Clontarf to City Centre Project

Final Business Case

November 2021

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National Transport Authority

Comhairle Cathrach
Bhaile Átha Cliath
Dublin City Council

Quality information

Prepared by	Verified by	Approved by
Stavroula Manta, Consultant; Ciarán Maguire, Economic Consultant; Shane Dunny, Regional Director	Neil Caughey, Principal Consultant; Ernest Etim, Design Engineer	Shane Dunny, Regional Director; Eoin Ó Catháin, Technical Director

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Prepared for:

Dublin City Council and the National Transport Authority

Prepared by:

Roughan & O'Donovan Limited
Arena House
Arena Road
Sandyford
Dublin 18
+353 (0)1 294 0800
rod.ie

and

AECOM Ireland Limited
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin A96 T927
Ireland

T: +353 1 238 3100
aecom.com

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1. Executive Summary

1.1. Report Purpose

This report sets out the business case for the Clontarf to City Centre Project. The scheme proposes the delivery of a 2.7km cycle route that promotes and improves cycling accessibility from the Clontarf area into and out of the city centre and will also deliver significant upgrades to bus infrastructure and public realm along the route corridor.

This business case has been developed to:

- Outline the existing issues along the Clontarf to City Centre road corridor and outline the case for change;
- Define the aims and objectives to the Clontarf to City Centre Project; and
- Appraise the options for change.

The report has been prepared in accordance with the Department of Public Expenditure & Reform (DPER) Public Spending Code (PSC) 2019, the Department of Transport, (DoT) Common Appraisal Framework (CAF) 2016 and the Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG). The business case therefore provides an evidence-based representation of expected return on public investment.

Economic appraisal supports decision-making, taking account of a wide range of costs and benefits provided in monetary terms, or where a monetary equivalent can be estimated. Economic appraisal in the transport sector usually takes the form of Cost-Benefit Analysis (CBA) and serves several functions at the individual project level, and for state-wide comparisons of public investment:

- At a project level, the CBA defines the economic viability of the project in terms of transport benefits, provides a comparison of alternative options, and takes account of relevant sensitivity testing; and
- At a national level, the economic appraisal compares projects that would provide positive returns on investment.

While CBA usually only incorporates the monetised transport benefits, it is important to acknowledge that these represent only a portion of the total suite of benefits associated with a scheme. These wider non-monetised benefits also need to be considered as part of broader case for change.

1.2. Case for Change

The case for change identified in this Clontarf to City Centre Project is multi-faceted. Several key benefits have been identified, which support the case for change along the study corridor as follows:

Safety – Significantly reduce collision injuries over a 30-year appraisal period.

Physical Activity – Facilitate the increasing number of people travelling by sustainable and active modes.

Public Transport – Improve journey times and journey time reliability for bus services on the existing corridor.

Accessibility – Improve accessibility to employment, education and healthcare for road users (both private vehicles and public transport) for the local and wider region.

Integration – Deliver on the objectives of the Project Ireland 2040 and the Climate Action Plan (among other national and international commitments).

Traffic Reduction in Urban Settlements – Promote walking, cycling and public transport by increasing their relative attractiveness while reducing provision for private car demand.

Journey Time Savings – Reduce journey times between Busáras Bus Station/Connolly Train Station and Clontarf Road for the majority of road users.

Journey Time Reliability – Achieve more consistent journey times throughout the day and across the week for all journeys including freight, tourism, and public transport.

Noise & Air Quality – Reduce noise and improve air quality as traffic is reduced in populated areas.

Economic Stimulus – In addition to the long-term economic benefits to the wider region, investment in the construction phase will bring much needed employment and economic stimulus within the local region.

1.3. Scheme Aims and Objectives

The aim of the Clontarf to City Centre Project is to:

Provide a high-quality cycle route linking the Clontarf area to the city centre to cater for existing and future demand; to facilitate improvements to bus journey time reliability through the introduction of bus priority infrastructure along the corridor; and to improve the pedestrian environment through the delivery of public realm and environmental enhancements along the route.

The objectives to realise the aims of the Clontarf to City Centre Project are;

1. To provide high quality, continuous and consistent cycling facilities to cater for existing and future demand;
2. To protect vulnerable road users through the delivery of a safe and attractive route for commuter and recreational cyclists and to provide attractive, safe, segregated pedestrian facilities;
3. To improve bus journey times and reliability;
4. To simplify the interchange between bus services and other transport modes;
5. To reduce reliance on private car transport;
6. To reduce the growth in transport emissions;
7. To improve the urban realm, landscape and built environment along the route;
8. To enable National (*Project Ireland 2040),* Regional (*GDA Transport Strategy)* and Local *(Dublin City Development Plan, 2016-2022)* strategic outcomes and deliver on relevant climate action targets.

Figure 1.1 - Clontarf to City Centre Project

1.4. Scheme Identification

A Route Options and Feasibility Report[1] was undertaken in order to identify the preferred design option. The option selection process was heavily influenced by National Transport Authority's (NTA's) Greater Dublin Area Cycle Network Plan, which identified the need to provide a cycle route along this corridor in order to achieve a cohesive and interconnected cycle network as well as the overall aims of the project as identified above. In total, four options were appraised using the six CAF criteria, including a do-nothing scenario. Based on this assessment, the preferred route was brought forward for consideration as it best met the scheme aims and objectives.

1.5. Appraisal Findings

The results of economic appraisal forecast a **BCR of 2.9** for the project[2] and a Net Present Value (NPV) **of €100 million** as shown in Table 1.1. Thus, the economic appraisal presents a strong case for the Clontarf to City Centre Project to proceed.

Table 1.1 - Summary of BCR values (2011 values)

CBA breakdown	*Benefit values (€)*
Present Value of Benefits (PVB)	**€ 153,861,419**
Present Value of Costs (PVC) (incl. Shadow Pricing)	**€ 53,350,946[3]**
Net Present Value (NPV)	**€100,510,473**
Benefit-Cost Ratio (BCR)	**2.9**

The appraisal undertook a number of sensitivity tests for assessing the impact of alternative future cyclist demands and economic parameters. Specifically, a 50% increase in cost would reduce the BCR to 1.9, an alternative post-COVID future demand scenario would result in a BCR of 2.5, the 4% growth rate in new cyclists showed a BCR of 2.8, while the 15% growth rate had a BCR of 3.0. In all cases a positive BCR would be expected. The full results of the base and sensitivity tested BCRs are shown in Table 1.2 below.

Table 1.2- Summary of BCR values

Case scenarios	BCR
Base case – 10% cycle demand growth rate	**2.9**
Alternative Future Demand	2.5
Sensitivity – 4% cycle demand growth rate	2.8
Sensitivity – 15% cycle demand growth rate	3.0
Sensitivity – Journey Quality Benefit Excluded	2.5
Sensitivity – 20% increase in cost	2.4
Sensitivity – 50% increase in cost	1.9

In addition to the above, additional benefits expected of the proposal are provided in Section 1.6.

1.6. Impacts of the Clontarf to City Centre Project

The key impacts of the Clontarf to City Centre Project, estimated using the NTA's Eastern Regional Transport Model, as well as a review of literature and case studies include:

- **An increase in cycle patronage** – representing an additional 330 and 433 cyclists per day by 2026 and 2035 respectively, equivalent to a 10% increase in cyclist numbers;
- **Cycle journey time savings** - due to improvements in the level of service of the cycle facilities, which will result in a time saving of approximately 75 seconds for cyclists travelling along the route corridor;

[1] *Clontarf to City Centre Cycle Route, Options Review & Feasibility Report, April 2016 by RPS*
[2] *Base Case Scenario*
[3] Present Value of Costs discounted to 2011 to align with benefits parameters

- **Significant cycle journey time saving benefits of €28 million (2011 value) -** over the 30-year appraisal period (plus residual period) in-line with guidance set out in PAG and CAF.
- **A modal shift towards sustainable travel, which will reduce reliance on private car** - by 2035 the scheme will encourage ~500 new cyclists, which in the absence of the scheme would potentially represent ~400 cars or the need for 5-6 additional buses;
- **An increase in bus patronage** - the proposed scheme will result in a 3-4% uplift in bus passengers along the corridor;
- **Significant bus journey time savings** - the proposed scheme will significantly reduce bus journey times along the Clontarf to City Centre corridor resulting in a 24-48% reduction in bus journey times during the peak periods;
- **Significant journey time savings (accounting for all modes) of circa €70 million (2011 value)** - over the 30-year appraisal period (plus residual period) in line with guidance set out in PAG and CAF.
- **Significant safety benefit savings of circa €29 million (2011 value)** - over the 30-year appraisal period (plus residual period) in line with guidance set out in PAG and CAF
- **Health benefits savings of circa €6 million (2011 value)** - over the 30-year appraisal period (plus residual period) in line with guidance set out in PAG and CAF;
- **Absenteeism reduction savings of circa €0.7 million (2011 value**) - over the 30-year appraisal period (plus residual period) in line with guidance set out in PAG and CAF; and
- **Journey Quality improvements of circa €23 million (2011 value) -** over the 30-year appraisal period (plus residual period) in line with guidance set out in PAG and CAF.

The results of the economic appraisal demonstrate that the proposed scheme provides a strong return on investment and is economically viable under all scenarios assessed. These benefits assume that the design aspirations are realised to their full extent. The significant enhancement proposed to cycling facilities will lead to significant improvements in both safety and perceived safety. The latter will in turn lead to a greater diversification of the user market, leading to greater age, gender and race diversity among cyclists using the route. The benefits to pedestrians, local residents and businesses associated with the significant public realm and environmental enhancements to be delivered by the scheme have not been monetised. Neither have the reliability benefits to bus services that will accrue from the provision of continuous bus priority through physical infrastructure. Both of these benefits will improve the attractiveness of the areas served along the route.

The scheme includes significant investment in the Fairview Area, both within and outside the Park. The entire road frontage is to be repaved in high quality paving materials, and there will be considerable public realm enhancements for local businesses. The Park will be linked through to the network of greenways and City Farm being developed at Alfie Byrne Road, Dublin Port and East Wall Road, which will provide for cross pollination between the respective user groups, delivering economic benefit in both directions (agglomeration benefit).

Footpaths on Amiens Street, North Strand Road and Annesley Bridge Road will be repaved, decluttered and improved, and enhanced landscaping including suds bio-retention areas and pollinator friendly planting will be introduced where space permits. Paving materials in the historic core will be sympathetic to the historic environs and Leinster Granite will be used where appropriate.

The scheme will also involve the renewal of public and private utility infrastructure along the route, including replacing approximately 6km of old water mains. This will reduce leakage and will improve water quality in the area. Irish Water has committed €3m in funding towards the project in recognition of this significant gain, which will also avoid the need for costly and disruptive regular repairs on dilapidated infrastructure in future. Enhanced fibre connections will be installed for Dublin City Council to improve fibre connectivity around the city.

Taking account of the above non-monetised benefits, it is clear that the already exceptional Benefits to Cost Ratio of the scheme is conservatively low, and doesn't fully account for the significant benefits that it will deliver along the corridor and to the wider north inner city area under all of the CAF headings, as recorded in the Project Appraisal Balance Sheet.

1.7. Monitoring & Evaluation

The success of the Clontarf to City Centre Project in achieving these objectives and benefits will be measured through a post-construction Monitoring and Evaluation process, including post-construction surveys and regular traffic counts. Particular emphasis will be placed on identifying whether the project has been successful in encouraging under-represented groups to take up cycling, such as women, children and the elderly.

2. Introduction

This business case for the Clontarf to City Centre Project has been prepared jointly by Roughan and O'Donovan and AECOM at the request of Dublin City Council (DCC) and the National Transport Authority (NTA). The business case is a key tool for assessing the anticipated return on public investment.

This document is developed in accordance with the requirements of Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (*PAG Unit 8.0: Business Case*) and Department of Transport (DoT) 'Guidelines on a Common Appraisal Framework (CAF) for Transport Projects and Programmes' (2020). Given the Clontarf to City Centre Project (C2CC) has a tendered cost in the region of €40 million excluding VAT and inflation, it will be appraised in accordance with the relevant criteria of the TII Project Appraisal Guidelines (PAG), CAF and the PSC.

2.1. Scope of study

In accordance with the PSC and the CAF, the purpose of this Final Business Case ("FBC") is to:

- Outline the problems that the C2CC scheme aims to solve and the case for change
- Define the objectives of the C2CC scheme
- Appraise the options for change
- Set out the impacts of the C2CC scheme
- Outline next steps.

The purpose of the business case is to confirm that the C2CC scheme is a good use of public money. It does this by demonstrating that there is a clear understanding of the problem it is intended to solve, that different options have been considered, that the interventions address stated objectives, that the forecast benefits outweigh the forecast costs, that the proposed expenditure is affordable and that there is a plan for implementation. The business case informs decisions to commit public expenditure.

Planning process is a different and separate process, in that planning decisions must balance all the benefits and potential negative impacts of the scheme relevant to the areas of impact such as environment and land use planning. Statutory planning approval processes address these issues – including by way of further public consultation and environmental impact assessment. Planning approval allows construction to take place. It is independent of funding matters.

Specifically, the scheme includes the delivery of improved pedestrian, cycle and bus facilities that will promote improved accessibility into and out of the city centre and necessitate a reallocation of road space from Talbot Street to beyond Alfie Byrne Road along the R105. According to the CAF guidelines, six appraisal criteria have been used in the assessment as follows:

- Economy;
- Integration;
- Environment;
- Social Inclusion & Accessibility;
- Safety; and
- Physical activity.

The main objectives of the project are to provide a high-quality pedestrian, cycle and bus facilities. In turn, this will promote and improve cycling accessibility from the Clontarf area into and out of the city centre in addition to upgrading bus infrastructure along the route corridor. The scheme also provides improvements in relation to the journey time impacts on bus passengers and the impact on pedestrians and cyclists in the form of health, journey quality & ambience, absenteeism, and safety. These benefits are considered key socio-economic returns from such a cycling project and are expressed in monetary terms.

To undertake the economic appraisal, existing information was collated to understand the existing situation, and suitable cycle demand forecasts were developed. Analysis of the benefits relating to existing and new cyclists was conducted and the forecast demand included into the economic assessment. Finally, the overall user needs and positive benefits of the project were explored through a project appraisal balance sheet alongside anticipated costs of delivery.

2.2. Policy context

The Clontarf to City Centre Project aims to deliver multiple initiatives contained in the *Transport Strategy for the Greater Dublin Area (2016-2035)*[4] by improving the Core Bus Network between Clontarf and Connolly Station and delivers an important element of the Greater Dublin Area Cycle Network Plan 2013.

The Greater Dublin Area Cycle Network Plan 2013 identifies a total of 13 primary radial cycle routes that ultimately link the city centre to seven outer sectors encompassing the GDA. The Clontarf to City Centre Project forms part of Primary Route 1 running from Beresford Place to the North East Sector via Amiens Street, North Strand and Fairview. This primary route provides an important link between various other primary and secondary cycle routes and greenways, most notably the East Coast Trail Greenway, the Tolka Valley Greenway, the Royal Canal Greenway [which ultimately links to the Grand Canal Greenway], and the Liffey Cycle Route, among other secondary orbital and radial routes. The delivery of this section of Primary Route 1 will help realise one of the essential strands of the GDA Cycle Network Plan. The extent of the Clontarf to City Centre Project as part of Primary Route 1, as identified in the GDA Cycle Network Plan, is shown in Figure 2.1.

Figure 2.1- Primary Route 1 as identified in the GDA Cycle Network Plan 2013
Source: GDA Cycle Network Plan 2013

The Department of Transport's Land Transport Investment Framework sets out the Government's priorities with regards to transport investment in Ireland. The Framework is of great significance to the Clontarf to City Centre Project as it specifies new Modal and Intervention hierarchies for investment. The 'Intervention Hierarchy' aims to prioritise the maintenance, optimisation and improvement of existing assets before the construction of new assets. This scheme is largely an improvement project, as it is working within the existing road profile and aims to improve the reliability and safety of existing

[4] *National Transport Authority, 2016, Transport Strategy for the Greater Dublin Area (2016-2035)*

services. The 'Modal Hierarchy' aims to prioritise active travel and public transport investment (in that order) over private cars; with which the objectives of the project are clearly well aligned.

The project will also contribute to the *Project Ireland 2040*'s National Strategic Outcomes[5] of:

- NSO 1: Compact Growth;
- NSO 4: Sustainable Mobility;
- NSO 8: Transition to a Low Carbon and Climate Resilient Society; and
- NSO 10: Access to Quality Childcare, Education and Health Services because improved transport will improve access to services.

Investing in transport infrastructure is a key enabler in delivering the National Strategic Outcomes listed above. In particular, the scheme will support the Government's objectives in *Project Ireland 2040* and the *Climate Action Plan 2019* to transition to a low-carbon economy. Ireland is required to reduce its greenhouse gas emissions by 50% by 2030, and with transport accounting for about 40% of Ireland's energy-related emissions, it is a key policy priority to encourage a shift from private cars towards walking, cycling and public transport.

The Department of Transport (DoT) is reviewing sustainable mobility policy, looking at all aspects of active travel (walking and cycling) and public transport policy. The review will result in a new 10-year sustainable mobility framework that will replace the policies published in 2009: *Smarter Travel: A Sustainable Transport Future 2009 – 2020* and *the National Cycle Policy Framework 2009 -2020*.

An extensive range of background papers were prepared by DoT looking at aspects of sustainability mobility e.g. public transport accessibility, active travel, congestion and the climate change challenge. These were the basis for a public consultation which ran until the end of February 2020.

DoT is now developing a policy, within the context of the COVID-19 pandemic, that supports a shift away from the private car to greater use of active travel and public transport; travel by cleaner and greener transport; and comfortable and affordable journeys to and from work, home, school, college, shops and leisure. The C2CC project is already designed to accomplish all those objectives. It is pivotal that cycling be considered at the fore when considering improvements to the transport system across the GDA. The NTA's *Cycle Network Plan for the Greater Dublin Area 2013* has supported key successes in the intervening period, most notably the +50% increase in cycling, (with a +130% increase recognised since 2006). BikeLife 2019, developed by the NTA and Sustrans, identified key drivers for cycling, and the barriers preventing uptake, with safety continuing to be the greatest barrier.

European policy[6] additionally indicates that mobility is key for the continued progression towards more sustainable societies, equitable access to services for many users and decarbonisation of transport. Progressing to 2050, three notable pillars of action are described at the European level: to make transport more sustainable; make alternatives widely available and put in place the right incentives for change.

The positive personal outcomes (health, wellbeing and finances) and national benefits (lower burden of healthcare and reduced carbon emissions) of cycling must continue to be driven forward through dedicated cycling facilities. Ideally these facilities will be segregated from traffic, reducing the real and perceived risks to safety which burden current cyclists, as well as those who do not currently cycle.

The C2CC project also aligns with planning documents such as Transport Strategy for the GDA 2016-2035, and Dublin City Development Plan 2016-2022.

It is clear that significant investment in active modes and public transport is required to realise these policy objectives and to cater for the long-term transport needs of the Greater Dublin area. As with all public Exchequer investment, appraisal in-line with the PSC is required before expenditure is approved, to ensure the appropriate use of funds. [7,8]

[5] *Project Ireland 2040 Executive Summary*
[6] Sustainable and Smart Mobility Strategy – putting European transport on track for the future COM (2020) 789 final
[7] *Department of Public Expenditure and Reform. 2012. The Public Spending Code.*
[8] *Department of Transport. 2016. Guidelines on a Common Appraisal Framework for Transport Projects and Programmes.*

2.3. Long term impact of COVID-19

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 travelling 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. Demand for cycling and public transport recovered quickly in June-September 2020 when Covid-19 restrictions were eased, indicating that demand for sustainable 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 overall demand for sustainable transport, particularly as the Irish economy is expected to return to growth quickly after the distribution of vaccines. In light of this, investment in the C2CC project is justified to improve conditions for existing pedestrians, cyclists and bus users, and to increase the appeal of walking, cycling and bus travel to attract mode transfer from car users to achieve sustainability policy goals in the years following the pandemic.

3. Overview of the proposed scheme

3.1. Aim and Objectives

The aim of the Clontarf to City Centre Project is to:

Provide a high-quality cycle route linking the Clontarf area to the city centre to cater for existing and future demand; to facilitate improvements to bus journey time reliability through the introduction of bus priority infrastructure along the corridor; and to improve the pedestrian environment through the delivery of public realm and environmental enhancements along the route.

The objectives to realise the aims of the Clontarf to City Centre Project are;

1. To provide a high quality, continuous and consistent cycling facilities to cater for existing and future demand;
2. To protect vulnerable road users through the delivery of a safe and attractive route for commuter and recreational cyclists and to provide attractive, safe, segregated pedestrian facilities;
3. To improve bus journey times and reliability;
4. To simplify the interchange between bus services and other transport modes;
5. To reduce reliance on private car transport;
6. To reduce the growth in transport emissions;
7. To improve the urban realm, landscape and built environment along the route;
8. To enable National (Project Ireland 2040), Regional (GDA Transport Strategy) and Local (Dublin City Development Plan, 2016-2022) strategic outcomes and deliver on relevant climate action targets.

3.2. Scheme Options Assessment

A Route Options and Feasibility Report[9] was undertaken in order to identify the preferred design option. The option selection process was informed by the National Transport Authority's (NTA's) Greater Dublin Area Cycle Network Plan 2013, which identified the need to provide a cycle route along this corridor in order to achieve a cohesive and interconnected cycle network as well as the overall aims of the project as identified above. In total, four options were appraised using the six CAF criteria, including a do-nothing scenario. Based on this assessment, the preferred route was brought forward for consideration as it best met the scheme aims and objectives. The options considered included:

- Option 1 – Retention of the cycle lanes on Amiens Street and provision of a two-way cycle track on the southbound side of North Strand Road and a two-way cycle track along the perimeter of Fairview Park;
- Option 2 – Upgrade of the existing cycle lanes on each side of the road to cycle tracks where possible and filling in the gaps where no dedicated cycle facilities currently exist;
- Option 3 – An alternative route via 'back streets' between Fairview Park and Strandville Avenue; and
- Option 4 – Do-Nothing, no change to existing cycle infrastructure.

The first three options were appraised and compared with the Do Nothing Option. The appraisal was based on the Department of Transport Project Appraisal Balance Sheet and as per the NTA Project Appraisal Guidelines. All road users were considered and not cyclists alone. The five criteria for the appraisal included Environment, Economy, Safety, Accessibility and Integration. The sixth CAF criterion of Physical Activity was not considered since there is no material difference between the options in this regard.

Environment

[9] *Clontarf to City Centre Cycle Route, Options Review & Feasibility Report, April 2016 by RPS*

A high level assessment of the environmental impacts of the options was undertaken. Firstly, the route corridor is an existing transportation corridor, and the works will comprise alterations within this existing transportation route. Therefore, in terms of air quality, noise, architectural and archaeological heritage, soils and geology, hydrology and hydrogeology, the impacts will be minimal and similar for all options. Air quality, noise and air impacts would be worse in the Do Nothing scenario as congestion increases with time as a result of the bus services and cycling facilities not offering a sufficiently attractive alternative to the car. In terms of biodiversity and the natural environment and landscape and visual, there will be some impacts on the existing trees and to Fairview Park in all but the Do Nothing scenario. The impact is broadly similar for all 3 Options and is slightly negative. To mitigate this negative impact, a landscape plan and public realm proposals will be developed for the preferred route.

Economy

The economic assessment is considered to be the relative welfare gain of the overall scheme. The scheme will improve cycle and pedestrian facilities, encouraging a shift towards sustainable transport and offers regeneration to the area. Therefore, the scheme is positive in terms of welfare gain and equal for all improvement options. However, all improvement options will come at a cost, while the do nothing option will cost nothing. However, the economic cost of delays to road users over time will be considerably greater than the cost of any of the improvement options. Option 3 scores more poorly than the other route options as a result of the indirectness of the cycling route resulting in longer journey times for cyclists.

Safety

The safety assessment considers the possible reduction in accidents and improvements to the security of road users. The scheme will improve cycle and pedestrian facilities, reduce traffic speeds and encourage a shift towards more sustainable transport. Therefore, all improvement options will be positive in terms of safety. Option 2 scores best in terms of safety; Option 1 will have positive impacts but less so than Option 2 – due to the need for cyclists to cross the carriageway to access/egress the two-way cycle track. A larger number of cyclists will avoid the cycle track on that basis and will cycle on road. This will also arise with Option 3. Also, Option 1 has additional cyclist safety risks at side roads where exiting drivers may not expect the contra-flow cyclist movement. Option 3 scores poorly in terms of safety due the poor security by the quiet back streets.

Accessibility and Social Inclusion

Accessibility and social inclusion is a measure of the improvement of accessibility to employment, education and essential services and amenities. Overall, the scheme will improve bus, cycling and pedestrian facilities and will contribute towards urban regeneration in the area. This improvement will be greater for Options 1 and 2 and these score more positively in terms of accessibility and social inclusion.

Integration

The integration criterion considers transportation, land use and geographical integration. The proposed scheme is aligned with current Transportation Policy in Dublin City as described in the NTA Draft Transport Strategy for the Greater Dublin Area 2011 – 2030. Overall, the scheme will improve transport efficiency for cyclists on this very important corridor and will improve connectivity between transport modes, support sustainable transport and connectivity to cycle routes such as the Clontarf Seafront, the Royal Canal, Alfie Byrne Road. The scheme takes cognisance of the Dublin Development Plan and local environmental improvement plans (Fairview and Marino). The assessment concludes that all Options rank positively in terms of integration, Options 1 and 2 are considered higher as they follow the existing route corridor and integrate better with existing Transportation Plans and Policy compared to Option 3, the quiet back streets option. Option 2 is ranked slightly higher than Option 1 as it caters better for outbound commuter cyclists by providing facilities on the outbound carriageway which is a bit more natural and expected for these cyclists.

Table 2.6 - Options Appraisal and Ranking

Ranking	Do Nothing (as existing)	Option 1	Option 2	Option 3
Environment	0	0	0	0
Economy	0	+2	+2	+1
Safety	0	+1	+2.5	-1
Accessibility & Social Inclusion	0	+2	+2	+1
Integration	0	+2	+2	+1
Overall	**0**	**+7**	**+8.5**	**+2**

The ranking is a 7-point scale, with +3 as highly positive, 0 as neutral and -3 as highly negative. The table indicates that Option 2 is the best of the options considered. Following this analysis, Option 2, the upgrade of the existing cycle lanes to cycle tracks and filling gaps along the route, was the option recommended to be brought forward. This option was considered to best meet the scheme objectives, providing continuous and consistent cycle facilities, catering for commuter and recreational cycling and providing a high (Level A) QoS.

Preferred Route Option Refinement

A design was developed for the preferred option to upgrade the existing cycling facilities and was submitted to the Part VIII planning process in 2017. The subsequent public consultation raised significant concerns about the impacts the scheme would have on trees at Fairview Park. As a result, the scheme design was altered during the Part VIII process to reduce the impact on these trees. This was achieved by reducing the length of the right turning lane from the mainline to Fairview Strand. The amended scheme was approved with conditions.

The conditions appended to the Part VIII required further design improvements to provide greater segregation of the cycling facilities – in particular at junctions and bus stops. This refinement was undertaken, reviewed for conformance with the planning approval, and incorporated in the detailed design. The final scheme is described below.

3.3. Overview of the scheme

The Clontarf to City Centre Project is a 2.7km road and public realm improvement project that will deliver significantly improved facilities for pedestrians, cyclists and public transport users, while continuing to accommodate essential freight and private car transport. It has been designed to improve the connection between the Clontarf area and the city centre and to tie-into the Sutton to Sandycove greenway. The route is designed with a High (Level A) Quality of Service (QoS) to cater for all levels of cyclists, including commuter and leisure cyclists. The Greater Dublin Area (GDA) Cycle Network Plan identifies 13 primary radial cycle routes that link the city centre to seven sectors encompassing the GDA. The Clontarf to City Centre Project forms part of Primary Route 1 running from Beresford Place to the North East Sector via Amiens Street, North Strand and Fairview. The delivery of this section of Primary Route 1 will help realise one of the essential strands of the GDA Cycle Network Plan. The scheme includes the following:

- Provision of 2.7km of segregated cycle tracks in each direction;
- Upgrading of 4.4km of existing bus lane and provision of 1km of new bus lanes to provide continuous bus lanes in both directions over the 2.7km length of the scheme;
- Upgrading of 12 bus stops to island bus stop standard with appropriate provision for the mobility impaired and disabled;
- Upgrading of 9 signalised junctions, including the provision of six additional signalised pedestrian crossings.

In the delivery of the above, the scheme will also deliver the below;

- Pavement construction - Upgrading of approx. 24,700m^2 of footpath, covering a linear distance of 7.9km;

- Creation of approximately 18 locations of nature-based Sustainable Urban Drainage Systems (SUDS)
- Upgrading of approximately 170 public lighting units and provision of approximately 30 new public lighting units;
- Laying of approximately 3,000 linear metres of surface water collector drainage pipes;
- Laying of approximately 6,000 linear metres of new or upgraded watermain;
- Linkage to other cycle routes such as the Royal Canal Greenway, Howth Road, Malahide Road, East Coast Trail, Seville Place, Killarney Street and Amiens Street/Talbot Street;
- Provision of 0.5km of the Tolka Greenway via a riverside link through Fairview Park to link Annesley Bridge Road to Alfie Byrne Road;
- Upgrading the existing cycle tracks at Clontarf seafront to resolve conflicts with pedestrians, public realm recommendations, footway widths, street furniture and materials;
- A full landscape design proposal for the route, including lighting, several new trees, street furniture and materials;
- Installation of DCC CCTV Infrastructure;
- High quality paving and kerbing, including areas in granite and Leinster granite, as appropriate;
- Construction of new or replacement Retaining walls;
- Utility diversions;
- Protection of existing utilities;
- Road markings and traffic signs; and
- Traffic management including traffic diversions during construction; and
- Replacement of road pavement through reconstruction where fatigued and road resurfacing throughout.

Figure 3.1 shows the location of the Clontarf to City Centre Project.

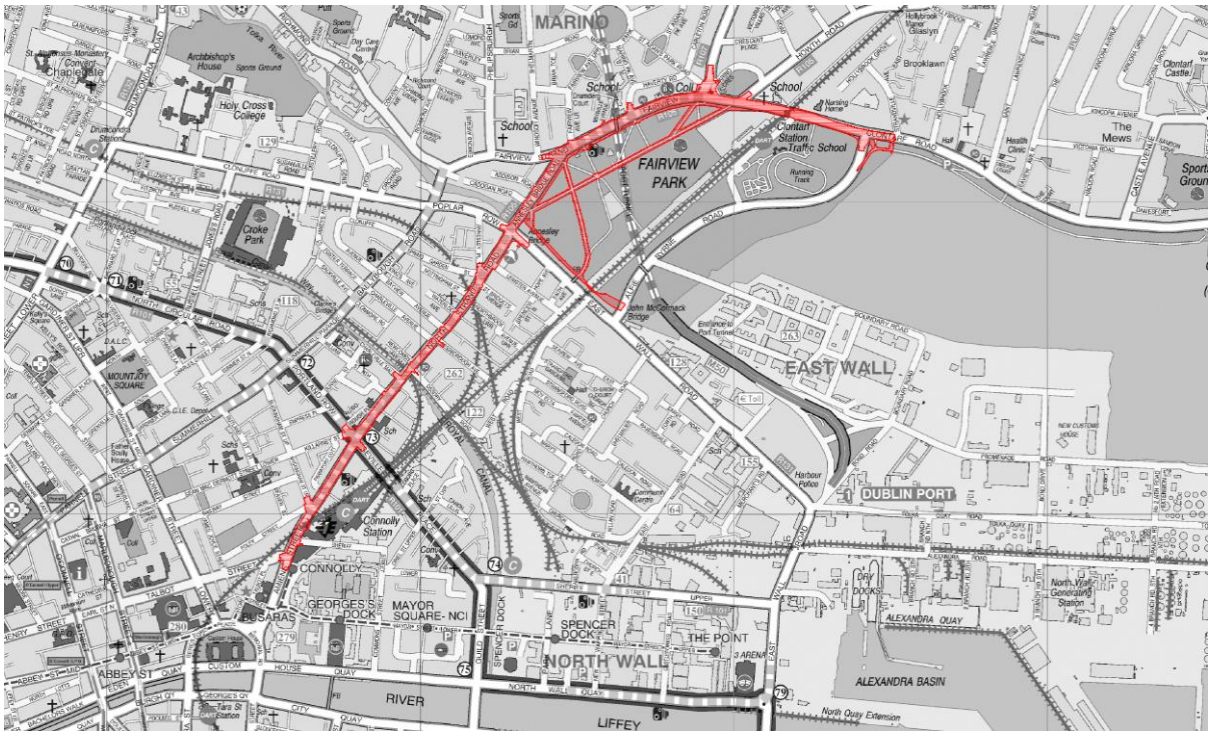

Figure 3.1- Location of the Clontarf to City Centre Project (red line mark-up)
Source: ROD

Figure 3.2- Artist's Impression of Annesley Bridge Road with project in place

The Clontarf to City Centre Project was analysed and appraised through the use and development of specific tools. The TII PAG and DoT's CAF provide guidelines and economic variables for assessing the health, wellbeing, ambience (journey quality) and safety impacts of cycling interventions and gives a method for monetising these benefits. Further details about the analysis are presented in Sections 6 and 8. The NTA's Eastern Regional Model (ERM) was also used to assist in forming a complete picture of the performance of the proposed scheme and to assess the qualitative assessment of potential impacts on traffic conditions and on the public transport in the vicinity of the scheme. Section 5.2.1 provides additional details relating to the use of the ERM.

4. The case for change

The Clontarf to City Centre Project will provide high-quality pedestrian, cycle and public transport infrastructure along the Amiens Street to Clontarf Road corridor. The scheme aims to provide a higher quality, faster and safer route for pedestrians, cyclists and buses along the Clontarf to City Centre corridor. The case for intervention is based on a number of existing issues as outlined below.

4.1. Need to deliver infrastructure to cater for growth in transport demand

More people are using sustainable modes of transport in Dublin. The annual 'Canal Cordon Count'[10] shows this switch, with a reduction in the number of cars and a steady increase in numbers using public transport, walking and cycling over the last decade (Figure 4.1). The increasing importance of public and active transport modes can be observed in the declining number of people who travel to the city centre by car.

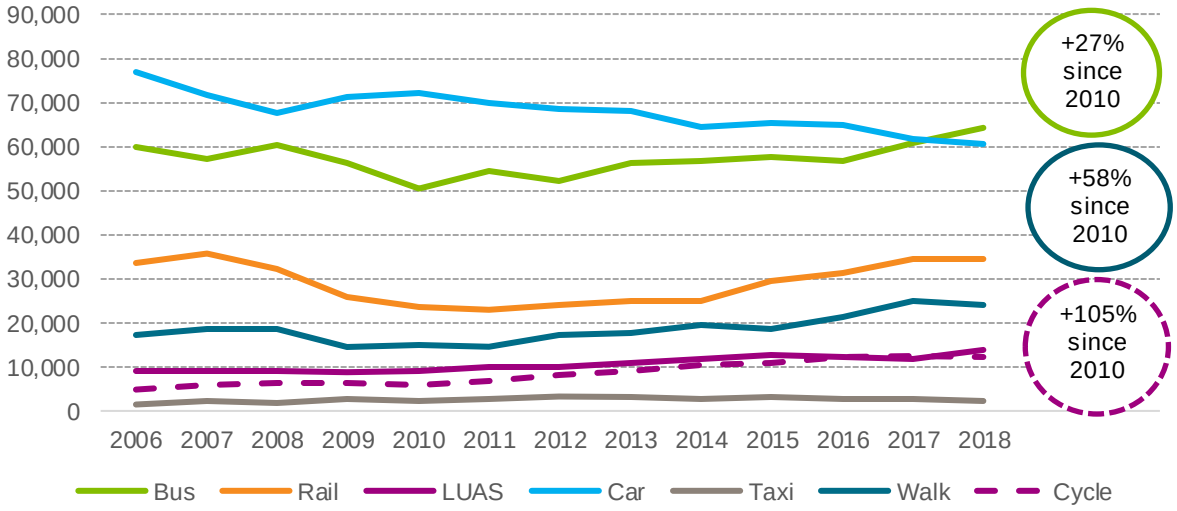

Figure 4.1 - Number of people crossing the canal cordon by mode (AM peak period)

In 2018, more people entered the city centre by bus (30%) than any other mode, and in the same year most people entered the city centre by public transport, walking and cycling (69%). There has been an enormous growth in the popularity of cycling over the last 10 years, and now 6% of people enter the city centre by bicycle. Since 2010 the total number of cyclists across the canal cordon has increased by 105% from 5,952 (representing a 3% modal share) to 12,227 (6% modal share) in 2018.

In the same period, the share of trips into the city centre using sustainable modes increased from 58% to 70%. Figure 4.2 shows the change in modal share experienced across the canal cordon since 2006.

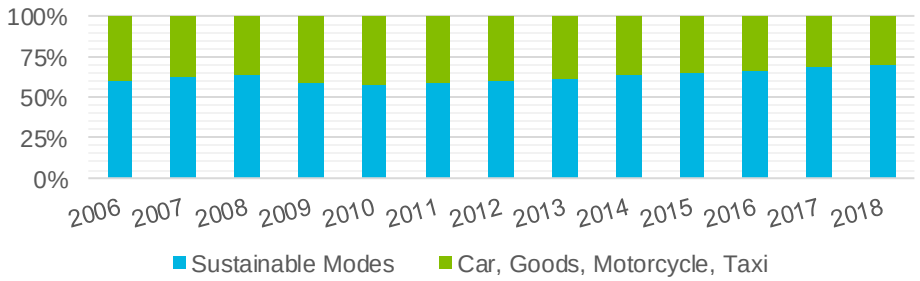

Figure 4.2 – Share of all trips across canal cordon (AM peak period)

This growth in demand needs continued investment in infrastructure to deliver reliable and safe journeys for users. The Clontarf to City Centre corridor carries high volumes of buses and cyclists and forecasts suggest that by 2026 the bus passenger demand will continue to increase significantly and there will be a ~26% increase in cyclists. The corridor needs investment to cater for these future demands.

[10] *Every November a count is undertaken of the number of people crossing a cordon around the city centre, formed by the canals*

4.2. Quality and safety of cycle facilities

There has been significant investment in cycling infrastructure in the Dublin area in recent years however to date the investment in safe cycle infrastructure has not kept pace with the rate of growth. There has been a 105% increase in cyclist numbers between 2010 and 2019.

There is a lot to be done to provide a safe and high-quality network of cycle lanes and other facilities. The most recent strategy assessment of the cycle network, the *Greater Dublin Area Cycle Network Plan*[11], found that '*the predominant provision for cycling in the Dublin City area is by means of either on street cycle lanes (both advisory and mandatory) or bus lanes. These facilities are generally of a low Quality of Service in the city area mainly due to the lack of width for cyclists and the discomfort caused by large volumes of vehicular traffic sharing the road space. Typically, the cycle lanes achieve a QoS score of C or D'.*

More recently, BikeLife 2019 has surveyed over 1,100 people living in the GDA aged 16 years or older (all residents not only cyclists). The barriers to cycling continue to show similar trends as those of the 2013 *Greater Dublin Area Cycle Network Plan,* shown in Figure 4.3.

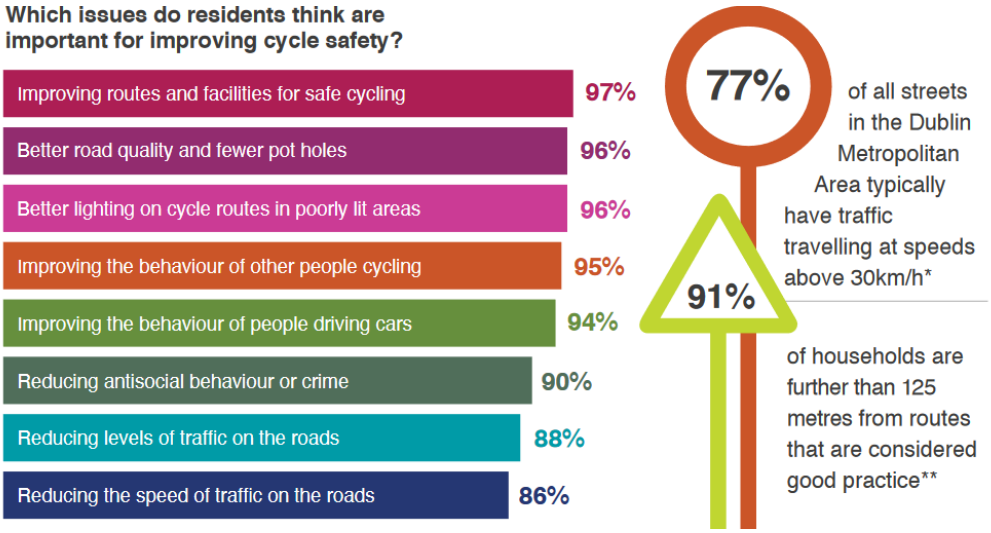

Figure 4.3 - Barriers to cycling in the GDA (surveyed June-July 2019, multiple responses allowed)

The C2CC project aims to address the barriers to cycling along the Clontarf to City Centre route by creating a safe and high-quality cycle corridor through the delivery of over 2.7km of cycle facilities in each direction.

The results of the annual cordon count indicate a steady increase in the number of cyclists entering the city. This is largely due to changing perceptions of cycling, supportive fiscal policies and investment in infrastructure. An increase in the number of cyclists on the road, however, has led to an increase in the number of collisions involving cyclists. This is evident from the Road Safety Authority's online database of road collisions,[12] which indicates that collisions involving cyclists in Dublin increased from 219 in 2010, to 594 in 2016 (the latest year for which statistics are provided). This highlights a need to ensure adequate provision of appropriate cycling infrastructure to sustain the current level of growth in a safe manner.

The Clontarf to City Centre Route currently has some form of cycle facilities for 93% of its length, however, 23% of the facilities are online and interact with buses/cars/taxis, whilst a significant proportion of the offline facilities are low quality and exposed at junctions. Overall, 7% of the route does not offer any cycle facilities, with cyclists fully exposed to traffic. Figure 4.4 shows the existing cycle facilities along the project corridor.

[11] *https://www.nationaltransport.ie/publications/strategic-planning/gda-cycle-network-plan/*
[12] *http://www.rsa.ie/en/RSA/Road-Safety/RSA-Statistics/Collision-Statistics/Ireland-Road-Collisions/*

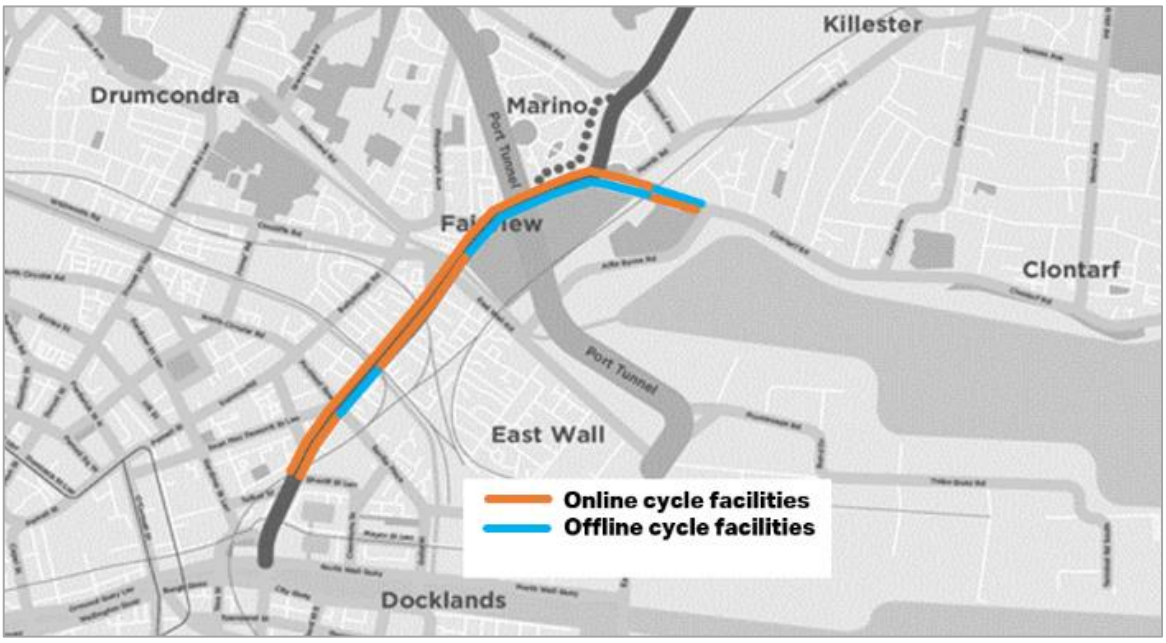

Figure 4.4 – Offline & online cycle facilities in study area

There is an evident need to deliver route consistency and to reduce the level of exposure to live traffic for cyclists along this corridor in order to encourage new cyclists and to cater for the ever-increasing demand. As safer facilities are provided, it is anticipated that a wider spectrum of cyclists will use the facilities, including greater age, gender and race diversity.

4.3. Unreliable bus journey times

Unreliability undermines customer confidence in using a service or mode. Significant variations in journey times also has a significant impact on the ability of operators to maintain headways and can result in bunching of buses. Investment in bus infrastructure will reduce interaction between buses and general traffic and reduce the likelihood of unpredictable headways, i.e. reduced reliability. Figure 4.5 shows the variability (standard deviation) in journey times along the full No. 27 route based on data extracted from the Automatic Vehicle Location (AVL) sensors on the bus fleet. The proposed scheme represents a short section of this bus route, but the data shows the impact the lack of bus priority measures has on bus journey time reliability. Figure 4.6 shows the impact of congestion on bus journey times along the corridor (No. 27 route), which increases significantly during 7:00 – 8.30 and 16:00 – 18:00 in particular.

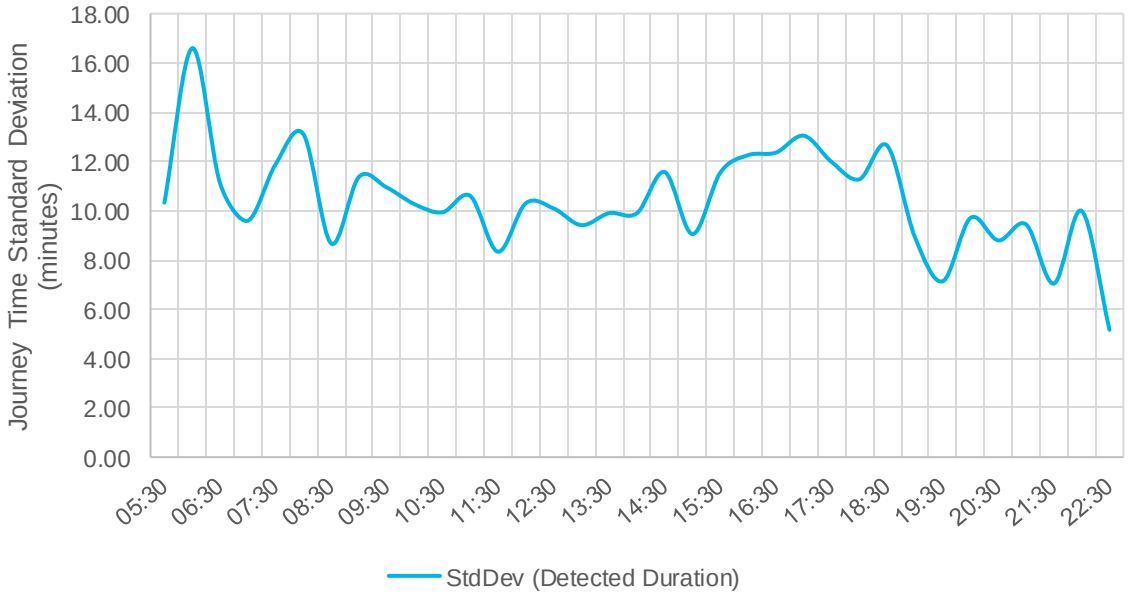

Figure 4.5 –Variance in Bus Journey Times for entire No. 27 Route (Source: AVL data)

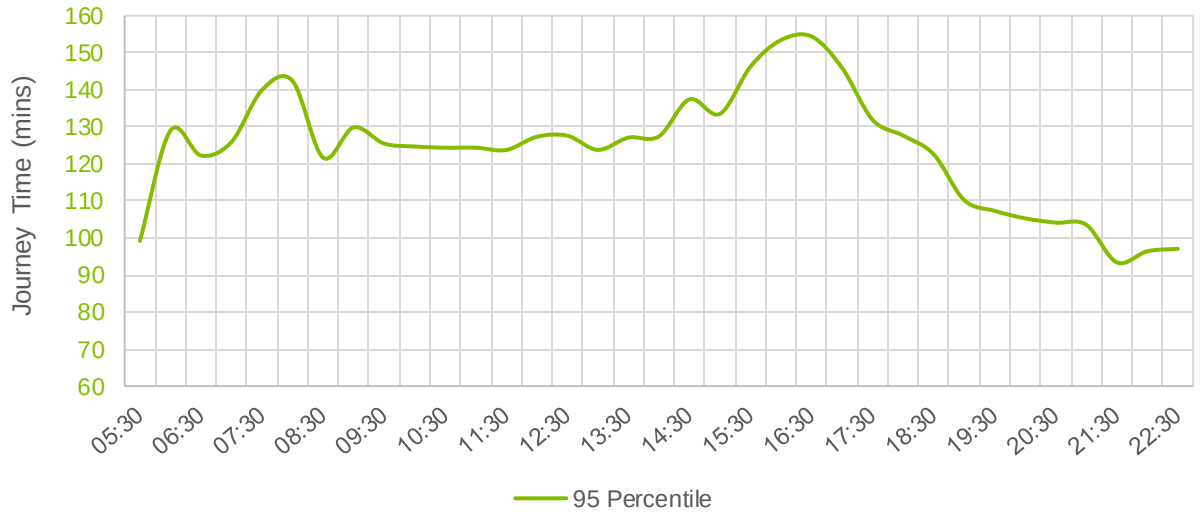

Figure 4.6 – Bus Journey Times for entire No. 27 Route (Source: AVL data)

The above graphs show 95th percentile bus journey times for the entire 27 bus route, which the Clontarf to City Centre section makes up a portion. The proposed scheme will play a part in improving the performance of the overall route and other interventions, due to be delivered as part of the BusConnects programme, will provide improvements on the other sections of the route.

In terms of the impacts along the Clontarf to City Centre corridor, the existing performance of a few key sections of the corridor have been extracted from the inbound AVL data. Figure 4.7 shows the sections assessed[13], while Figure 4.8 shows that the variance in journey times along these sections on a day-to-day basis can vary by up to 60 seconds over relatively short sections between stops. A comparison with Figure 4.9 below highlights that the variability can represent up to 25% of the average journey time of each the key sections shown. The variation during peak congestion periods is the most pronounced. This unreliability is likely caused by external influences such as general traffic impacting on buses, interaction with cyclists, etc.

[13] Source: www.dublinbus.ie

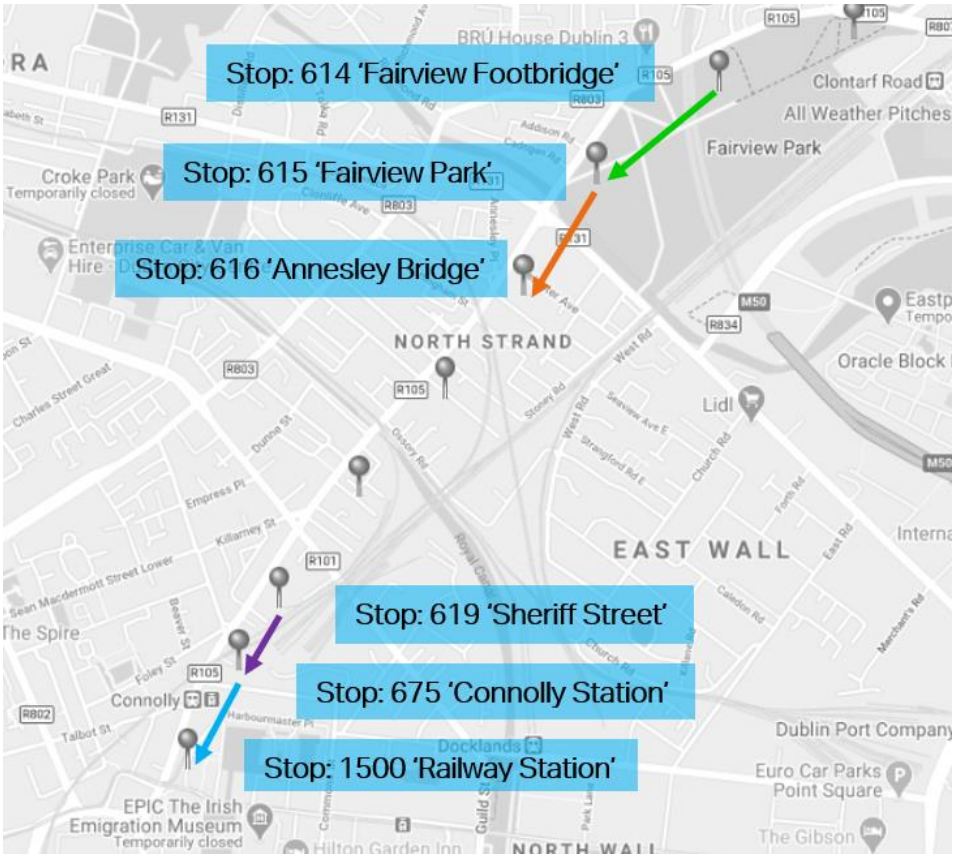

Figure 4.7 - Extract of Dublin Bus planner (greyscale), with stops names and AVL annotation (colour)

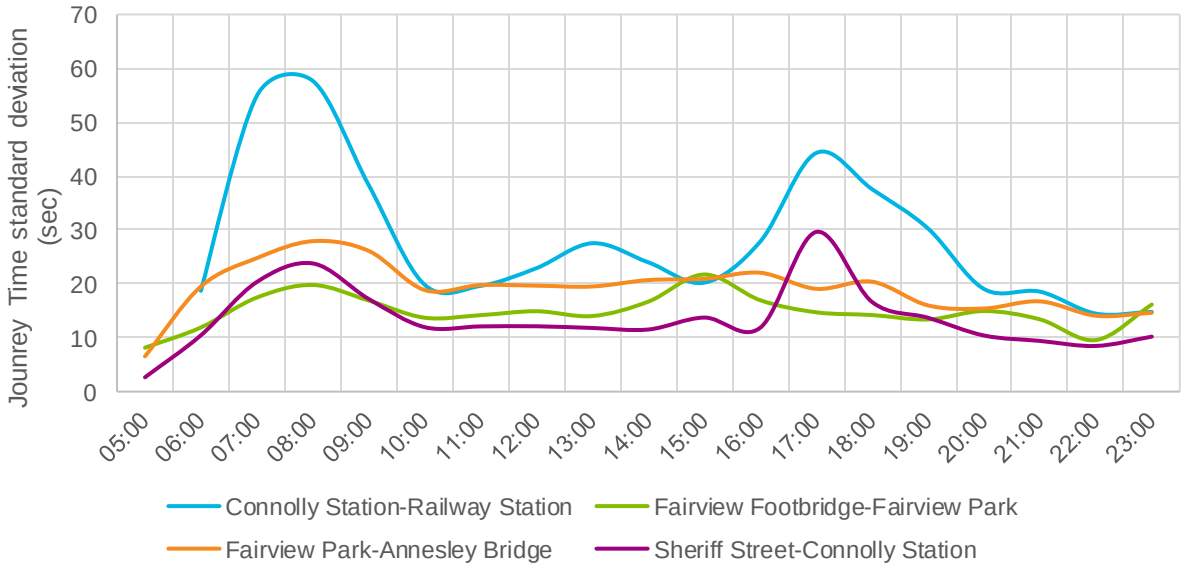

Figure 4.8 – Standard Deviation in the inbound Bus Journey Times by Section (Source: AVL data for No. 27 route)

To further understand the impact of congestion and lack of priority on bus services on the corridor, the actual running time for key sections of the Clontarf – City Centre corridor is shown in Figure 4.9. It shows that bus journey times on some sections of the corridor increase by 250% during peak periods, especially the morning period.

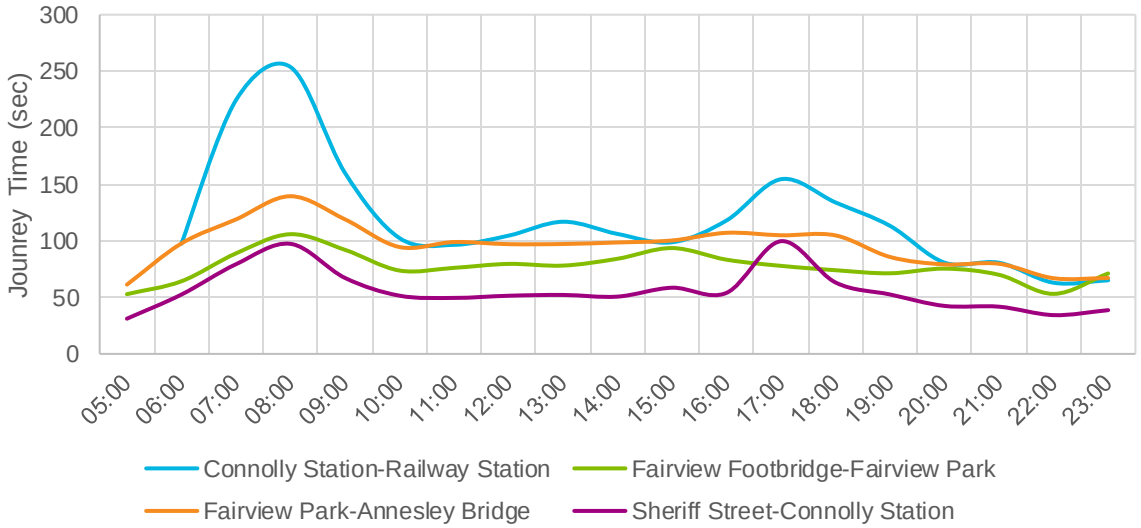

Figure 4.9 – Actual Running Time by Section – 95th Percentile (Source: AVL data for No. 27 route)

4.4. Need for modal shift to decarbonise transport

While the number of public transport trips is growing in the Dublin area, private motorised transport remains the dominant mode of travel for work trips accounting for (53.6%) of all work-based trips[14]. Figure 4.10 shows the modal share for Dublin City and suburbs as set out in the 2016 Census. This is particularly true for trips to places outside the city centre. It highlights the need to achieve significant modal shift to ensure future growth in population and jobs is accommodated primarily by sustainable modes. If this does not occur, then congestion will continue to grow as the number of jobs, commercial vehicles and tourists increases[15].

Public transport, cars, HGVs and bicycles all compete for limited road space. In order to encourage a modal shift away from the private car, a multi-modal approach is required that will improve the attractiveness of public transport, cycling and walking to provide a combined offering that presents viable alternatives to the private car.

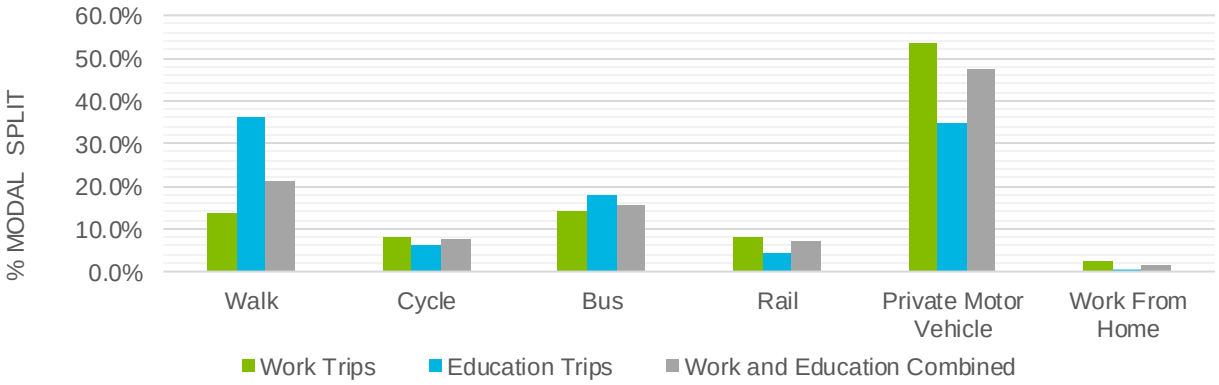

Figure 4.10 - Census 2016 – Dublin City and Suburbs Modal Share

Cycling is considered an integral part of a multimodal mix of commuting and general travel demand, so it is expected that the new cycle route will benefit users of the corridor across various modes, providing them with improved opportunity to easily transfer between multiple transport modes. Simultaneously, the cycle route is proposed to be segregated from vehicular traffic by way of a segregated cycle lane that operates behind each bus stop along its way and will provide an increasingly safe environment for cycling.

Thus, the combination of health benefits along with the provided high level of safety and journey quality will attract new cyclists who may wish to change their travel habits and turn to cycling for their everyday

[14] *Census (2016): Modal split data for the CSO Settlement: Dublin City and Suburbs*
[15] *BusConnects Clongriffin Core Bus Corridor (CBC) Consultation Brochure (2018), p.3*

business, commuting or leisure trips. An additional impact of the high-quality cycle infrastructure is an increase in the number of trips being undertaken by existing cyclists.

Cycling is beneficial for the environment – it is a considered a sustainable, active transport mode that is environmentally friendly, with near-zero emissions and assists in achieving the goals of the Climate Action Plan 2019 and other international carbon reduction targets. The increase in the number of cyclists will result in a reduction in the use of private vehicles and support the reduction of greenhouse gas emissions.

4.5. Importance of Sustainable Transport

Sustainable transport, including active modes and public transport, is essential in large cities such as Dublin because there is simply not enough road space for everyone to drive a car. In ideal circumstances, effective public transport, combined with active modes, would provide an alternative to the private car that is fast, reliable, punctual, convenient and affordable.

Effective sustainable transport can deliver important benefits to wider society in respect of:

Economy: Shorter travel times increasing economic efficiency and public transport allowing non-drivers to enter the labour market.

Well-being: Resultant short and reliable trips reducing travel-related stress and allowing people to travel safely without fear or higher risk of collisions. Increased physical activity reduces the likelihood of illness and leads to societal benefits through reduced health costs.

Competitiveness: Effective public transport encourages compact urban development, leading to shorter trips and efficient travel, which attracts business and tourism, as well as extending the labour market catchment for employers.

Environment: Reductions in car dependency and vehicle emissions lead to a decrease in risk of death/diseases due to high exposure to CO2, NOx, SO2 or particulate matter. Moreover, physical fitness and the reduction of traffic-related stress levels can be also enhanced by the promotion of active modes.

Accessibility Increasing levels of access to basic services (e.g. healthcare, education) and life opportunities (e.g. employment, social network) are vital to promote an equitable and socially inclusive urban development.

4.6. Logic Path Model

A Logic Path Model is a tool to demonstrate the coherence of a proposal in achieving certain outcomes or objectives. The Model shows the relationship between an issue or objective that the sponsoring agency seeks to address, the actions it carries out, and the results of these actions. In this case, the Logic Path Model summarises how the Clontarf to City Centre Project is expected to deliver on this case for change.

Table 4.1 displays the Logic Path Model for the route, and demonstrates how improved journey quality, safety and reliability for pedestrians, cyclists and bus passengers is likely to encourage a shift from private vehicles, and result in benefits for health, safety and the environment.

Table 4.1 - Logic Path Model

Inputs	Activities	Outputs	Results	Impacts
Public Funding *(€52 million)* Time *(24 months)* Administrative Support	Construction of Cycle Infrastructure	2.7km of segregated cycle tracks in each direction Upgraded junctions	Improved cycling journey quality and perception of safety Reduced risk of conflicts with cars	Increase in the number of cyclists Increased diversity of cyclists with more universal uptake
	Construction of Bus Infrastructure	1km of new bus lane 4.4km of upgraded bus lane 12 High Quality Bus Stops	Reduction in bus journey times Improvements in bus reliability	Increase in the number of bus passengers Increase in the number of pedestrians
	Construction of Public Realm & Drainage Works	24,700m^2 of upgraded footpath 200 new and upgraded public lighting units 40 new nature-based Sustainable Urban Drainage Systems (SUDS)	Improvements in pedestrian journey quality, safety & accessibility Enhanced public realm Increased water retention & filtering	Reduced car use and carbon emissions Health & physical activity benefits for new pedestrians & cyclists Reduction in cyclist collisions and casualties Reduced risk of flooding & improved water quality

5. Approach

This section provides a detailed overview of the steps followed in the delivery of the supporting analysis, which feeds into the appraisal of the Clontarf to City Centre Project. The methodology is based on the following:

- A literature and impact review of similar cycling projects (to assess their post-implementation effects),
- A review of existing available cycling data; and
- The preparation of a forecast of potential cyclist use along the route (Section 5.1).

Furthermore, the development and completion of the appraisal was based on data related to current travel demand and travel demand projections, travel times, travel distance and travel costs for all modes. Detailed analysis of the methodology stages is presented below.

5.1. Cyclist Demand Projections

5.1.1. Review of available data

The first step in developing the appraisal was to collect available data for the proposed scheme. In the case of Clontarf to City Centre Project, applicable data provided included:

- Previous route assessments, optioneering details and multi-criteria assessments applied to other similar schemes;
- Cyclist user demand data, such as site surveys, canal cordon counts and prior modelling exercises; and
- Diagrams, drawings of the scheme, and cost estimates.

The information collated was appropriate for the completion of the scheme appraisal and for enabling benefits of the scheme to be quantified.

There have been a number of changes to the appraisal of transport projects which have had a direct impact upon the calculation of both the economic and safety benefits of transport schemes. These changes include:

National Parameters

- The Department of Public Expenditure and Reform (DPER) in their Public Spending Code (PSC) 2019 document have changed the applicable Discount Rate used in project appraisal from 5% to 4% (years 1-30) and 3.5% (years 31 – 60); and
- DPER have also updated the Shadow Price of Carbon (€20 per tonne CO_2 equivalent) and the values of Non-Greenhouse Gas Emissions.

Economic Parameters (DoT CAF and TII PAG)

- Annex 1 (Parameter Values) of the Department of Transport (DoT) Common Appraisal Framework (CAF)[16] and several units of the Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) were updated in 2019 to reflect the change made by DPER to the Public Spending Code; and
- In October 2020, DoT updated Annex 1 (Parameter Values) of the CAF to account for the revision of the Value of Time parameters used in the appraisal of transport projects.

Traffic Parameters (TII PAG)

- TII have updated their traffic growth projections to take into account the population and employment projections set out in the Governments National Planning Framework which was published in 2018; and

[16] https://www.gov.ie/en/organisation-information/800ea3-common-appraisal-framework/

- The formula and parameters used to calculate fuel consumption in the Transport User Benefit Appraisal (TUBA) software was updated in 2018.

5.1.2. Assessing the expected future cycle demand

5.1.2.1. Literature review

The first stage of the economic appraisal focused on gathering data from existing research and literature related to the increase in the number of cyclist trips due to new or improved cycling infrastructure. The collection of cyclist and other quantitative road user data focused on applicable studies and previously developed projects in Ireland and other European countries. Presented below is an overview of the analysis that was undertaken:

- The Integrated Implementation Plan for 2013-2018 as developed by the NTA. This included a historic analysis of the means of travel to work and education from 2006 until 2011. The results showed an increase of 23% in cycling trips in the GDA. The percentage increase within the city centre of Dublin reached 40%, and nationally 10% (National Transport Authority, 2018);
- A supplementary survey was conducted by the NTA and DCC based on the annual Canal Cordon counts. This showed an increase of 114% in the number of cyclists travelling towards the city centre between 2006 and 2014 (National Transport Authority, 2016). Recent data from the Canal Cordon counts showed an increase of 11% in the number of cyclists between 2015 and 2016 and an increase of 150% in the last decade (National Transport Authority, 2017);
- A scheme developed along the Wyattville Road that included new and upgraded cycle lanes and tracks from Kilbogget Park to Glenavon Park across Wyattville Road. The scheme was completed in February 2018 and by the following year the number of cyclists had increased by 250%, with an average daily number of pedestrians and cyclists estimated to be around 1,000 (National Transport Authority, 2018);
- In the UK, the Cycling City and Town (CCT) and the Cycling Demonstration Towns (CDT) (Sustrans, 2017) programmes examined cycle trends in more than 15 towns and cities. The report focused on exploring the relationship between investing in cycling and the effects of the investments on the number of cyclists and cycling trips. With the CCT programme in place, the overall number of cycling trips for the 12 participating towns increased by 24% over the three years of the research. The range of increase for each individual town was found to be from 9% to 62% (Sustrans, 2017). On the CDT programme, the increase for the six towns reached 29%, with a range of 5% to 59%, over the five-and-a-half-year period (Sustrans, 2017);
- Transport for London (TfL) launched the Cycle Superhighways (CS) and Quietways (QW) schemes for making cycling more attractive to users. According to a TfL report, so far, the new infrastructure has resulted in an increase of 54% in the number of cyclists. On the basis of this success, further expansion of these cycle route's is already planned (London Assembly Transport Committee, 2018). Also, an initiative of the previous Mayor of London, called 'mini-Hollands', that aimed to improve the cycling infrastructure for selected outer London boroughs, led to a 42% increase in the number of cycling users (London Assembly Transport Committee, 2018);
- Various research studies promoted cycling as a transport mode for students to travel to and from school. In Scotland, a survey conducted in 3,000 schools, revealed that the percentage of students cycling every day in 2010 was 2.8%, while in 2018 this figure increased to 3.8%, a 35% rise over an eight-year period (Sustrans, 2019);
- Additional cycling studies of European countries reinforces the connection between better cycling infrastructure and the growth in the number of cyclists. In Seville, Spain, the expansion of cycle tracks from 19km to 164km over a five-year period resulted in a 6% increase in the number of cycling trips and a simultaneous decrease in the number of collisions (Sustrans, 2018).
- The European Union funded numerous cycle projects for improving cycling infrastructure. In Riga, Latvia's capital, the improvement of cycling infrastructure and cycle parking increased the modal share for cycling from 3% in 2006 to 12.3% in 2012, a rise of 310% (PTP Cycle, 2016). Moreover, the measures implemented in Ljubljana, Slovenia for promoting walking, cycling and public transport led to a 27% increase in cycling over a six-month period (PTP Cycle, 2016).

Summarising the findings of cycling demand studies, the minimum annual increase was 1.2% in Spain, while the maximum annual increase of 250% was experienced locally at Wyattville Road, Dublin (though low cycling activity before the infrastructure was implemented may skew this study). The minimum and maximum cycle trip percentage changes are considered extremes of the studies and may not be interpreted as typical or representative values.

Analysis of the literature review regarding the potential future cycling demand due to new cycling infrastructure is that in the majority of cases, cycle demand increases in the range of between 4% and 15%.

Table 5.1 summarises the data from the analysed research and literature and presents the percentage increase of the number of cyclists on a comparative annualised basis.

Table 5.1 - Percentage increase of number of cyclists

Project	Study Area	Time Period	Increase in No. of Cyclists	Annualised Increase in No. of Cyclists
Integrated Implementation 2013-2018	IE	2006-2011	10% - 23%	1.9 – 4.2%
Transport Strategy for the Greater Dublin Area 2016-2035	Dublin City Centre, IE	2006-2011 2006-2014	40% 114%	7.0% 10%
Canal Cordon Count Report	Dublin, IE	2015-2016 2006-2016	11% 150%	11% 9.6%
2018 Annual Report Sustainable Transport Measures Grants	Wyattville Road, Dublin, IE	2018-2019	250%	250%
Cycling City and Town Programme	UK	2008-2011	24%	7.4%
Cycling Demonstration Towns Programme	UK	2005-2011	29%	4.3%
Cycle Quietways & Superhighways	London, UK	2014-2018	54%	11.4%
'mini-Hollands' Programme	London, UK	2015-2016	42%	42.0%
Hands Up Scotland Survey	Scotland, UK	2010-2018	35%	3.8%
Urban City Masterplan	Seville, ES	2006-2011	6%	1.2%
PTP Cycle Project	Ljubljana, SI	2016	27%	27.0%
PTP Cycle Project	Riga, LV	2006-2012	310%	52%

The annualised values are presented visually below to show the strong evidence base for annual growth of 5-15% for new cycle schemes (excluding Wyattville Road scheme). This is in-line with the experience across the canal cordon in Dublin, which suggests annual growth of between 10-11% since 2006.

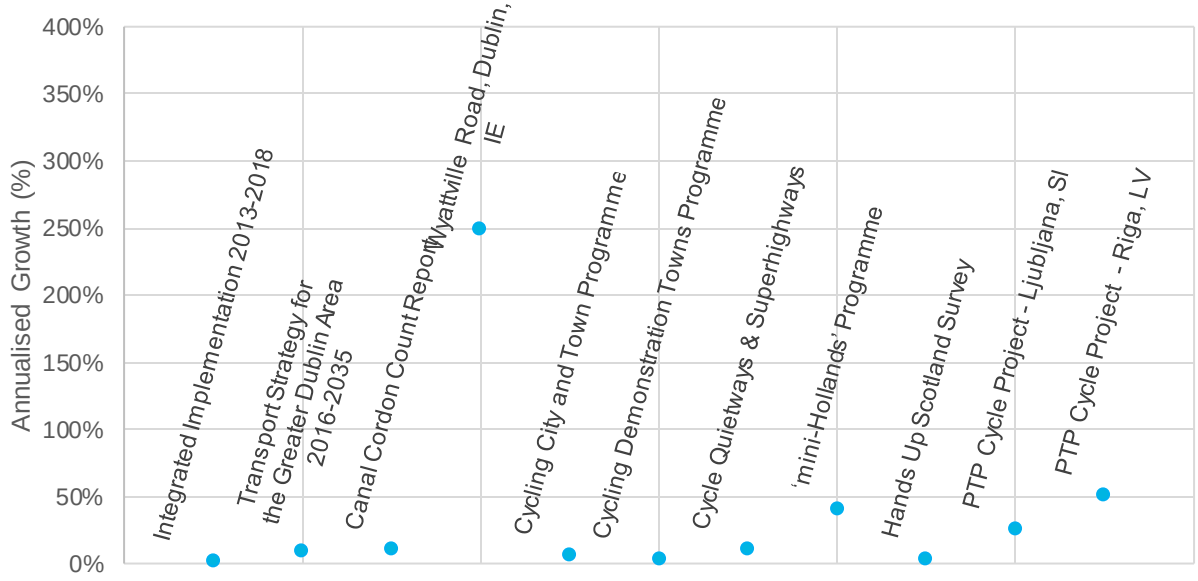

Figure 5.1 – Annual growth of cyclists

The review of previous research and projects around Ireland, UK and Europe provided an indication of the interdependent relationship between the investment in cycling infrastructure and the increase in the number of cyclists.

The research results show that the development of new cycling infrastructure or the upgrade of existing infrastructure will significantly contribute to an increased level of cycling participation.

Other independent factors, such as the general trend for increased cycling modal shares were noted throughout the literature review – such natural tendencies for increased cycling across the European studies would also apply to Dublin's Clontarf to City Centre Project and therefore other factors are not subject to specific or further assessment.

5.1.2.2. Quasi-experimental study

This section sets out a second approach to validate the findings from the literature review described above. The case study that is proposed applies a quasi-experimental method to evaluate the outcomes of a similar project implemented in Dublin, namely, the Frascati cycle route.

The core principle of this method is to estimate the *effect* of a *treatment* over time. In this particular case, the *effect* being evaluated is the increase in the number of cyclists, and the *treatment* applied is the implementation of a new cycle route. In this sense, two variations are calculated;

1. The difference of number of cyclists over time, and
2. The difference between groups of population affected (i.e. control and treatment). This method is grounded on the traditional difference-in-difference technique[17].

There are three main reasons to believe that the Frascati cycle route is an appropriate example to be investigated in the present study.

Firstly, because the implementation of this project occurred between the last two Censuses (2011 and 2016), which enables the Small Area Population Statistics (SAPS) to be used for longitudinal comparisons.

Secondly, because this cycle track is part of a longer route that connects the Southern shore of Dublin to the city centre, and only this stretch has been upgraded to a fully segregated cycle lane. Thus, the SAPS around the non-upgraded stretch of this cycle route can be used as an appropriate control group with very similar characteristics, reducing the confounding factors that could arise in this analysis.

[17] *Cook, T.D., Campbell, D.T. and Shadish, W., 2002. Experimental and quasi-experimental designs for generalized causal inference. Boston: Houghton Mifflin.*

Finally, the Frascati Cycle route has been often referred to as a successful case study of how improvements on the cycling infrastructure can lead to a modal shift and promote a more sustainable use of the transport network. Figure 5.2 summarises the presented methods showing the location and current conditions of the treatment and control group.

Figure 5.2 - Summary of the quasi-experimental study

Figure 5.3 presents the increase in the number of cyclists of both groups over time. The percentage population growth of each group has been deducted from the respective values of 2016 in order to reduce bias potentially caused by population growth imbalances.

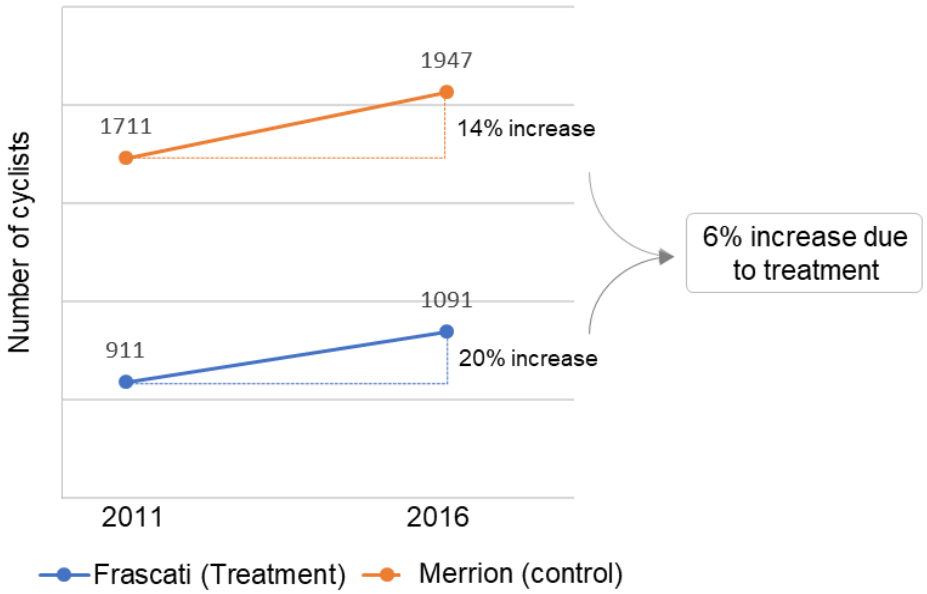

Figure 5.3 - Results of the difference-in-difference method

This analysis has revealed that despite the natural growth in the cycling demand, the implementation of a new segregated cycle track has led to an additional 6% of increase in the number of cyclists around the Frascati cycle track. The influence of the lack of infrastructure downstream i.e. at Merrion, on people's decision to cycle or not does need to be considered however it is likely to be suppressing demand rather than inflating demand. Overall, considering the similarity of contexts and project characteristics, it is possible to conclude that the growth rates previously suggested in the literature review (5%-15%) are also applicable to estimate the impact of the Clontarf to City Centre Project on future cycle demand.

5.1.3. Forecast of new potential cyclist usage

A forecast of potential demand for new cyclists over the 30-year period was developed. In Ireland, the official transport-specific evaluation period of 30 years is applied. This time period should normally be used where the life of the asset is 30 years or more.

The forecast was based on the most recent trends in cyclist growth analysed in the previous section of the methodology. Specifically, the analysis of the new cyclists' data (summarised in Table 5.1), gathered from studies and projects on cycling routes in Ireland and other European countries, provided a lower and upper limit for forecasting of cycle demand of the Clontarf to City Centre Project.

The lower boundary for the economic appraisal was set at a 4% increase in the annual number of cyclists and the upper boundary at 15%, while an intermediate value of 10% was assessed as the central case (rounded up from the mid-point of 9.5%).

Thus, the new cyclist annual demand was calculated by multiplying the existing cyclist trends by the percentage increase growth factors.

5.1.4. Forecasting of total cycling demand

The overall cycling demand represents a combination of both existing and new cyclists. The cycle demand of expectant **new users** was defined previously in Section 5.1.3 Additionally, for calculating the demand of the **existing cyclists** that are not related to the new cycle scheme, a transport projection method was applied based on historical trends of growth on the corridor.

The method of forecasting benefits for existing cyclists was based on data collated from the Canal Cordon Counts Site 30 (located at Newcomen Bridge), which is within the study area. The data used in forecasting future annual average daily cycle demand was extracted from the cordon counts' latest 14 years (2004-2018). The operation of the new scheme is expected to begin in 2023. The cyclists forecast for the study period is based on a trendline (linear regression) created by the available data from the previous three-year period from site 30, Newcomen Bridge, of the Canal Cordon counts. The trendline derived from the latest data is presented in Figure 5.4 .

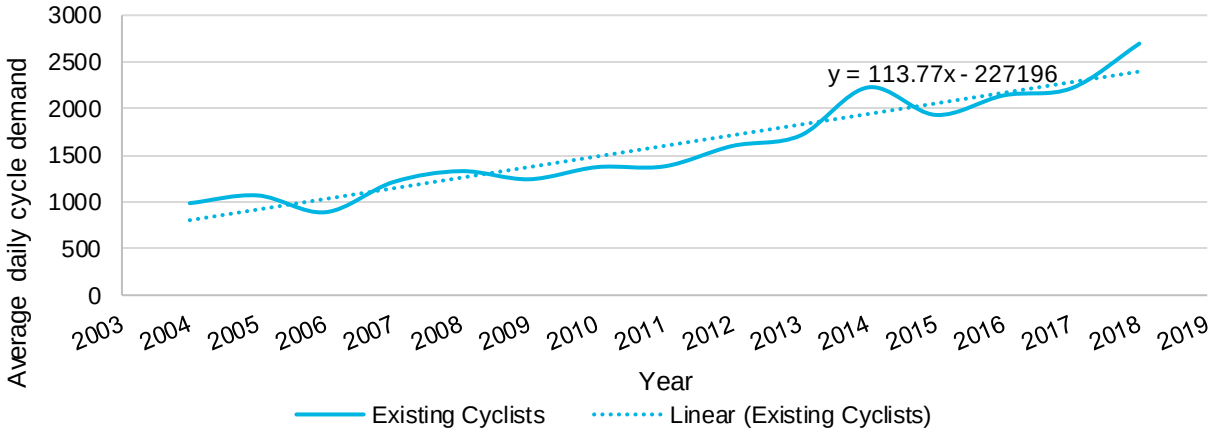

Figure 5.4 - Annual average daily cycle demand 2004 – 2018 with linear trendline

The forecast trend of overall future cycle demand along the corridor is projected from the linear trendline developed from historic data and increased by the new cycle demand resulting from the growth scenarios (4%, 10%, 15%).

While linear, straight-line growth is proposed, based on the available previous years' annual counts, the true trajectory of new cyclist numbers will be slightly different – an initial rapid increase might be expected on scheme opening and may taper off over time, landing at the same 4% annualised average increase in cycling. This might create a 'hockey stick' profile of new cyclist numbers. Indeed, if an early and rapid increase in cycling did occur, these cyclists would gain more benefits early-on, increasing the monetised benefits beyond those reported in later sections.

Figure 5.5 shows the trendline of the existing cycle demand without the development of the new infrastructure and the three additional conservative, straight-line trendlines with the new overall cycle demand due to the new cycle scheme for the three different growth scenarios.

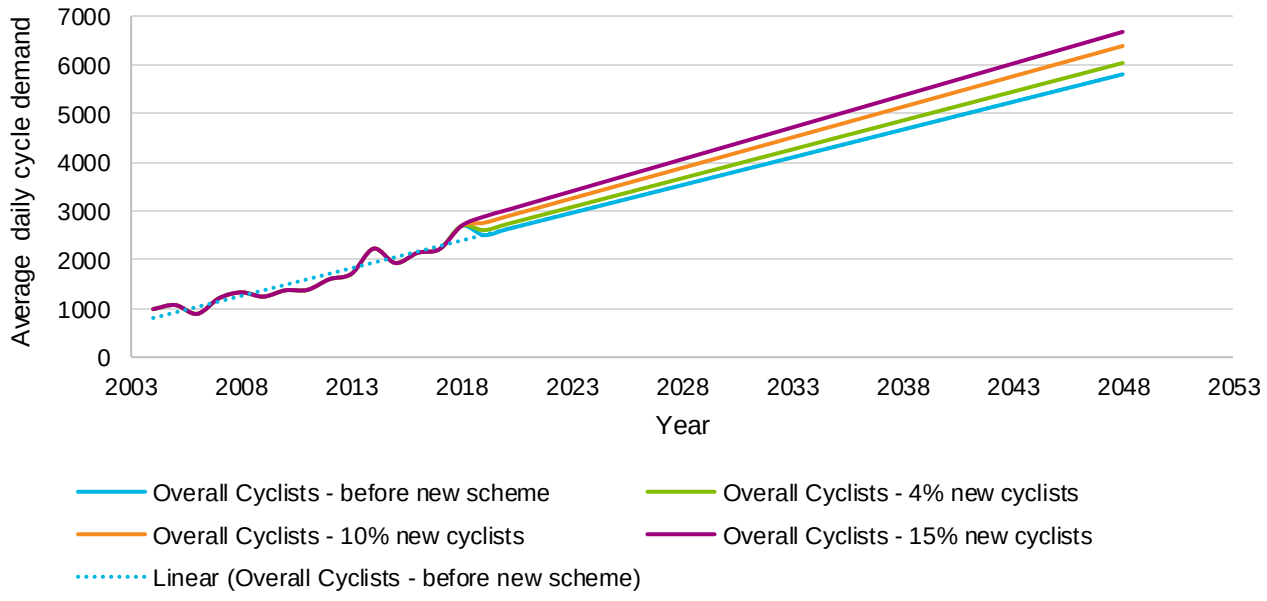

Figure 5.5 - Annual average daily cycle demand for the three growth scenarios

5.2. Transport planning analysis

In developing the business case for the scheme, the approach was to use the NTA Eastern Regional Model (ERM) for both traffic impact and appraisal purposes. In particular, our approach was to use the ERM to understand changes in bus patronage, bus journey times and impacts on private vehicles as a result of any traffic management changes on the road network.

In validating our approach, the first step was to ascertain whether the proposed scheme was of a scale that could be accurately appraised in Transport Users Benefit Appraisal (TUBA) software, through the

use of outputs from the ERM. In-depth analysis of the model proved that the model was adept at forecasting patronage and bus journey times. However, it was determined that the scale of the ERM was such that the outputs from the model could not be used in economic appraisal as the scale of 'noise' throughout the model was of such a scale as to overshadow the impacts of the scheme, which is localised in nature. Our final approach was to use elements of the ERM, such as patronage and wider impacts where possible in developing the business case with economic appraisal inputs sourced via different methods – further information is provided in Section 5.2.1.

5.2.1. Eastern Regional Model

The ERM is one of five strategic models in the NTA's Regional Modelling System and focuses on the eastern counties including the Greater Dublin Area (GDA). It provides information on indicators such as the total travel time per person across different times of the day and modes, the total kilometres travelled per person and the demand by mode.

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, 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); and
- Demand Model.

Figure 5.6 – Extent of ERM

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. The NTA have developed three ERM reference case forecasts (2026, 2035 and 2057), which are in line with the projections contained in the Project Ireland 2040: National Planning Framework (NPF). These projections take account of employment, population and education projections at Small Area level. 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 using 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 resultant trip matrix totals show that the demand for travel is forecast to increase by:

- 9-10% between 2026 and 2035; and
- 30-31% between 2026 and 2057.

The ERM was to be used to test scenarios for each of the years 2026 and 2035 for the Clontarf to City Centre Project. The ERM model runs included both Do Minimum and Do Something scenarios, both with and without the interaction of the full BusConnects programme.

6. Scheme Impacts

This section analyses the different impacts considered as part of the economic appraisal based on the methodology outlined in Section 5.

6.1. Impacts on cyclists

Safety, health, socio-economic and journey time benefits were identified and quantified using data and findings gained from the previous demand forecasting stages. These factors were applied to a spreadsheet model with parameters based on DoT CAF and TII PAG (*Unit 13: Walking and Cycling Facilities).* The following benefits are included in the appraisal:

- Safety improvements due to the segregation 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. In addition, the reduction in congestion will reduce cyclists' exposure to harmful greenhouse gases and particulates;
- Socio-Economic benefits in the form of improved journey quality & ambience, leading to reduced stress and decreased absenteeism due to improved cycle trip quality as a result of the offline cycle lanes; and
- Travel time reductions due to improvements in the level of service of the cycle facility type.

In terms of appraising the highway and public transport travel time impacts, all general parameters such as value of time, value of time growth rates, discount rates, shadow pricing factors etc., were applied from TII PAG *(Unit 6.11 – National Parameters Value Sheet)* and the DoT CAF.

Collision reduction
A key goal of new transport infrastructure is to reduce the risk of serious injuries or fatalities due to collisions. Where there is a reduction in the interaction between cyclists and general traffic, a lower collision risk may be anticipated. 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 severity of injury). Combining these estimates with values for the prevention of casualties and incidents, yields a monetary estimate of the incident-related costs or benefits of proposed transport interventions.

The development of a new segregated cycle route will provide a safer environment for the existing users and an attractive transport mode for the new users. Consequently, a reduction in the number of collisions, particularly involving cyclists, is expected. The benefit related to the reduction of collision risk is therefore assessed for both new and the existing cyclists.

Health
Health and physical activity are highly correlated. 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.

By demonstrating the significant contribution of cycling to physical activity improvements, users may shift to this active mode, and the health benefits that the new users gain due to cycling are measurable. This benefit is only attributable to new cyclists.

Socio-Economic

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). [18]

The new Clontarf to City Centre Project will deliver high quality offline cycle facilities, which will have positive impacts in the form of improved journey quality and associated improvements in users' perceptions of danger (a reduced fear of potential collisions/incidents) and quality of journey.

Absenteeism

Introducing cycling into the everyday behaviours of people results in a reduction in short-term absence from work due to improvements in the physical health of the users (Transport Infrastructure Ireland, 2016).

Working people affected by the development of new infrastructure are calculated from the number of new cyclists who are expected to use the facility, so the absenteeism is only calculated based on new commuting cyclists.

Cycling journey time savings

Different average cycling speeds can be estimated depending on the cycle facility type. Existing cycle facilities along the route vary for inbound (towards the city) and outbound (towards Clontarf) cyclists.

For the purposes of journey times the inbound cyclists the cycle route alongside the Fairview Park is considered as already fully segregated from the mixed traffic. Therefore, cycle journey time benefits for inbound cyclists will only be realised on the section of the route between Annesley Bridge and Amiens Street / Talbot Street junction.

For outbound cyclists no segregated facilities are provided along Fairview Park. While between Annesley Bridge / Fairview Park Road and Amiens Street / Talbot Street junction there is some variation to the existing provision and quality of cycling facilities provided for inbound and outbound cyclists. Overall, in terms of journey time savings, the scheme will provide the greatest journey time benefits to outbound cyclists.

For outbound cyclists there are no segregated facilities in-situ alongside Fairview Park and therefore cycle journey time savings will be experienced along the entirety of the route. For the purpose of the Business Case the outbound cycle route benefits have been used as the basis for the analysis. Figure 6.1 shows the different cycle facility types in place along this section of the route along with the respective lengths that are currently implemented along this section of the cycle route[19] .

[18] *Source: Wardman et al, 2007*

[19] Figure 6.1 shows the cycle types on outbound direction only (i.e. City to Clontarf direction) as this represents the greatest cycle journey time benefits

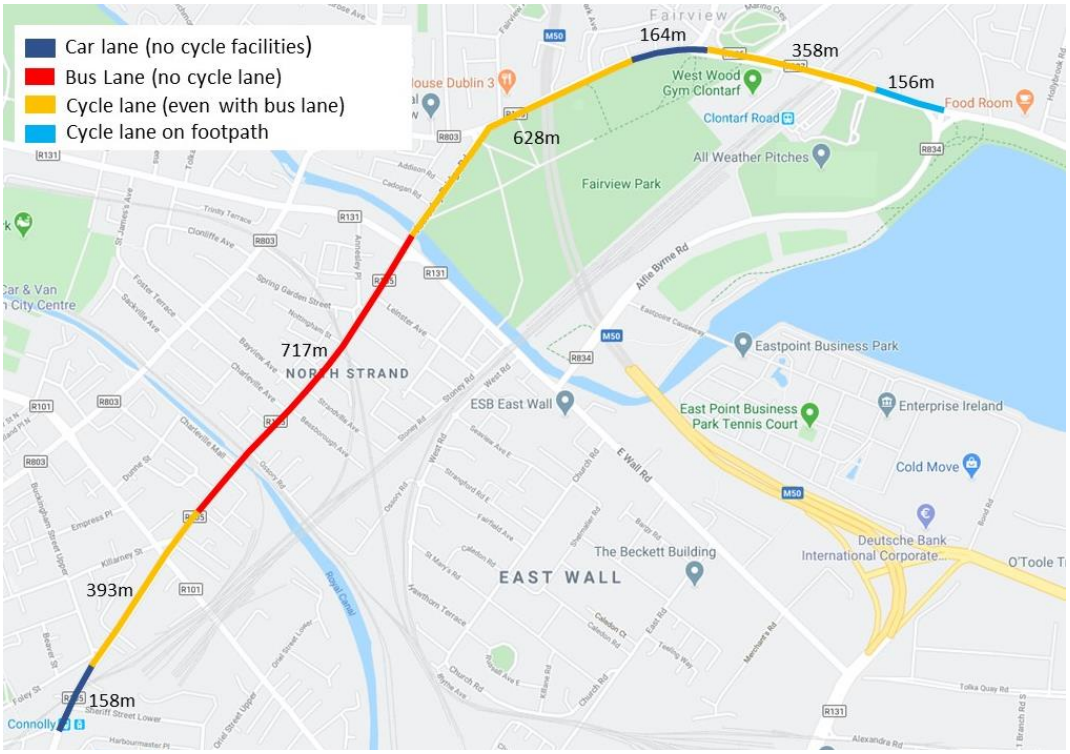

Figure 6.1 - Extent of existing outbound cycle facility types along the route corridor

Based on a 2015 study[20], different average travel speeds were applied to estimate the travel time for each section depending on the respective type of cycle facility. These travel speeds consider factors such as level of disturbance on off-street and on-street facilities. Table 6.1 presents an estimate of the cyclist journey time savings associated with delivering this scheme. It is estimated that with the proposed segregated cycle facilities in place cyclists will save on average 138 seconds while travelling along this route travelling from the city towards Clontarf in comparison to the existing situation.

Table 6.1 -Cyclist journey time savings

	Cycle facility type	Length [m]	Average speed [km/h]	Travel time [secs]
Before	Bus lane (no cycle lane)	717	12	215
	Cycle lane (on footway)	156	13	43
	Cycle Lane (including shared bus lane)	1379	13	382
	Car lane (mixed traffic no cycle facilities)	322	15	77
After	Cycle lane (separated)	2574	16	579
			Travel time saving per trip [secs]	**138**

6.2. Impacts on Bus Users and General Traffic

The proposed Clontarf to City Centre Project is primarily a cycle scheme, however it delivers bus infrastructure in the form of bus priority and improved bus stops, which will improve the attractiveness of bus travel and is complementary to the BusConnects programme. In addition, the scheme will deliver considerable public realm and environmental improvements along the route, benefiting pedestrians and local residents and businesses. The NTA ERM was used to assess the potential impact of the proposed scheme on public transport services. The key findings are outlined below and further discussed later in this section.

- The proposed scheme will result in a 3-4% uplift in bus passengers along the corridor;

[20] *Bernardi, S. and Rupi, F., 2015. An analysis of bicycle travel speed and disturbances on off-street and on-street facilities. Transportation Research Procedia, 5, pp.82-94. Available at https://core.ac.uk/download/pdf/82484444.pdf*

- In a scenario where the impacts of the extensive BusConnects programme have been captured in a DoMin scenario, the passenger numbers along the corridor remain largely unchanged in the DoSomething scenario, however, the interventions improve bus reliability and reduce journey times; and
- The proposed scheme will significantly reduce bus journey times along the Clontarf to City Centre corridor, resulting in 24-48% reductions in journey times during the peak periods.

6.2.1. *ERM results – Eastern Region*

As outlined previously the ERM model was not used for the economic appraisal for the Clontarf to City Centre Project, however, it has been used to give an in-depth understanding of the transport network impacts.

The modelling scenarios tested for 2026 include the Do Minimum and Do Something scenarios, with and without the interaction of the BusConnects programme. The Do Minimum scenario evaluates the current transport conditions without the scheme, while the Do Something includes the operation of the proposed scheme. The difference between the Do Minimum and Do Something scenarios presents the measurable outcomes of the new scheme and is expressed in journey time savings for bus journeys and in bus patronage.

The parameters are calculated with and without the BusConnects operation for a typical workday for the following periods:

- AM peak period (AM),
- Lunch Time (LT) and
- School Run (SR) periods
- PM peak period (PM) [21].

The hourly outputs were converted into daily and annual values for bus passengers and bus journey times for 2026. Table 6.2 presents the difference in bus passengers along the scheme corridor between the Do Minimum and Do Something scenarios for the AM, LT, SR and PM periods. A comparison is also visually represented in Figure 6.2.

Table 6.2 – ERM results - 2026 – No. of bus passengers by period and scenario

ERM scenarios		No. of bus passengers			
		Do Minimum	Do Something	Difference	% difference
AM	No BusConnects	11,261	11,665	404	3.59%
	BusConnects	13,817	13,670	-147	- 1.06%
LT	No BusConnects	4,111	4,308	197	4.79%
	BusConnects	5,256	5,243	-13	-0.25%
SR	No BusConnects	5,917	6,095	178	3.00%
	BusConnects	7,527	7,498	-29	-0.39%
PM	No BusConnects	10,258	10,527	269	2.62%
	BusConnects	11,945	11,944	-1	-0.01%

[21] *The AM peak period begins at 07.00 and lasts for 3 hours until 10.00, while PM is measured from 16.00-19.00. Lunch time is referred to the time period between 10.00 and 13.00 and the school run period between 13.00 and 16.00.*

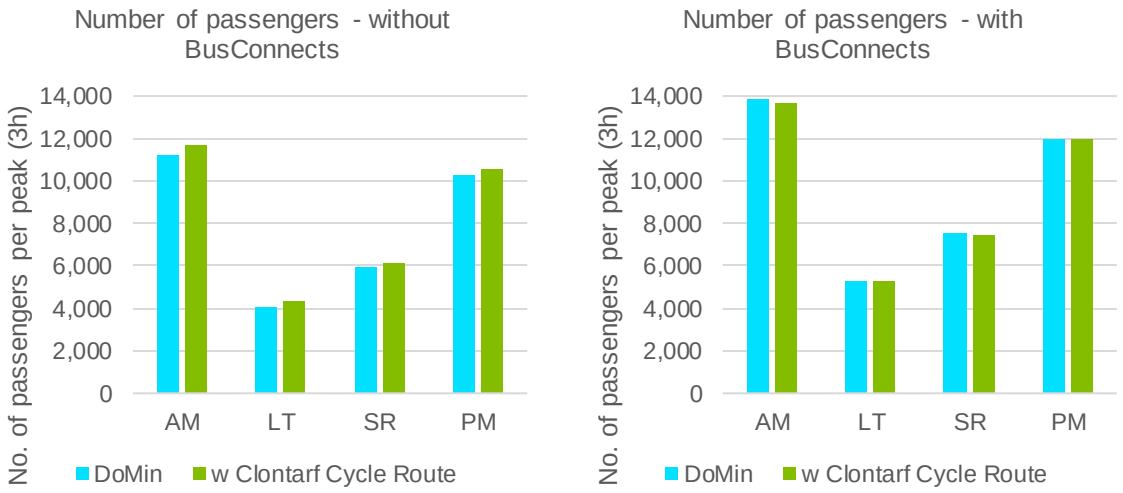

Figure 6.2 - Peak period passengers under differing BusConnects provision.

Table 6.3 shows the anticipated number of bus passengers on an annualised basis.

Table 6.3 - ERM results – No. of annual bus passengers along the Clontarf to City Centre study area

ERM scenarios	No. of bus passengers			
	Do Minimum	Do Something	Difference	% difference
No BusConnects	9,098,494	9,400,894	302,400	3.32%
BusConnects	11,117,449	11,062,300	-55,149	-0.50%

Table 6.4 presents the journey time savings of buses for each of the time periods. Journey time savings are presented in both absolute and percentage difference terms.

Table 6.4 - ERM results – Weighted average bus journey time savings (s) – 2026 daily peak periods

ERM scenarios		Bus journey time (s)			
		Do Minimum	Do Something	Journey time savings	% time savings
AM	2026	578	302	-276	-48%
LT		351	302	-49	-14%
SR		367	306	-61	-17%
PM		385	295	-90	-24%
Daily		441	302	-139	-31.5%

Table 6.5 presents the change in annual passenger hours per year. In a situation where BusConnects is not in place (which may also be a proxy / representative of the case where BusConnects is progressively being rolled out), a significant improvement in bus passenger time savings is expected. A 46% time saving may be expected for bus passengers along this section of the corridor.

Table 6.5 - ERM results – Journey time per bus passenger per year (hours)

ERM scenarios	Journey time per passenger per year (hours)			
	Do Minimum	Do Something	Difference	% difference
2026	35.4	24.2	-11.1	-46%

6.2.2. ERM results – Proposed Scheme Corridor

An additional parameter extracted from the ERM runs is the number of boardings per bus stop along the **proposed scheme only.** Table 6.6 shows the total number of boardings for each developed scenario. The highest increase was identified in the AM peak period, with a 6.43% increase in boardings without BusConnects. All peak periods had a similar increase in daily boarding in scenarios that did not include BusConnects, while the BusConnects scenarios presented a similar or slight negative boarding difference before and after the proposed scheme.

Table 6.6 - ERM results – No. of passenger boardings – peak periods

ERM scenarios		No. of peak passenger boardings (along the proposed scheme)			
		Do Minimum	Do Something	Difference	% difference
AM	No BusConnects	1,431	1,523	92	6.43%
	BusConnects	950	942	-8	-0.84%
LT	No BusConnects	609	639	30	4.93%
	BusConnects	409	412	3	0.73%
SR	No BusConnects	856	885	29	3.39%
	BusConnects	644	640	-4	-0.62%
PM	No BusConnects	1,996	2,091	95	4.76%
	BusConnects	1,398	1,413	15	1.07%

As shown in Table 6.7, bus boardings are projected to increase by 5% without BusConnects (acting as a proxy during the scheme's rollout) and experience a slight increase in a scenario with BusConnects in place (although bus patronage in Dublin will be higher overall with BusConnects due to the extensive service and programme upgrades).

Table: 6.7 - ERM results – No. of annual boardings along the Clontarf study area

ERM scenarios	No. of annual boardings (along the proposed scheme)			
	Do Minimum	Do Something	Difference	% difference
No BusConnects	1,411,000	1,482,000	71,000	5%
BusConnects	981,000	983,000	2,000	0.2%

7. Financial Appraisal

The Financial Appraisal considers only the financial costs and benefits of a project or programme to a Sponsoring Agency or to the Government, whereas economic costs and benefits are considered in the Economic Appraisal. While these broader objectives are important in determining a project's overall value for money, and whether it represents a net positive for society, the Financial Appraisal is necessary for determining whether the programme is affordable.

The Public Spending Code identifies a number of standardised financial appraisal outputs that will be presented in this section for the Clontarf to City Centre Project. These include:

- General Financial Analysis – identifying the financial impact to the Sponsoring Agency
- Exchequer Cash Flow Analysis – identifying the financial impact to the Government / Exchequer
- Sources of Funding Analysis – identifying the nominal costs and sources of funding for a project.

7.1. Financial Cost Projections

This section presents the final cost projections for the Clontarf to City Centre Project, based on received tender prices. The cost estimate includes construction, preparation, traffic management, risk and contingency, and property costs. Table 7.1 presents the values of the cost forecast.

Table 7.1 – Nominal Cost projections (July 2021, €)

Type of cost	Value (€)
Construction	€38,067,422
Preparation & administration	€5,241,532
Traffic management	€1,449,203
Land use & property	€176,000
Adjustments (risk & contingency)	€11,159,359
Nominal Capital cost exclusive of VAT	**€56,093,536**
Nominal Capital cost inclusive of VAT[22]	**€62,520,482**

Source: Roughan & O'Donovan, 2021

The total nominal capital cost (i.e. the nominal funding that will be required for this project) is estimated at €56.1 million - or €62.5 million once VAT is included – from project inception to completion. In addition, maintenance and operations costs were included for the 60-year appraisal period based on pro-rata rates provided by the NTA for the BusConnects Programme. These equate to approx. €0.3million per annum.

Funding for the capital cost of the Clontarf to City Centre Project will be provided by the National Transport Authority, while day-to-day maintenance and management of the infrastructure will be carried out by Dublin City Council.

7.2. General Financial Analysis

A General Financial Analysis is mandatory for all business cases. The purpose of GFA is to forecast the present value of cash flows over the course of the construction and operational phases (i.e. in real terms), and to return a 'Financial Net Present Value' (FNPV). FNPV is a measurement of net financial flows calculated by subtracting the present values of financial outflows from the present values of financial inflows over the appraisal period. As the Clontarf to City Centre Project is not a revenue-generating scheme, the FNPV is effectively the net present financial cost of each option.

Both financial outflows are presented in present values, which were calculated by adjusting future costs or benefits by a discount rate. Discount rates are intended to reflect the time value of money, meaning that people are generally more responsive to costs/benefits the closer in time they occur. The National

[22] *VAT on construction costs and traffic management related costs =13.5%*
VAT on preparation and administration costs = 23%

Development Finance Agency (NDFA) discount rate of 2.28% was used for the financial appraisal, although the Public Spending Code rate of 4% was also used for the purposes of sensitivity testing. Present values also exclude inflation over the appraisal period, meaning that the FNPV is expressed in base 2019 values.

Table 7.2 below displays the FNPV for the Clontarf to City Centre Project, using both the NDFA and PSC discount rates.

Table 7.2 - Results of the General Financial Analysis

	NDFA Discount Rate (2.28%)	PSC Discount Rate (4%)
Present Value of Financial Costs	**-€59,554,677**	**-€55,977,625**

It should be noted that this differs from the Present Value of Costs that is given in the Cost-Benefit Analysis. In the CBA, all costs and benefits have been rebased and discounted to a 2011 base year to maintain compatibility with the economic benefits, while the Shadow Price of Public Funds (at 130%) has also been factored into the PVC calculations. This will be outlined further in Section 8.

7.3. Exchequer Cash Flow Analysis

The exchequer cash flow analysis is specified in the Public Spending Code for the appraisal of publicly-funded projects. It identifies and quantifies the financial flows that impact the Exchequer as a result of a proposed project.

As the Clontarf to City Centre Project is publicly funded, the main exchequer outflow will ultimately be the cost of developing and maintaining the route. The FNPV from the previous section – which represents the sum of discounted cash flows – has been classed as a net exchequer outflow in this analysis. However, three other potential Exchequer flows were also considered as part of this analysis:

- **Bus Fare Impacts –** As outlined in previous sections, the Clontarf to City Centre Project is expected to have impacts on demand for bus services along this route. The modelling indicates that the Route will result in an initial increase in bus passengers due to shorter and more reliable journey times. However, once BusConnects has been implemented, the scheme will result in a slight fall in bus passengers, which is likely due to the greater options users have in terms of the expanded bus and cycle network.

  Any change in passenger numbers is likely to affect the Exchequer in two ways. If they are regular fare-paying passengers, a reduction in boardings is likely to represent a net exchequer outflow, given that less fare revenue will be collected by transport authorities. However, if they are travelling on schemes such as the Free Travel Scheme, then a reduction in passengers might represent a net inflow to the Exchequer, as it would reduce the subsidy paid by the Department of Transport to transport operators. Bus Fare impacts were calculated based on the change in passenger boardings from the modelling, an assumption that 75% would be fare-paying passengers, an average fare assumption of €2.50 per passenger, and an average Free Travel subsidy of €0.89 per passenger. These assumptions are all based on data contained in the NTA Bus and Rail Statistics 2020[23].
- **Income Tax Impacts -** Spending on labour during the construction and operational phase will also result money directly returning to the Exchequer in the form of income tax; an exchequer inflow. The amount spent on labour was estimated based on the typical labour component of construction expenditure (17%) and professional fees (40%), as derived from the 2015 Input-Output tables. An effective income tax rate of 16.6% was applied to the labour component of expenditure, based on data from the Revenue Commissioners.
- **Indirect Tax Impacts –** While VAT paid on direct project expenditure has been excluded from the Financial Appraisal (and therefore from the Exchequer Cash Flow), VAT paid by suppliers

[23] NTA, 2020. 'Bus and Rail Statistics for Ireland – State-funded Services'. Available at: https://www.nationaltransport.ie/wp-content/uploads/2020/09/NTA-Bus-and-Rail-Statistics-Final-for-Web.pdf

and firms further up the supply chain will represent an indirect exchequer inflow for the Exchequer. Indirect tax factors have been calculated based on the 2015 'Input-Output Tables for Ireland', and range from between 8-10% of spending, depending on the specific sector in question.

If the scheme results in a significant shift away from private car use towards sustainable modes, then there may be additional impacts on the exchequer, such as reduced fuel duties. However, as a change in vehicle kilometres driven (a key input to calculate changes in fuel revenue) have not been estimated from the Eastern Regional Model, these impacts have not been included in the Exchequer Cash Flow Analysis.

Table 7.3 below summarises the main exchequer inflows and outflows over the appraisal period. Future values have been discounted by using two separate discount rates: the 4% rate specified by the Public Spending Code, and the 2.28% rate specified by the National Development Finance Agency (NDFA).

The impact on the Exchequer is not as significant as the FNPV, given that a portion of project spending will immediately return to the Exchequer through taxation, and the scheme is expected to result in a Net Exchequer Outflow of €57 million (in present values) using the NDFA Discount rate. There are slightly differences between the two discount rates, but these are minor in the context of the projected spend.

Table 7.3 - Results of the Exchequer Cash Flow Analysis

	NDFA Discount Rate (2.28%)	PSC Discount Rate (4%)
Financial Costs (FNPV)	-€59,554,677	-€55,977,625
Fare Impacts	-€27,155	€309,787
Income Tax	€1,711,452	€1,638,981
Indirect Taxes	€847,462	€794,999
Net Exchequer Cash Flow	**-€57,022,919**	**-€53,233,858**

8. Economic appraisal

8.1. Economic appraisal - Definition

The key purpose of appraisal is to ensure public funds are allocated in an economically advantageous manner for the state and its residents, by establishing the merits of a proposal using a consistent and comprehensive framework – the CAF.

This section sets out the economic appraisal of the scheme and forms a key element of the business case. The Clontarf to City Centre Project is anticipated to be a complementary scheme to BusConnects, where the provision of a programme of high-quality bus corridors throughout the city has already been assessed as having a positive economic impact.

Economic appraisal is a decision method applied to a project that takes account of a wide range of costs and benefits, provided in monetary terms or where a monetary equivalent can be estimated. Economic appraisal in the transport sector takes the form of a CBA and serves several functions at the individual project level and for comparing across a variety of projects and State-wide locations:

- On a project level, the CBA defines the economic viability of the project and can provide a comparison of alternative options, as well as taking account of sensitivity testing; and
- At a national level, the economic appraisal compares and identifies the projects that would provide positive return on investment.

In general terms, where a project has a Benefit to Cost Ratio (BCR) of over 1, the project provides a positive return to the economy. The net present value (NPV) and BCR are key indicators of worth but do not provide information on benefits and costs that cannot be monetised, e.g. wider economic benefits (WEB). Therefore, although an important input, the economic analysis should not be used as the sole basis for decision making.

This section of the report presents a summary of the appraisal undertaken for the Clontarf to City Centre Project. The appraisal has been undertaken in compliance with DoT's CAF for Transport Projects and Programmes 2016.

8.2. Appraisal assumptions

The assumptions that support this assessment are based on are the following:

- The cycling elements have been appraised over a 30-year period (plus a10-year residual value) reflective of their lifecycle;
- The bus infrastructure has been appraised over a 30-year period (plus a 30-year residual value);
- An estimate of the number of people who begin cycling as a result of the proposed scheme will be made based on outputs from applicable research and literature review undertaken;
- The cycle facilities are offline and segregated with no interaction with the live carriageway except at junctions, which will result in a 50% reduction in incidents (compared to historical rates) along the length of Clontarf to City Centre Project;
- All parameter values for the calculation of economic benefits are referenced from PAG Unit 6.11: National Parameter Values Sheet and PAG Unit 13: Pedestrian and Cyclist Facilities; and
- Benefits will be accounted for across the cyclist peak hour within a single workday and factored up by 253 standard working days in a full year.
- A 4% discount rate over the standard appraisal period (i.e. years 1 - 30) and a declining discount rates of 3.5% over the residual value period (years 31 – 60) has been assumed for the central scenario.
- Value of Time values have been updated with the latest version of the CAF, published in Oct 2020.
- To maintain compatibility with the benefits, all capital and O&M costs have been rebased and discounted to 2011 prices, and factored by a Shadow Price of Public Funds of 130%.

8.3. Cyclist Benefits

This section outlines the monetary benefits associated with the delivery of the Clontarf to City Centre Project. In accordance with all the previous chapters, the costs for the journey quality (ambience and reduced stress) and the collision reduction benefits were calculated for existing and new cyclists, since

both groups will benefit from the new scheme and take account of the increase in cyclist demand. Benefits for absenteeism and health only took new cyclists into consideration.

Table 8.1 presents the benefits for existing cyclists and Table 8.2 the benefits for new cyclists. Respectively, within Table 8.1 the journey quality benefit refers to the number of existing cyclists and in Table 8.2, new cyclists. Collision benefits for the two groups (existing cyclists and new) are provided respectively in the two tables also. Absenteeism and health benefits are attributable to new cyclists only, and therefore solely provided in Table 8.2.

Both Table 8.1 and Table 8.2 present results over a 30-year appraisal period for the base case, with a cyclist growth rate of 10% as a result of the implementation of the scheme.

*Table 8.1 - Cycle facility benefits for **existing** cyclists – Base case (2011 values, €)*

Type of benefit	Benefit values (€) Base case - 10% new cyclists
Absenteeism	0
Journey Quality	€20,778,818
Collisions	€25,718,469
Health	0
Cyclist Travel Time Benefit	€25,360,468
Present Value of Benefits (PVB)	**€71,857,755**

*Table 8.2 - Cycle facility benefits for **new** cyclists – Base case (2011 values, €)*

Type of benefit	Benefit values (€) Base case - 10% new cyclists
Absenteeism	€742,770
Journey Quality	€2,077,882
Collisions	€2,857,608
Health	€5,796,611
Cyclist Travel Time Benefit	€2,536,047
Present Value of Benefits (PVB)	**€14,010,918**

8.4. Bus User and General Traffic Benefits

To understand the economic impact of the proposed scheme, the following analysis was undertaken:

- The quantum of bus users experiencing reduced journey times due to the proposed scheme was quantified using the ERM. This was applied to the bus journey time reductions along the scheme corridor by time period and monetised for a 30-year period (plus a 30-year residual period) using variables set out in PAG;
- Due to the scale of noise created within the full ERM, it was difficult to ascertain the impact of the proposed scheme on general traffic, so to resolve the noise issue, a cordoned model of the ERM was created of the ERM as shown below in Figure 8.1; and
- The impact of the scheme on bus and general traffic was based on 2026 demand and travel time impacts. In-line with policy and reflective of road space capacity, the general traffic demand along the corridor was capped at 2026 levels, whilst PT demand continued to grow. Impacts on general traffic were captured during peak periods of congestion, when impacts are likely, whilst PT impacts were captured across the day to account for reliability and junction priority improvements.
- The bus infrastructure will deliver segregation and priority for buses. This will reduce the variability in bus journey times along the corridor. Knowing exactly how long a journey will take provides a greater level of confidence and assurance to passengers. Reliability benefits are separate from journey time savings. They capture the perceived benefit associated with reduced uncertainty that

users experience when the variation in their bus journey times is reduced. These benefits have **not been quantified** for this scheme – therefore it is considered that the economic benefit is understated since they will increase in the economic benefits associated with the scheme.

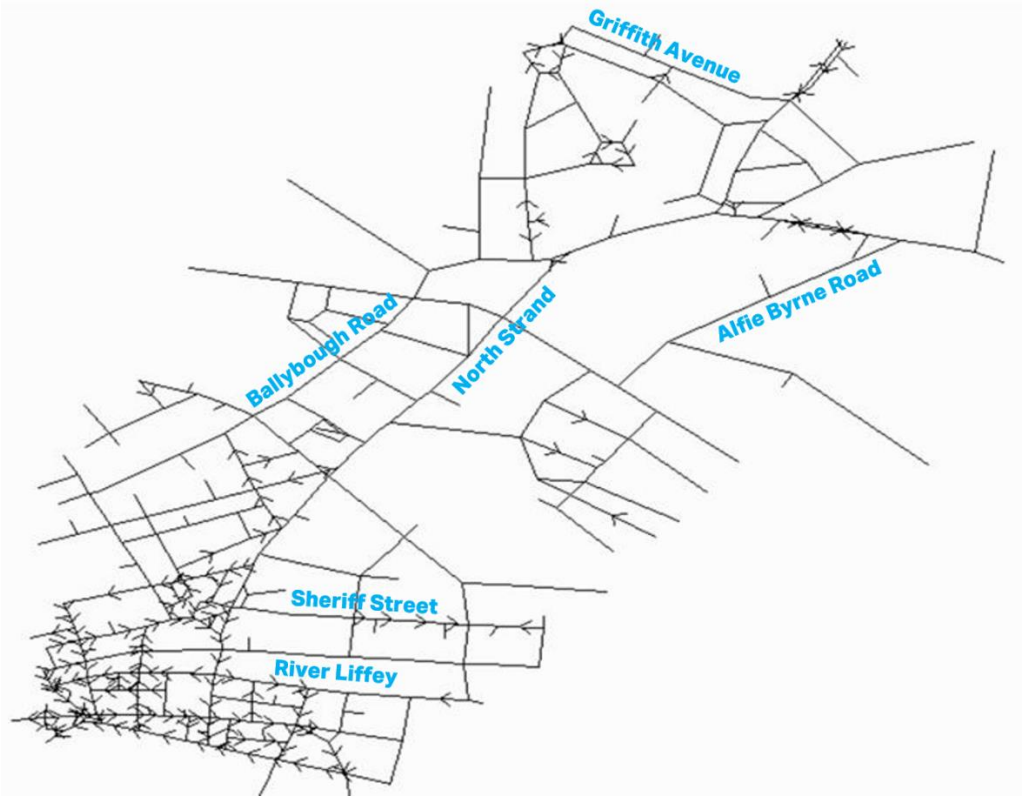

Figure 8.1 – Cordon of ERM used in assessing economic impact of the proposed scheme

The results of this analysis are presented below and monetised in line with PAG guidance. The appraisal focussed on the AM and PM peak periods, when the proposed scheme will deliver the greatest journey time savings and offer significant reliability improvements.

Table 8.3 – Bus Users & General Traffic CBA – 60-Year Appraisal Period – 2011 values

Period	Bus Demand (pax.)	Bus Impact (secs)	Bus Impact (€m, 2011 values)	HW Demand* (veh)	HW Impact (secs)*	HW Impact (€m, 2011 values)
AM	3,192	-275	+€ 117.5	22,973	+93	-€137.5
LT (Lunch Time)	4,812	-49	+€ 17.0	16,841		
SR (School Run)	7,128	-61	+€ 29.4	17,836		
PM	13,330	-90	+€ 74.5	21,480	+24	-€32.9
Sub-Total			**+€238 million**			**-€170 million**
TOTAL						**€68 million**

*Highway (*HW) impact refers to highway impacts within cordon area shown in Figure 8.1 only*

The above shows the positive impact of the proposed scheme overall. Whilst there are some negative impacts on general traffic (highway), it would be expected that as mobility options increase and behaviours continue to change, a significant proportion of existing car drivers on this corridor would switch mode, time of travel or decide not to travel. The promotion of sustainable modes over private car modes in Dublin City Centre is in line with Dublin City Council and National Transport Authority policies.

8.5. CBA results summary

This section provides a summary of the overall economic appraisal, in the form of:

- Present Value of Costs (PVC),

- Present Value of Benefits (PVB), and
- Benefit-Cost Ratio (BCR).

The PVC (shown in Table 8.4) is a combination of investment costs, maintenance costs, changes in operator revenues and allows for shadow pricing of funds and labour.

- Capital costs of the scheme have been developed by ROD and provide an estimate of approximately €56.1 million (2021 prices) exclusive of VAT and inflation for the CBA in-line with guidance.
- For compatibility with scheme benefits, the capital cost estimate is re-based to 2011[24] and factored to include the Shadow Price of Public Funds of 130%. The Shadow Price of Public Funds is an adjustment specified by the Public Spending Code to reflect the economic costs associated with raising public funds through taxation, and is generally applied to all publicly-funded expenditure. O+M costs are also added to gain the combined PVC applicable for the scheme - this results in an economic cost estimate of €53.4 million in 2011 prices.

Table 8.4 - Present Value of Costs (2011 Values)

Type of cost	Value (€)
Capital Costs (incl. Risk and Contingency)	**€56,093,537**
Present Value of Costs (rebased to 2011 values)	*€41,039,189*
Shadow Price of Public Funds	*€12,311,757*
Present Value of Costs incl. Shadow Price of Public Funds	**€53,350,946**

The PVB refers to the overall benefits from travel time impacts across all modes and impacts on cyclists in the form of health, collision reduction, journey quality / ambience and absenteeism benefits. Table 8.5 displays the PVC, PVB and BCR of the Clontarf to City Centre Project.

Table 8.5 – CBA summary – Base case (including 10-year residual value)

CBA breakdown	*Benefit values (€)*
Type of benefit	***Base case - 10% new cyclists***
Travel Time – Bus and Private vehicles	€ 67,992,746
Absenteeism	€ 742,770
Journey Quality	€ 22,856,699
Collisions	€ 28,576,077
Health	€ 5,796,611
Cyclist Travel Time Benefit	€ 27,896,515
Present Value of Benefits (PVB)	**€ 153,861,419**
Present Value of Costs incl. Shadow Pricing (PVC)	**€ 53,350,946**
Benefit-Cost Ratio (BCR)	**2.9**

The analysis concluded a PVB of €153.9 million is applicable over the 30-year appraisal period (plus residual period) in line with guidance set out in PAG and CAF.

The results on Table 8.5 show that the economic appraisal of the Base case scenario presents a strong business case for the Clontarf to City Centre Project based on the information provided. **Notably, these benefits are applicable with or without the wider BusConnects programme in place**.

Overall, the proposed scheme is expected to have a positive impact on all road users based on the monetised transport benefits, with a BCR of 2.9. The results of the economic appraisal demonstrate that the proposed scheme provides a strong return on investment and is economically

[24] Re-based using CPI of the Central Statistics Office

viable under all scenarios assessed. These benefits assume that the design aspirations are realised to their full extent. The benefits to pedestrians, local residents and businesses associated with the significant public realm and environmental enhancements to be delivered by the scheme have not been monetised. Neither have the reliability benefits to bus services that will accrue from the provision of continuous bus priority through physical infrastructure. Both of these benefits will improve the attractiveness of the areas served along the route.

The scheme includes significant investment in the Fairview Area, both within and outside the Park. The entire road frontage is to be repaved in high quality paving materials, and there will be considerable public realm enhancements for local businesses. The Park will be linked through to the network of greenways and City Farm being developed at Alfie Byrne Road, Dublin Port and East Wall Road, which will provide for cross pollination between the respective user groups, delivering economic benefit in both directions (agglomeration benefit).

Footpaths on Amiens Street, North Strand Road and Annesley Bridge Road will be repaved, decluttered and improved, and enhanced landscaping including suds bio-retention areas and pollinator friendly planting will be introduced where space permits. Paving materials in the historic core will be sympathetic to the historic environs and Leinster Granite will be used where appropriate.

The scheme will also involve the renewal of public and private utility infrastructure along the route, including replacing approximately 6km of old water mains. This will reduce leakage and will improve water quality in the area. Irish Water has committed €3m in funding towards the project in recognition of this significant gain, which will also avoid the need for costly and disruptive regular repairs on dilapidated infrastructure in future. Enhanced fibre connections will be installed for Dublin City Council to improve fibre connectivity around the city.

Taking account of the above non-monetised benefits, it is clear that the Transportation Benefits to Cost Ratio of the scheme doesn't fully account for the benefits that the scheme is likely to deliver along the corridor and to the wider north inner city area under all of the CAF headings, as recorded in the Project Appraisal Balance Sheet.

8.6. CBA Sensitivity analysis

A number of sensitivity tests in relation to modelling assumptions, economic variables and costs have been undertaken and are set out below:

- A scenario where journey quality impacts are excluded from the appraisal;
- A scenario where alternative plausible future demand is used as the basis for appraisal;
- Increased and decreased growth rate for the number of new cyclists due to the development of the proposed scheme; and
- Cost increases of 20% and 50%.

The results of these sensitivity tests are presented in the following sections.

8.6.1. Journey Quality Impacts are excluded

Journey quality benefits have been proven to exist through extensive international research; however, a scenario where this is excluded from the benefits has been assessed for completeness. With journey quality benefits removed the scheme would generate a BCR of **2.5**.

Table 8.6 - CBA summary – Exclusion of Journey Quality Impacts

CBA breakdown	Benefit values (€)	
Type of benefit	Base case	Journey Quality Excluded
Travel Time – Bus and Private vehicles	€ 67,992,746	€ 67,992,746
Absenteeism	€ 742,770	€ 742,770
Journey Quality	€ 22,856,699	-

Collisions	€ 28,576,077	€ 28,576,077
Health	€ 5,796,611	€ 5,796,611
Cyclist Travel Time Benefit	€ 27,896,515	€ 27,896,515
Present Value of Benefits (PVB)	**€ 153,861,419**	**€ 131,004,720**
Present Value of Costs (PVC)	**€ 53,350,946**	**€ 53,350,946**
Benefit-Cost Ratio (BCR)	**2.9**	**2.5**

8.6.2. *Alternative Future Demand*

The long-term impacts of COVID-19 are unknown; however the scenario planning provides a framework to consider "shock waves" that occur from time to time. These "shock waves" can lead to an acceleration in the natural rate of change in society. The COVID-19 pandemic is an example of such a shockwave.

An alternative scenario for future travel demand has been developed by the NTA which considers the medium to long-term impacts associated with an accelerated transition to remote working, remote education and associated changes for a proportion of the population. In respect to employment, there is an assumption that a higher proportion of white-collar employees will utilise working from home when commuting distances are longer, while short distance commuters or blue-collar workers will be less able or inclined to work from home. For education, the greatest change is assumed in respect to university or college travel where it is assumed that a substantial shift to online learning and partial attendance will occur. Other economic assumptions regard an increase in online shopping, a reduction in business travel and an increase in freight volumes to service growing demand for online deliveries. Overall, the scenario assumes that the economy rebounds quickly and grows back with economic trends and factors, such as unemployment remaining unchanged. The full details of the travel demand assumptions used in the alternative scenario are described in a separate NTA report entitled 'Alternative Future Scenario for Travel Demand'.

The trip rates assigned with the NTA National Demand Forecasting Model have been adjusted to reflect the impact of greater working from home on different cohorts of the population considering employment type and trip type.

Overall the alternative scenario results in a significant reduction in the total number of trips on the transport network, approximately 8% lower than base projections. For the purposes of this appraisal the % reduction in benefits found on other schemes such as BusConnects Dublin has been used as a 'stress test' to understand the potential impact of this demand scenario – these reductions have been applied to the highway and PT impacts only given that cycling is likely to keep growing at pace - these changes in demand and travel behaviour reduces the overall benefits however C2CC still returns a robust BCR.

Table 8.7 - CBA summary – Alternative Future

CBA breakdown	Benefit values (€)	
Type of benefit	**Base case**	**Alternative Future**
Travel Time – Bus and Private vehicles	€ 67,992,746	€ 50,038,000
Absenteeism	€ 742,770	€ 742,770
Journey Quality	€ 22,856,699	€ 22,856,699
Collisions	€ 28,576,077	€ 28,576,077
Health	€ 5,796,611	€ 5,796,611
Cyclist Travel Time Benefit	€ 27,896,515	€ 27,896,515
Present Value of Benefits (PVB)	**€ 153,861,419**	**€ 135,906,673**
Present Value of Costs (PVC)	**€ 53,350,946**	**€ 53,350,946**
Benefit-Cost Ratio (BCR)	**2.9**	**2.5**

8.6.3. New cyclist growth rate

The cycle demand related to new cyclists (due to the development of the Clontarf to City Centre Project), was calculated in Section 5.1. A set of lower and higher growth rates for new cyclists was assessed within that section and allows for a sensitivity assessment to be carried out to estimate the impact that the growth rates would have on the economic assessment.

A summary of the CBAs under the two growth rate sensitivities are provided in Table 8.8. The results of the sensitivity assessment indicate that the proposed Clontarf to City Centre Project would generate a BCR of 2.8 if the 4% growth rate of the number of new cyclists eventuated, and 3.0 if the 15% cyclist growth rate eventuated.

Table 8.8 - CBA summary – 4% & 15% cyclist growth rates

CBA breakdown	Benefit values (€)		
Type of benefit	**Base case**	**4% growth rate**	**15% growth rate**
Travel Time– Bus and Private vehicles	€ 67,992,746	€ 67,992,746	€ 67,992,746
Absenteeism	€ 742,770	€ 297,108	€ 1,114,156
Journey Quality	€ 22,856,699	€ 21,609,970	€ 23,895,640
Collisions	€ 28,576,077	€ 28,576,077	€ 28,576,077
Health	€ 5,796,611	€ 2,318,645	€ 8,694,917
Cyclist Travel Time Benefit	€ 27,896,515	€ 26,374,887	€ 29,164,539
Present Value of Benefits (PVB)	**€ 153,861,419**	**€ 147,169,433**	**€ 159,438,074**
Present Value of Costs (PVC)	**€ 53,350,946**	**€ 53,350,946**	**€ 53,350,946**
Benefit-Cost Ratio (BCR)	**2.9**	**2.8**	**3.0**

8.6.4. Cost Sensitivities

A number of cost sensitivities have been assessed for the scheme, including a scenario where PVC increase by 20% and 50%. The results of this cost sensitivity analysis are presented in Table 8.9.

Table 8.9 - CBA summary – Present value of Costs Increases

CBA breakdown	Benefit values (€)		
Type of benefit	**Base case**	**20% Increase**	**50% Increase**
Travel Time – Bus and Private vehicles	€ 67,992,746	€ 67,992,746	€ 67,992,746
Absenteeism	€ 742,770	€ 742,770	€ 742,770
Journey Quality	€ 22,856,699	€ 22,856,699	€ 22,856,699
Collisions	€ 28,576,077	€ 28,576,077	€ 28,576,077
Health	€ 5,796,611	€ 5,796,611	€ 5,796,611
Cyclist Travel Time Benefit	€ 27,896,515	€ 27,896,515	€ 27,896,515
Present Value of Benefits (PVB)	**€ 153,861,419**	**€ 153,861,419**	**€ 153,861,419**
Present Value of Costs (PVC)	**€ 53,350,946**	**€ 64,021,135**	**€ 80,026,419**
Benefit-Cost Ratio (BCR)	**2.9**	**2.4**	**1.9**

9. Project appraisal balance sheet

The project appraisal balance sheet (PABS) is based on the CBA outcomes and anticipated scheme impacts. A range of criteria and elements are appraised, as outlined in CAF and *PAG (Unit 7.1 – Project Appraisal Balance Sheet).* The evaluation of the project is based on the six multi-criteria appraisal headings presented below and in Table 9.1:

- Economy
- Environment;
- Safety;
- Physical Activity;
- Accessibility and Social Inclusion; and
- Integration.

The six criteria were qualitatively evaluated and present some anticipated benefits of the Clontarf to City Centre Project.

Table 9.1 - Project appraisal balance sheet

Project appraisal balance sheet			
Criteria		**Scoring**	**Qualitative assessment**
Economy	**Transport efficiency & effectiveness**	Highly positive	The proposed scheme will have a number of positive impacts under this criterion: • Increased numbers of people cycling makes more efficient use of road space and creates multi-modal behaviours, which will likely increase usage of public transport across the year; • A modal shift away from private cars will lead to more efficiently used (higher occupancy) public transport; • Improvements in bus infrastructure will lead to improved journey time reliability and increase the attractiveness of bus services; • The proposed scheme will significantly reduce peak period bus journey times, which will improve accessibility and social inclusion by improving access to the majority of the city; and • Cycling is a very effective means of transport. By 2035 the scheme will encourage ~500 new cyclists, which in the absence of the scheme would potentially represent ~400 cars or the need for 5-6 additional buses. Reduced capacity and turn restrictions for private cars along the corridor will lead to increased travel times, which will offset the reductions in congestion as a result of modal shift to buses and cycling.
	Benefit -Cost Ratio (BCR)	Highly positive	The economic appraisal of the proposed scheme results in a positive return on investment and presents a strong economic case for the scheme.
	Wider Impacts	Moderate positive	The proposed scheme will deliver a number of wider impacts, including the delivery of various utility, infrastructure and economic impacts for residents and commercial premises through the delivery of an enhanced public realm.
Environment	**Air quality & climate**	Highly positive	Air quality and climate will be positively affected due to a modal shift towards cycling and increased usage of buses, which will be LEV's in the near future. As part of the ongoing bus fleet renewal programme, the NTA will replace the existing fleet with low emission vehicles. At this point, it is assumed any new vehicles purchased up to 2023 will be hybrid with fully electric assumed from 2024 onwards. In appraisal terms, the shift from a largely diesel fleet to fully electric is the implementation of a Government policy, which will occur with or without the proposed scheme, so there is no impact on the economic appraisal. It should be noted, however, that the proposed scheme protects and enhances the attractiveness of the buses along this corridor and will maximise the environmental benefits by increasing the usage and the efficiency of the buses.
	Noise & vibration	Moderate positive	The proposed scheme will result in an increase in public transport use and cycling and a reduction in car use, which would reduce traffic and relatively reduce noise and vibration.

Safety	**Collision reduction**	Highly positive	The proposed scheme includes significantly enhanced cycling facilities, which will make it safer for people to cycle to and from work or for leisure. The improved cycling infrastructure will reduce collisions and protect cyclists, who are the most vulnerable road users currently. This impact has been quantified and monetised as part of this business case. The proposed scheme will encourage people to shift from private cars to cycling, bus and rail. This will decrease road traffic, which due to the lesser likelihood of injury incidents on buses, will reduce the number and severity of injury incidents overall. The impact has NOT been quantified nor monetised as part of this business case.
	Security	Neutral	No specific changes to security assessed as part of this scheme.
Physical Activity	**Journey Quality / Ambience**	Highly positive	The segregated cycle tracks provide a safer and more enjoyable cycling environment. The provided high quality infrastructure will attract more users to shift to cycling. Journey quality (ambience) is a measure of the real and perceived physical and social environment experienced while travelling. The proposed scheme will deliver high quality offline cycle facilities, will have a positive impact on users' perception of danger (a reduced fear of potential collisions/incidents) and improve their quality of journey. This is achieved through segregated cycle facilities, which will reduce the conflict between cyclists and other road users and significantly improve the travel experience and ambience for the user, making cycling a more attractive travel option.
	Absenteeism	Highly positive	The proposed scheme will have a positive effect on citizens' health and physical activity. By introducing cycling and walking into people's everyday travel, it will subsequently have a positive effect on reducing absenteeism.
	Reduced health risk	Highly positive	The new infrastructure will encourage people to cycle. The physical activity benefits from cycling will positively affect the health and wellbeing of the users and reduce multiple health risks.
Accessibilit	**Vulnerable groups**	Highly positive	It is essential for socially deprived individuals who cannot afford to own a car or afford regular public transport fares to have access to a safe and resilient non-motorised transport network that can enhance their accessibility to employment opportunities, social networks, education and healthcare centres.
Integration	**Transport integration**	Highly positive	The proposed scheme will be complementary to other schemes outlined in the Project Ireland 2040: National Planning Framework such as BusConnects and Metrolink. • The proposed scheme will improve active and public transport at local, regional and national levels by improving cycle facilities and bus journey times and reliability throughout the city. The proposed scheme will achieve the objectives of the Project Ireland 2040: National Planning Framework, the GDA Transport Strategy 2016 – 2035 and the City and County Development Plans to generally improve quality of life and improve accessibility to work, education and other activities. • The design has been future-proofed to allow for increases in the use of Cargo Bikes, eBikes and eCars, etc.
	Other	Moderate positive	

10. Procurement Strategy

The project has been procured using the Restricted Procedure set out in the Capital Works Management Framework. Initially, a Suitability Assessment Process was undertaken, and six candidates were shortlisted. Tenders were invited from the six candidates in late 2020 and three of these returned tenders in May 2021. A tender assessment process was concluded in early July 2021 resulting in the identification of the Most Economically Advantageous Tender. The costs included in same have been used to prepare this Detailed Business Case.

11. Risk Management Strategy

The Clontarf to City Centre Project follows the Common Appraisal Framework approach to evaluating risk. This approach suggests a stepped approach in order to fully understand and evaluate the risks in accordance with best practice project management. The steps are:

1 **Risk identification**: develop a risk register grouping risks by type.

2 **Assess impacts and estimate likelihood of outcomes**: identify what aspects of the project are impacted (cost, schedule, and quality), quantify the consequences, and estimate the probability of a risk happening.

3 **Derive probability distribution for the costs of the scheme**: considering all identified risks, their impacts and likelihoods, a probability distribution is created which gives the probability of the scheme cost estimate being less than or equal to any specific value. Modelling software can assist on establishing the range of costs and probabilities of outcomes.

4 **Risk mitigation**: once risks are identified and defined the focus is on preparing mitigation plans and providing evidence of the approach to responding to risks. Responding to risks will involve accepting, eliminating or transferring risks.

5 **Identify potential contingencies**: Even where an evaluation of risks and their impacts is undertaken, some risks will remain unknown. As programmes progress new risks can appear. Therefore, projects should include a provision for unknown contingencies.

A detailed Project Risk Register has been prepared and is being managed and maintained by the Project Team. An adjustment for risk and contingency to the value of €11,159,359 ex. VAT has been included in the Total Capital Cost.

12. Benefits Realisation Plan

The Logic Path Model (Section 4.6) and the Financial and Economic Appraisal (Sections 7 and 8) set out the measurable outputs and expected impacts that will arise from delivery of the Clontarf to City Centre Project. The outputs are the physical, measurable infrastructure improvements to be delivered. The expected impacts of delivering these outputs are:

- Improved cycle journey quality and perception of safety
- Reduced risk of cyclist conflict with cars
- Reduction in bus journey times
- Improvement in bus reliability
- Improvements in pedestrian journey quality
- Enhanced public realm
- Improved surface-water management

The Benefits Realisation Plan for the Clontarf to City Centre Project proposes a programme for ensuring that these impacts materialise. This programme includes:

- Conducting pre and post project qualitative surveys with regard to cycle journey time and perceived route safety

- Conducting a pre and post project review of cyclist conflicts along the route
- Preparation of a comparative pre and post project collisions and casualties report
- Assessment of bus reliability along the route pre and post project
- Pre and post project assessments and surveys of pedestrian journey quality
- Citizen surveys to monitor public perception in relation to public realm improvements

13. Evaluation Plan

13.1. Construction Stage Monitoring and Evaluation

Schemes must be monitored on an on-going basis to ensure that they are being completed to the required cost, quality and time profiles. As the scheme progresses to the final business case stage, there is an opportunity to review the formal mechanisms to monitor and evaluate progress with a greater focus on performance indicators and metrics that measure success and are more forward-looking regarding the attainment of delivery timeframes and milestones. This will help ensure that any future interventions to get schemes on track are both timely and effective.

The C2CC Project works contractor has prepared a baseline programme and Dublin City Council has developed a resource plan to monitor and track the costs, schedule and the quality of works during construction. The resource plan includes putting in place a cross-departmental team in Dublin City Council who will be engaged in site supervision, risk management, and resolution of issues that may arise as the project progresses.

13.2. Ex-Post Construction Evaluation

The Department of Public Expenditure and Reform and the Department of Transport require a Post Project Review to be carried out for all projects in excess of €20m. Guidance on the requirements and preparation of a Post Project Review are provided in *PAG Unit 9.0 – Post Project Review.*

The Post Project Review for the proposed scheme will be undertaken 5 years after opening to allow sufficient time for the project impacts to be evaluated. The Post Project Review will evaluate the following four stages of the project:

- Project Conception;
- Project Planning;
- Project Implementation; and
- Project Operational Performance.

In accordance with the Public Spending Code guidelines, a Project Completion Report will also be prepared. In addition, arrangements will be put in place to ensure ongoing monitoring, review and evaluation of the project upon completion.

The key monitoring indicators should be determined by the programme objectives and results defined in the logic map and through the appraisal process. Consideration has been given in the Business Case to the range of results and associated indicators that are relevant for C2CC. These indicators represent a method for measuring the success of the C2CC post implementation and allow us to assess actual performance against projected performance.

The initial focus has been on the quantifiable results that form the core of impact assessment for the project. Establishing the indicators will ensure that robust baseline data is collected/collated and suitable resources allocated to the ongoing monitoring throughout the programme implementation period.

How the Goal and Objectives relate to the performance indicators and initial targets are outlined in Table 13.1.

Key aspects of the Project are subject to statutory planning consent processes which may result in alterations and amendments to elements and parameters of the Project. Following the planning stage, the expected outcomes from the delivery of the Project can be finalised and specific Performance

Indicators targets can be established. These specific Performance Indicator targets will be included in the Final Business Case, providing clear metrics and timelines against which the Project can be measured and evaluated.

Table 13.1 - Goals, objectives, indicators and data sources

Goal and Objectives	Performance Indicator	Target	Source / Attribution	
			Ex Ante	Ex Post
Goal - *Provide a high-quality cycle route linking the Clontarf area to the city centre to cater for existing and future demand; to facilitate improvements to bus journey time reliability through the introduction of bus priority infrastructure along the corridor; and to improve the pedestrian environment through the delivery of public realm and environmental enhancements along the route.*				
To provide a high quality, continuous and consistent cycling facilities to cater for existing and future demand;	Number of additional cycle users	An additional 330 and 433 cyclists per day by 2026 and 2035 respectively, equivalent to a 10% increase in cyclist numbers Time saving of approximately 75 seconds for cyclists travelling along the route corridor;	NTA Eastern Regional Model – Cycle Models	Transport surveys
To protect vulnerable road users through the delivery of a safe and attractive route for commuter and recreational cyclists and to provide attractive, safe, segregated pedestrian facilities;	Reduction in collisions and increase in vulnerable users	A reduction in collisions along the corridor	Collision data NTA Eastern Regional Model	RSA Transport surveys
To improve bus journey times and reliability;	Average bus speed / average bus speed on corridor Increase in level of bus punctuality	A 24-48% reduction in bus journey times during the peak periods and a significant improvement in bus service reliability	NTA ERM and other transport modelling Existing performance against timetable	Bus AVL data and transport surveys
To simplify the interchange between bus services and other transport modes;	Level of interchange between modes and services	Cycle facilities and improved bus infrastructure/facilities will improve interchange between modes and services	NTA ERM and other transport modelling	Customer Surveys
To reduce reliance on private car transport;	Increase in bus patronage and cyclists and reduction in private car demand on corridor	A 3-4% uplift in bus passengers along the corridor	NTA ERM and other transport modelling	Transport Surveys

Goal and Objectives	Performance Indicator	Target	Source / Attribution	
			Ex Ante	Ex Post
growth in transport emissions;	Reduced emissions on the corridor compared to a DoMinimum scenario	A 3-4% uplift in bus passengers and a 10% increase in cyclists along the corridor and an associated reduction in private car volumes.	NTA ERM and other transport modelling	Transport Surveys
To improve the urban realm, landscape and built environment along the route;	Increased provision of CCTV, lighting, shelters and improved urban realm	Deliver C2CC as defined in Section 3.3 including 2.7km of cycle facilities	C2CC Designs	Customer Surveys
To enable National (Project Ireland 2040), Regional (GDA Transport Strategy) and Local (Dublin City Development Plan, 2016-2022) strategic outcomes and deliver on relevant climate action targets.	Delivery of C2CC which supports the NSO's Number of residents within 400 metres of an all-day frequent (15 minutes or better) bus service	An increase in the population within 400m of bus services A 3-4% uplift in bus passengers and a 10% increase in cyclists along the corridor and an associated reduction in private car volumes	GIS analysis of catchments using CSO population and employment and NTA projections NTA ERM and other transport modelling	CSO Census data Transport Surveys

In order to monitor the design quality and operational performance, post-project review workshops will be held with relevant stakeholders, including relevant maintenance and operations departments in Dublin City Council. DCC and NTA continuously monitor cyclist demand through fixed cyclist counters and annual canal cordon multi-modal surveys. Monitoring will continue on this route. The performance of buses on the corridor are monitored using the AVL System. Post-construction surveys & counts will also be undertaken to assess the impact of the project on cycling levels. These surveys will place particular emphasis on identifying whether the project has been successful in increasing cycling among key demographic groups, such as women, children and older people.

14. Conclusions

An economic appraisal was undertaken for the Clontarf to City Centre Project that assessed the transport benefits expected of the scheme. The scheme proposes the delivery of pedestrian, cycle and public transport enhancements that will promote and improve accessibility into and out of the city for sustainable transport modes, while making provision for continued essential freight and private vehicle movements. The assessment was based on a CBA that is part of the economic appraisal required for all transport projects with estimated lifetime costs in excess of €20 million. The assessment was undertaken in accordance with TII Project Appraisal Guidelines (2016) and DoT's CAF.

The central assessment results were expressed in the BCR over a 30-year appraisal period (plus a residual period of 10 years). The economic appraisal forecasts a BCR of 2.9 for the base case scenario and Net Present Value (NPV) of €100 million. Thus, the economic appraisal presents a strong case for

the Clontarf to City Centre Project to proceed. **Notably, the benefits of the scheme will be realised with or without the wider BusConnects programme in place.**

A number of sensitivity analyses were also developed for assessing the impact of varying future demand levels, and the application of a higher discount rate on the economic viability of the scheme. Specifically, a 50% increase in cost would reduce the BCR to 1.9, an alternative post-COVID future demand scenario would result in a BCR of 2.5, the 4% growth rate in new cyclists showed a BCR of 2.8, while the 15% growth rate had a BCR of 3.0. In all cases, a positive BCR would be expected. BCRs from the analysis, including sensitivities, are summarised in Table 14.1.

Table 14.1 – Summary of BCR values

Case scenarios	BCR
Base case – 10% cycle demand growth rate	**2.9**
Alternative Future Demand	2.5
Sensitivity – 4% cycle demand growth rate	2.8
Sensitivity – 15% cycle demand growth rate	3.0
Sensitivity – Journey Quality Benefit Excluded	2.5
Sensitivity – 20% increase in cost	2.4
Sensitivity – 50% increase in cost	1.9

Finally, the results of the economic appraisal assessment demonstrate that the proposed scheme provides a strong return on investment and is economically viable under all scenarios that were assessed.

Appendix A

A.1 References

Department of Public Expenditure and Reform, D., 2018. *Central Technical Appraisal Parameters, Discount Rate, Time Horizon, Shadow Price of Public Funds and Shadow Price of Labour*.
Department of Transport Tourism and Sport, D., 2016. *Common Appraisal Framework for Trasnport Projects and Programmes*.
London Assembly Transport Committee, 2018. *London.gov.uk.* [Online]
Available at: https://www.london.gov.uk/sites/default/files/londons_cycling_infrastructure.pdf
National Transport Authority, N., 2016. *NTA Transport Strategy for the Greater Dublin Area 2016-2035*.
National Transport Authority, N., 2011. *Project Management Guidelines for Projects Funded by the National Transport Authority*.
National Transport Authority, N., 2016. *Transport Strategy for the Greater Dublin Area 2016-2035*.
National Transport Authority, N., 2017. *Report on trends in mode share of vehicles and people crossing the Canal Cordon*.
National Transport Authority, N., 2018. *2018 Annual Report: Sustainable Transport Measures Grants*.
National Transport Authority, N., 2018. *Integrated Implementation Plan for 2013-2018,* s.l.: s.n.
Netherlands Institute for Transport Policy Analysis, K., 2018. *Cycling Facts* .
PTP Cycle, 2016. *PTP - Cycle.* [Online]
Available at: http://ptpcycle-europe.eu/cities/riga/
Sustrans, 2017. *Outcomes of the Cycling City and Towns programme: monitoring project report*.
Sustrans, 2017. *Outcomes of the Cycling Demonstration Towns programme: monitoring project report*.
Sustrans, 2018. *The effectiveness of building spurs into linear cycling routes*.
Sustrans, 2019. *Travel to School in Scotland Hands Up Scotland Survey 2018: National Summary Report*.
Transport Infrastructure Ireland, T., 2011. *TII Project Appraisal Guidelines, Unit 63: Guidance on using TUBA*.
Transport Infrastructure Ireland, T., 2016. *TII Project Appraisal Guidelines for National Roads Unit 7.1 - Project Appraisal Balance Sheet*.
Transport Infrastructure Ireland, T., 2016. *TII Project Appraisal Guidelines, Unit 13: Walking and Cycling Facilities*.
Transport Infrastructure Ireland, T., 2016. *TII Project Appraisal Guidelines, Unit 6.11: National Parameters Value Sheet*.
UK Department for Transport, D., 2019. *Transport Analysis Guidance - TAG UNIT A4.1: Social Impact Appraisal*.

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