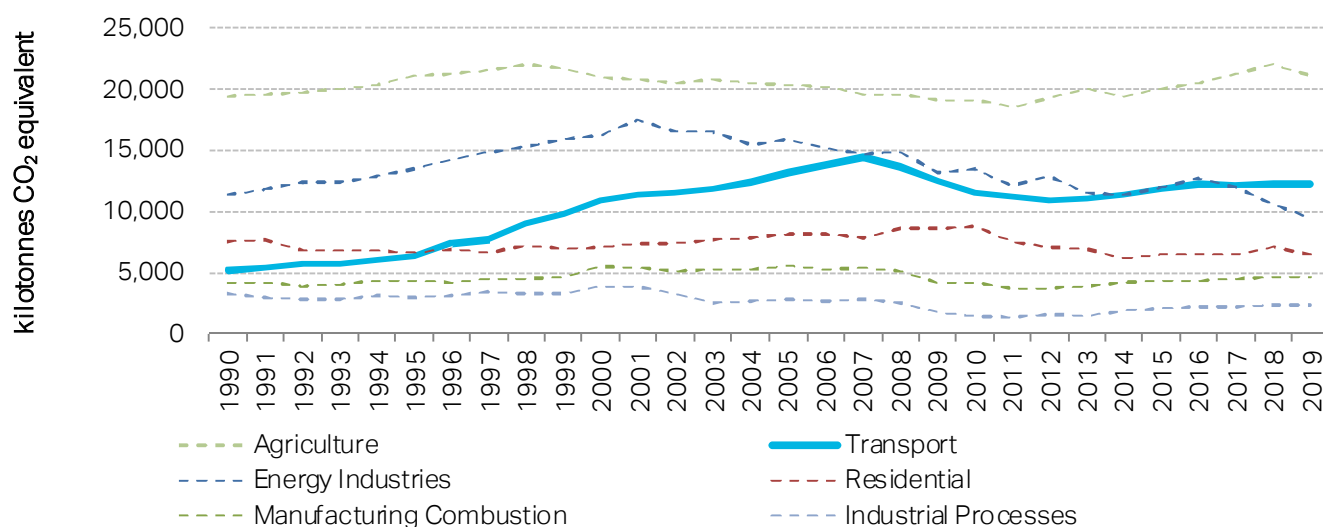


Figure 8.3 - CO<sub>2</sub> emissions by sector (1990-2019)<sup>18</sup>

Within the transport sector, road-based transportation represents a large proportion of CO<sub>2</sub> emissions, as demonstrated in Figure 8.4. Road transport was responsible for approximately 100 times the CO<sub>2</sub> emissions of railways in 2019, emitting around 11.5 megatons CO<sub>2</sub> equivalent (mtCO<sub>2</sub>e). Railways by comparison emitted 0.1 mtCO<sub>2</sub>e. Given the high disparity in travel by Road Transport and Railways, there is a need to transition to lower polluting modes. The amount of carbon emitted from each mode per passenger km is provided in Figure 8.5 and indicates the comparative low emissions of 'tram' (light rail).

Luas Lucan provides a high-quality transport alternative to the car, offering a less stressful, quieter, smoother and lower carbon journey. Analysis of the Luas Lucan catchment (from Ballyfermot to Adamstown), proposes that many journeys may be able to transition from other modes to Luas, and that lower carbon emissions may result. Future trips (which are not yet taking place) will also be able to avail of Luas Lucan's direct access to the city and wider connectivity.

<sup>18</sup> Greenhouse Gas emissions Final 2019 (EPA Publications, April 2021)

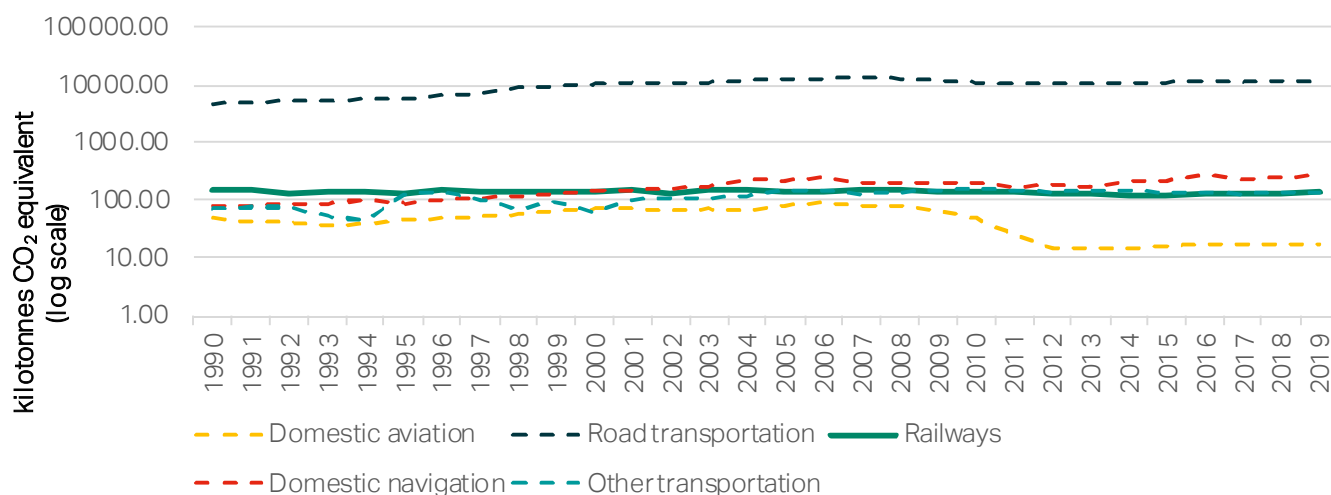


Figure 8.4 - CO2 Emissions from Transport<sup>18</sup>

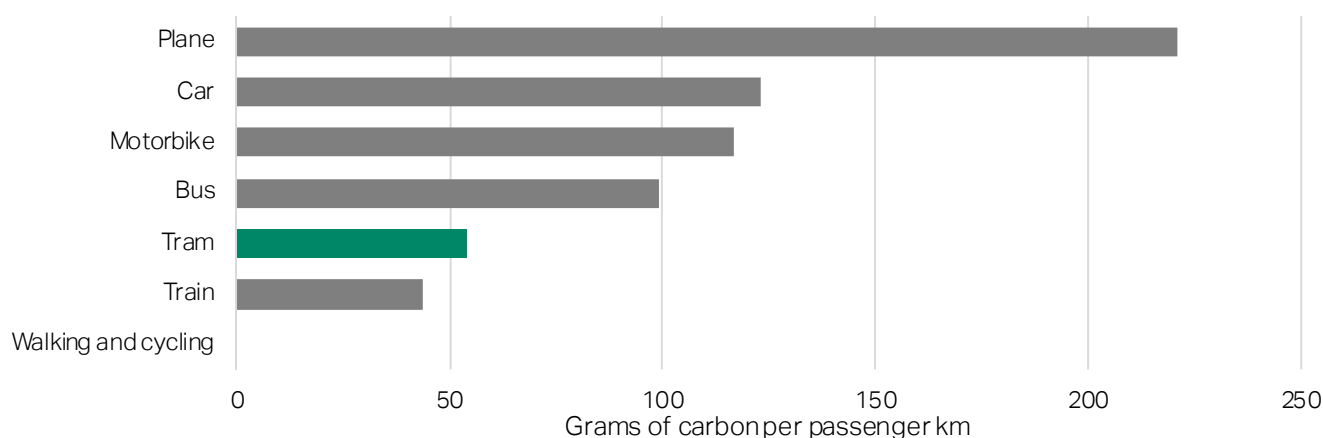


Figure 8.5 - Comparative carbon emissions per km by mode<sup>19</sup>

### 8.3 Community Severance

The presence of the M50 has led to severance between some communities and has made it difficult to build thriving communities. The provision of additional crossing points and links across the M50 will improve connections between these communities and encourage an increase in interactions.

### 8.4 Network Effect

Luas Lucan offers a high level of network connectivity across a widespread area connecting between different public transport lines.



It is envisaged that Luas Lucan will form two new branches of the red line, shown indicatively in Figure 8.6, and connecting:

- Areas of Ballyfermot, Liffey Valley, south Lucan and Adamstown
- Central areas of the city, either towards Heuston Station, or southward to the likes of St. Stephen's Green or Charlemont

<sup>19</sup> <https://tfgm.com/public-transport/tram/metrolink-and-the-environment>



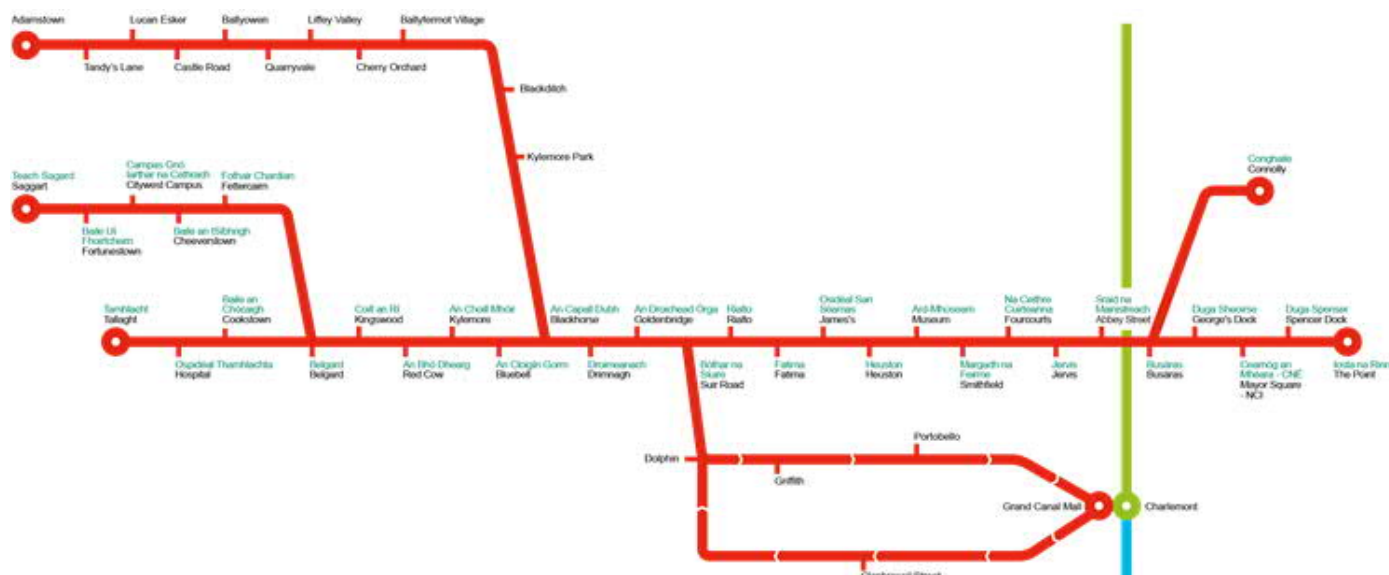


Figure 8.6 - Luas Red Line with Luas Lucan indicatively shown

#### 8.4.1 Inter-connectivity of Red Line branches

The new branches being proposed as part of Luas Lucan enable a range of new routes to be provided. Where an existing section of the red line becomes shared, between Blackhorse and Suir Road, trams may 'switch branches' and ultimately reach destinations on both new and existing line sections. For example, services may run from the existing termini of Saggart and Tallaght to both the existing destinations, or any stops towards St. Stephen's Green or Charlemont depending on the scenario. Similarly, Adamstown services will also be able to access the new branch into the southern city (linking with the Green Line at Charlemont), or to several of the existing north side termini, Connolly and The Point. Connolly Station, for example, also provides onward connectivity to the DART and wider Irish Rail networks.

#### 8.4.2 Connection with the Luas Green Line and other networks

A southern branch of Luas Lucan into the city could form a comprehensive and connected Luas network. Joining the Luas Green Line at Charlemont, for example, will enable onward travel across a wide expanse of the Greater Dublin Area.

Connecting to the Green Line, simple and sustainable access will be enabled with one interchange to northern areas of the city centre, Broombridge, Finglas and Charlestown (via Luas Finglas). Southward from Charlemont, Luas Lucan users will be able to access all Green Line stops to Bride's Glen and Bray (via a future Bray extension).

Subsequent works as part of MetroLink may also enable all Luas lines to connect to Dublin Airport with only one interchange at Charlemont, delivering a journey time of approximately 20 minutes to the airport.

#### 8.4.3 Interconnectivity with BusConnects Dublin

BusConnects Dublin is a transformative programme for buses across the capital. Improvements proposed as part of that programme include procuring more environmentally friendly buses, improved ticketing and information, a redesign of the bus service network and importantly developing an

improved network with the inclusion of 16 Core Bus Corridors<sup>20</sup> (CBCs).



Figure 8.7 - BusConnects Dublin Core Bus Corridors

Each of the 16 CBCs seeks to deliver rapid bus transit across the city's key radial routes, in addition to delivering enhanced cycling facilities. Two of the CBCs, 6 and 7, respectively to Lucan and Liffey Valley will deliver high quality public transport to or via the Ballyfermot and Lucan areas.

As part of this feasibility assessment of Luas Lucan, the BusConnects Dublin CBCs 6 and 7 are unaffected, and continue in planning. It is not envisaged that Luas Lucan will impact upon the CBC infrastructure. This assessment has also not assumed any changes to the bus services in the area. It is likely that some redesign of bus routes and/or frequencies may occur where bus and Luas overlap to provide users with a much enhanced and complementary transport network.

Luas Lucan has the potential to deliver a high frequency and speed of service into Dublin City Centre, avoiding road-based congestion. Luas also provides additional opportunity to connect into

areas of high job densities in the south of the city, approximately between St. Stephen's Green and the Grand Canal, and therefore affords a different offering to passengers compared to BusConnects. It is also important to acknowledge that this area is forecast to experience significant population growth so it is likely a combination of bus and light rail will be required to cater for future demand.

Given that Luas Lucan is in a feasibility stage of investigation with no EPR yet decided upon, both BusConnect Dublin and Luas Lucan schemes should continue planning in earnest.

#### 8.4.4 Interconnectivity with DART+

DART+ represents the largest heavy rail investment programme in the history of the State, providing a transformational increase in capacity and frequency of the existing system between Dublin City Centre and the areas of Drogheda, Maynooth, Dunboyne, Celbridge and Greystones.

Amongst the outcomes of the programme is the expectation of increased connectivity and commuter flows along the Kildare Line. Several DART stations are located at the southern extents of the Luas Lucan study area.

Two contrasting outcomes may result in relation to Luas Lucan and DART+ being in close proximity:

- DART+ may improve the influence and reach of Luas Lucan, providing a comprehensive public transport network. Large scale employers in the Lucan catchment, such as Liffey Valley Shopping Centre, may gain an increased employee and sales reach. Local residents would benefit from improved regional and national access afforded by DART+.
- Conversely, especially in a scenario where the DART Underground element of DART+ proceeds, public transport users may choose heavy rail as an alternative to Luas Lucan, where it offers a quicker service to some city centre heavy rail stations.

<sup>20</sup> <https://busconnects.ie/initiatives/core-bus-corridor/>

As such, the interactions between DART+ and Luas Lucan are complex. Luas Lucan and DART+ should work cooperatively to improve public transport for local residents and businesses.

### 8.5 *Summary of Luas Lucan's Wider Economic Benefits*

Luas Lucan from Dublin's western suburbs to the city centre will provide substantial benefits to its users located in its immediate catchment, wider transport users and the state.

Key benefits arise from the improved access to high-quality and low-stress public transport to key destinations such as city centre workplaces, key employers like Liffey Valley Shopping Centre and onward connectivity to other community centres and recreational facilities. While travel time benefits are monetisable (as detailed in the outline economic assessment, Section 0), the heightened level of accessibility to wider facilities is considered a valuable non-monetised benefit. Transport users across the GDA will be able to access more areas conveniently and quickly with Luas Lucan in place.

Another key benefit of Luas Lucan is its positive impact on the environment and sustainability of transport. Light rail achieves low carbon emissions compared to other modes of transport and will be key in not only meeting Ireland's commitments for decarbonisation, but also for improving air quality in Dublin's west and central areas.

Another stream of non-monetised benefits relate to the change in people's perceptions towards public transport due to the greatly enhanced network effect which Luas Lucan helps deliver. Connecting with other bus services and Luas lines directly (including existing sections of Luas Red Line), Luas Lucan creates a comprehensive public transport network for users. With either no or one interchange, users will be able to travel to almost all areas of Dublin, as well as wider regions via the rail and bus (coach) networks. Travel to Dublin Airport will also be enhanced greatly where users may be able to transfer onto MetroLink services at Charlemont.

A continued assessment of non-monetisable, but vitally important benefits will continue as Luas Lucan progresses.

## 9. High level environmental assessment

This section provides a high-level environmental assessment in this early feasibility assessment stage. As the design develops it is recommended that a more detailed environmental assessment is undertaken for progressive iterations to fully understand the potential environmental constraints and to ensure that they are considered as part of the later design stage. Four sections of Luas Lucan's route corridor options have been considered as part of this feasibility assessment, these include:

- Western (common) route section: Adamstown to M50
- Route corridor 1: Suir Road to Charlemont
- Route corridor 2: Fatima to St. Stephen's Green
- Route corridor 3: M50 to Heuston

Relevant resources have been employed as part of this assessment including:

- Online mapping
- Historic Environment Viewer
- Environmental Protection Agency Interactive Map
- Heritage Maps
- Flood Maps
- Geological Survey Ireland Spatial Resources

It should be noted that the environmental findings in this summary document have been based on high-level information and that a full environmental assessment should be undertaken in due course.

### 9.1 Western (common) route section: Adamstown to M50

#### 9.1.1 Scheme summary:

The western section would encompass a mix of grass track and shared embedded track bed for a route from Adamstown Station to the M50 which is approximately 7km in length. The route starts at Adamstown Station going east, then following Adamstown Park Road north joining L1030 heading east and then joining the L1011 heading east. At the roundabout on L1011 the route carries on east through Griffeen Valley Park following the boundary of the park north, the route then diverts across the park to the east following a line of trees and joins Griffeen Glen Close travelling east to join Griffeen Glen Drive. From here the route travels north along Elm Drive to the roundabout on Griffeen Road, at the roundabout the route travels east through an area of greenspace between two residential areas, then travelling under the R136 to join Abbeywood Ct. From here the route travels east to join Castle Road and then diverts north along the western boundary of Ballyowen Park following the boundary and then heading north parallel to Fonthill Road, at the roundabout the route then travels east parallel to Coldcut Road and ends at the M50.



Figure 9.1 - Western (common) route section: Adamstown to M50



### 9.1.2 High level environmental findings

This route section passes through a mixture of industrial and residential areas, as well as passing through green open spaces. The main constraints for this option include designated heritage assets, sensitive residential receptors, loss of open space and flood risk in Griffeen Valley Park, and tree removal.

There are two National Inventory of Architectural Heritage (NIAH) sites (No. 11204029 and No. 11204028) which are adjacent to the route section on Esker South. It is uncertain at this stage if these historic assets would be affected. The introduction of light rail may have an impact on the setting of these NIAH, but it is considered at this stage that the effect would not be significant.

There are sensitive residential receptors located adjacent to the proposed scheme for the majority of this option, which may experience an increase in noise during construction and operation. Appropriate mitigation measures may be considered as part of any later design stages to ensure that there is no significant effect on these receptors.

The proposed route will cross through Griffeen Valley Park, which is a green open space in Lucan. This will have a potential amenity impact, in that the

area of open space may be severed and may reduce the amenity value of the green open space in a built-up suburb of Dublin. The proposed route will cross the River Griffeen, which has a high probability of flooding, this would need to be considered as part of the design stage and flood mitigation measures may be required.

The proposed route may require the removal of trees along the roadside, within the areas of green open space and along the canal. The removal of trees would need to be considered as part of the design and appropriate mitigation provided, if required, either in the form of a root protection zone and or replacement tree planting.

## 9.2 Route corridor 1: Suir Road to Charlemont

### 9.2.1 Scheme summary

This route corridor proposes a mix of segregated track and grass track where possible, with a route running from Suir Road to Charlemont Tram Stop approximately 2km long. The route starts at Suir Road Luas Stop and travels south east adjacent to Dolphin Road and the canal, then travelling east on land adjacent to Parnell Road. The route then travels east adjacent to Windsor Terrace then joining Portobello Road, Richmond Row and then following Charlemont Mall towards Charlemont Luas Stop

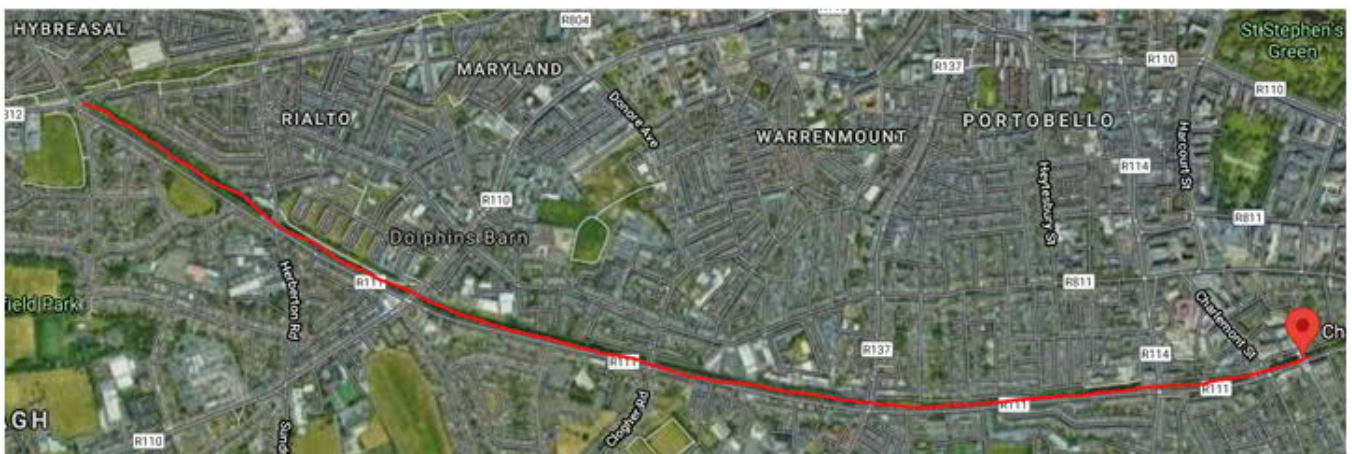


Figure 9.2 - Route Corridor 1: Suir Road to Charlemont

### 9.2.2 High level environmental findings

The route corridor passes through a mix of residential and industrial areas, and travels adjacent to Grand Canal, a proposed Natural Heritage Area, for the majority of the route. The main constraints for options 3A include proximity to European designated sites, heritage designated sites, noise sensitive receptors, flood risk and tree removal.

The closest European designated sites to the proposed scheme include the South Dublin Bay Special Area of Conservation (SAC), and the South Dublin Bay and River Tolka Estuary Special Protection Area (SPA) located 2km east of Charlemont. Further assessment will be required to understand any impacts of the proposed scheme on these sites and appropriate mitigation provided if necessary.

There are a number of NIAH sites located along the proposed line and within the surrounding area, these include houses located on Windsor Terrace where the proposed line runs parallel. The introduction of a light rail transit system may have an impact on the setting of these NIAH, but it is considered at this stage that the effect would not be significant.

There are sensitive residential receptors located adjacent to the proposed scheme for the majority of this option, which will experience a potential increase in noise levels both during the construction and operation of the proposed scheme. Appropriate mitigation measures may be considered as part of the detailed design to ensure that there is no significant effect on these receptors. Route corridor 1 may necessitate the removal of some on-street

parking along areas of the route, loss of allotments and the line may travel adjacent to Public Rights of Way (PRoW), which may affect the users of these facilities.

Parts of Dolphin Road are categorised as low risk of river flooding and the area surrounding Charlemont is medium risk of river flooding, which would need to be considered in the design and flood mitigation measures may be required. The River Poddle is a Geological Heritage Site which crosses the route corridor at Parnell Road. It is culverted where it passes the proposed scheme and would need further consideration if earthworks are proposed as part of the scheme.

The route corridor may require the removal of trees along the roadside and canal side. The removal of trees would need to be considered as part of the design and appropriate mitigation provided, if required.

### 9.3 Route corridor 2: Fatima to St. Stephen's Green

#### 9.3.1 Scheme overview

This corridor proposes a shared embed track route from Fatima Tram Stop to St Stephens Green approximately 2.18km in length. The route Starts at Fatima tram Stop and travels east adjacent to James's Walk, then passing south east through an industrial area and Joins Cork Street where the route runs east adjacent to the road. At the end of Cork Street, the route joins The Coombe traveling south east joining Kevin Street Upper following on to Kevin Street Lower and finishes at St Stephens Green.

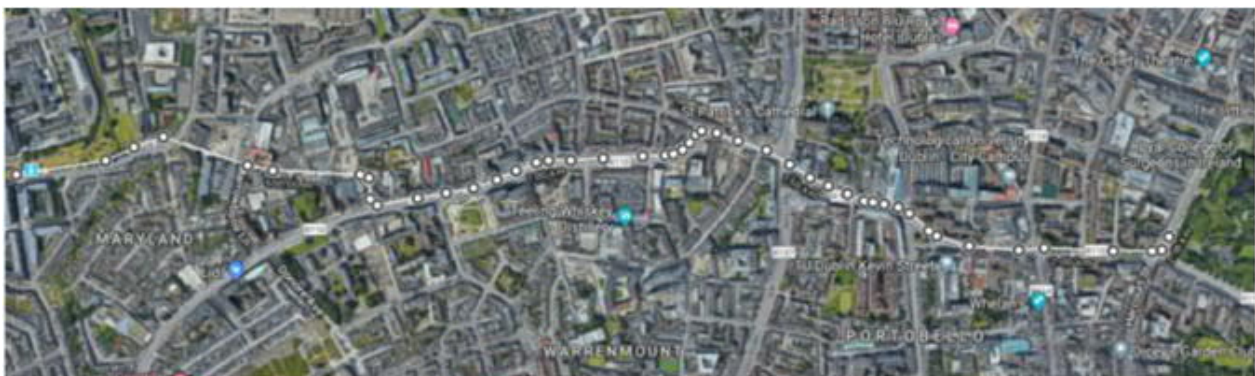


Figure 9.3 - Route corridor 2: Fatima to St. Stephen's Green

### 9.3.2 High level environmental findings

The option passes through a mix of residential and industrial area for the majority of the route. The main environmental constraints for route corridor 2 include proximity to European designated sites, heritage designated sites, noise sensitive receptors, flood risk and tree removal.

The closest European designated sites to the proposed scheme include the South Dublin Bay Special Area of Conservation (SAC), and the South Dublin Bay and River Tolka Estuary Special Protection Area (SPA) located 3.5km east of St Stephan's Green. Further assessment may be required to understand any impacts of the proposed scheme on these sites and appropriate mitigation provided if necessary.

There are a number of heritage assets located along the proposed scheme the Thomas Street Architectural Conservation Area (ACA), and several NIAH sites and Sites and Monuments Records (SMR) located adjacent to areas of the proposed line along Dean Street, Cork Street and Kevin Street Upper. There are three NIAH sites (a chimney, the International Language and Business School, and a house) located in the James Walk area which has been identified as an area of possible land take. The introduction of a light rail transit system may have an impact on the setting of these heritage assets, at this stage it is uncertain if any of the heritage assets will be affected by the scheme and further assessment may be required.

There are sensitive receptors including St James Hospital and residential properties located adjacent to the proposed scheme for the majority of this option, which will experience a potential increase in

noise levels both during the construction and operation of the proposed scheme. Appropriate mitigation measures would need to be considered as part of the detailed design to ensure that there is no significant effect on these receptors.

There are areas of low and medium probability of river flooding along and adjacent to the proposed line at Cork Street and Dean Street and will need to be considered as part of the design. The River Poddle is a Geological Heritage Site which crosses the proposed line at Dean Street. It is culverted where it passes the proposed scheme and would need further consideration if earthworks are proposed as part of the scheme.

The proposed route may require the removal of trees along the roadside. The removal of trees would need to be considered as part of the design and appropriate mitigation provided, if required.

## 9.4 Route corridor 3: M50 to Heuston

### 9.4.1 Scheme summary

Route corridor 3's eastern section proposes a mix of grass track and shared embedded track from the M50 to Heuston, approximately 7km in length. The route starts on Coldcut Road travelling east adjacent to the road passing over the M50, joining Ballyfermot Road and following it east. At the roundabout by De La Salle national School the route travels north east through Longmeadows Pitch & Putt and Liffey GAA Club. The route then travels east adjacent to Chapelizod Bypass until reaching Heuston Station.





*Figure 9.4 - Route corridor 3: M50 to Heuston*

#### 9.4.2 High level environmental findings

This route corridor passes through a mixture of residential, industrial and open green spaces. The main environmental constraints for this option include proximity to European designated sites, heritage designated sites, noise sensitive receptors, effects on community facilities and tree removal.

The closest European designated sites to the proposed scheme include the South Dublin Bay Special Area of Conservation (SAC), and the South Dublin Bay and River Tolka Estuary Special Protection Area (SPA) located 5km east of Heuston Station. Further assessment will be required to understand any impacts of the proposed scheme on these sites and appropriate mitigation provided if necessary.

There are several NIAH sites located adjacent to proposed scheme, including buildings associated with Cherry Orchard Hospital, St Matthews Church, a post box, and Heuston Station. There are four Sites and Monuments Records (SMR) including two houses and two burial sites, located adjacent to the proposed scheme on Chapelizod Bypass and Con Colbert Road. The introduction of light rail may have an impact on the setting of these heritage assets, but it is considered at this stage that the effect would not be significant.

There are sensitive receptors including Cherry Orchard Hospital, two churches, four schools and residential receptors located adjacent to the proposed line along most of its route. Which will experience a potential increase in noise levels both

during the construction and operation of the proposed scheme. Appropriate mitigation measures would need to be considered as part of the detailed design to ensure that there is no significant effect on these receptors.

The proposed route corridor may cross Longmeadows Pitch and Putt and Liffey Gaels GAA Club which is a community facility in Lucan. This will have a potential impact on the users of these facilities. The route also proposes to pass along the edge of the Irish National War Memorial which is open green space in Lucan. This may lead to the loss of trees within this area and a potential impact on the amenity value of the green open space in a built-up suburb of Dublin. The proposed route may require the removal of trees along the roadside and within the areas of green open space. The removal of trees would need to be considered as part of the design and appropriate mitigation provided, if required.

The land surrounding Heuston Station is associated with low probability of river flooding, which would need to be considered as part of the design and flood mitigation measures may be required.



## 10. Implementation

Luas Lucan was initially proposed as part of the Greater Dublin Area Transport Strategy 2016 – 2035. Prior assessment<sup>21</sup> indicated that there was sufficient demand for light rail to be progressed into the ‘western corridor’ of Lucan and Ballyfermot. The study pointed to the need for a comprehensive light rail solution in the area, ‘Western Luas’, initially to Liffey Valley Shopping Centre, supported by two quality bus corridor (QBCs) and various accompanying rail and feeder bus services.

It is recognised that given the scale of investment and the potential for BusConnects to serve short to medium term demands in some areas, there may be potential to deliver Luas Lucan in phases in line with demand. It is therefore advisable that Luas Lucan progress to a point west of the M50 as a minimum, where the greatest demand exists. This mirrors outcomes of the policy review which discusses the provision of Luas Lucan to the Liffey Valley Shopping Centre as a minimum extent.

## 11. Summary and conclusions

### Introduction

Luas Lucan consists of an extension of approximately 14-17km to the existing red line between the west city centre and the wider Lucan area. Luas Lucan has the potential to play a key role in transforming the public transport offer in the west city and wider Lucan areas. It represents a significant investment and expansion of the Luas network to provide access to high density residential areas, key employment hubs and areas designated for future expansion. It will enable direct travel to many city centre locations without interchange, while other key destinations will be served with one interchange, including Ballymount, Tallaght and wider city suburbs allowing 75% of resident’s work destinations to be accessed within 1km of the Luas network.

It will build on the success of the Luas network, improve the attractiveness of light rail, support compact urban growth, encourage and enable modal shift to public transport, and reduce congestion and emissions.

In the context of the State’s climate action plans, investment in transport infrastructure is vital. Luas Lucan will be essential to the reduction in transport emissions through the expansion of the zero ‘tailpipe’ emissions tram fleet and through the reduction emissions from road congestion by encouraging and enabling people to choose public transport.

### Purpose of this Report

This report sets out the findings of a feasibility study of Luas Lucan. The purpose of this feasibility study is to assess the feasibility of a Luas line extension between the west city centre and the wider Lucan area (‘Luas Lucan’) in the context of the current and planned transport network in the area. The purpose of the study is to investigate the viability of delivering Luas Lucan with particular reference to the strategic and economic need for the scheme, its retention in the updated Greater Dublin Area (GDA) Transport

<sup>21</sup> West Corridor Study, undertaken to inform the GDA Transport Strategy 2016-2035

Strategy (expected end Q3 2021) and subsequently its progression to the route selection stage.

### Alignment with Policy

The assessment of Luas Lucan follows several previous studies and inclusion in strategic documents over a long period including:

- 'Line F' EPF (2008-line assessment)
- Inclusion in Transport 21 (capital investment programme)
- Western Corridor Study (informing the GDA Transport Strategy)
- Inclusion in the GDA Transport Strategy (2016-2035)
- 2017 Luas Line F (Outline assessment)

There is a strong strategic policy fit between Luas Lucan and European, national, regional and local policy objectives, relating to sustainable mobility, emissions reductions, compact land use development, and consolidation of population and employment growth along high-frequency transport corridors. Luas Lucan aligns with the following policies:

- Project Ireland 2040: National Planning Framework
- Project Ireland 2040 National Development Plan (NDP)
- Climate Action and Low Carbon Development (Amendment) Act 2021
- Draft Sustainable Mobility Policy
- Draft Future Land Transport Investment Framework (FLTIF) (2021)
- Five Cities Demand Management Study (2021)
- Regional Spatial and Economic Strategy for the Eastern and Midland Region (EMRARSES) 2019–2031
- Transport Strategy for the Greater Dublin Area (GDA) 2016–2035
- NTA Integrated Implementation Plan 2019-2024

### Costs

AECOM undertook an independent feasibility costing exercise using various datasets, particulars and outline route corridors. This exercise arrived at

a cost for each of the high-level corridor options and derived an overall cost range for the project. Across the three plausible route corridor options, the forecast cost for Luas Lucan will be in the region of €0.9 billion to €1.6 billion, in 2021 prices. In addition, the annual O&M cost range for Luas Lucan is forecast as €18-25 million. In-line with national guidance, this range will be discounted and assessed in 2011 prices as part of any future economic appraisal.

### Benefits

This feasibility study used a range of three potential route corridors for the basis of the feasibility assessment. The assessment has been undertaken with the notable backdrop of several major projects being maintained as programmed, BusConnects Dublin, DART+ and Metrolink. This feasibility study does not therefore seek to undermine these projects but does recognise that optimisation will be needed to deliver a high-quality public transport services without an over-provision in specific areas.

Some key outcomes from the analysis are outlined below:

- Luas Lucan is being proposed at a vital time for population growth in Ireland. Project Ireland 2040 requires that much of the imminent growth of the population be accommodated in existing urban centres.
  - The area served by Luas Lucan is forecast to experience a 20%+ growth in population over the coming 20 years, 15%+ growth in jobs and an even greater (45%+) increase in the numbers living in the area who are employed.
  - The analysis of job destinations also points to around 75% of jobs being accessible with 1km of the Luas network which could be increased further as part of the route corridor options assessment.

It is clear that Luas Lucan is planned to serve an area of significant recent and future planned growth.

- A screenline assessment suggests that by 2043 up to 10,000 AM trips will seek to travel eastbound towards the city centre from western suburbs on either public or private transport, and around 130,000 two-way movements across a 12-hr period by 2043. Of these ~35% are projected to use public transport but wider demand management and climate action policies, improvements to the public transport network and changing perceptions around sustainability and carbon footprint will likely push this demand for PT higher.
- In terms of modal shift – Currently 74% of people in the study area west of the M50 use car as their mode for travel to work which is very high for Dublin – modelling suggests that upon opening of Luas Lucan in circa 2031 there is the potential for ~4,000 new public transport trips from local zones on a daily basis equivalent to ~1.2 million trips per annum<sup>22</sup>.
- Line loadings, extracted from the ERM, indicated reasonable demand for Luas Lucan with AM Peak line loadings of up to 3,000 passengers by 2050. The findings also acknowledged that there is scope for route optimisation to reduce the competition between BusConnects (CBCs 6 and 7, notably) and Luas Lucan. A two-way AM line loading of up to 5,000 may therefore be reasonably achievable in the longer-term following optimisation of the alignment during the route selection process. These flows therefore maintain Luas as a viable, highly sustainable public transport option.
- Significant non-monetised benefits are expected in relation to positive network effects and high level of interchange, links to many schools, education institutes and healthcare facilities, improved recreation and leisure access and wider regional and national transport links.
- In 2017, the transport sector accounted for approximately 20% of Ireland's greenhouse gas emissions. Within this, travel by car was responsible for 51.9% of all transport emissions, however, for the same period public transport accounted for just 4.4% of emissions. Modal shift from car to public transport will therefore play a key role in achieving emissions targets. Luas Lucan has the potential to increase PT mode shares in the area by 8%+ and will play an important role in this modal shift onto public transport.
- The outline economic assessment suggests that Luas Lucan has the potential to return a positive economic appraisal and that Luas Lucan be maintained as a viable transport project as part of the wider GDA transport network, and that further optioneering and analyses be conducted.
- Future economic appraisal will fully capture all benefits including journey time reliability, agglomeration, carbon and active travel time, health and quality benefits as appropriate.
- It is recognised that given the scale of investment and the potential for BusConnects to serve short to medium term demands in some areas there may be potential to deliver Luas Lucan in phases in line with demand. It is therefore advisable that Luas Lucan progress to a point west of the M50 as a minimum, where the greatest demand exists. This mirrors outcomes of the policy review which discusses the provision of Luas Lucan to the Liffey Valley Shopping Centre as a minimum extent.

### Summary

The outcome of the analyses is that whilst Luas Lucan attracts good passenger demand, a later optimisation exercise is necessary to ensure the overall public transport offer in the area best serves users. It is also reasoned that alternatives such as a shorter line (for example, to Liffey Valley Shopping

<sup>22</sup> Approximately bounded by the M4 to the north, Grand Canal to the south, Dodsborough Road/ Adamstown Boulevard to the west and Kilemore Road to the east

Centre) may also be valid either as phases or long term with supporting 'feeder' services and links.

This feasibility study therefore points to the ongoing inclusion of Luas Lucan in the forthcoming GDA Transport Strategy, with an acknowledged need for more detailed analysis, optioneering and route assessment.

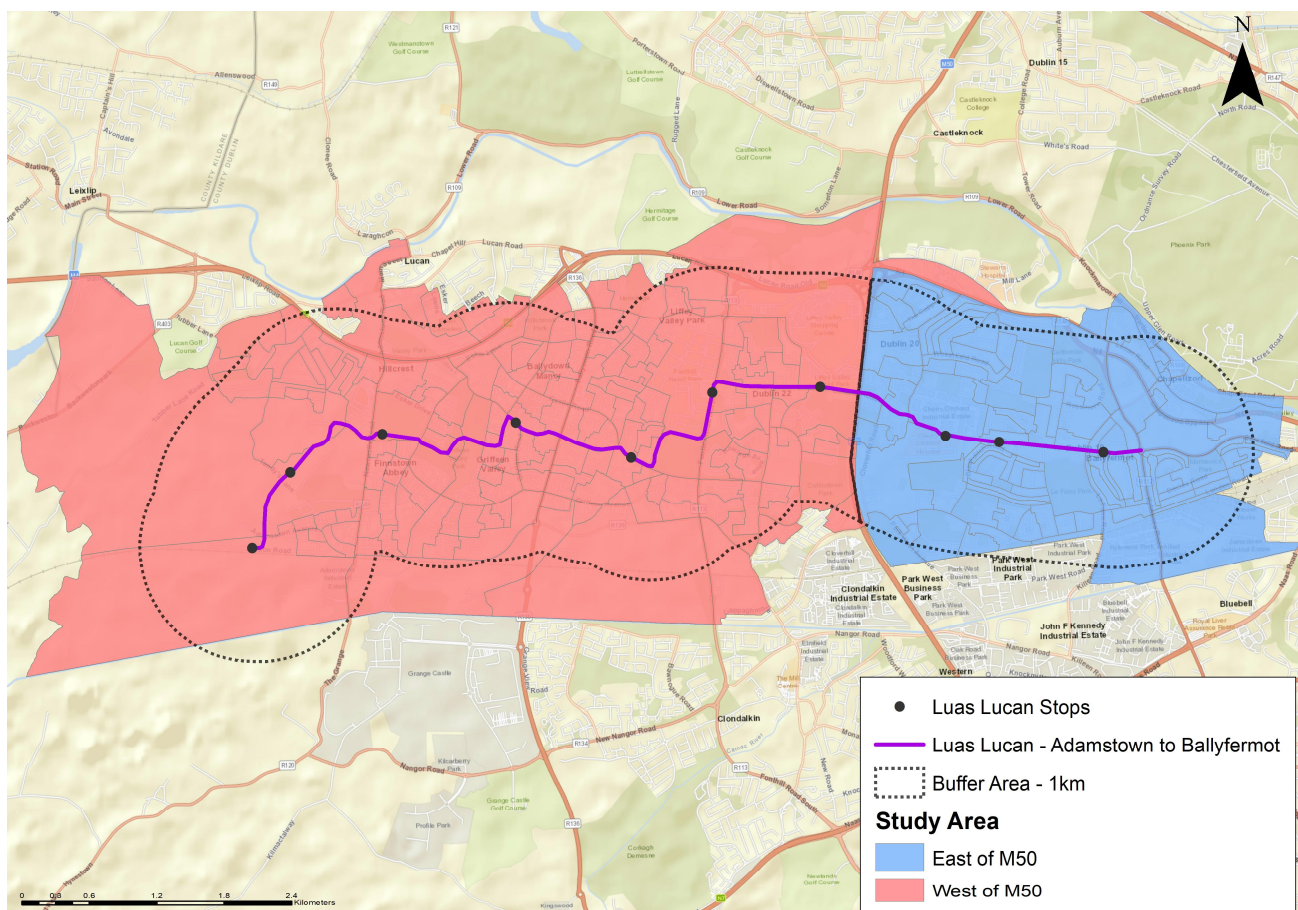


## Appendix A - Spatial Analysis

## Ballyfermot-Adamstown Luas Study Area

## Study Area Definition

In order to produce statistical results and Census analysis, a study area for the Ballyfermot-Adamstown section of the Luas to Lucan line had to be developed. To achieve this, a 1 km buffer was applied to the Luas route and the CSOSmall Areas which had their centroid within the 1 km buffer were extracted. Due to contrasting conditions on either side of the M50, the study area was divided into east and west of the M50 versions so that the results could be compared. In some cases, such as the POWSCAR analysis, the east/west divide is not used and the whole study areas forms the origin and destination of trips under study. The CSOSmall Areas which make up the Ballyfermot-Adamstown study area, including the east/west division at the M50, are shown below.



### Ballyfermot-Adamstown Study Area CSO Small Areas

### Demographic Characteristics

This section contains a range of demographic statistics and maps on the Ballyfermot-Adamstown study area to inform the need for scheme and the types of people who would benefit from a new Luas line in this area.

### Study Area Demographic Profile

The population of the eastern study area is 30,874 and the population of the western study area is 55,652, with the total population for the entire study area being 86,526. In the eastern study area, there is a near 50/50 split in respect to the gender of residents, while in the western study area residents are 49.2% male and 50.8% female. The table below shows the breakdown of the resident population by nationality, which indicates that a higher proportion of residents in the eastern study area are Irish, with a slightly higher proportion of non-Irish nationals living in the western study area. As the western study area encompasses newer development areas on the outskirts of the city, it is logical that they contain a greater mix of nationalities because higher immigration has taken place in recent decades.

#### Census 2016 - % Nationality in Each Study Area of Ballyfermot-Adamstown section

	Ireland - Nationality	UK - Nationality	Poland - Nationality	Lithuania - Nationality	Other EU28 - Nationality	Rest of world - Nationality
East of M50	93.6%	0.8%	1.4%	0.2%	2.1%	1.9%
West of M50	86.3%	1.1%	2.8%	1.6%	4.1%	4.1%

The table below provides a breakdown of the resident population by principle economic status for residents over the age of 15. There are some clear differences between the two study areas, with a higher proportion of people working or studying in the western study area and lower proportions of people who are retired or unable to work due to disability. As the eastern study area residences will have been constructed prior to the western study area, it is unsurprising that the eastern study area contains fewer workers and more residents who are older or retired as this is an older demographic. However, across both study areas, 35,746 people are at work and this will produce significant travel demand which a new Luas line could service.

#### Census 2016 - % of Population aged 15 years and over by principle economic status

	At work	Looking for first regular job	Unemployed having lost or given up previous job	Student	Looking after home/family	Retired	Unable to work due to permanent sickness or disability	Other
East of M50	48.1%	1.0%	10.8%	9.6%	7.8%	13.7%	7.2%	1.8%
West of M50	58.6%	1.2%	8.6%	12.5%	8.2%	7.0%	3.7%	0.3%

The table below shows the number of people with a disability, by gender, in the two study areas. In total, there are 12,003 people with a disability across the entire study area. In cases where this involves a physical disability, the provision of a Luas route would be beneficial as they have low floor access where a wheelchair, or mobility aid, can roll onto the tram without need for a ramp as would be required for a bus or heavy rail. The addition of a Luas to this area for people with physical disabilities would be a major advantage for them in respect to improving access and independent mobility to jobs and services. In respect to the gender breakdown, there are slightly more women living in the study area with a disability than men.

#### Census 2016 – Number of People with a Disability by Gender

	Males	Females	Total
East of M50	2,709	3,043	5,752
West of M50	3,063	3,188	6,251
Total	5,772	6,231	12,003

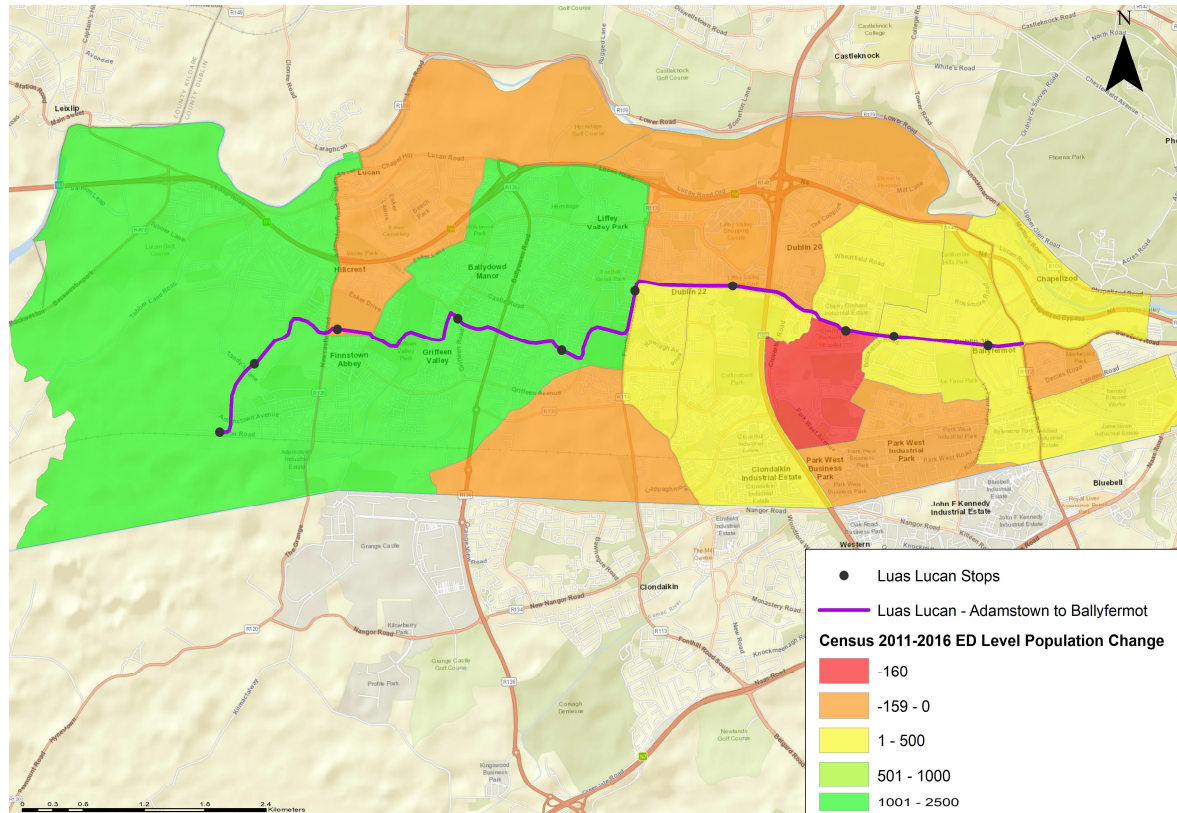
The table below provides the proportion of households in each study area which have access to broadband. Similar to trends observed previously, there is less access to broadband in the eastern study area and this could be related to the older, retired population in this area. The Census was over 5 years ago and the number of households with access to broadband will likely have increased in recent years, particularly during the Covid-19 pandemic to facilitate working from home. Due to the high level of broadband access in the study area, it is likely that some of the working population may work from home for at least some of the week following the end of the pandemic.

*Census 2016 - % Households with Broadband*

	Broadband	Other	No
East of M50	74.3%	4.0%	21.7%
West of M50	88.2%	3.1%	8.7%

### *Census 2011-2016 Population Change (Electoral Divisions)*

The figure below shows the population growth which occurred in the study area between Census 2011 and 2016 according to CSO electoral divisions. Electoral divisions are a consistent boundary between multiple Census years; however, they are less accurate than CSO Small Areas due to them covering a larger geographic area. This figure shows similar trends to the population change grid with strong population growth in central and western parts of the study area, with lesser population growth or population decline taking place in the eastern parts of the study area.



*Census 2011-2016 Population Change per Electoral Division*

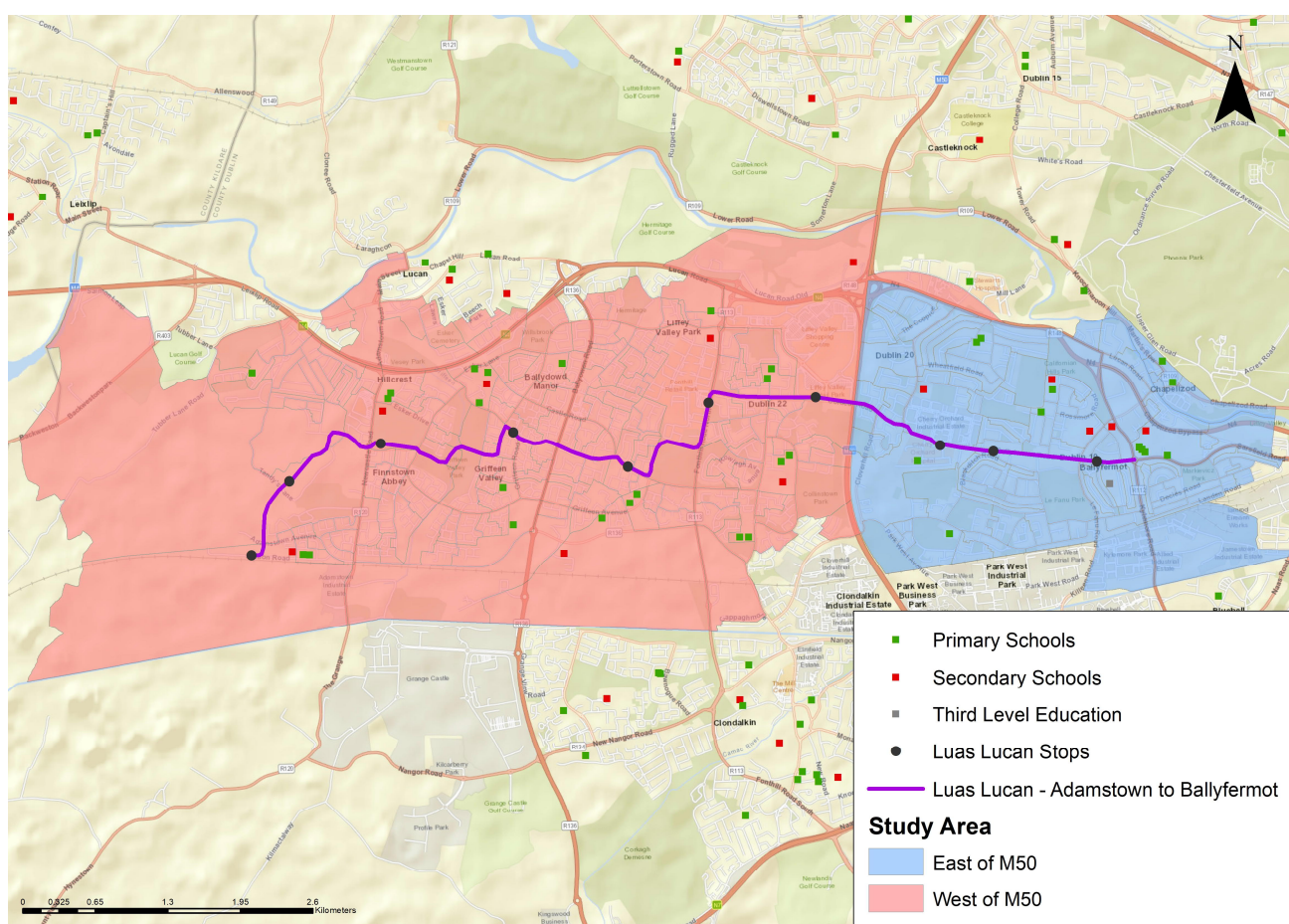


## Development Characteristics

This section presents a range of summary statistics and maps in respect to development characteristics in the study area such as building uses, job locations, education facilities and land use.

### Education Facilities

The figure below shows the location of primary and secondary schools in the study area as well as third level institutions. In the western study area, there are 21 primary schools and 7 secondary schools, while in the eastern study area there are 13 primary schools and 5 secondary schools. There is only one third level institution, Ballyfermot College of Further Education, located in the eastern study area. While light rail is not typically a common mode of school travel, the proximity of the proposed Luas line to a large number of primary and secondary schools means that a certain amount of school travel is likely to take place via Luas if the new line is constructed, particularly for non-car households which are too far from school to walk or cycle.



Location of Education Facilities in Ballyfermot-Adamstown Study Area

### GeoDirectory Building Uses

The table below shows the number of residential and commercial addresses in each study area using the GeoDirectory (2020) database. The western study area contains a significantly higher number of residential homes, but both study areas have a similar amount of commercial addresses. It is important to note that this

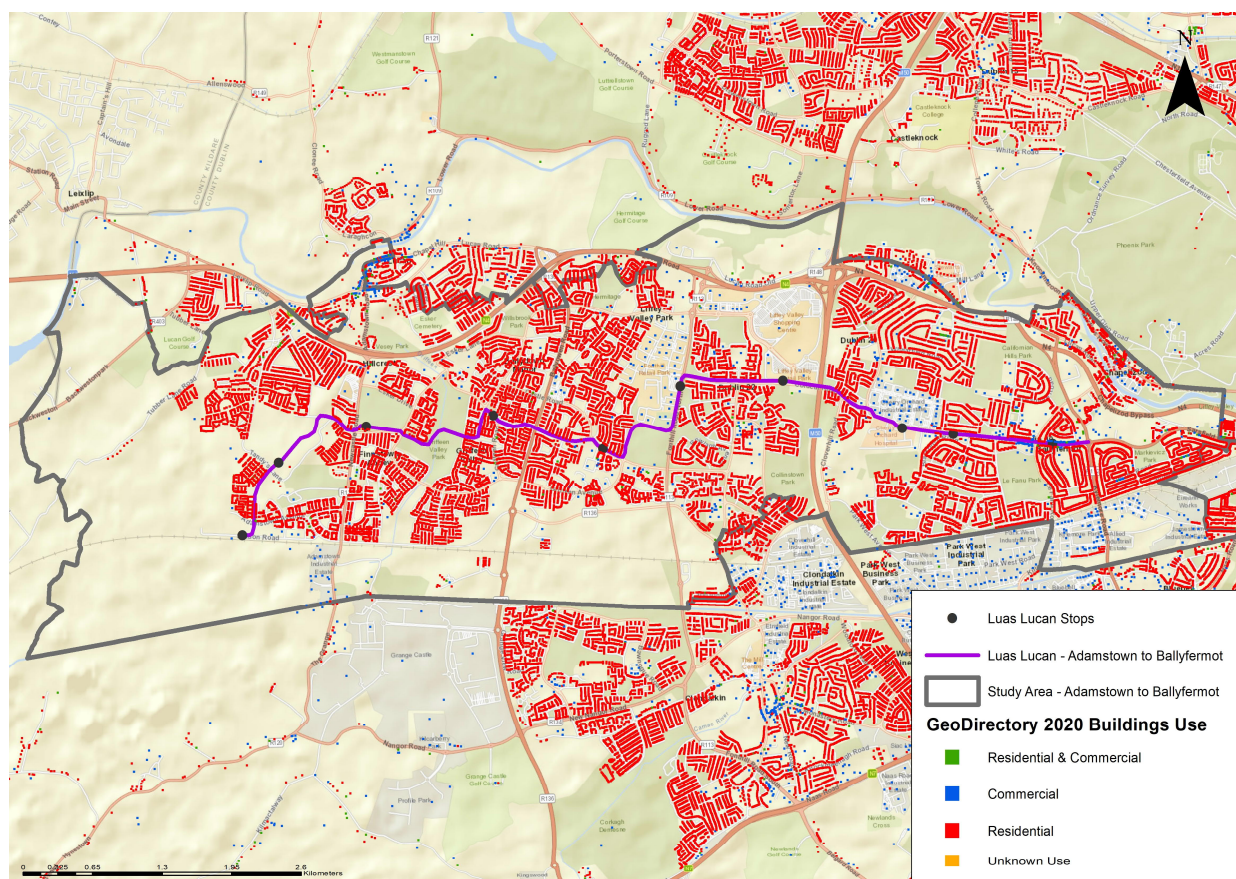


database provides the number of commercial addresses, but this data does not include information on the size of the business and the importance of the businesses involved could vary significantly. However, this database is useful for understanding the land-uses present in the study area and the split between commercial and residential buildings.

#### *GeoDirectory 2020 – Building Uses in Ballyfermot-Adamstown Study Area*

	No. Residential Addresses	No. Commercial Addresses
East of M50	29,007	2,687
West of M50	44,570	20,162
<b>Total</b>	<b>73,577</b>	<b>22,849</b>

The figure below shows each building in the study area according to residential or commercial use according to the GeoDirectory (2020) database. As the table highlighted, there are a larger number of commercial buildings to the east of the M50, but fewer houses. The western study area contains a larger number of residential properties, which will expand over time as the Adamstown and Clonburris Strategic Development Zones are constructed. The addition of the Adamstown and Clonburris residential units, which will be denser than most other areas of the study area, will significantly increase the catchment population for a future Luas line in this area.



*GeoDirectory 2020 – Building Use in the Ballyfermot-Adamstown Study Area*

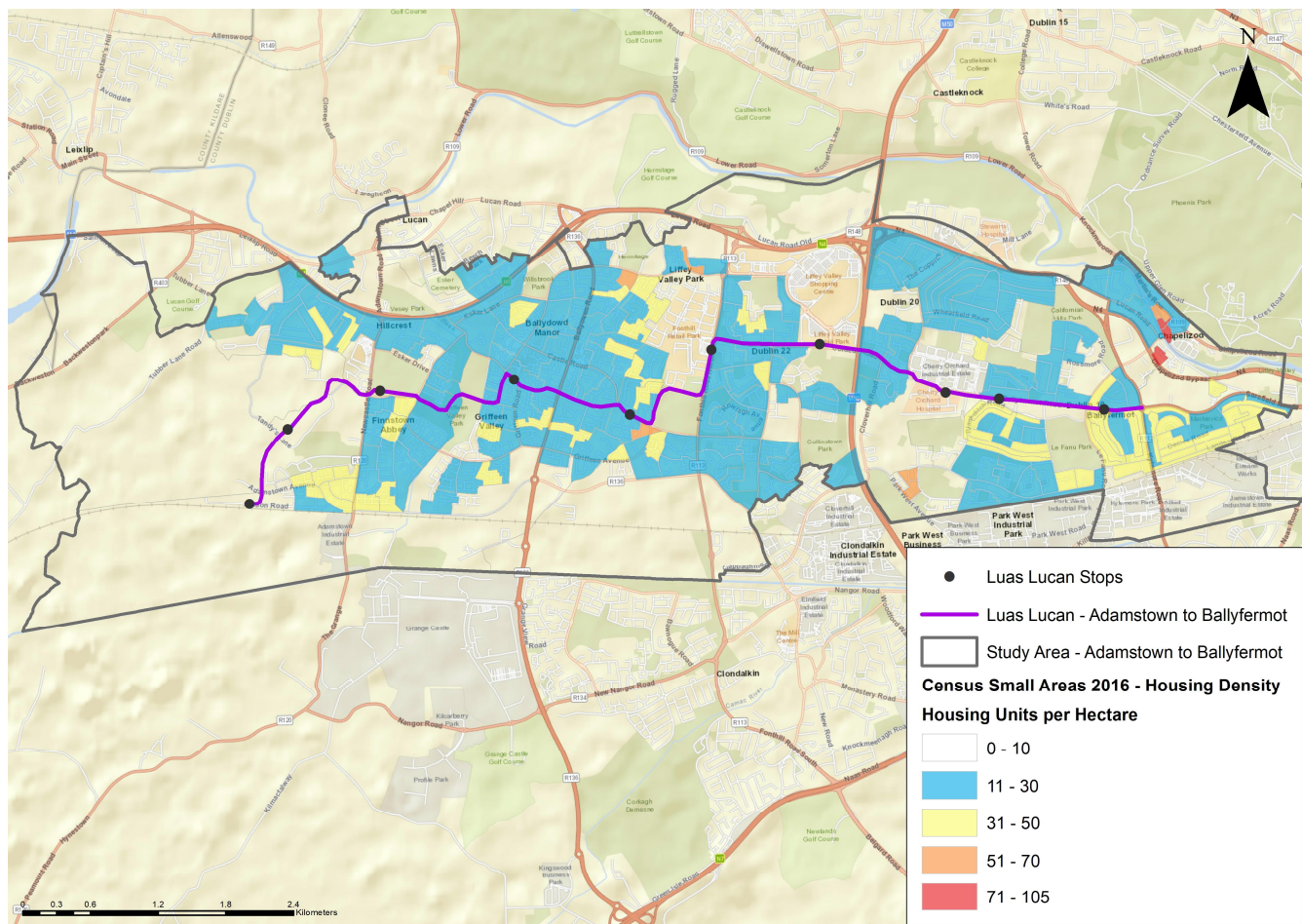
## Housing Density

provides a breakdown of the number of houses in each study area and the average housing density in units per hectare (UPH). While the western study area contains more residential units, the housing density is lower than the eastern study area and this will affect the potential patronage for a future light rail service in this area. The Sustainable Residential Development in Urban Areas (2009), state that housing densities of 35-50 UPH should be encouraged on suburban greenfield sites for the most efficient utilisation of land and UPH levels below 30 should be discouraged. Housing density is important for public transport patronage, with higher density areas being able to support higher frequencies of service. Clearly, the housing density at 21-26 UPH is very low in the study area and this will reflect a large number of semi-detached and detached homes on low density housing estates. However, there is the potential for the average housing density in the study area to increase significantly with the completion of the Adamstown and Clonburris SDZ sites. The SDZ sites are masterplan-led developments with a focus on sustainable development and so they will support a greater mix of houses and apartments with higher average UPH levels than the surrounding areas.

### *Census 2016 – Number of Homes and Housing Density*

Study Area	Number of Homes	Housing Density (UPH)
East of M50	10,894	26.75
West of M50	17,055	21.56
Total	27,949	23.61

The figure below shows the units per hectare in CSO Small Areas across the study area based on Census 2016 records, with the lowest values (under 10 UPH) excluded to focus on the higher density areas. This figure shows that there are clear pockets of higher density development near Liffey Valley and in Ballyfermot, but these are very much in a minority across the study area. The predominant housing density level across the study area is 11-30 units per hectare, which will be typical modern semi-detached housing estates, where public transport patronage will be weaker. However, there are also a substantial number of areas with higher 31-50 units per hectare; particularly in Ballyfermot which will probably involve former Council housing estates which are typically denser than modern suburban housing estates. These higher density areas are more likely to produce a substantial number of potential passengers for a future Luas line in this area. Overall, the construction of Adamstown and Clonburris will be vital to raise housing density levels in the study area to support a reasonable frequency on light rail.



*Census 2016 – Housing Density per Small Area (Units Per Hectare)*

### Type of Housing

Across the two study areas, the majority (86%) of private housing is composed of houses while only 12-13% of units are apartments (see table below). The limited number of apartments in each study area, helps to explain why housing densities are so low along the corridor, with most housing composed of lower density housing estates.

*Census 2016 - % Private Households by Type of Accommodation*

	House/Bungalow	Flat/Apartment	Bed-Sit	Caravan/Mobile home
East of M50	86.9%	12.7%	0.1%	0.3%
West of M50	86.8%	13.0%	0.0%	0.1%

### Age of Housing Stock

The table below shows a breakdown of the age of housing stock in the two study areas. This highlights a clear contrast in the age of housing stock, with the majority of eastern study area housing constructed prior to 1991, while most of the western study area housing has been constructed since 1991. This difference helps to explain the higher number of retired people living in the eastern study area, with less access to broadband.

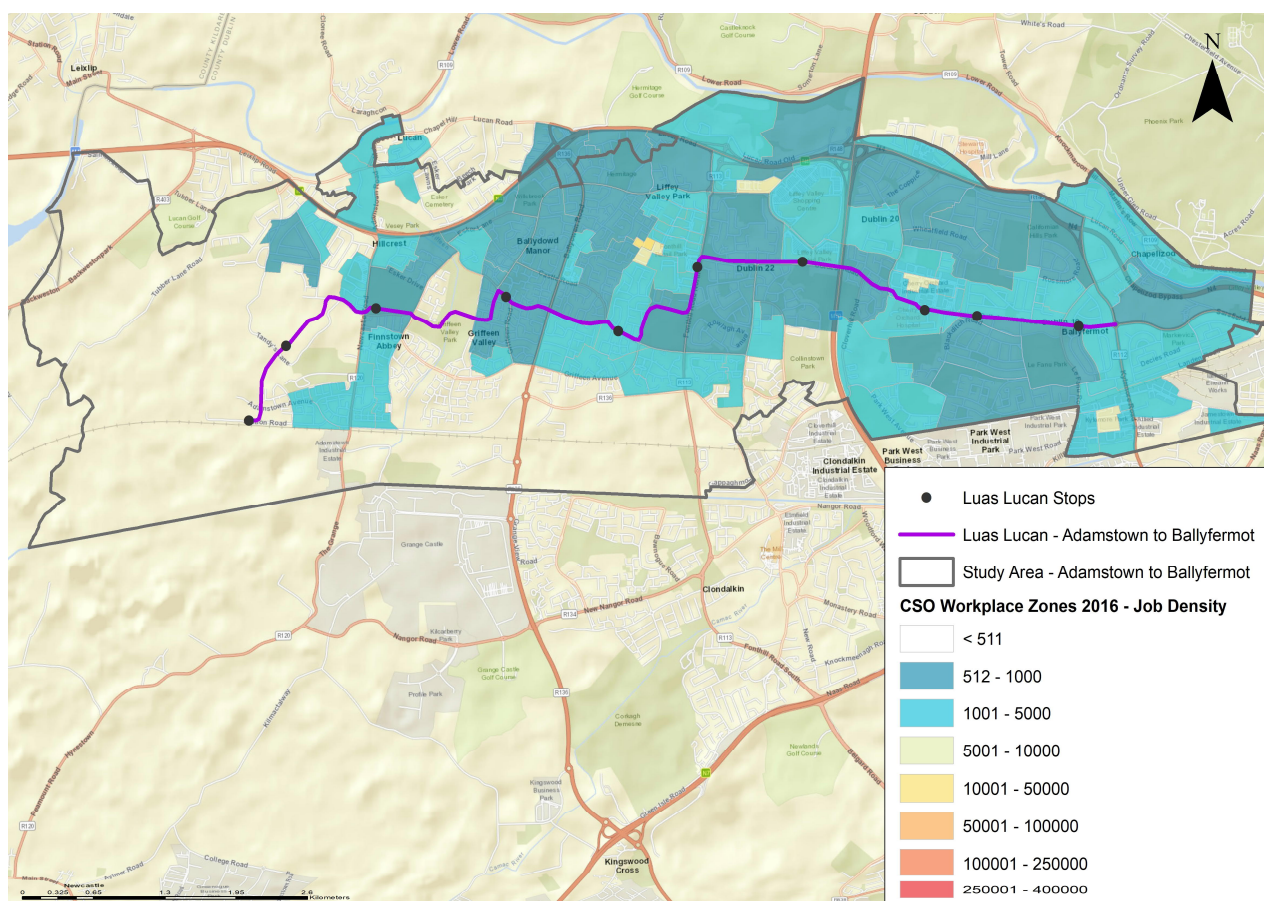


### Census 2016 – % Housing by Year Constructed

	Pre 1919	1919 - 1945	1946 - 1960	1961 - 1970	1971 - 1980	1981 - 1990	1991 - 2000	2001 - 2010	2011 or Later
East of M50	1.9%	4.6%	39.6%	11.8%	10.5%	11.6%	9.6%	10.0%	0.4%
West of M50	0.5%	0.6%	0.9%	4.2%	19.0%	12.6%	34.9%	25.3%	2.0%

### Location of Jobs

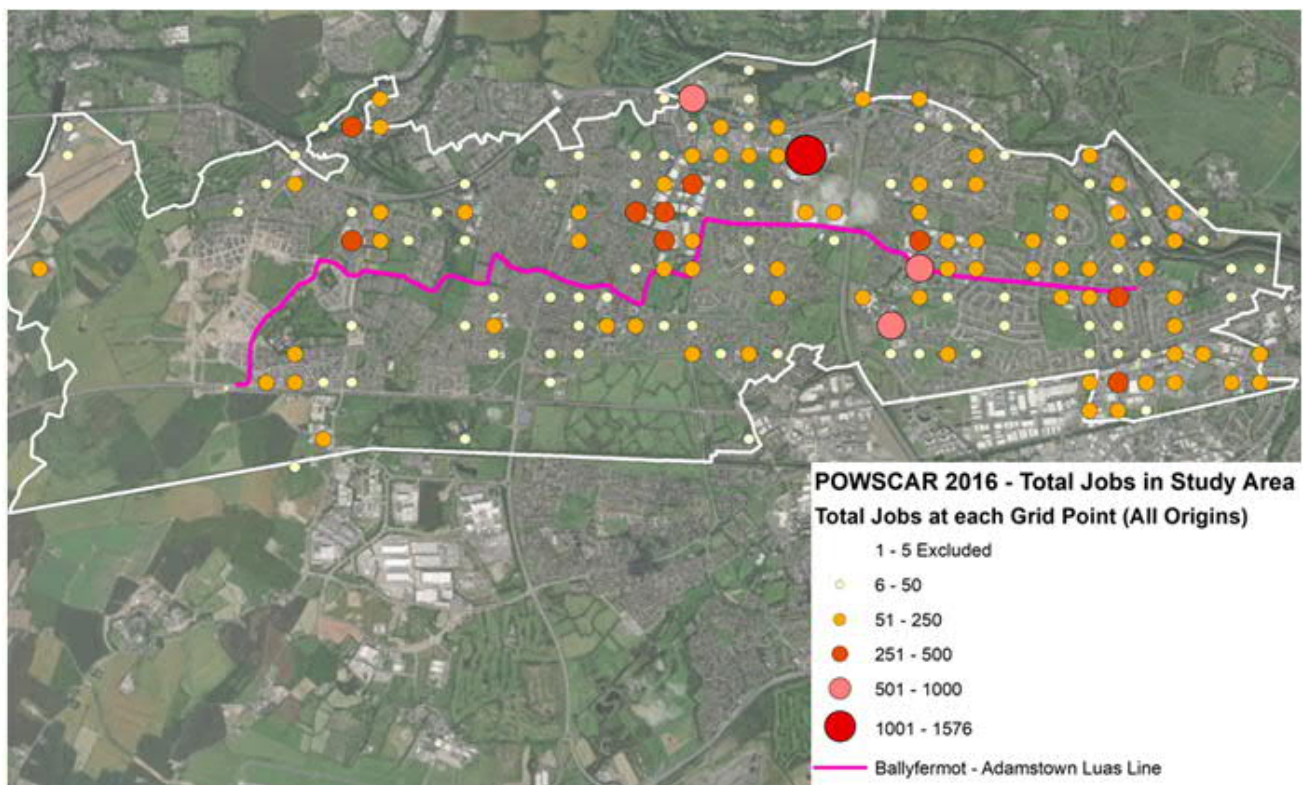
The figure below shows the job density according to CSO workplace zones across the study area in 2016. The CSO Workplace Zones have different boundaries to the CSO Small Areas, which are the basis of the study area outline, and so this data extends outside the study area boundary in some cases. Job density is used to compare workplace zones of different geographic size in respect to their importance for local employment. However, it is important to note that while job density refers to the number of jobs per square kilometre, in most cases the workplace zone will not contain this number of jobs because it is smaller than a square kilometre. In total, there are 10,143 jobs in the eastern study area workplace zones and 15,078 jobs in the western study area. In respect to job density, there is a pocket of higher job density in Fonthill Retail Park but otherwise most of the study area Small Areas have a job density of 500-5000 jobs per square kilometre, with some areas containing less than 500 jobs per square kilometre in largely residential areas.



Census 2016 – Job Density Per Square Kilometre in CSO Workplace Zones



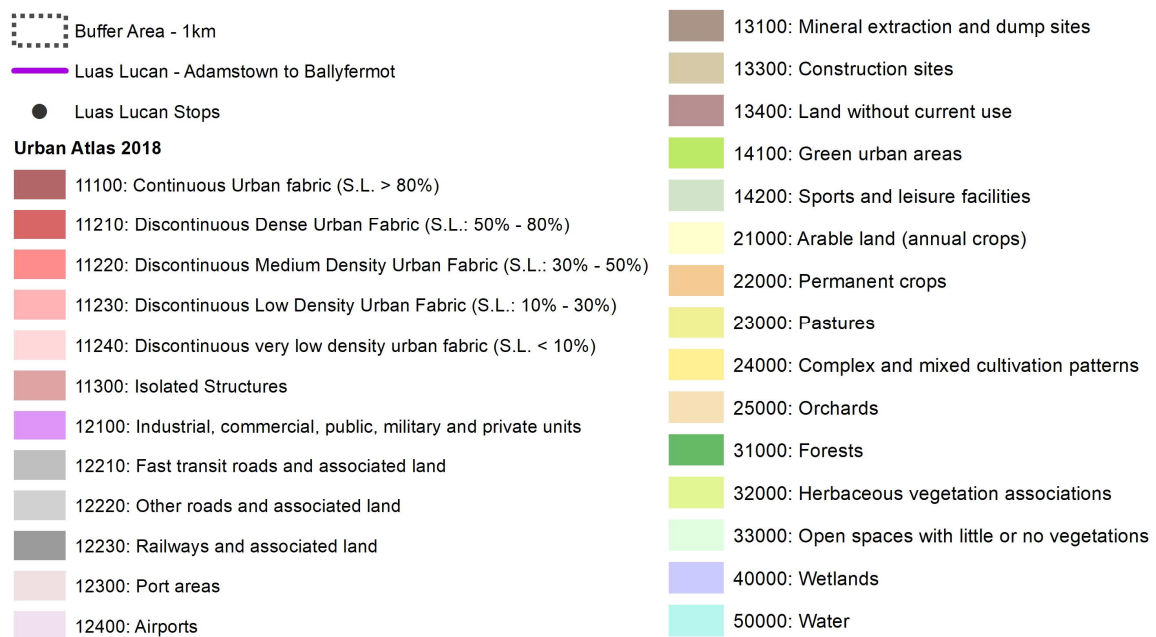
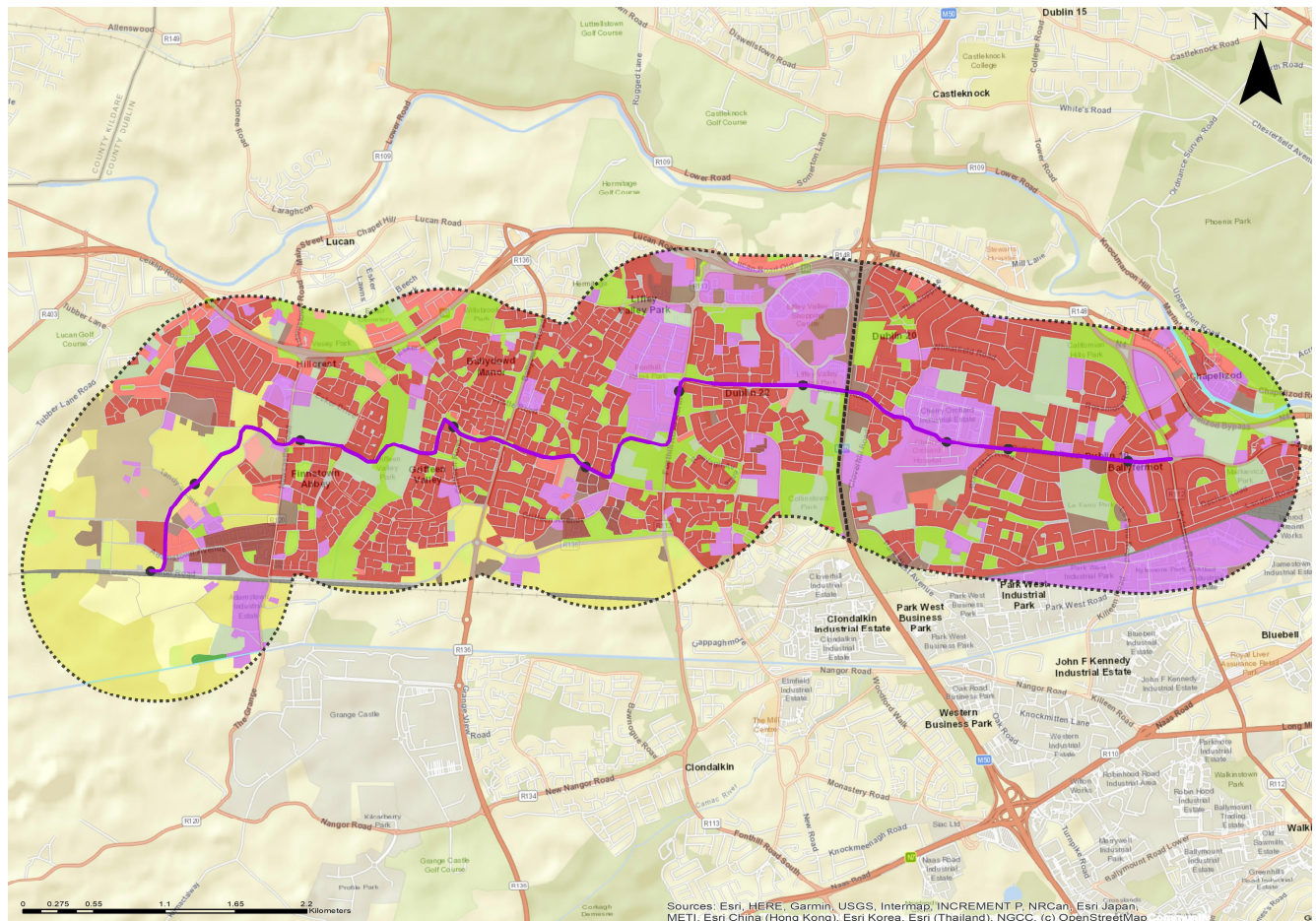
The figure below shows the location of job destinations in the study area using POWSCAR (2016) for work trips originating in any location nationwide. This is useful to understand the importance of commercial areas for local employment, with locations such as Liffey Valley Shopping Centre, Fonthill business park, the Hermitage hospital, Cloverhill prison and Cherry Orchard Hospital highlighted as major job destinations in the study area. There are strong concentrations of jobs in the eastern study area, while the western study area has weaker concentrations of jobs as distance increases from the M50 and neighbourhoods transition into largely residential uses. The presence of major employment destinations within the catchment of Luas Lucan will help to attract trips on the service for people living across the Luas network for employment.



*POWSCAR 2016 – Location of Job Destinations (from Nationwide) in Ballyfermot-Adamstown Study Area*

### *Urban Atlas Land Uses*

The figure below shows the European Urban Atlas land-uses categories in the study area to identify the different types of trip attractors and generators which are present along this corridor. This figure shows that the two major land uses are 'continuous urban fabric', which will consist of office and residential uses, and industrial/commercial uses. Following this, green space and parkland take up a substantial amount of land, as well as undeveloped pastures or active construction sites in Adamstown. This figure shows that the Luas Lucan corridor would serve a wide variety of land-uses, which will assist in providing sufficient patronage on the service. Furthermore, there is a substantial amount of undeveloped land which could provide for densification of residential and employment land uses to support the new Luas line.



Urban Atlas (2018) Land Uses in Ballyfermot-Adamstown Study Area

The table below provides a breakdown of Urban Atlas (2018) land-uses in the study by area (Sq. KM). This shows that nearly half of the study area is composed of discontinuous dense urban fabric and industrial/commercial uses. Following this, roughly 11% of the study area is pastures, which shows the potential for infill development and densification. Similarly, 10.8% of the study area is composed of green urban areas which may also have some infill potential. If the Lucan Luas line is constructed then it will lead to an increase in local land values which would make it more attractive to develop, particularly at higher densities which would result in a greater number of units per site, and the Urban Atlas shows that there is the potential for a significant amount of further development to take place.

*Breakdown of Urban Atlas Land Use in Study Area by Square Kilometre*

Urban Atlas (2018) Land Use Category	% of Area per land use (Sq. KM)
Discontinuous dense urban fabric	31.50%
Industrial, commercial, public, military and private units	15.46%
Pastures	11.18%
Green urban areas	10.88%
Other roads and associated land	8.37%
Sports and leisure facilities	6.50%
Discontinuous medium density urban fabric	2.98%
Construction sites	2.70%
Arable land (annual crops)	2.47%
Land without current use	2.40%
Continuous urban fabric	1.41%
Herbaceous vegetation associations (natural grassland, moors...)	1.10%
Railways and associated land	0.90%
Mineral extraction and dumpsites	0.79%
Fast transit roads and associated land	0.70%
Discontinuous low-density urban fabric	0.36%
Water	0.23%
Forests	0.05%
Isolated structures	0.02%



## Travel Behaviour

This section provides an overview of modal split characteristics and other travel behaviour indicators from the Irish Census.

### Car Ownership

The table below shows the proportion of households in each study area which own a motor vehicle. Notably, car ownership is lower in the eastern study area with 29% of households living without a motor vehicle and this population would benefit from a new Luas line in this area. Furthermore, in the eastern study area, car ownership generally involves 1 car households with only a minority of households owning 2+ vehicles. In contrast with this, only 11% of households in the western study area live without a car and 1 or 2 car ownership is much more prevalent. This difference may reflect the weaker public transport options available in the western study area and a new Luas line would provide a viable alternative to the car for radial trips and Luas-accessible destinations.

#### Census 2016 - % of Households with a Car

	No car	1 car	2 cars	3 cars	4 or more cars	Total
East of M50	29.0%	46.7%	19.9%	3.9%	0.6%	100%
West of M50	11.9%	45.6%	37.0%	4.4%	1.1%	100%

### Modal Split

The table below provides the modal split results for residents of the two study areas for work trips. Similar to the car ownership results, the eastern study area is less car dependent with larger proportions of people travelling to work via walking, cycling, bus and rail than in the western study area. However, 61-73% of people in both study areas are still using private motor vehicles to get to work and this suggests a significant level of car dependency. The bus is the primary mode of public transport in both study areas with around a fifth of people travelling to work via this mode. While current public transport use is quite modest in the study area, this may reflect the lack of viable alternatives to the car and the provision of a new Luas line may have the potential to promote substantial modal shift from cars to light rail in the future.

#### Census 2016 – Modal Split for Work Trips

	Walk	Cycle	Rail & Luas	Bus	Private motorised vehicles
East of M50	9.5%	5.1%	1.6%	22.7%	61.1%
West of M50	4.8%	2.9%	0.9%	17.8%	73.7%

The table below provides the modal split characteristics for residents of the two study areas for education trips. Due to school travel, education trips generally have a higher percentage of walking trips and this is the case in Lucan with 39-40% of people walking to education. Similarly, the provision of school buses has resulted in 18-24% of people taking the bus to education, but very few children or students are travelling to education by bike or rail.

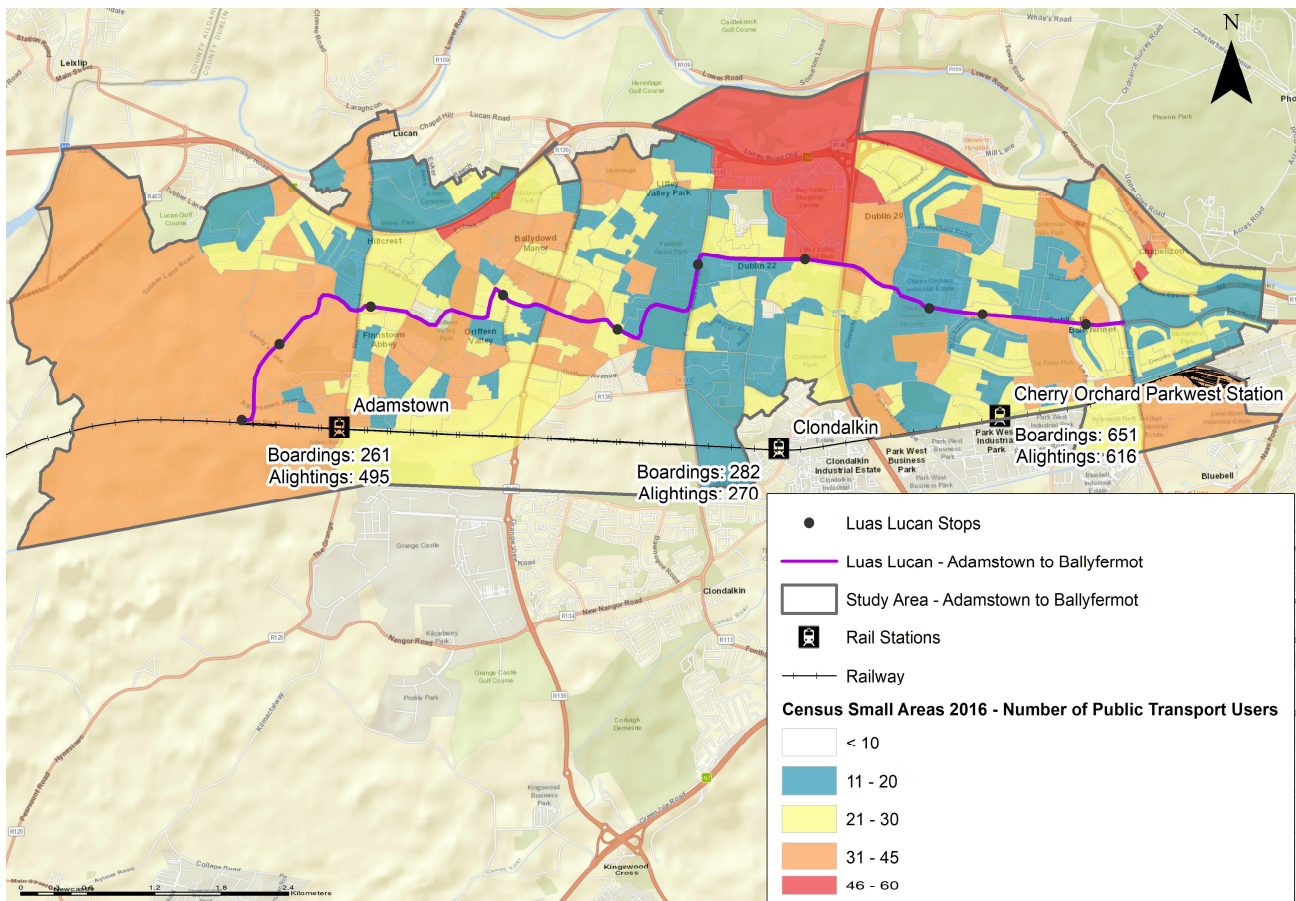
#### Census 2016 – Modal Split for Education Trips

	Walk	Cycle	Rail & Luas	Bus	Private motorised vehicles
East of M50	40.7%	2.3%	0.5%	24.5%	32.0%
West of M50	39.6%	4.0%	0.2%	18.3%	37.9%



## Public Transport Users

The figure below shows the number of people in each CSOSmall Area who travel to work or education by public transport, along with the number of people who use each train station on a typical day according to the 2019 heavy rail census. Most areas have 11-45 public transport users per small area, which considering each small area contains an average of 90 homes is quite low at present. Parkwest is the most used heavy rail station in the study area, with circa 600 people using trains there each day, followed by Adamstown and Clondalkin/Fonthill station. It should be noted that there is another train station, Kishoge, located between the Adamstown and Clondalkin stations which has not been opened and will serve the future development at Clonburris.



*Census 2016 – Number of Public Transport Users per Small Area (Work and Education Trips)*

### Time Leaving for Work or Education

The table below shows when people leave for work or education across both study areas. There is little difference between the east and west study areas, with most people departing for commuting trips between 7.30am and 9am.

#### Census 2016 – Time People Age 5+ Leave Home for Commuting Trips

	Before 06:30	06:30 - 07:00	07:01 - 07:30	07:31 - 08:00	08:01 - 08:30	08:31 - 09:00	09:01 - 09:30	After 09:30
East of M50	6.5%	8.8%	10.5%	16.3%	24.1%	19.9%	4.9%	9.0%
West of M50	6.6%	9.6%	11.5%	16.3%	22.4%	22.1%	3.7%	7.7%

### Duration of Work or Education Trips

The table below shows the time people estimated their trip to work or education took in the 2016 Census. There is little variation between the two study areas, with the largest proportion of people taking 15-30 minutes to commute to work or education.

#### Census 2016 – Time Taken for Commuting Trips for People Age 5+

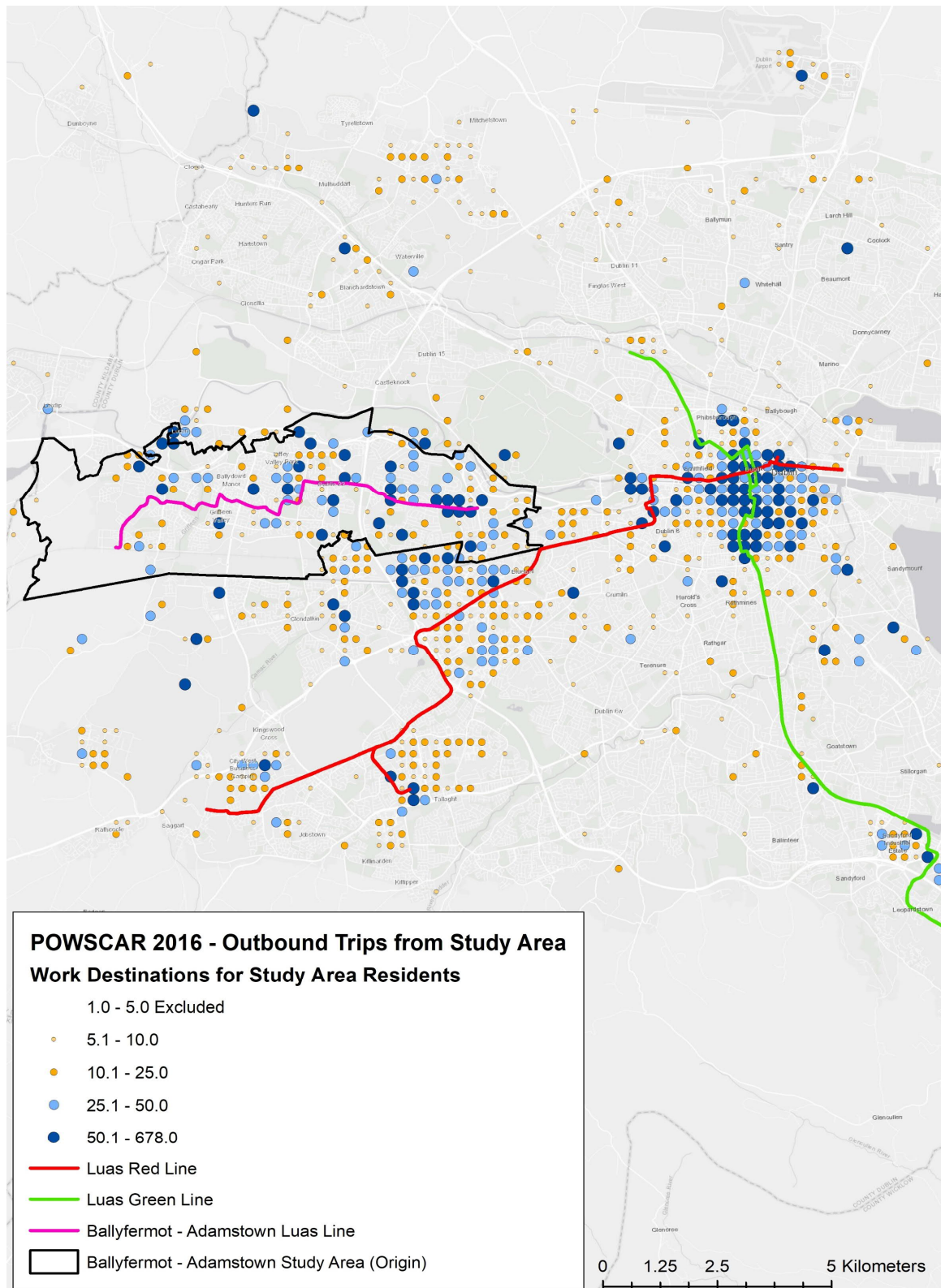
	Under 15 mins	1/4 hour - under 1/2 hour	1/2 hour - under 3/4 hour	3/4 hour - under 1 hour	1 hour - under 1 1/2 hours	1 1/2 hours and over
East of M50	26.1%	35.3%	23.2%	7.2%	6.6%	1.6%
West of M50	25.7%	32.5%	21.7%	8.4%	9.3%	2.4%

### POWSCAR Origin-Destination Analysis

This section presents the results of the POWSCAR (2016) origin-destination analysis for the Ballyfemot-Adamstown study area.

#### Destination of Outbound Work Trips by Study Area Residents

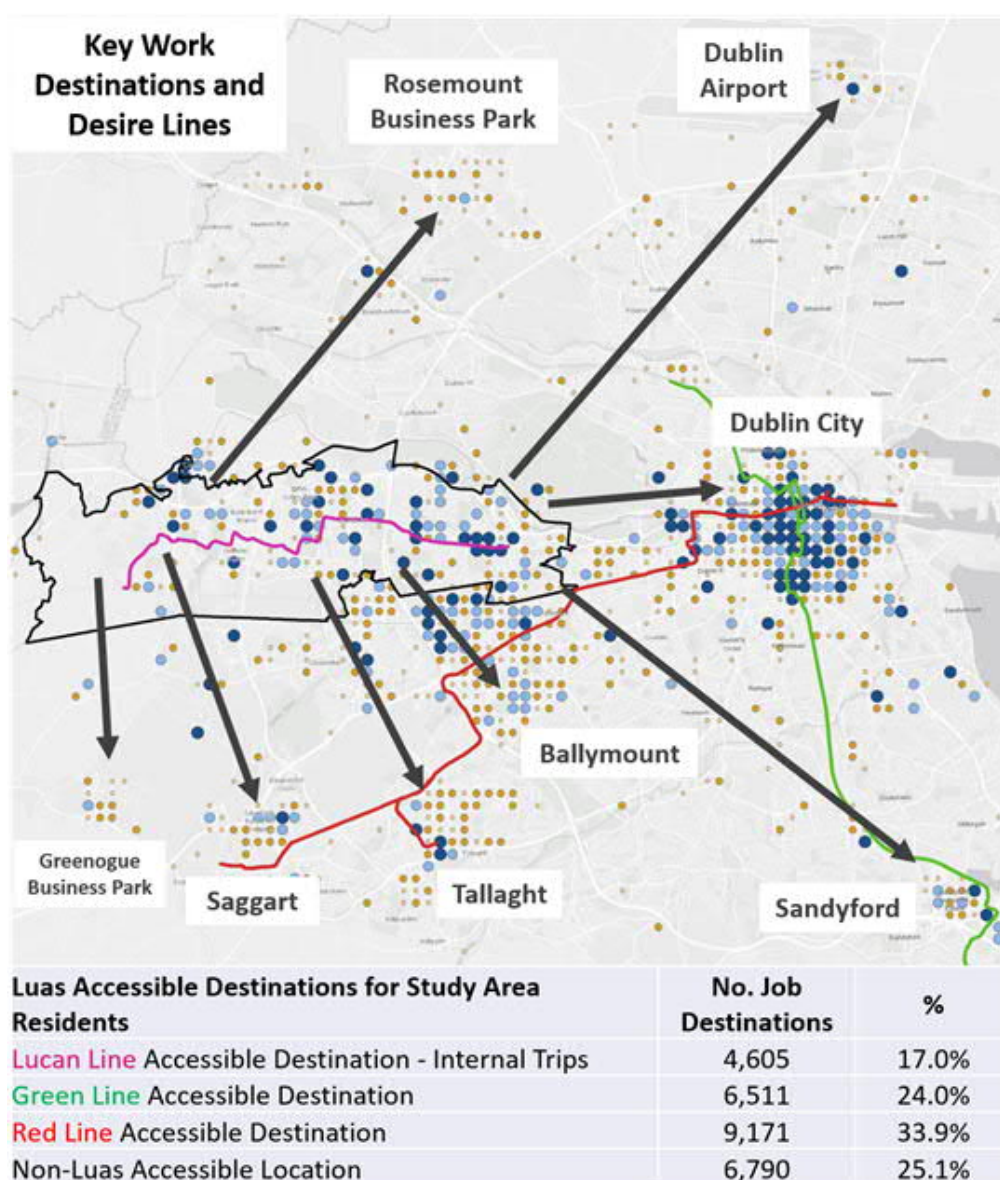
The figure below shows the destinations for work trips made by the study area residents to locations in Dublin. This figure clearly shows that a significant amount of work travel is made via radial trips to the city centre and a future Luas service would help to cater for this demand. Similarly, a large number of work trips are made to locations along the Luas red line in Tallaght, Ballymount and Saggart which could be served by Luas Lucan via a transfer. While many of these trips will be made by car at present, the provision of a regular and reliable public transport alternative through a new Luas line has the potential to promote significant mode transfer to light rail.



*POWSCAR 2016 – Work Destinations for Study Area Residents*



The figure below summarises the main desire lines for work trips originating in the study area and travelling to other areas of Dublin. Some of the work trips are to Luas accessible destinations such as the city centre, Ballymount, Saggart, Tallaght and Sandyford; but there are also concentrations of trips to areas which are inaccessible to the Luas network such as Dublin Airport, Rosemount Business Park and Greenogue Business Park. A 1km buffer was applied to the red and green Luas lines, as well as the Ballyfermot-Adamstown Luas Lucan line, to estimate the percentage of work trips from the study area which are to Luas accessible destinations. This showed that 17% of work trips are internal to the Luas Lucan study area, 24% of work trips are to green line destinations and 33.9% of work trips are to red line accessible destinations. Importantly, only a quarter of work trips (25.1%) are to locations outside of the 1km Luas catchment, with three quarters of trips being to Luas accessible locations. This shows the potential of the Luas Lucan to attract a significant amount of work trips from other modes of transport, particularly private motor vehicles.



*POWSCAR 2016 – Work Destination Desire Lines From Study Area*

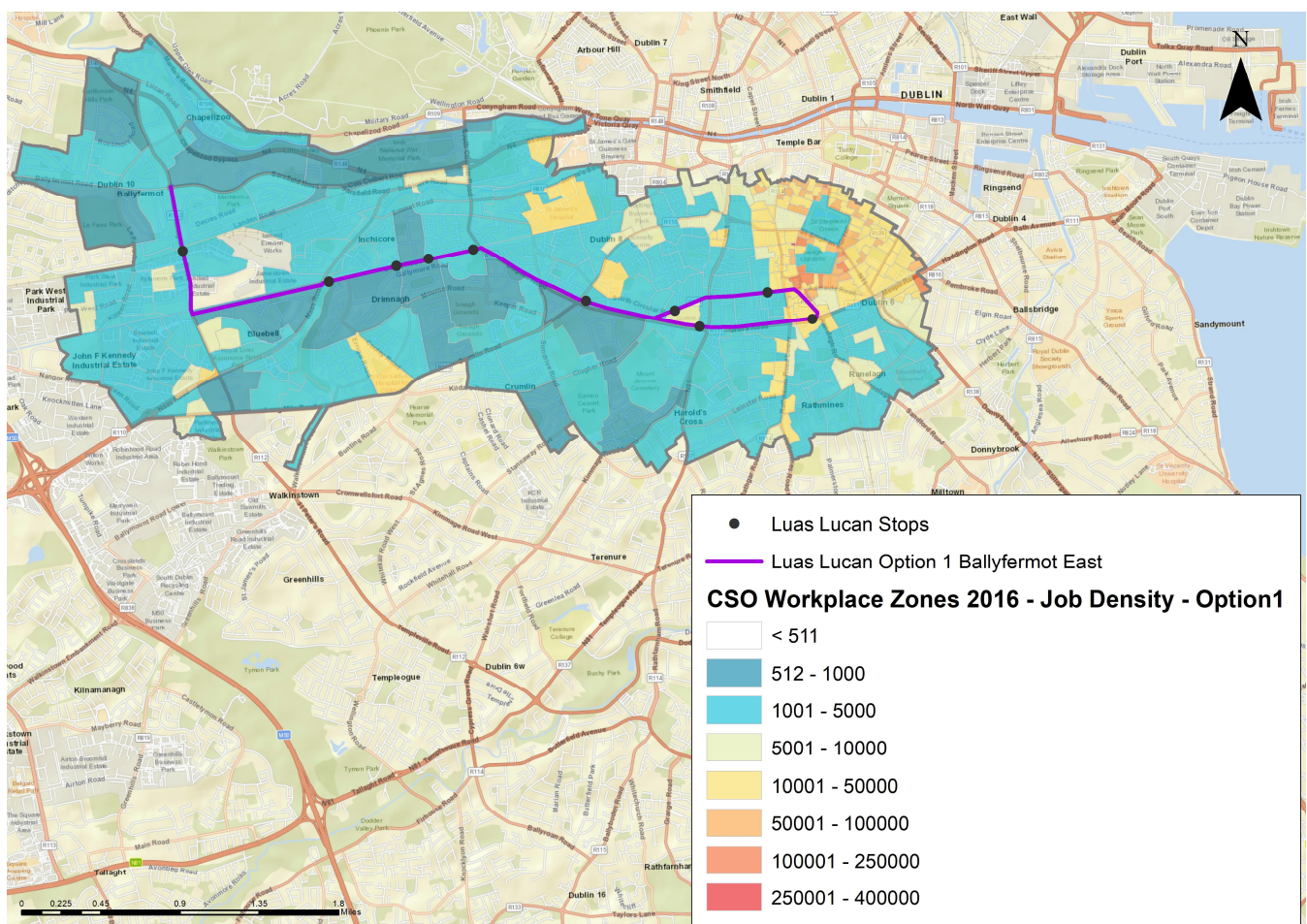


## Comparison of Job Density

This section provides an overview of job density characteristics and CSO Workplace zones. Job density is used to compare workplace zones of different geographic size in respect to their importance for local employment. However, it is important to note that while job density refers to the number of jobs per square kilometre, in most cases the workplace zone will not contain this number of jobs because it is smaller than a square kilometre.

### Option 1

The figure below shows the job density in each CSO Workplace zone for option 1 in 2016. In total, there are 96,420 jobs in the current study area workplace zones. Most areas present a density of 5000 jobs or less per square kilometre. Closer to the Dublin City centre the density is significantly increased, due to high concentration of offices near and inside the city centre. A zone on the east of Ballyfermot presents very low values of job density, since the area is used by Irish Rail for railway works.



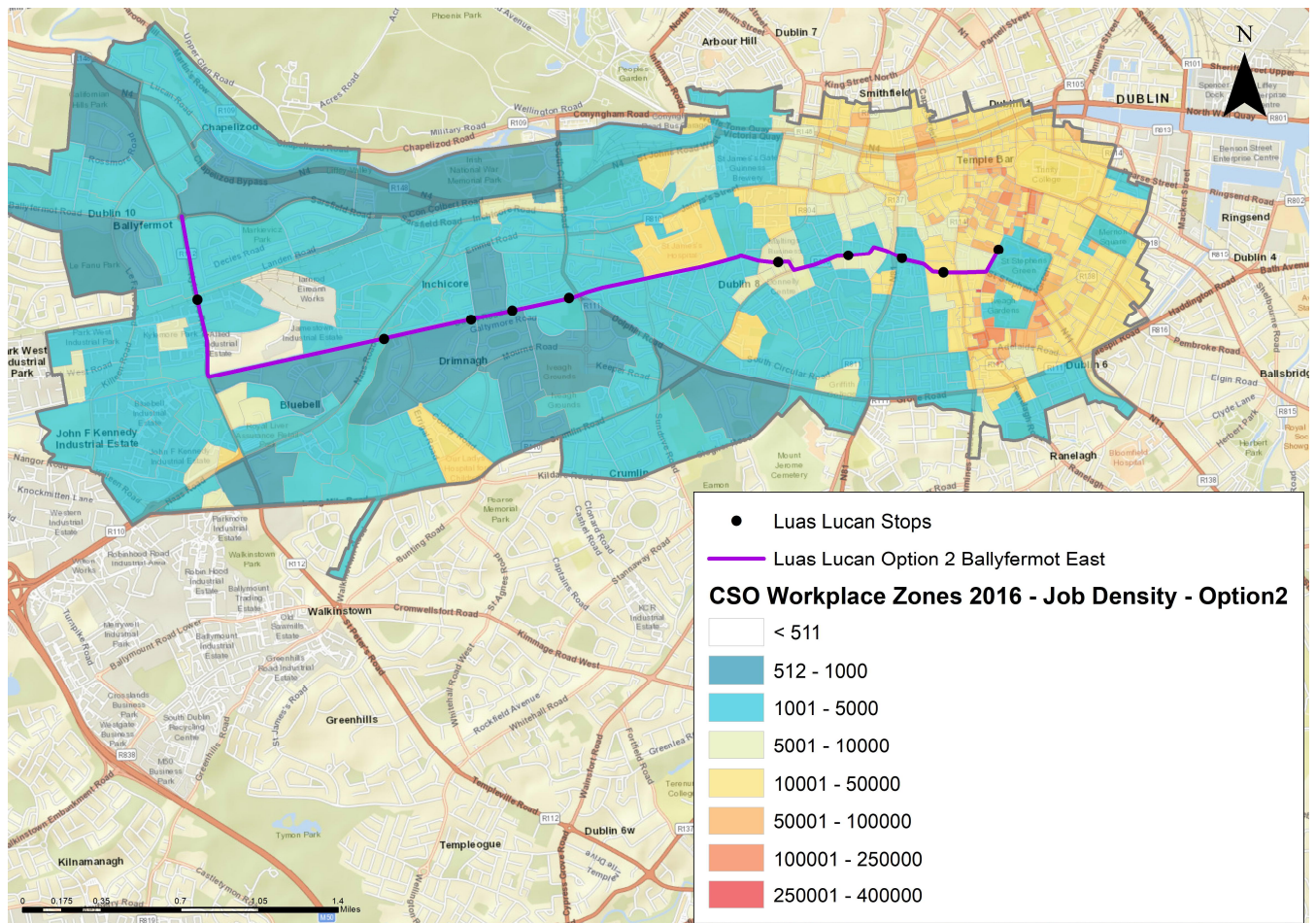
CSO Workplace zones Job density - Option 1

### Option 2

The job density for Option 2 is presented in based on CSO Workplace zones. A part of option's 2

alignment overlaps with option 1, thus it shows generally low values of job density on the western part of the study area. In respect to the City centre are, job density increases. Many public offices are

based in the city or to its wider area, along with numerous private companies within the same area, led to increased number of jobs per zone. The total number of jobs for option 2 study area is 134,015 and is considered to contain the highest number of workers compared to the other two options.



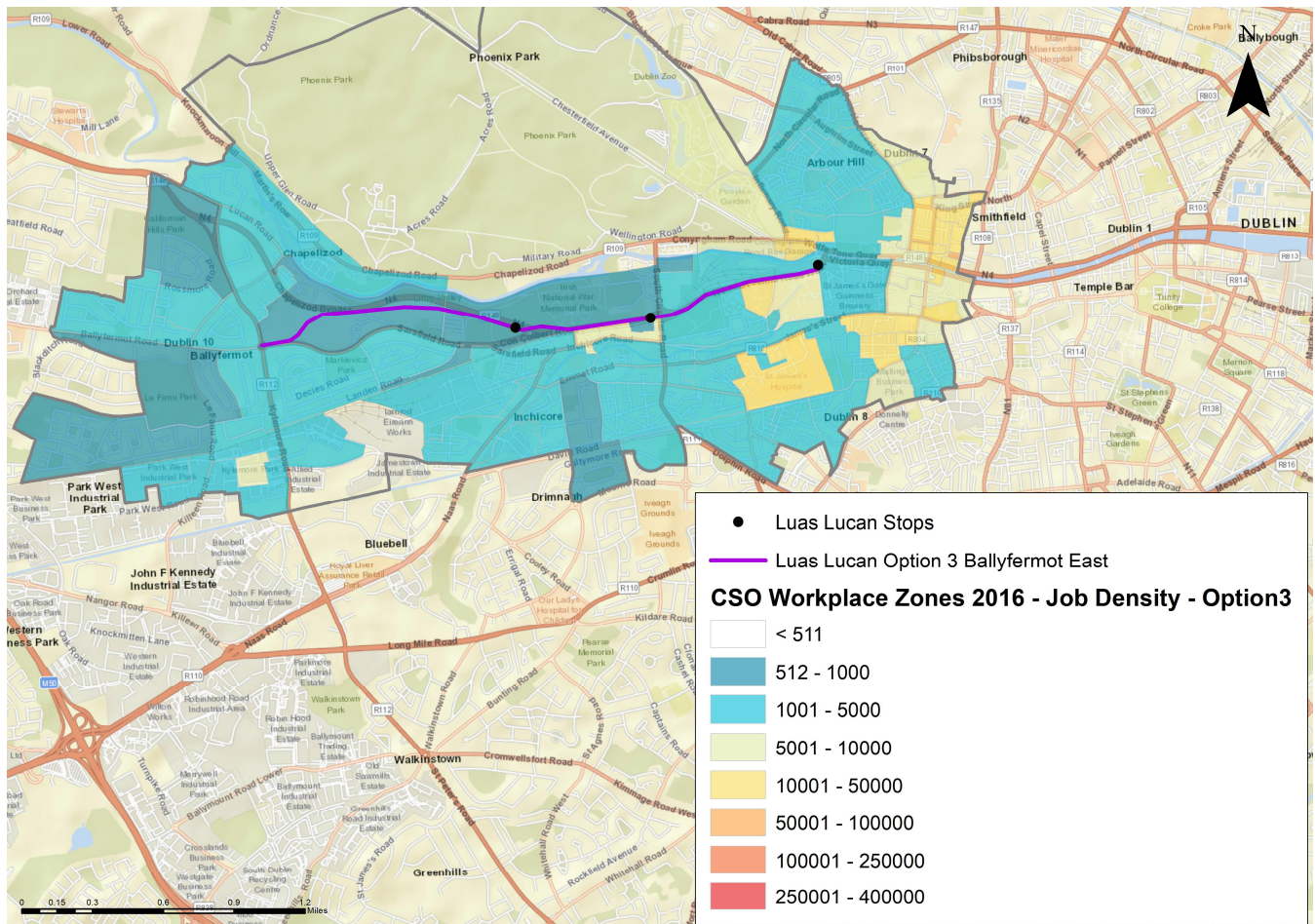
CSO Workplace zones Job density - Option 2

### Option 3

The figure below shows the job density in each CSO Workplace zone for option 3. In total, there are 33,227 jobs in the current study area workplace zones, the lowest number of workers amongst the analysed Luas Lucan options. The last option ends

before reaching the City centre, compared to the previous options, so the job density along the study area is generally low. It is acknowledged that this option provides interchange with the city centre network, DART Underground in particular, so does indirectly provide access to significantly more jobs than outlined above.

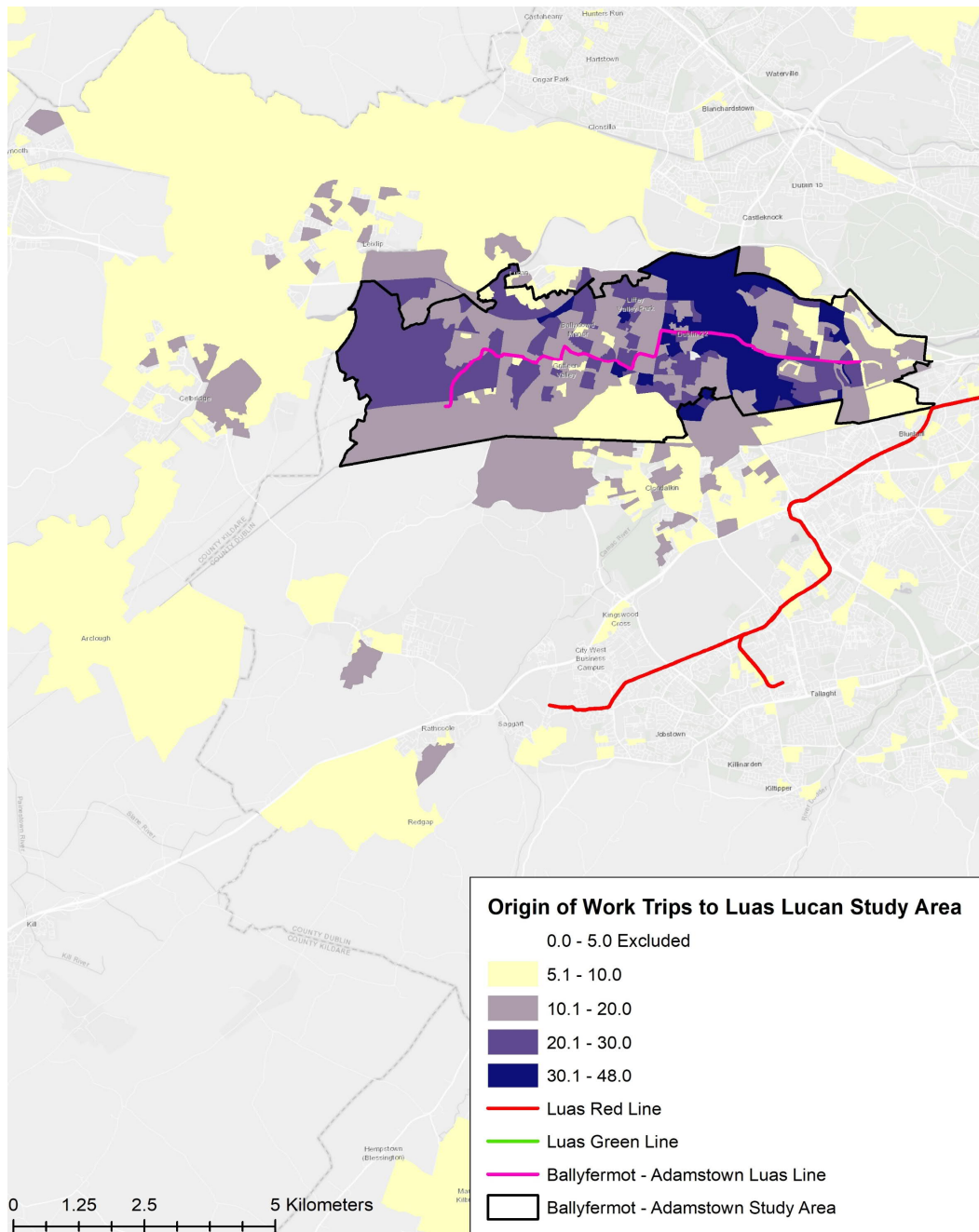




CSO Workplace zones Job density - Option 3

### Origin of Inbound Work Trips by Visitors to Study Area

shows the origin of inbound work trips to the study area from locations across Dublin. As can be observed in this figure, a large proportion of trips are internal to the study area, with a lot of people employed in the study area living locally, particularly in areas close to Liffey Valley shopping centre. To a certain extent, the lack of concentration of origin trips outside the study area will reflect the fact that most of these trips are made by car from dispersed locations across the GDA, diluting the results when represented by Small Area on a map.



*POWSCAR 2016 – Origin of Work Trips to Study Area*



