

Chapter 03
Consideration
of Reasonable
Alternatives

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3. Consideration of Reasonable Alternatives

3.1 Environmental Impact Assessment Directive requirements

Article 5(1)(d) of Directive 2011/92/EU, as amended by Directive 2014/52/EU (“the EIA Directive”) requires that the Environmental Impact Assessment Report (EIAR) contains ‘a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and the main reasons for the option chosen, taking into account the effects of the project on the environment’.

In addition, Annex IV to the EIA Directive provides that the EIAR shall include:

‘a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics and an indication of the main reasons selecting the chosen option, including a comparison of the environmental effects’

In addition, given the proposed road development for which approval is sought in this instance, section 50(2)(b)(iv) of the Roads Act 1993, as amended (“the Roads Act”) states that that the EIAR shall contain the following information:

‘...a description of the reasonable alternatives studied by the road authority or the Authority, as the case may be, which are relevant to the proposed road development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed road development on the environment’

Section 50(2)(b)(vi) of the Roads Act also requires that “any additional information specified in Annex IV that is relevant to the specific characteristics of the particular proposed road development or type of proposed road development and to the environmental features likely to be affected” also be included in the EIAR.

Accordingly, this Chapter of the EIAR describes the reasonable alternatives studied and the main reasons for the selection of the proposed Lucan to City Centre Scheme (hereafter referred to as the “Proposed Scheme” or “proposed development”) taking into account the effects on the environment.

It considers the alternatives at three levels:

- Strategic Alternatives;
- Route Alternatives; and
- Design Alternatives.

The reasonable alternatives studied which are relevant to the Proposed Scheme and its specific characteristics are described in the subsequent sections of this chapter.

3.2 Strategic Alternatives

3.2.1 GDA Transport Strategy

The Transport Strategy for the Greater Dublin Area 2016-2035 (hereafter referred to as “GDA Transport Strategy”) was prepared by the NTA pursuant to Section 12 of the Dublin Transport Authority Act 2008 and approved by the Minister for Transport, Tourism and Sport in February 2016 in accordance with sub-section 12(13) of that Act.

The GDA Transport Strategy provides a comprehensive framework to guide the development of transport across the Greater Dublin Region over the period of the strategy. Careful consideration was undertaken of the transport requirements across the seven counties of the GDA and the GDA Transport Strategy then formulated the appropriate transport responses to those requirements.

Various studies and reports were undertaken in the development of the GDA Transport Strategy, including:

- Area-based studies covering the GDA area;
- Demand Management Study;
- Core Bus Network Study;
- Park & Ride Study;
- Transport Modelling Analysis; and
- Environmental reports.

Specifically, a Strategic Environmental Assessment (SEA) was undertaken on the GDA Transport Strategy (NTA 2016). As set out in the Environmental Report, in respect of which the SEA of the GDA Transport Strategy was undertaken, a number of reasonable alternative strategies were devised and assessed, taking into account the objectives and the geographical scope of the strategy. The provisions of the GDA Transport Strategy (including bus-based transport modes), were evaluated for potential significant effects, and measures integrated into the Strategy on foot of SEA recommendations in order to ensure that potential adverse effects were mitigated. In considering the alternative modes on a corridor basis, the environmental assessment undertaken considered that bus-based projects could contribute towards facilitating the achievement of Ireland's greenhouse gas (GHG) emission targets in terms of emissions per passenger per kilometre.

In addition to direct studies and analyses undertaken as part of the strategy preparation work, the GDA Transport Strategy also took into account prior reports and plans in relation to transport provision. These prior studies included, inter alia, the following:

- GDA Cycle Network Plan (2013);
- Bus Rapid Transit – Core Network Report (2012);
- Fingal / North Dublin Transport Study (2015);
- Review of the DART Expansion Programme (2015);
- Various prior Luas studies (including Line B2 (Bray), Line D1 (Finglas), Line F1, and F2 (Lucan and Liberties), and Line E (2008)); and
- Analysis carried for a 2011 Draft Transport Strategy.

Given the importance of bus transport as the main public transport mode for the overall region, the delivery of an efficient and reliable bus system forms an important element of the GDA Transport Strategy, integrated appropriately with the other transport modes. As Dublin is a low-density city with a large geographic footprint, there are few areas with the size and concentration of population necessary to support rail-based public transport, and the bus system remains essential to serve the needs of much of the region.

The bus system has continued to remain an essential element of the public transport infrastructure since the publication of the GDA Transport Strategy. The bus system in the Dublin metropolitan area carried 159 million passengers in 2019 (the last full year before the COVID-19 pandemic), compared with 48 million passengers on Luas and 36 million passengers on the DART and rail commuter services over the same year. Converting to percentage figures, the bus system accounts for 65% of public transport passenger journeys in the Dublin region, roughly two thirds of all public transport passengers, with Luas carrying 20% and DART and commuter rail services delivering the remaining 15%.

The area-based studies referenced above provided an appraisal of existing and future land use and travel patterns, including identifying trends and issues, within eight transport corridors as presented in Image 3.1 (Figure 3.8 in the GDA Transport Strategy). These corridors were also divided into Outer Hinterland, Outer Metropolitan, and Inner Metropolitan areas in terms of character.

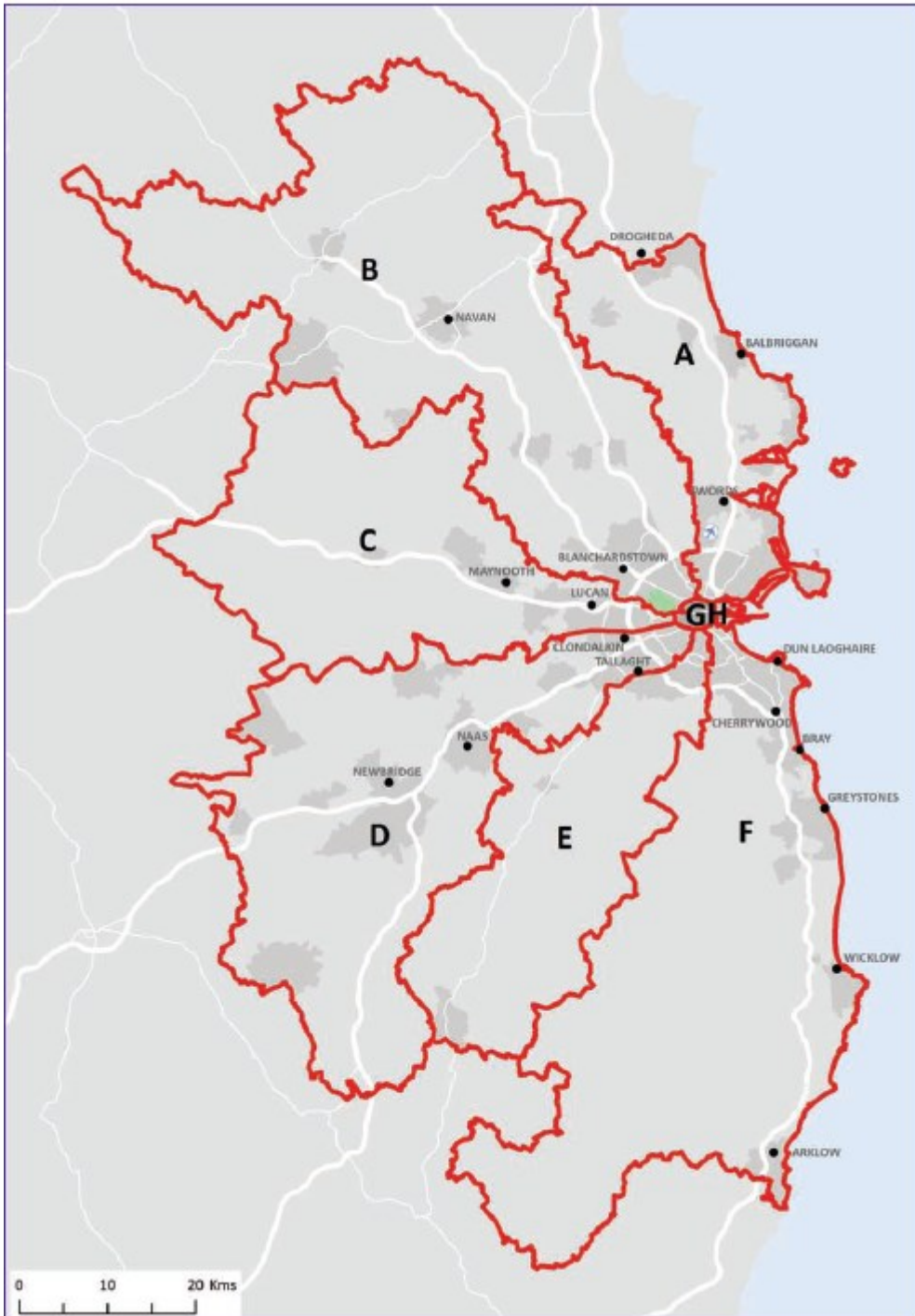


Image 3.1: Transport Strategy Corridors

The development of the GDA Transport Strategy took into account the data and analysis provided through the supporting studies and background information, and formulated an overall integrated transport system to serve the needs of the GDA up to 2035. In relation to public transport, the GDA Transport Strategy set out a network of heavy rail, metro, light rail and bus proposals, with those networks combining to serve the overall public transport needs of the region.

The Lucan to City Centre Core Bus Corridor Scheme aligns generally with Corridor C in the GDA Transport Strategy which extends from the core city centre area along the N4 corridor and contains two of the region's most important future residential and commercial development areas at Clonburris and Adamstown, both based on the

Kildare rail line. Major employers are also located in this corridor in Leixlip and Celbridge. Other key areas of transport demand include Maynooth town, Lucan village, Liffey Valley Town Centre, and Ballyfermot.

The Proposed Scheme is located in, and primarily serves demand within the inner and outer metropolitan areas of Corridor C, the West Corridor. This corridor stretches from the business districts in the western part of Dublin City to the western boundaries of Counties Kildare and Meath, based around the N / M4 route and containing both the Maynooth Railway Line and part of the Luas Red Line in Corridor. The southern part of the Lucan, Ronanstown and Celbridge fall within the catchment of stations on the Kildare Railway Line and the Strategic Development Zones of Adamstown and Clonburris are in this corridor.

During the preparation of the GDA Transport Strategy, the NTA assessed Corridor C to identify public transport options that could effectively meet the projected growth in travel demand to year 2035, from within the corridor and Dublin City Centre. A number of options to cater for transport growth were examined, including the expansion of the DART network and new light rail / bus rapid transit solutions.

Given the need to accommodate expected growth in demand within Corridor C, as well as from within the corridor to the city centre, a number of schemes are proposed. The DART network will be expanded to Maynooth will have an impact on the northern part of the corridor containing Maynooth itself as well as serving south Lucan and the new development areas mentioned above. This will require new tracks between Heuston and Cherry Orchard, which will also form part of the investment in the DART Expansion Programme. In terms of new infrastructure, the requirement to serve north and central Lucan, as well as areas such as Ballyfermot, has led to the proposal for a new Luas line linking to Dublin City Centre. The demand along this corridor was too high to be accommodated by a Bus Rapid Transit (BRT) solution and, as such, a light rail scheme will be required to be developed. These three rail corridors will be supplemented with two core bus corridors. The first, the Lucan to City Centre Core Bus Corridor along the N4, will cater for demand close to Lucan Village as well as from Palmerstown. The second, the Liffey Valley to City Centre Core Bus Corridor, is intended to cater for any specific demand that will not be catered for by the new Luas line, and will aim to link origins and destinations not served by the fixed rail line.

Through the work undertaken in the preparation of the GDA Transport Strategy, including its supporting studies, various alternatives to deal with the transport needs which are intended to be addressed by the Proposed Scheme were identified and considered. These are set out in the subsequent sections.

3.2.2 'Do Nothing' Alternative

The GDA Transport Strategy was developed as the economy was emerging from the post 2008 economic downturn. In turn, the GDA Transport Strategy set out a number of key challenges and opportunities within the GDA:

- Suburbanisation and the spread of population, employment and other land uses has continued;
- Arising from the above trend, the mode share of car use continues to increase;
- Car ownership – a key determinant of car use – is likely to increase further, up to saturation levels;
- Cycling has increased significantly in numbers and in mode share;
- Recovery is occurring in public transport use, but not in its mode share;
- Encouraging non-car use for trips to education is a significant challenge;
- There is no spare capacity on the M50 Motorway;
- Protecting and enhancing access to the ports and Dublin Airport is a strategic priority; and
- Current economic growth will mean that within the next few years, overall levels of travel demand are likely to exceed the travel demand experienced in 2006 and 2007.

Congestion throughout the GDA is particularly high with the number of cars on the road increasing and significant daily traffic delays. Without intervention, potential impacts could worsen for the region including:

- Continued growth of traffic congestion;
- Impacts on the ability of the region to grow economically due to increased congestion;
- Longer journey times and increased travel stress will diminish quality of life; and

- Environmental emissions targets will not be met.

Ultimately, few areas within the GDA have the size and concentration of population to support rail-based public transport. For most transport corridors in Dublin, bus transport represents the most appropriate transport solution.

In terms of the out-workings of a strategic “Do Nothing” Alternative, it should be noted that, currently, the bus network is characterised by discontinuity, whereby buses and cyclists are competing for space with general traffic and are negatively affected by the increasing levels of congestion. This lack of segregated space for different road users results in delayed buses and unreliable journey times for passengers. Issues related to frequency, reliability and a complex network have persisted for many years and will continue to do so without further intervention. In the absence of enhanced frequencies, journey time and reliability the ability to attract new passengers is limited, particularly from private car and also impacts on the ability of the bus network to retain passengers and acts as a demotivator to travel by bus. Within the extents of the Lucan to City Centre Core Bus Corridor Scheme, bus lanes are currently provided on approximately 67% and 77% of route outbound and inbound routes respectively of which significant portions of the route are shared with cyclists and or parking lanes, which can in turn impact on bus reliability.

Adopting a Do Nothing approach to infrastructure improvements, would be likely to result in an exacerbation of the problems arising from discontinuity – such as delayed buses and unreliable journey times. The capacity and potential of the public transport system would remain restricted by the existing deficient and inconsistent provision of bus lanes and the resulting sub-standard levels of bus priority and journey-time reliability. As such, in addition to the continuation of issues relating to existing bus services, future bus services, including the Bus Network Redesign currently being implemented as part of the wider BusConnects Programme, would also suffer from the same lack of journey-time reliability. This would severely impact the attractiveness of public transport as an alternative to private car usage for those who need to travel to/from various locations along the route of the Proposed Scheme.

In addition, without the provision of safe cycling infrastructure, intended as part of the Proposed Scheme, there would also continue to be an insufficient level of safe, segregated provision for cyclists who currently, or in the future would be attracted to use the route of the Proposed Scheme. Whilst, in the “Do Nothing” Alternative, ongoing improvements may be provided along the route of the existing corridor extents, this is likely to be piecemeal and disconnected without the wide-strategic benefits to be derived from the Proposed Scheme.

In addition, with the “Do Nothing” Alternative, there would not be significant strategic investment in improvements to the pedestrian environment. Rather, improvements would be limited to relatively limited interventions, for example, ongoing maintenance of existing footpaths and adjacent public spaces. The “Do Nothing” Alternative would not result in improvements to encourage more journeys generally at a local level by active travel, including connecting to and from bus stops for all pedestrians, and in particular improving facilities for the mobility and visually impaired.

For all of these reasons, and having regard to these environmental considerations in particular, a Do Nothing alternative is not considered to be a viable reasonable alternative relative to the outcomes which can be realised by the Lucan to City Centre Core Bus Corridor Scheme.

3.2.3 Bus Rapid Transit (BRT) Alternative

Bus Rapid Transit (BRT) has emerged in recent years as an effective, cost efficient and high-quality public transport system. As BRT is a relatively new mode of transport, there are various definitions and interpretations as to what BRT comprises and there are many different forms of BRT systems in operation worldwide. Definitions of BRT range from a Quality Bus Corridor (QBC) to being a fully guided, fully segregated bus system.

A Bus Rapid Transit (BRT) – Core Network Report, prepared in 2012 (NTA 2012) at feasibility study level, investigated the demand, technical, environmental, and economic feasibility of a proposed core BRT network. The feasibility study recommended that further and more detailed work should proceed on two cross city corridors, the Blanchardstown to University College Dublin (UCD) and the Clongriffin to Tallaght corridor.

Within a broader corridor two Core Bus Corridors were identified to meet the transport demand. The first, (the Proposed Scheme) along the N4 will cater for demand close to Lucan Village as well as from Palmerstown towards the city centre. The second, the Liffey Valley to City Centre Core Bus Corridor, is intended to cater for any specific demand that will not be catered for by the proposed new Luas line to Lucan. Both Core Bus Corridors will aim to link origins and destinations not served by the fixed heavy rail lines.

Prior to the completion of these studies, the GDA Transport Strategy identified the development of a number of Core Bus Corridors as BRT schemes. These BRT routes formed part of the overall Core Bus Corridor network set out in the GDA Transport Strategy. As design and planning work progressed on the Core Bus Corridors, it became clear that the level of differentiation between the BRT corridors and the other Core Bus Corridors would, ultimately, be limited, and that all the corridors should be developed to a consistent standard, providing a more integrated, legible and coherent overall bus system.

By way of illustration of the similarities, all of the Core Bus Corridors are proposed to be developed to provide a high level of priority for the bus vehicles, which is an essential component of a BRT system. Integrated, cashless ticketing systems are planned under the overall BusConnects Programme, delivering the type of functionality often required for a BRT system. While different type vehicles are used around the world on BRT schemes, the longer routes present in Dublin, due to the low density nature of the city, favours the use of double deck vehicles on both BRT and conventional bus corridors, given the better ratio of seated to standing passengers on such vehicles.

Accordingly, it is intended that all of the Core Bus Corridor Infrastructure Works, including the Proposed Scheme, will be developed to provide a BRT level of service, rather than establishing a separate mode on some corridors. Consequently the Proposed Scheme as a separate BRT mode was not progressed given the limited differentiation from the Core Bus Corridors and the advantages identified above of a unified integrated bus system.

Environmentally the BRT option compared to the Core Bus Corridor proposal would be more impactful in terms of construction impacts, including flora and fauna, heritage, air and noise. BRT typically requires continuous unbroken physical lane infrastructure to achieve high-priority. This would involve significantly more landtake and potentially involve demolition of buildings at pinch-points. In the case of the Core Bus Corridor proposals bus-priority can be achieved through short lengths at pinch-points by the use of signal-control priority.

3.2.4 Light Rail Alternative

The appropriate type of public transport provision in any particular case is predominantly determined by the likely quantum of passenger demand along the particular public transport route.

For urban transport systems, bus-based transport is the appropriate public transport mode for passenger demand levels of up to 4,000 passengers per hour per direction (UITP 2009). Light rail provision would generally be appropriate to cater for passenger demand of between 3,500 and about 7,000 passengers per hour per direction. Passenger demand levels above 7,000 passengers per hour per direction would generally be catered for by heavy rail or metro modes, which would usually be expected to serve a number of major origins or destinations along a particular corridor. In the case of both the bus and light rail modes, higher levels of passenger demand than the above stated figures can be accommodated under specific conditions.

The development of the GDA Transport Strategy considered the likely public transport passenger demand levels across the region using the NTA's transport model and took into account the other studies referenced above, in addition to studies that had been carried out to investigate a potential light rail scheme within the area of this corridor. Likely passenger flows were identified to be within the capacity of bus transport, without reaching the quantum of passenger demand which would support the provision of higher capacity rail solutions. Therefore it is intended to further develop the light rail network along this corridor through the implementation of the Luas to Lucan project.

3.2.4.1 Luas to Lucan

The Luas Line to Lucan is intended to develop a high capacity east-west Luas line, commencing in the residential areas of Lucan to the south of the N4 national road, and connecting into Dublin City Centre. This will provide a

high capacity radial service from this area to the City Centre, sufficient to cater for the high transport demand along this corridor, and will serve Lucan, Liffey Valley and Ballyfermot along its route.

Arising from the various studies and analysis that had been carried out, and the specific assessment and transport modelling work undertaken for the GDA Transport Strategy, it was concluded that a high quality bus-based transport system supplemented by the implementation of the Luas to Lucan, would be part of the proposed public transport solution in the corridor of the Proposed Scheme, and would comprise an environmentally appropriate combination of projects in the corridor.

3.2.5 Metro Alternative

As highlighted above, when considering the appropriate transport systems to meet the expected transport demand, metro systems are a higher capacity form of light rail, generally designed for peak hour passenger numbers exceeding about 7,000 passengers per hour per direction, and often catering for multiples of that level.

Given the consideration of light rail provision, and the level of likely public passenger use along this overall corridor assessed in the transport modelling work, the development of the GDA Transport Strategy identified that a metro solution would not be economically justified within the area covered by this corridor. Accordingly, it was concluded that a high quality bus-based transport system would be part of the proposed public transport solution in the corridor of the Proposed Scheme.

Environmentally the metro option compared to the Core Bus Corridor proposal would be more impactful in terms of construction impacts, including flora and fauna, heritage, air and noise. Metro systems require unbroken physical lane infrastructure to achieve high-priority. This would involve significantly more land take and potentially involve demolition of buildings at pinch-points. In the case of the Core Bus Corridor proposals bus-priority can be achieved through short lengths at pinch-points by the use of signal-control priority.

3.2.6 Heavy Rail Alternative

Commuter heavy rail systems are generally designed for high levels of passenger demand, usually designed to carry in excess of 10,000 passengers per hour per direction. Where a surface corridor does not already exist in a built-up urban area, there are major challenges in creating sufficient surface space for such provision, requiring large amounts of property acquisition and building demolition.

For those reasons, new heavy rail projects running at surface level are rarely developed in built-up urban areas. Instead, underground rail links, including metro schemes, are deployed instead to avoid the severe impacts that would accompany a new surface rail line. Environmentally the heavy rail option compared to the CBC proposal would be more impactful in terms of construction impacts, including flora and fauna, heritage, air and noise. Heavy rail requires unbroken physical lane infrastructure to achieve high-priority. This would involve significantly more land take and potentially involve demolition of buildings at pinch-points.

The appropriate locations for new heavy rail provision were carefully considered in the development of the GDA Transport Strategy. Having regard to the level of likely public passenger use (demand) along the overall corridor of the Proposed Scheme assessed in the transport modelling work, the development of the GDA Transport Strategy did not consider that a new heavy rail solution would be required along this corridor and would not be economically justifiable.

In relation to underground provision, this issue was considered as part of the metro analysis, given the similarity of underground heavy rail and underground metro schemes. Similar to the metro considerations, the provision of an underground heavy rail solution would not remove the need for additional infrastructure to serve the residual bus needs of the area covered by the Proposed Scheme, nor would it obviate the need to develop the cycling infrastructure required along the route of the Proposed Scheme.

In addition to a new heavy rail solution the potential system expansion of the existing DART to include the upgrade of the existing Maynooth/Sligo line as far as Maynooth and M3 Parkway, and the Kildare Line to Hazelhatch which is contained within the broader corridor was considered as part of the development of the GDA Transport Strategy. In 2015, the NTA carried out a review of the key transport infrastructure projects that were proposed to support

the growth of the Greater Dublin Region. This included a review of the DART Expansion Scheme ((now) 'DART + Programme') which included DART Underground, the Fingal/North Dublin Study and a study of the orbital movements around Dublin all designed to inform the GDA Transport Strategy. Image 3.2 below shows the various projects in the DART Expansion Programme.

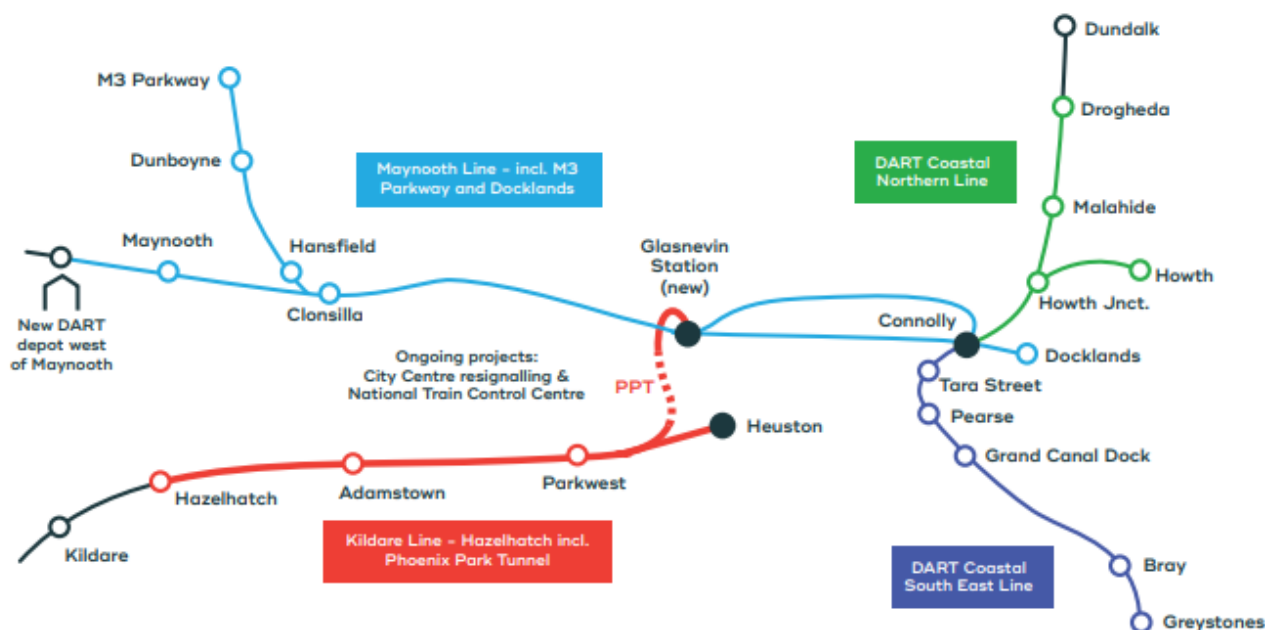


Image 3.2: DART Expansion Programme (Source: Irish Rail Website)

Arising from the various studies and analysis that had been carried out, and the specific assessment and transport modelling work undertaken for the GDA Transport Strategy, it was concluded that a high quality bus-based transport system supplemented by the expansion of the DART system on both the Maynooth/Sligo and Kildare line to provide fast, high frequency services to Maynooth, M3 Parkway, and Hazelhatch, as part of a phased delivery of DART Expansion (now DART + programme), would be part of the proposed public transport solution in the corridor of the Proposed Scheme. Environmentally the combination of a rail upgrade involving limited construction works and the Proposed Scheme to achieve high-quality bus priority and safer cycling and walking infrastructure represents a balanced strategy by limiting the overall construction impact while enhancing the capacity for sustainable people-movement options.

3.2.7 Demand Management Alternative

One of the primary aims of the GDA Transport Strategy is to significantly reduce demand for travel by private vehicles, particularly during the commuter peaks, and to encourage use of walking, cycling and public transport. One of the mechanisms to achieve such reduction of private vehicle use is the use of measures to discourage travel by car – i.e. demand management.

Demand management can take many different forms from restricting car movement or car access through regulatory signage and access prohibitions, to parking restrictions, to fiscal measures such as tolls, road pricing, congestion charging, fuel/vehicle surcharges and similar. All of these approaches discourage car use through physical means or by adding additional costs to car use such that it becomes more expensive and alternative modes become more attractive. A key success factor of demand management is greater use of alternative travel modes, in particular public transport.

However, in the case of Dublin, the existing public transport system does not currently have sufficient capacity to cater for large volumes of additional users. In the case of the bus system, the increasing levels of traffic congestion over recent years prior to the Covid pandemic has added to bus delays and has meant that additional bus fleet and driver resources has been utilised simply to maintain existing timetables, rather than adding overall additional

capacity. The objective of the overall GDA Transport Strategy is to significantly increase the capacity, and subsequent use, of the public transport system, focusing on the overall BusConnects Programme in the case of the bus system, the DART+ Programme in the case of heavy rail, and the Luas/Metro programme in the case of light rail.

Congestion is a significant contributor to GHG emissions, and the related negative environmental impacts associated with poor air quality, noise levels, and related health and quality of life consequences. Demand management measures need to be associated with positive environmental benefits that can be achieved when commuters change modes to high-quality public transport, walking, and cycling that can help reduce GHG emissions and bring associated health benefits. The objective of the GDA Transport Strategy to significantly increase the capacity, and subsequent use of these alternative modes requires that the necessary physical infrastructure is necessary to deliver the efficiencies to make the mode-shift attractive and environmentally beneficial.

In advance of a significant uplift in overall public transport capacity in the Dublin metropolitan area, the implementation of major demand management measures across that area would be unsuccessful. Effectively constraining people from making journeys by car and requiring them to use other modes, without those modes having the necessary capacity to cater for such transfer, would not deliver an effective overall transport system. Instead, the capacity of the public transport system needs to be built up in advance of, or in conjunction with, the introduction of major demand management measures in the Dublin metropolitan area. This is especially true in the case of the bus system where a major increase in bus capacity through measures such as the Proposed Scheme would be required for the successful implementation of large scale demand management initiatives.

While the foregoing addresses the dependency of demand management measures on public transport capacity, it is equally correct that the provision of greatly enhanced cycling facilities will also be required to cater for the anticipated increase in cycling numbers, both in the absence of demand management measures and, even more so, with the implementation of such measures. Demand management initiatives by themselves will not deliver the level of segregated cycling infrastructure required to support the growth in that mode. Consequently, the progression of demand management proposals will not secure the enhanced safe cycling infrastructure envisaged under the Proposed Scheme.

Accordingly, the implementation of demand management measures would not remove the need for additional infrastructure to serve the bus transport needs of the corridor covered by the Proposed Scheme, nor would it obviate the need to develop the cycling infrastructure required along the route of the Proposed Scheme.

3.2.8 Technological Alternatives

Technological advances have opened up new areas of potential in the delivery of transport infrastructure. Driverless trains and smart highways are two examples. Some of these initiatives, such as driverless trains, are now in use. Technological advancements relating to car use have the potential to improve road safety by reducing potential for driver error and with the use of global positioning systems to be guided to the most efficient route. A shift to electric vehicles will help reduce GHG emissions, but road space is limited and three typical cars (electric or otherwise) still take the same road space for up to 12 occupants that a typical double-deck bus requires to carry up to 90 occupants. The environmental impact of continuing to build more road space for low-occupancy vehicles is unsustainable from both the construction environmental impact and operational environmental impact perspectives. Despite advancements in road-user technology road congestion is not reducing as populations grow, and old inner-city areas of Dublin do not have space to add more car lanes.

The shift to hybrid and ultimately electric buses will reduce both noise and air quality impacts. The evolution of bike-share schemes and advancements in electric bike technology means that cycling is increasing in attractiveness and for longer distances. This attractiveness is only for the few however if cycling infrastructure in the form of safe segregated facilities is not available.

While road construction is costly and has a negative GHG impact there are few (if any) advancements in construction technology that present any viable alternatives when conversion of road infrastructure involves reconfiguration of lanes for bus priority, safer segregated cycle tracks and improved pedestrian facilities, or even more significantly for rail-related infrastructure. Road right-of-way space is still shared with multiple underground

and overhead utilities that may require to be relocated, and road materials require to be resilient to minimise maintenance frequencies.

Ultimately, however, alternatives have to be able to accomplish the objectives of the project in a satisfactory manner, and should also be feasible including in terms of technology and other relevant criteria. In this context, there is no evidence that such developments will displace the need for mass transit, which is essential to the operation of a modern city. Accordingly, the need to improve the overall bus system will still remain.

Overall, while certain technological advances do provide new opportunities in the transport area, particularly in the area of information provision, they do not yet provide viable alternatives to the core need to provide for the movement of more people by non-car modes, including the provision of safe, segregated cycling facilities. Accordingly, there are no viable technological alternatives to meet the transport needs of this sector of the city.

3.3 Route Alternatives

Following on from the strategic alternatives considered earlier, this Section sets out the route alternatives which were considered as part of the process to establish the Proposed Scheme. Development of the Proposed Scheme has evolved in the following stages:

1. **Options Study - Feasibility Report**, associated with the Proposed Scheme (Lucan to City Centre Core Bus Corridor Options Study Feasibility Report) was concluded in December 2016, setting out the initial route options and concluding with the identification of an Emerging Preferred Route;
2. The first non-statutory public consultation took place on a phased basis. The first phase of non-statutory **Public Consultation** was undertaken on the Emerging Preferred Route from 14 November 2018 to 29 March 2019 (which included the Lucan to City Centre CBC Emerging Preferred Route Option), a second phase ran from 23 January 2019 to 30 April 2019, and a final phase ran from 26 February 2019 until 31 May 2019;
3. Development of **Draft Preferred Route Option** (April 2019 to March 2020). Informed by feedback from the first round of public consultation, stakeholder engagement and the availability of additional design information, the design of the Emerging Preferred Route evolved with further alternatives considered;
4. A second round of non-statutory **Public Consultation** was undertaken on the Draft Preferred Route Option from 04 March 2020 to 17 April 2020. Due to the introduction of Covid-19 restrictions by Government in mid-March, the planned Public Information Events were impacted;
5. Further development of an updated **Draft Preferred Route Option** was undertaken subsequent to the second round of public consultation, which took account of submissions received, continuing stakeholder engagement and additional design information;
6. A third round of non-statutory **Public Consultation** was undertaken on the updated Draft Preferred Route Option from 04 November 2020 to 16 December 2020; and
7. Finalisation of **Preferred Route Option**. Informed by feedback from the overall public consultation process, continuing stakeholder engagement and the availability of additional design information, the Preferred Route Option, being the Proposed Scheme, was finalised.

Alternative options have been considered in a number of areas during the design development of the Proposed Scheme, such as the location of offline cycle routes and the road layout in constrained locations. The development of the design has also been informed by a review of feedback and new information received during each stage of public consultation and additional data, such as topographical surveys, transport and environmental data was collected and assessed. In addition, the potential for climate impact was considered in all phases of the design process for the Proposed Scheme. As the design progressed climate was indirectly affected in a positive way by refining the design at each stage through reducing the physical footprint of the scheme coupled with the inclusion of technological bus priority measures.

Key environmental aspects have been considered during the examination of reasonable alternatives in the development of the Preferred Route Option for the Proposed Scheme. Environmental specialists have been involved in the iteration of key aspects of the Proposed Scheme with the engineering design team.

The following key environmental aspects were considered:

- **Archaeological, Architectural and Cultural Heritage** – there is the potential for impacts on archaeological, architectural and cultural heritage when providing CBC infrastructure. The assessment had regard to the Record of Monuments and Places (RMP) and Protected Structures, Sites of Archaeological or Cultural Heritage and buildings listed on the National Inventory of Architectural Heritage adjacent to the corridor;
- **Flora and Fauna** - The provision of the CBC could have negative impacts on flora and fauna, for example, through construction of new infrastructure through green field sites;
- **Soils and Geology** - Construction of infrastructure necessary for the provision of the CBC has the potential to negatively impact on soils and geology. For example, through land acquisition and ground excavation. There is also the potential to encounter ground contamination from historical industries;
- **Hydrology** - The provision of CBC infrastructure may include aspects (for example structures) with the potential to impact on hydrology;
- **Landscape and Visual** - Provision of CBC infrastructure has the potential to negatively impact on the landscape and visual aspects of the area, for example, by the removal of front gardens or green spaces or the altering of streetscapes, character and features;
- **Noise, Vibration and Air** - Provision of CBC infrastructure (e.g., the construction activities), has the potential to negatively impact on noise, vibration and air quality along a scheme;
- **Land Use and the Built Environment** - This criterion assesses the impact of each option on land use character, and measured impacts which would prevent land from achieving its intended use, for example through land acquisition, removal of parking spaces or severance of land; and
- **Climate** – Construction works involve negative GHG emissions impacts, while operational efficiencies of public transport, walking and cycling through modal shift from car usage has the potential to reduce GHG impacts.

3.3.1 Initial High Level Route Alternatives

The Lucan to City Centre Core Bus Corridor Options Study Feasibility Report (December 2016) (hereafter referred to as the Feasibility Report) was prepared which identified feasible options along the corridor, assessed these options and arrived at an EPR Option. These proposals formed the basis for the first Non-Statutory Public Consultation. A summary of the process is described below.

The Feasibility Report used a two-stage assessment process to determine the Emerging Preferred Route, comprising:

- Stage 1 – An initial high-level route options assessment, or ‘sifting’ process, which appraised routes in terms of ability to achieve scheme objectives and whether they could be practically delivered. The assessment included consideration of the potential high level environmental constraints as well as other indicators such as land take (particularly the impact on residential front gardens); and
- Stage 2 - Routes which passed the Stage 1 assessment were taken forward to a more detailed qualitative and quantitative assessment. All route options that progressed to this stage were compared against one another using a detailed Multi-Criteria Analysis in accordance with the Department of Transport Document “Common Appraisal Framework for Transport Projects and Programmes” (DTTAS 2016).

The study area for the corridor comprised four main sections. The sections examined feasible route options for the following:

- Section 1 - N4 Junction 5 (Celbridge/Leixlip) to N4 Junction 3 (Ballyowen/Lucan);
- Section 2 - N4 Junction 3 (Ballyowen/Lucan) to Kennelsfort Road Upper;
- Section 3 - Kennelsfort Road Upper to Con Colbert Road; and
- Section 4 - Con Colbert Road to City Centre.

In 2017, the NTA began work on reviewing the Dublin Area Bus Network, in collaboration with Bus Operators and other stakeholders (including local authorities). The Dublin Area Bus Network Redesign project was launched by the NTA, which looked at the existing bus network and the radial Core Bus Network identified in the GDA Transport Strategy. The output from this study identified Corridor C terminating at the N4 Junction 3 (Ballyowen/Lucan), within the GDA Transport Strategy Corridor C discussed in Section 3.2.1. West of this point, there is a three-way split of future services planned. As such, the decision was taken to exclude Section 1 (N4 Junction 5 to N4 Junction 3) of the route in the Emerging Preferred Route Option for the Proposed Scheme. Further discussion on the route options assessment process for Sections 2, 3 and 4 is provided below.

At the start of the Stage 1 assessment, an initial ‘spiders web’ of potential route options that could accommodate the CBC was developed for the entire study area. The resulting spider web of route options for the entire study area is shown in Image 3.3 (extracted from the Feasibility Report).

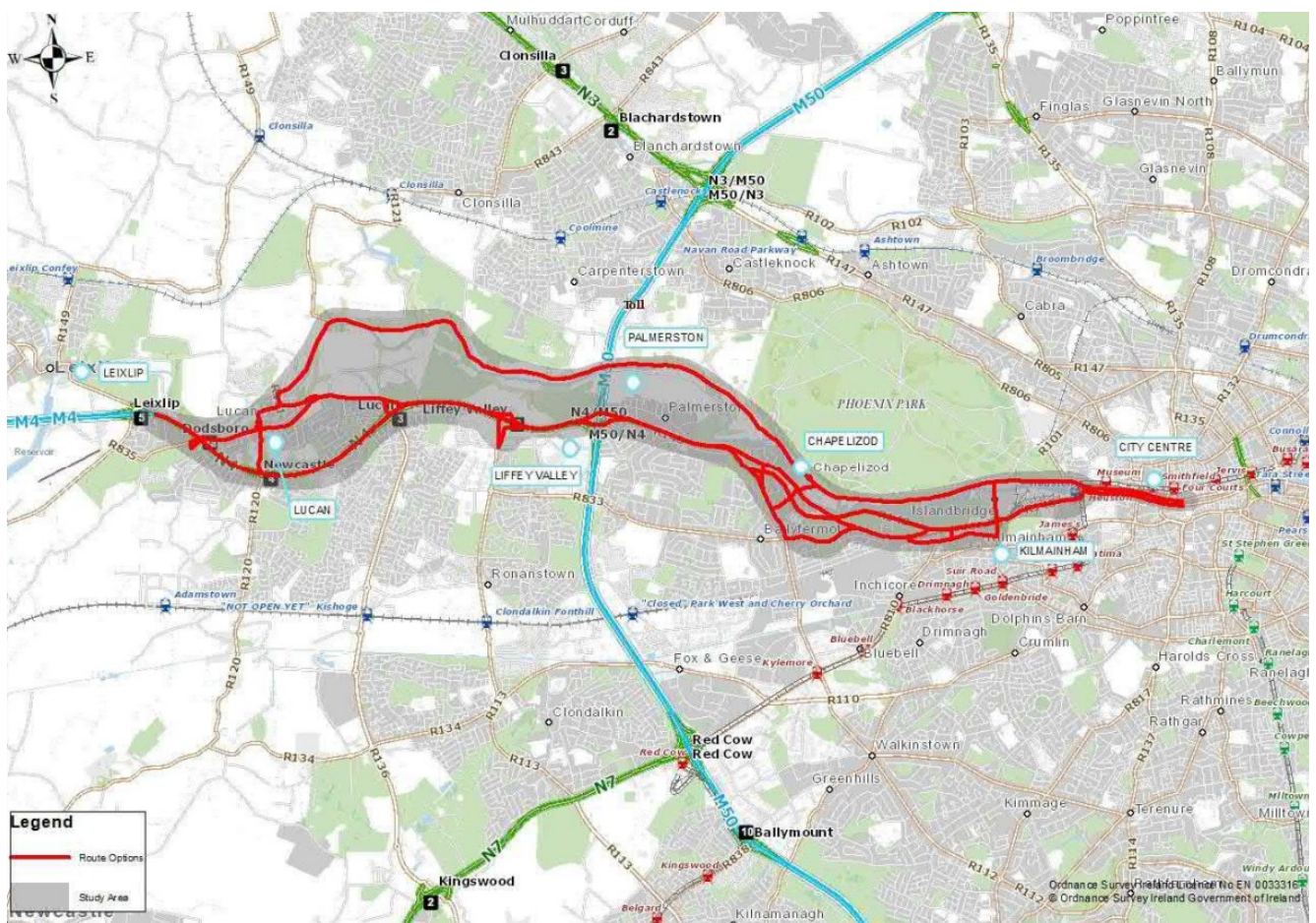


Image 3.3: Spiders Web of Route Options extracted from Feasibility Report

The study area begins at the Leixlip junction on the N4 and ends at Fr. Mathew Bridge in the City Centre. The study area is defined as not extending to the south of the N4, as local bus routes serving these areas will feed into the CBC corridor using the existing distributor roads.

The potential route options (consisting of 45 individual links), that could accommodate a Core Bus Corridor were identified for each study area section as shown in Image 3.3.

The initial “spider’s web” were narrowed down using a high-level qualitative method based on professional judgement and a general appreciation for existing physical conditions/constraints within the study area. This exercise examined and assessed technically feasible route options, based upon specific objectives. In addition to being assessed on their individual merits, routes were also assessed relative to each other enabling some routes to be ruled out if more suitable alternatives existed.

The Stage 1 assessment considered engineering constraints, identified high-level environmental constraints and an analysis of population catchments. Several links forming part of the “spider’s web” were not brought forward to the Stage 2 assessment due to space constraints, lack of appropriate adjacent linkages to form a coherent end-to-end route, unsuitability of particular routes, in addition to other factors. For example in section R121 (Lower Lucan Road) between the mini-roundabout within Lucan village and the junction at Tinkers Hill, the route is predominantly a narrow, rural road with poor horizontal and vertical geometry. Due to the significant areas of land-take that would be required in order to provide bus priority along this route and the minimal population served by the route, this link was considered not viable for the Proposed Scheme.

Arising from consideration of the various permutations possible in respect of the “spider’s web”, a reduced number of coherent end-to-end options were identified for specific sections for further assessment. In arriving at these options, those links which failed the initial sifting stage were removed as well as those links that were disconnected and could not clearly form part of the end-to-end options.

The consolidated options associated with the Lucan to City Centre corridor Sections 1, 2, 3 and 4 are presented in Image 3.4, Image 3.5, Image 3.6 and Image 3.7 respectively.



Image 3.4: Route Options from Initial Sift of Section 1 of the Lucan to City Centre Corridor



Image 3.5: Route Options from Initial Sift of Section 2 of the Lucan to City Centre Corridor



Image 3.6: Route Options from Initial Sift of Section 3 of the Lucan to City Centre Corridor

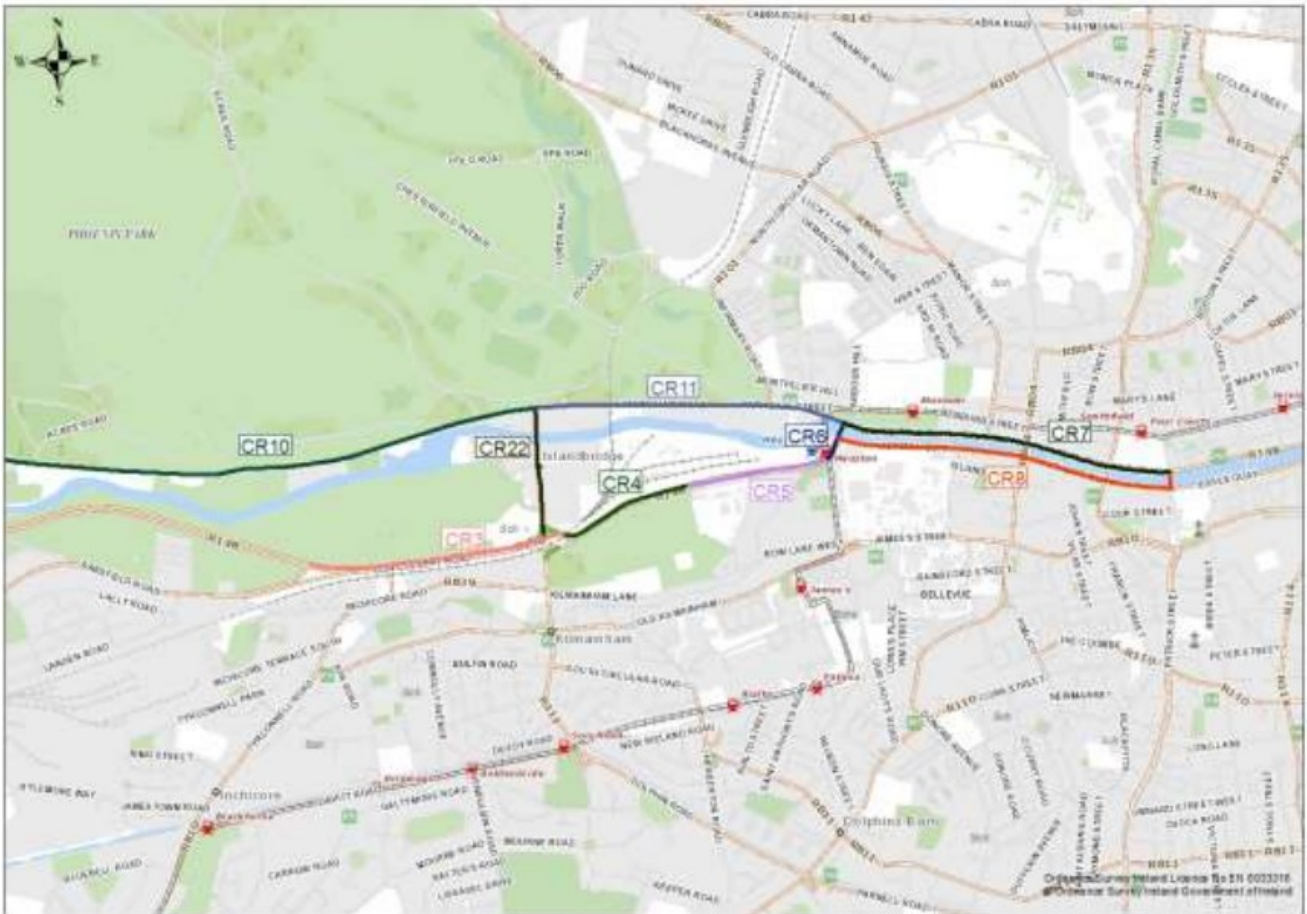


Image 3.7: Route Options from Initial Sift of Section 4 of the Lucan to City Centre Corridor

3.3.2 Stage 2 – Route Options Assessment

Following completion of Stage 1 initial appraisal, the remaining reasonable alternative options were progressed to Stage 2 of the assessment process. This process involved a more detailed qualitative and quantitative assessment using criteria established to compare the route options.

The indicative scheme for each route option was evaluated using a multi-criteria assessment. The 'Common Appraisal Framework for Transport Projects and Programmes' published by the Department of Transport, Tourism and Sport (DTTAS), March 2016, requires schemes to undergo a 'Multi-Criteria Analysis' (MCA) which evaluated the route options under the assessment criteria set out below. The indicative scheme for each route option was then progressed to a Multi-Criteria Analysis (MCA) which evaluated the route options under the assessment criteria set out below:

1. Economy;
2. Integration;
3. Accessibility & Social Inclusion;
4. Safety; and
5. Environment.

Under each headline criterion, a set of sub-criteria were used to comparatively evaluate the options. For the Environment criterion the following sub-criteria were considered in the assessment to inform the Emerging Preferred Route:

- **Archaeological, Architectural and Cultural Heritage** – there is the potential for impacts on archaeological, architectural and cultural heritage environment when providing CBC infrastructure.

- The evaluation of options had regard to RMPs, Sites of Archaeological or Cultural Heritage and buildings listed on the National Inventory of Architectural Heritage along or adjacent to the corridor;
- **Flora and Fauna** - The provision of CBC infrastructure could have negative impacts on flora and fauna, for example, through construction of new infrastructure through green field sites. These impacts were compared for each option under this criterion;
 - **Soils and Geology** - Construction of infrastructure necessary for the provision of CBC infrastructure has the potential to impact on soils and geology. For example, through land acquisition and ground excavation. These considerations were compared for each option under this criterion;
 - **Hydrology** - The provision of CBC infrastructure has the potential to impact on surface water bodies as a result of land-take (with particular emphasis on floodplains and flood zones). Any such impacts were considered for each option under this criterion;
 - **Landscape and Visual** - Provision of CBC infrastructure has the potential to impact on the townscape/streetscape as well as the landscape and visual aspects of the area, for example, by the removal of front gardens or green spaces or the altering of streetscapes, character and features. Different options were compared, and any negative effects considered under this criterion;
 - **Air Quality** - The provision of CBC infrastructure has the potential to impact the air quality along the route. These effects were compared for each option under this criterion in relation to the volumes of traffic and on whether the road is moving closer to a sensitive receptor, for example road widening or new realignment;
 - **Noise & Vibration** - Provision of CBC infrastructure (e.g., the construction activities), has the potential to negatively impact on noise and vibration along a scheme. These effects were compared for each option under this criterion. The impact was quantified in relation to the volumes of traffic and on whether the road is moving closer to a sensitive receptor, for example road widening or new realignment; and
 - **Land Use Character** - The provision of CBC infrastructure has the potential to impact on land use character through land-take, severance or reduction of viability which prevents or reduces it from being used for its intended use. These effects were compared for each option under this criterion.

Route options were compared based on a five-point scale, ranging from having significant advantages to having significant disadvantages over other route options. Route options could also be considered neutral when no apparent advantages or disadvantages are identified across all scheme options.

In order to simplify the assessment process and allow it to be presented in a clear manner, the study area was divided into four sections for the stage two assessment (see Image 3.8).

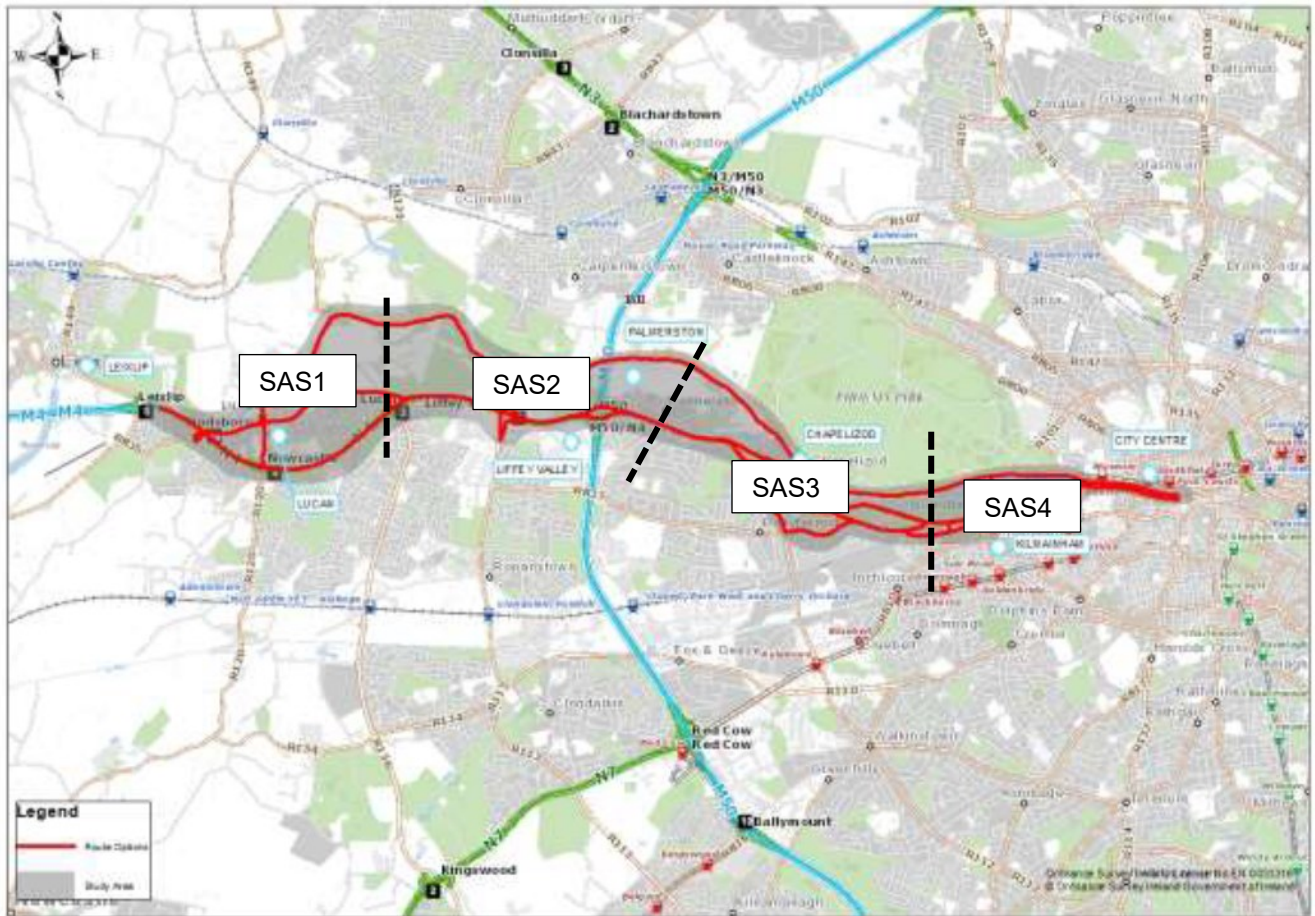


Image 3.8: Stage 2 Route Options sub-section division extracted from Feasibility Report

3.3.2.1 Sub-Section SAS1 Route Options Assessment

Following the Stage 1 sifting process, five viable route options for sub-section SAS1 were taken forward for assessment and further refinement as follows:

- Route Option LN01 (Comprising LR1, LR3, LR4 and LR5 on Image 3.9): Using the existing bus lanes and cycle tracks along the N4 for most of its length;
- Route Option LN02 (Comprising LR1, LR9, LR10, LLR11, LR16 and LR5 on Image 3.9): the same as LN01 except for a diversion of inbound buses off the N4 via the off-ramp at Junction 2 (Fonthill/Liffey Valley) before re-joining the N4 again via the on-ramp;
- Route Option LN03 (Comprising LR1, LR3, LR21, LR9, LR10, LLR11, LR16 and LR5 on Image 3.9): Similar to LN02 except for the section between N4 Junction 4a (Dodsboro/Kew Park) and the junction of the R835 (Lucan Road) and R120 (Adamstown Road);
- Route Option LN04 (Comprising LR1, LR9, LR10, LLR11, LR12, LR16 and LR5 on Image 3.9): Similar to LN02 except inbound buses travel directly through Lucan Village by turning left on the R109 (Main Street) and straight along Chapel Hill rather than staying on the R835 (Lucan Road); and
- Route Option LN05 (Comprising LR1, LR9, LR10, LLR11, LR12, LR16 and LR5 on Image 3.9): Similar to LN04 except that both inbound and outbound buses would travel directly through Lucan Village.



Image 3.9: Sub-Section SAS1 (N4 Junction 5 (Celbridge/Leixlip) to N4 Junction 3 (Ballyowen/Lucan)) Route Options extracted from the Feasibility Report

Two scheme options were considered along each route which would provide traffic lanes, bus lanes and cycle tracks in each direction. The primary difference between these scheme options was the treatment at the junctions (Option 2 of each option required buses to share with left-turning traffic at junctions). The assessment sub-criteria which were differentiators between scheme options included Capital Cost, Transport Reliability and Quality, Residential Population and Employment Catchments, Traffic Network Integration and Land Use Character. Route LN01 Option 1 was identified as having some advantages over other options in relation to both Capital Cost and Land Use Character. Following a detailed MCA, route LN01 was identified as the preferred option for this section and was brought forward into the Emerging Preferred Route.

As mentioned previously each route option was evaluated using a multi-criteria assessment with one of the primary criteria being 'Environment', under which there was a number of sub-criteria against which each route option was compared.

In terms of potential Archaeological, Cultural Heritage and Architectural Heritage impacts, it was considered that LN01 Route Option which had no recorded monuments/places, protected structures or sites of cultural heritage identified along this route had advantages when compared with the other options which had between five and twenty recorded monuments and protected structures directly affected or in close proximity.

With regard to Flora and Fauna, LN01 Route Option was considered to have advantages when compared with the other options as although it did impact road verges, it did not impact parkland.

All five route options were considered neutral when compared against one another under the Soils and Geology sub-criterion, given none were considered to result in any appreciable impacts.

All five route options were considered neutral when compared against one another under the Hydrology sub-criterion, given none were considered to result in any appreciable impacts.

With regard to Landscape and Visual, it was considered that the LN01, LN02 and LN03 route options were considered to have some advantages, with LN04 and LN05 having a visual amenity impact on Lucan Village including the possibility of footway narrowing and loss of street trees.

With regard to Air Quality, it was considered that all five route options were considered neutral when compared against one another given that in each option there is already existing vehicular and bus traffic, and each would have an equivalent level of road widening.

With regard to Noise and Vibration, it was considered that all five route options were considered neutral when compared against one another given that in each option there is already existing vehicular and bus traffic, and each would have an equivalent level of road widening.

When the options were considered under the Land Use Character sub-criteria, Route Options LN04 and LN05 were considered to have some disadvantages when compared to Route Options LN01, LN02 and LN03, with Route Option LN01 presenting further advantages over Option LN02. In all five options a large number of trees and on-street parking provision was expected to be affected, however to a greater extent on Route Options LN03 and LN04, with the lowest impact being under Route Option LN01. Route Option LN01 was therefore considered to have advantages given the lower impact on existing land use character.

Route Option LN01, which is largely contained within the existing N4 road reservation for the majority of its length, was identified as the preferred option for this section and was brought forward into the Emerging Preferred Route.

3.3.2.2 Sub-Section SAS2 Route Options Assessment

Following the Stage 1 sifting process two viable route options for sub-section SAS2 were taken forward for assessment and further refinement as follows:

- Route Option PM01 (comprising LR6, LR13, LR15, LR7, LR8 in Image 3.10): Using the existing lanes and cycle tracks on the N4 for most of its length. Inbound there is a continuous bus lane from N4 Junction 3 (Ballyowen/Lucan) to the approach to the M50 junction. Outbound there is a continuous bus lane from the M50 junction to just after Junction 2 (Fonthill/Liffey Valley) where the buses will continue along a parallel side road before joining the on-ramp at Junction 3 (Ballyowen/Lucan), and
- Route Option PM02 (comprising LR6, LR13, LR15, LR7, LR8 in Image 3.10): Same as PM01 except for a diversion of inbound buses off the N4 via the off-ramp at Junction 2 (Fonthill/Liffey Valley) before re-joining the N4 again via the on-ramp.



Image 3.10: Sub-Section SAS2 (N4 Junction 3 (Ballyowen/Lucan) to Kennelsfort Road Upper) Route Options extracted from the Feasibility Report

Two scheme options were considered along this route which would provide traffic lanes, bus lanes and cycle tracks in each direction. The primary difference between these scheme options was the treatment at the junctions. The assessment sub-criteria which were differentiators between route options were Integration and Accessibility and Social Inclusion, with Route PM02 being identified as having some advantages over the other option under these two sub-criteria. Following a detailed MCA, Route PM02 was identified as the preferred option for this section and was brought forward into the Emerging Preferred Route.

As mentioned previously each route option was evaluated using a multi-criteria assessment with one of the primary criteria being 'Environment', under which there were a number of sub-criteria against which each route option was compared. The two route options were considered neutral when compared against one another under each of the Environmental sub-criteria, given the equivalent impacts associated with each.

Route Option PM02 was identified as the preferred option for this section, based on the population catchment and providing more trip attracters sub-criteria, noting that the two options were considered neutral under the Environment and all other criteria. Route Option PM02 was therefore brought forward into the Emerging Preferred Route.

3.3.2.3 Sub-Section SAS3 Route Options Assessment

Following the Stage 1 sifting process three viable route options for sub-section SAS3 were taken forward for assessment and further refinement as follows:

- Route Option CZ01 (comprising CR1, CR12, CR27 and CR10 in Image 3.11): Using the existing bus lanes on the R148 (Palmerstown Bypass) before diverting to the R112 Lucan Road and travelling through Chapelizod;

- Route Option CZ02 (comprising CR1 and CR2 in Image 3.11): remains on the R148 (Palmerstown Bypass and Chapelizod Bypass) for its entire length, using the existing bus lanes along this road. These bus lanes have recently been upgraded to the required standard and works to the junction at Kylemore Road to provide bus priority are due to be completed in the near future [works now completed]; and

Route Option CZ03 (comprising CR1, CR12, CR23, CR24, CR25, CR15, CR16 and CR17 in Image 3.11): Travels along the R148 (Palmerstown Bypass) before diverting to the R112 (Lucan Road and Kylemore Road) and Ballyfermot Road (R833) and re-joining the R148 at Con Colbert Road junction.



Image 3.11: Sub-Section SAS3 (Kennelsfort Road Upper to Con Colbert Road) Route Options extracted from the Feasibility Report

Three scheme options were considered along each route which would provide traffic lanes, bus lanes and cycle tracks in each direction. The assessment sub-criteria which were differentiators between scheme options included Capital Cost, Transport Reliability and Quality of Service, Residential Population and Employment Catchments, Traffic Network Integration and Land Use Character. Route Option CZ02 was identified as having some advantages over other options in relation to both Capital Cost and Reliability. Following a detailed MCA, Route CZ02 was identified as the preferred option for this section and was brought forward into the Emerging Preferred Route.

As mentioned previously each route option was evaluated using a multi-criteria assessment with one of the primary criteria being 'Environment', under which there was a number of sub-criteria against which each route option was compared.

In terms of potential Archaeological, Cultural Heritage and Architectural Heritage impacts, it was considered that Route Options CZ02 and CZ03 had advantages when compared against CZ01 given the number of recorded monuments and protected structures directly affected or in close proximity.

With regard to Flora and Fauna, it was considered that Route Options CZ02 and CZ03 had advantages when compared against CZ01 given the number of trees likely to be removed in each option.

All three route options were considered neutral when compared against one another under the Soils and Geology sub-criterion, given none presented any appreciable impacts.

Route Options CZ02 and CZ03 had advantages when compared against CZ01 under the Hydrology sub-criterion given the proximity of the route to the River Liffey for a large section..

With regard to Landscape and Visual, it was considered that Route Options CZ02 and CZ03 had advantages when compared against CZ01 given the level of road widening and impact on tree lines in each option, and whether they were verges or parks/ amenity areas.

With regard to Air Quality, it was considered that Route Options CZ02 and CZ03 had advantages when compared against CZ01 as it required widening in the vicinity of residential areas.

With regard to Noise and Vibration, it was considered that Route Options CZ02 and CZ03 had advantages when compared against CZ01 as it required widening in the vicinity of residential areas.

When the options were considered under the Land Use Character sub-criteria, Route Option CZ01 was considered to have some disadvantages when compared to Route Options CZ02 and CZ03, with Route Option CZ02 presenting further advantages over Option CZ03. In all three options a large number of trees and on-street parking provision was expected to be affected, however to a greater extent on Route Option CZ01 as it requires more extensive widening, with the lowest impact being under Route Option CZ02 which requires no landtake staying within the existing road reserve. Route Option CZ02 was therefore considered to have advantages given the lower impact on this criterion.

Based on the assessment undertaken, route option CZ02 appears to offer more benefits over other options. Route option CZ02 is therefore preferred for the following reasons:

- Its comparatively low capital cost coupled with the opportunity for journey time reliability and bus service efficiency;
- It provides the safest route regarding road safety
- It provides a good combination of both transport network integration and cycling integration when compared to the other options
- It has less impact on the environment compared to other options.

With regard to the consideration of the Environment criterion, Route Option CZ02 was considered to have some advantages when compared to the other options due to the reduced impact on Existing Land Use. Route Option CZ02 was therefore brought forward into the Emerging Preferred Route.

3.3.2.4 Sub-Section SAS4 Route Options Assessment

Following the Stage 1 sifting process four viable route options for sub-section SAS4 were taken forward for assessment and further refinement as follows:

- Route Option CT01 (comprising CR3, CR4, CR6, CR7 and CR8 in Image 3.12): Using the R148 (St. John's Road West) from Con Colbert Road to the City Centre via the North and South Quays;
- Route Option CT02 (comprising CR3, CR4, CR6, CR22, CR11, CR7 and CR8 in Image 3.12): The same as CZ01 from Con Colbert Road to the R111 (South Circular Road) junction, and from there travelling along the R111 and R109 (Conyngham Road) adjacent to the Phoenix Park before joining the quays and;
- Route Option CT03 (comprising CR10, CR4, CR6, CR22, CR11, CR7 and CR8 in Image 3.12): Beginning at the end point of Route Option CZ01 from Study Area Sub-Section 3 and travelling along the R109 (Conyngham Road) until joining the quays; and
- Route Option CT04 (comprising CR10, CR4, CR6, CR22, CR7 and CR8 in Image 3.12): Beginning at the end point of Route Option CZ01 from Study Area Sub-Section 3 and travelling along the R109 (Chapelizod Road) to the R111 (South Circular Road) junction same as route option CT03.

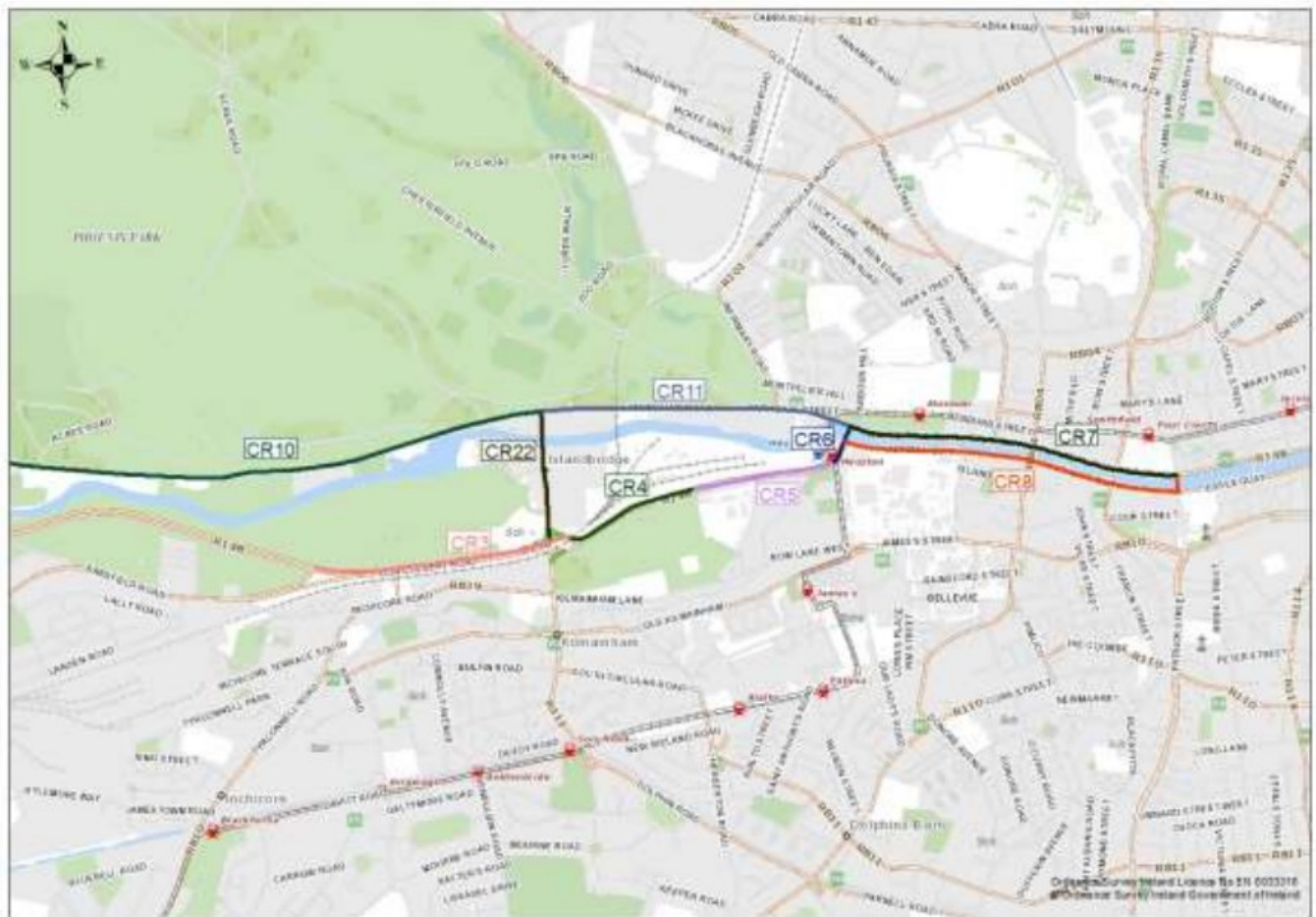


Image 3.12: Sub-Section SAS4 (Con Colbert Road to City Centre) Route Options extracted from the Feasibility Report

Alternative scheme options were considered along each route which would provide traffic lanes, bus lanes and cycle tracks in each direction. The assessment sub-criteria which were differentiators between scheme options included Capital Cost, Transport Reliability and Quality, Residential, Employment and Educational Catchments, Cycling Integration, Key Trip Attractors, Flora and Fauna, Hydrology, Landscape and Visual, and Land Use Character. Route Option CT01 was identified as having some advantages over other options in a number of key criteria. As this is the most direct route, it has the quickest journey time and the provision of bus lanes in almost all locations ensures it is also reliable. Following a detailed MCA, Route Option CT01 was identified as the preferred option for this section and was brought forward into the Emerging Preferred Route. As mentioned previously each route option was evaluated using a multi-criteria assessment with one of the primary criteria being 'Environment', under which there was a number of sub-criteria against which each route option was compared.

In terms of potential Archaeological, Cultural Heritage and Architectural Heritage impacts, it was considered that all four route options were considered neutral when compared against one another given the largely equivalent number of recorded monuments and protected structures directly affected or in close proximity.

With regard to Land Use Character, with the exception of CT03, all other route options were considered neutral when compared against one another given the largely equivalent number of trees likely to be removed in each option. Route Option CT03 has a greater impact as it has some impact on existing land use adjacent to the River Liffey.

When the options were considered under the Flora and Fauna sub-criteria, Route Option CT03 and CT04 were considered to have some disadvantages when compared to Route Options CT01 and CT02. In all four options a large number of trees were likely to be removed, however to a greater extent on Route Options CT03 and CT04.

All four route options were considered neutral when compared against one another under the Soils and Geology sub-criterion, given that none presented any appreciable impacts.

When the options were considered under the Hydrology sub-criteria, Route Options CT02, CT03 and CT04 were considered to have some disadvantages when compared to Route Option CT01. Route Option CT01 was therefore considered to have advantages given the lower risk of flooding to a portion of that route.

With regard to Air Quality, it was considered that all four route options were considered neutral when compared against one another given that in each option there is already existing vehicular and bus traffic, and each would have an equivalent level of road widening.

With regard to Noise and Vibration, it was considered that all four route options were considered neutral when compared against one another given that in each option there is already existing vehicular and bus traffic, and each would have an equivalent level of road widening.

When the options were considered under the Land Use Character sub-criteria, Route Option CT03 was considered to have some disadvantages when compared to Route Options CT01, CT02 and CT04. In all four options a large number of trees and on-street parking provision was expected to be affected, however to a greater extent on Route Option CT03 adjacent to the river Liffey. Route Option CT01 was identified as the preferred option for this section. With regard to the consideration of the Environment criterion, Route Option CT01 was considered to have some advantages when compared to the other options due to the reduced impact on Land Use Character. Route Option CT01 was therefore brought forward into the Emerging Preferred Route.

3.3.3 Cycling Options

Consideration of alternative cycling route options was fundamental in the process of defining the Emerging Preferred Route. When compared to the Emerging Preferred Route proposal, an alternative route option was developed (directing cyclists away from the N4 dual carriageway) which provides some advantages against each of the five key requirements described in the National Cycle Manual. The alternative provides a continuous fully segregated two-way facility that offers a significant improvement in terms of road safety, by taking cyclists offline, as well as improving safety for pedestrians by reducing shared spaces. Locating the two-way cycle track on the northside of the N4 reduces the number of intersections with junctions and accesses to private properties. This increases the safety of the cyclists using facilities along the route. The Emerging Preferred Route Option intersected with twelve private accesses and junctions between N4 junction 2 and Junction 3, compared to just two in the alternative route option.

The alternative route option provides all the necessary components of the GDA Cycling Strategy in this area, as well as introducing a new link between Ballyowen Lane and Ballyowen Road, providing a coherent network that links all main origin and destination zones / centres for cyclists, with minimal detours and interruptions minimised. This is a significant improvement on the Emerging Preferred Route (EPR) proposals which contains detours and gaps in the westbound direction.

The alternative route option provides a more direct route for westbound cyclists than the EPR proposals and also provides for several links from areas south of the N4 and R148 facilitating a more direct route for eastbound cyclists from those areas. The alternative route option would reduce journey times for cyclists using the route by reducing the stop-start nature of the EPR proposals, which was raised as an issue at the first Non-Statutory Public Consultation. The introduction of a segregated two-way cycle track will eliminate the need for cyclists to use the shared area at Junction 2 of the N4 in the westbound direction.

Overall, it is considered that the alternative route option would provide a more attractive and comfortable route to the EPR proposals as cyclists using the route as they will no longer be cycling directly next to traffic lane of the N4 dual carriageway west of the M50 and will not have to negotiate parked cars and traffic along Old Lucan Road east of the M50.

Where cycle facility options have been comparatively assessed in order to determine the preferred option for a cycle route, the assessment was based on a methodology that assesses options using the 'Five Needs of a

Cyclist' outlined in the National Cycle Manual Guidelines together with Capital Cost and Environmental Impacts. The cycle route options were assessed using the criteria and rationale presented in Table 3.1.

Table 3.1: Alternative Cycle Route Assessment Criteria

Appraisal Criteria	Rationale
1. Capital Cost	<ul style="list-style-type: none"> ▪ Capital cost estimates consist of both the indicative infrastructure cost estimate and land acquisition costs. ▪ The cycle route infrastructure cost examines the practicality and extent of works required to accommodate cycle route infrastructure along route options. ▪ This criterion evaluates the likely costs associated with land acquisition and associated boundary/accommodation works for each route option. The assessment takes consideration of: <ul style="list-style-type: none"> • The number of adjacent public/commercial/ residential/industrial properties, from which land acquisition would be required as well as the extent (area) of land acquisition likely to be necessary; and • The costs associated with boundary/accommodation works.
2. Road Safety	<ul style="list-style-type: none"> ▪ For the purposes of comparing route options, the extent of segregation and the number of junctions along the route has been used as a proxy for road safety. The number of junctions is effectively a measure of the number of potential conflicts on the route and therefore a measure of the potential for a collision. ▪ The type of movement required by the cyclist at junctions on the route is also considered with routes where turning movements (either left or right) are required being assigned a lower ranking in terms of safety. ▪ The quality of cycle provision practically achievable on route options has been assessed. For comparison purposes, the highest level of practical cycle provision achievable on each route has been determined and compared between route options.
3. Coherence	<ul style="list-style-type: none"> ▪ This criterion considers whether a route option forms part of the GDA Cycle Network Plan, with routes where CBC and designated Cycle Routes overlap given a higher designation in terms of benefits arising where cycle infrastructure can be provided as part of a proposed CBC scheme. In some instances, however it may be more appropriate to provide a parallel cycle track off the CBC route. Consideration is also given to cycle routes intersecting with the CBC route. The cycle route should also link the main origin and destination zones along the CBC route.
4. Directness	<ul style="list-style-type: none"> ▪ For the purposes of comparing route options, the number of junctions, length of the route and the number of detours and gaps from the CBC has been used as a proxy for directness.
5. Attractiveness	<ul style="list-style-type: none"> ▪ The cycling environment along the route should be pleasant and interesting. Monotony and lack of points of interest along the cycle route are unattractive to cyclists. Cycle routes should also be adequately lit so as not to deter evening and night-time use.
6. Comfort	<ul style="list-style-type: none"> ▪ The quality of cycle provision practically achievable on route options has been assessed. For comparison purposes, the highest level of practical cycle provision achievable on each route has been determined and compared between route options.
7. Environmental	<ul style="list-style-type: none"> ▪ The provision of segregated cycle tracks has the potential to impact on the archaeological, architectural and cultural heritage environment. At this stage of the assessment process, a conservative approach has been adopted in assessing the potential for impact and this is further described below. The provision of segregated cycle tracks has the potential to impact on flora and fauna, the townscape/streetscape along the route and on the land use character through land-take, severance or reduction of viability which prevents or reduces it from being used for its intended use.

3.3.4 Emerging Preferred Route

Informed by the appraisal of options as set out earlier, the EPR was identified. That EPR is summarised as follows:

'The Lucan to City Centre Core Bus Corridor (CBC) commences at Junction 3 on the N4 and it is routed via the N4 as far as Junction 1 (M50), and via the R148 along the Chapelizod Bypass, Con Colbert Road, St John's Road West and Frank Sherwin Bridge, where it will join the prevailing traffic

management regime on the North Quays. Priority for buses is provided along the entire route, consisting primarily of dedicated bus lanes in both directions, with alternative measures proposed at particularly constrained locations.'

A public consultation on this EPR was undertaken from 26 February 2019 to 31 May 2019, providing feedback which was then meaningfully considered in the further development of the Proposed Scheme.

3.4 Design Alternatives

3.4.1 Development of the Draft Preferred Route Option

Following the completion of the public consultation process in relation to the EPR, various amendments were made to the scheme proposals to address a number of the issues raised in submissions, including incorporating suggestions and recommendations from local residents, community groups and stakeholders, and/or arising from the availability of additional information. These amendments were incorporated into the designs and informed a draft Preferred Route Option.

This additional design development took account of:

- New and updated topographical survey information;
- Output from engagement and consultation activities on the EPR and draft Preferred Route Option proposals;
- Further design development and options assessment; and
- Changes in the extent of the scheme.

Where substantial revisions had been made to the design since the publication of the EPR, options were assessed using the same process as adopted in the original assessment to determine the preferred option. The MCA assessed any newly developed options against the previously identified EPR. The methodology and MCA used were consistent with that carried out during the initial route optioneering work (including consideration of the relevant environmental aspects), which informed the identification of the EPR.

Following this design development process, the draft Preferred Route Option was identified. For the purposes of reporting, the draft Preferred Route Option has been divided into three 'sections':

- Section 1 - N4 Junction 3 (Ballyowen/Lucan) to Kennelsfort Road Upper;
- Section 2 - Kennelsfort Road Upper to Con Colbert Road; and
- Section 3 - Con Colbert Road to City Centre (Heuston Station).

3.4.1.1 Alternatives Considered at Draft Preferred Route Option Stage

The main alternatives considered within these three sections during the development of the draft Preferred Route Option are set out in the following sections.

3.4.1.1.1 N4 Junction 3 to Palmerstown Cycle Facilities

Between the N4 Junction 3 and Old Lucan Road towards Chapelizod the EPR proposed one-way cycle tracks along the N4 between Junction 3 and Junction 2, with a Quiet Street along Old Lucan Road either side of the M50. The public consultation raised concerns around the stop-start nature of the cycle tracks, which would form part of Primary Cycle Route 06.

In the EPR, eastbound a one-way cycle track runs down the R835 Lucan Road parallel to the bus lane and then follows the N4 Junction 3 entry slip running parallel to the bus lane on the existing shared footpath/ single cycle track. The cycle track then continues along N4 Junction 2 exit slip road, crossing over the R113 Fonthill Road and running down Old Lucan Road as a proposed Quiet Street. East of the M50 the cycle route continues along the Old Lucan Road as a proposed Quiet Street and runs through Palmerstown village to the start of the R148

Chapelizod Bypass. Here it connects to the existing Pedestrian Priority Zone running parallel to the R148 (separated by a verge) and continues down the R112 Lucan Road towards Chapelizod village.

Westbound, from the start of the Chapelizod bypass the route runs along the Old Lucan Road as a proposed Quiet Street through Palmerstown village to the shared pedestrian / cyclist bridge over the M50. From there the route follows the existing two-way segregated cycle track as far as the existing pedestrian / cyclist shared bridge over the N4. It then runs along Old Lucan Road as a proposed Quiet Street as far as the N4 Junction 2.

At the N4 Junction 2 the route makes use of the existing shared areas around the dumb-bell roundabouts to cross underneath the N4 and turn east up the shared area on the westbound off-slip, before doubling back to join the cycle track that runs along the N4 next to the bus lane on the main carriageway. Alternatively, from N4 Junction 2 cyclists can head further south on the R113 Fonthill towards the roundabout with St Loman's Road and then double back up the N4 westbound on-slip with general traffic to join the cycle track along the N4 running next to the bus lane on the main carriageway.

Once on the N4 east of Junction 2 cyclists would then make use of a single way cycle track along the N4, and land acquisition will be required from two residential properties over this section. Either side of Ballyowen Lane a 270m length of shared area is proposed for cyclists and pedestrians and then the cycle route makes use of an existing cycle lane on the westbound off-slip road on the approach to the N4 Junction 3.

At the signalised junction with the R136 Ballyowen Road at the western end of the slip road, the cycle lane is located between the left-hand turn and straight-ahead lane. The westbound off-slip road will require widening to allow the planned works to take place which includes land acquisition from thirteen private residences and one commercial property. In addition to the land acquisition there would also be a requirement to remove a number of mature trees to facilitate the widening.

Starting at the commencement of the scheme the two-way cycle track runs along the northern side of the R835 Lucan Road and then along the access road towards the Hermitage Golf Course. It then runs along the southern edge of the golf club and the Hermitage Clinic lands. This will require the acquisition of a strip of land from the adjacent fields, the golf club, as well as the Hermitage Clinic lands.

East of the N4 Junction 2 the option continues as a segregated two-way cycle facility along the southern side of Old Lucan Road before making use of the existing pedestrian / cyclist bridge crossing of the M50. East of the M50 the option continues as a segregated two-way cycle facility along the northern side of Old Lucan Road, running through Palmerstown village before connecting to the existing Pedestrian Priority Zone at the start of the Chapelizod Bypass. At this point Primary Cycle Route 06 deviates from the BusConnects corridor and continues down the R112 towards Chapelizod village.

The provision of the segregated two-way cycle facility is considered to have some disadvantages when compared to the EPR with regard to environmental aspects (land take and existing trees and hedgerows). However, it provides greater integration of the cycle network. Notwithstanding the disadvantages in environmental terms, the provision of the two-way cycle track was identified as the draft Preferred Route Option as it was considered to provide improved integration (as part of Primary Cycle Route 06), accessibility and safety compared with the EPR.

3.4.1.1.2 Liffey Valley Bus Stops

The EPR maintained the existing bus stop arrangement and provision on the N4 serving the Liffey Valley Shopping Centre with no changes proposed. As Liffey Valley Shopping Centre is identified as one of the key interchange locations on the future bus network, it was considered that the existing pedestrian / cyclist bridge connecting the bus stops on the N4 with the shopping centre did not provide a direct link to the future public transport interchange and the existing bus stops were not of an adequate size and standard to serve future anticipated demand.

In the eastbound direction a single length bus layby is provided, with a ramped access to the shared pedestrian / cyclist bridge over the N4 dual carriageway connecting to the Liffey Valley Shopping Centre site. For buses leaving the stop and heading towards the R148 towards the City Centre there is a very short length for them to accelerate and negotiate with N4 traffic that is heading towards the M50 northbound, with a significant speed differential between the two movements.

In the westbound direction there is a similar provision of a single length bus layby, with a ramped access to the shared pedestrian / cyclist bridge over the N4 dual carriageway. For buses entering this stop there is a very short length for them to weave with N4 traffic that has come from the M50 northbound.

Alternative proposals were subsequently developed which were integrated into the Proposed Scheme, to relocate the existing bus stops 200m further west, segregated from the existing carriageway and increased in length in recognition of the future use by longer distance regional and national bus services as well as local Dublin bus services. To provide an enhanced connection to the recently permitted bus interchange within the shopping centre site, a new pedestrian bridge was proposed over the N4, with associated ramps and steps.

These alternative proposals provide the appropriate level of pedestrian facilities, which are of a significantly higher quality than the EPR Option. Furthermore, the alternative arrangements provide increased lengths for buses to accelerate and negotiate the N4 / M50 interchange more safely.

The alternative option was identified as the draft Preferred Route Option as despite the higher capital cost, there would be significant advantages in transport reliability and quality, as well as it being more advantageous through improved integration, accessibility and, in particular, significantly improved safety in comparison to the Emerging Preferred Route Option, with neutral effects with regard to environmental factors.

3.4.1.1.3 Other design alternatives

In addition, in specific areas where issues were identified through the non-statutory public consultation process the following changes were implemented in the design:

- Introduction of a westbound, bus only, right turn lane at the Oval junction to facilitate buses turning into Palmerstown village, providing better facilities for bus-users;
- Accommodation of a new eastbound right turn lane at the junction of the R148 Con Colbert Road with Memorial Road, to the tie-in with the proposals contained in the Liffey Valley to City Centre CBC, which proposes making Memorial Road two-way, providing better facilities for bus users.
- The introduction of a northbound right turn lane at the South Circular Road junction to allow vehicles to turn right from the South Circular Road to St John's Road West; and
- Removal and replacement of trees along St John's Road West to accommodate facilities for both taxis and bicycles on the approach to the train station.

3.4.2 Consideration following Draft Preferred Route Option Consultation (March 2020)

The draft Preferred Route Option was published in March 2020 and a second round of public consultation commenced on 4 March 2020 to 17 April 2020. Due to Covid-19 restrictions in mid-March 2020, the planned Public Information Events were impacted. There was a total of 16 submissions received during this second round of public consultation.

No material changes resulted from the second round of public consultation and dialogue with stakeholders. Changes made to the Draft Preferred Route Option were relatively small scale and no further option assessments using the MCA described in Section 3.3.2 were required.

The key changes included in the updated design of the draft Preferred Route Option included the following:

- The locations of bus stops were reviewed and rationalised, including the introduction of layby facilities to reduce delays to through buses, and stops being located closer to signalised crossing points;
- The proposed new bridge at Liffey Valley Shopping Centre was allocated for pedestrians only and the existing pedestrian / cycle bridge retained for shared use, providing improved facilities for pedestrians;
- The two-way cycle track on Old Lucan Road was extended through Palmerstown village to the start of the Chapelizod bypass;

- The new bus stops on Chapelizod bypass were lengthened, segregated and bus laybys introduced, with the existing bridge being widened on the north side; and
- At Heuston Station, a new bus layby on the south side of St John's Road West to the frontage of Dr Steevens' Hospital was incorporated within the Proposed Scheme to accommodate future forecast bus services at the transport interchange.

3.4.3 Further consideration following Updated Draft Preferred Route Option Consultation (November 2020)

The third round of non-statutory public consultation on the updated draft Preferred Route Option took place from the 04 November to 16 December 2020, and was held virtually due to the continuing effect of the Covid-19 pandemic and associated restrictions.

Further details are described in Chapter 1 (Introduction).

Virtual consultation rooms were developed and published, offering a 'call-back' facility along with descriptions, supporting documentation and mapping of the draft Preferred Route Option as well as information on all revisions, if any, made since the second round of non-statutory in March 2020. Submissions were accepted by email or by post.

- A total of 200 submissions were received relating to the Lucan to City Centre Core Bus Corridor during this third round of public consultation relating to the updated draft Preferred Route Option, ranging from individual submissions by residents, commuters, and local representatives to detailed proposals from various associations. Arising from the feedback received during this consultation process, a number of design amendments were identified and incorporated into the scheme proposals.

Following analysis of the feedback received from the public consultation for this scheme, a number of key design changes were made to the draft Preferred Route Option. These changes were relatively small scale and no further options assessments using MCA were required. The key changes for the Proposed Scheme following the draft Preferred Route Option were:

- At Junction 3 of the N4, the Proposed Scheme now includes a two-way cycle track along the eastern side of Ballyowen Road between the Lucan Road junction on the northern side of the N4 and the Hermitage Road junction on the southern side. This includes new combined pedestrian and cyclist bridge as a replacement for the existing footbridge over the N4 at this location, providing improved facilities for cyclist and pedestrians;
- In Palmerstown village, the layout of the Kennelsfort Road junction has been amended to provide an additional left turn lane in the in-bound direction. In addition the layout of the Oval junction has been amended to provide an additional lane to cater for the increase in left turning traffic exiting the village. Also, additional car parking has been accommodated on the south side of Old Lucan Road east of the village centre while maintaining the proposed two-way cycle track;
- The new ramps and steps on Chapelizod Hill Road serving the proposed bus stops on the Chapelizod Bypass have been moved to the southern side of the road, resulting in a reduction in height and length of the ramps, as well as reducing the overall area of the new facility, with environmental advantages associated with reduced earthworks, and reduced land-take;
- The layout of South Circular Road junction has been amended to reduce the number of general traffic lanes, thus reducing the length of the pedestrian crossings, as well as releasing additional road space for improved cyclist facilities and landscaping; and
- At Heuston Station landscaping and urban realm proposal has been developed for the proposed bus layby on the south side of St John's Road West in recognition of the importance of the facade of Dr. Steevens' Hospital, with advantages for landscape and visual amenity.

3.4.4 Scheme Design Alternatives

3.4.4.1 Ballyowen Road Cycle Track

The draft Preferred Route Option on the Ballyowen Road presented at the second and third round of public consultations included proposed cycle tracks in each direction on the bridge carrying the Ballyowen Road over the N4, with the subsequent loss of the southbound right turning lane for the N4 westbound on-slip. A large number of submissions to the third round of public consultation raised concerns about the loss of this right turning lane, in respect of potential traffic congestion, as well as highlighting concerns about cyclist safety along the road.

As part of the development of the detailed traffic modelling for the Proposed Scheme, analysis of the two signalised junctions either side of the existing bridge, as well as analysis of the junction with the Lucan Road, was undertaken and this indicated that all three junctions would be subject to significant queuing with the proposed arrangement in place, with consequential impact on traffic seeking to exit the N4 and move along Ballyowen Road. It was also noted that the future year demand for the right turn movement to the N4 westbound was forecast to increase compared to base year.

Therefore, alternative design options were considered at this location that would retain the right turn for general traffic lane while also providing the appropriate standard of cycle facilities. As there is adequate road space to accommodate cycle tracks both north and south of the bridge over the N4, the consideration of alternatives centred on feasible options for providing a new bridge for cycle movements across the N4, summarised as follows:

- a) Widening of the existing road bridge (not feasible due to structural form);
- b) Use existing pedestrian bridge (not feasible as existing structure too narrow);
- c) Widen existing pedestrian bridge (not feasible due to structural form);
- d) Retain existing pedestrian bridge with two new one-way cycle bridges each side (feasible but rejected due to impact of signalising N4 westbound on-slip);
- e) Retain existing pedestrian bridge with two-way cycle bridge on east side (feasible but rejected due operational pedestrian/cyclist conflicts and insufficient space adjacent to Lucan Retail Park);
- f) Retain existing pedestrian bridge with two-way cycle bridge on west side (feasible but rejected due to impact of signalising N4 westbound on-slip); and
- g) Remove existing pedestrian bridge and provide new combined pedestrian and two-way cyclist bridge on the east side (feasible and adopted as preferred option).

Of the seven potential options identified, options a), b), and c) were determined to be not feasible owing to the existing structural form. Of the remaining four feasible options, there was no significant difference identified in terms of environmental impact or economic aspects. Therefore, the ability of the option to deliver the required objectives in operational terms was identified as the key consideration. Options d) and f) were considered less favourable as they required a new signalised crossing of the N4 westbound on-slip, which led to unacceptable impacts on the capacity of the signalised junctions. Option e) was also considered less favourable as it would lead to additional pedestrian/cyclist conflicts, a poorer alignment for cyclists and also require land acquisition from the Lucan Retail Park. Option g) was therefore identified as the preferred option; while this option involved the demolition of the existing pedestrian bridge, ultimately it performed best in terms of the operational performance and these benefits more than offset the temporary construction impacts. This design option has therefore been incorporated into the Proposed Scheme.

Recognising that the Secondary Cycle Route SO6 is located along Ballyowen Road, in order to provide appropriate cycle facilities that connected to the two-way cycle track on the new bridge, the Proposed Scheme also includes the reallocation of existing road space to provide a continuous two-way cycle track on the east side of R136 Ballyowen Road between the junction with the R835 Lucan Road north of the N4 and the junction with Hermitage Road south of the N4. Design amendments to both these junctions are also included to provide the necessary connections for all cycle movements.

3.4.4.2 Two-way Cycle Track along N4 between Junction 3 and Junction 2

The draft Preferred Route Option presented at the second and third round of public consultations included proposals for a two-way cycle track located on the northern side of the N4 / R148 between the start of the Proposed Scheme at Junction 3 of the N4 and the start of the R148 Chapelizod Bypass. As described in the Preferred Route Options Report, this cycle track was developed in response to the submissions made in the first round of public consultation about the poor quality of cyclist facilities on the route, and in order to provide an appropriate standard of cyclist provision for the Primary Cycle Route 06 included in the GDA Cycle Network.

In response to the third round of public consultation, concerns were raised by the Hermitage Golf Club in respect of the impact of the two-way cycle track on their existing boundary with the N4, relating to the number of trees that would be lost. In particular, a suggestion was made that the two-way cycle track should be located on the south side of the N4 between the R136 Ballyowen Road and the existing pedestrian / cyclist bridge crossing the N4 immediately east of the golf club lands and west of the access to St Loman's Hospital. Consideration was given to this suggested alternative design option, with the two-way cycle track on the south side of the westbound off slip of the N4 at Junction 3 and connecting to the draft Preferred Route proposals on the north side of the N4 east of the golf club via the existing pedestrian / cyclist bridge.

This alternative design option would require the existing westbound service road and off-slip to be widened on the southern side over its full length to accommodate the two-way cycle track. This would require the removal of a significant line of mature trees that will impact the rear gardens of 21 residential properties adjacent to the N4 westbound off-slip, including land acquisition from 16 of these properties. In addition land acquisition and associated tree loss would be required from a further seven residential properties and two commercial properties adjacent to the westbound service road either side of Ballyowen Lane. It is also noted that the existing pedestrian / cyclist bridge over the N4 is not of sufficient width to provide segregated facilities and would require a new parallel cyclist bridge for the two-way cycle track.

When compared to the draft Preferred Route Option, the significant adverse impact on property and comparable length of tree loss associated with the alternative design resulted in this design alternative being rejected. Therefore, the Proposed Scheme retains the two-way segregated cycle track on the north side of the N4, as included in the draft Preferred Route Option.

Consideration was also given to a suggestion that the existing bus lane, or one of the general traffic lanes, be removed to accommodate the two-way cycle track within the existing road reservation. The removal of the bus lane was discounted as it would be directly contrary to the scheme objectives, and the possible removal of a general traffic lane was also discounted on the grounds of road traffic demand and associated road safety.

A number of design alternatives were considered for the new boundary wall with a view to minimising the number of trees that would be lost. These design alternatives included different construction methods. The final design included in the Proposed Scheme is the alternative that will result in the fewest number of trees lost and comprises a continuous piled retaining wall that will be able to be constructed entirely from the N4. In addition, the final design includes a substantial number of new trees replanted on the golf club's side of the new boundary wall to reinstate the visual boundary. Furthermore, at the western end of the new boundary wall the alignment of the proposed cycletrack was amended to avoid any impact on the existing entrance gate and barrier to the golf club, and at the eastern end the cycle track alignment was amended to minimise the impact at that location.

3.4.4.3 Retention of Existing Pedestrian / Cyclist bridge at Liffey Valley

As described above, the draft Preferred Route Option included the relocation of the existing bus stops serving Liffey Valley Shopping Centre including a new pedestrian / cyclist bridge over the N4, with associated ramps and steps, to provide an enhanced connection to the bus interchange within the shopping centre site. The draft Preferred Route provided for the removal of the existing pedestrian / cyclist bridge. An alternative design option was considered at this location that involved the retention of the existing bridge with the new bridge being provided to serve the relocated and extended bus stops being designated for pedestrians only.

The draft Preferred Route Option proposals concentrated all pedestrian and cyclist movements across the N4 into a single route. In view of the forecast increase in both pedestrian and cyclist movements there were clear benefits in retaining the existing pedestrian / cycle bridge to provide two separate routes. Accessibility across the

N4 for cyclists, would be unchanged as the crossing point would remain the same and provide an appropriate connection between the proposed two-way cycle track and the shopping centre.

As regards pedestrian accessibility, while the new pedestrian bridge provides the optimum crossing point to connect the relocated and lengthened bus stops to the shopping centre, retention of the existing bridge for shared use with cyclists would retain the existing connectivity for pedestrians from the Old Lucan road either side of the M50. Therefore, the Proposed Scheme includes the retention of the existing pedestrian / cyclist bridge, together with the associated ramps / steps serving the Old Lucan Road on the north side of the N4. The connection from the bridge to the shopping centre is retained, while the redundant ramp and steps serving the existing bus stop on the south side of the N4 will be removed.

3.4.4.4 Bus Stops, Junction Layouts and Parking Proposals in Palmerstown village

The draft Preferred Route Option in Palmerstown presented at the second and third round of public consultations included two-way cycle tracks along the north side of the Old Lucan Road and the east side of Kennelsfort Road Lower, with an associated pedestrian / cyclist crossing of the R148 Palmerstown Bypass dual carriageway. In order to provide this cycle track along the section of Old Lucan Road east of the village centre, the associated reallocation of existing road space resulted in the removal of a number of on-road pay and display car parking spaces.

In addition, with the introduction of the pedestrian / cyclist crossing of the R148 Palmerstown Bypass dual carriageway, vehicles wishing to exit Palmerstown village and turn left towards Chapelizod / Dublin City Centre would not be permitted to make this movement from Kennelsfort Road, instead making use of the eastern junction with The Oval. Finally, in order to facilitate the movement of the revised bus services through the village included in the approved Bus Network Redesign, the draft Preferred Route Option included a westbound, bus only, right turn lane to facilitate entry to the village at the Oval junction, with the consequential loss of one of the two lanes exiting the village, and new bus stops proposed close to the junction with Mill Lane.

A large number of submissions to the third round of public consultation raised concerns about the loss of parking, potential traffic congestion at the two junctions and the provision of new bus stops. In response to the concerns raised in the submissions, a number of design alternatives were considered as follows.

In respect of the proposed bus services and associated bus stops along the Old Lucan Road east of the village centre, it was confirmed that the future bus service included in the approved Bus Network redesign would serve this route. As such, the provision of the right turn bus lane at The Oval junction and the bus stops close to the Mill Lane junction are included in the Proposed Scheme.

As part of the development of the detailed traffic modelling for the Proposed Scheme, further analysis of the two signalised junctions on the R148 Palmerstown bypass was undertaken. While both junctions were forecast to operate satisfactorily in the future year scenario, it was noted that the single lane exit from the village at the junction with The Oval would be operating particularly close to capacity. As such an alternative design was developed to provide a second lane for traffic exiting the village and provide additional capacity at the junction. Notwithstanding that this alternative increased the land take from the adjacent petrol filling station site, the operational benefits of the alternative design were considered to be such that this alternative design has been included in the Proposed Scheme.

Finally, alternative design proposals were considered along Old Lucan Road east of the village centre with a view to reducing the number of on-street parking spaces lost in this part of the village. The design alternatives focused on the reallocation of the available road space width while still providing the new two-way cycle track and the new bus stops in the vicinity of Mill Lane. It was concluded that the new cycle facilities should remain along the north side of the road to allow the retention of parking spaces on the south side where the higher number of residential properties without off-street parking spaces are located. In view of the relatively wide road space on this section of carriageway an alternative proposal was developed to provide parking bays perpendicular to the carriageway. The design was prepared in accordance with the Design Manual for Urban Roads and Streets and allowed the inclusion of an additional 19 car parking spaces compared to the draft Preferred Route Option, while retaining the two-way cycle track and the new bus stops. This design alternative has been included in the Proposed Scheme and of the 62 existing on-street car parking spaces along this section of Old Lucan Road the number that will be lost as a result of the Proposed Scheme has been reduced from 33 to 14.

3.4.4.5 Chapelizod Hill Road Steps and Ramps

The proposals for the Proposed Scheme has consistently included the provisions of new bus stops on the R148 Chapelizod Bypass from the Emerging Preferred Route through to the draft Preferred Route Option. Access to these bus stops from Chapelizod village was provided via ramps on the northern side of Chapelizod Hill Road. The design of these connections were developed as part of the normal design process and included preparation of a number of alternative layout arrangements for the ramps, as well as the addition of steps. The design alternatives sought to minimise the impact on the vegetation and trees on the existing R148 Chapelizod bypass embankment, while providing the shortest possible length of ramp without compromising the safety and security of the pedestrians and cyclists using the ramp. The solution adopted in the draft Preferred Route Option comprised a series of short ramps that interacted with the steps at each return to avoid any long isolated lengths of ramp while allowing for the inclusion of landscaping proposals.

A number of design alternatives were also considered for the widening of the existing R148 Chapelizod Bypass embankment with a view to minimising the number of trees that would be lost. These design alternatives included different construction methods. The final design included in the Proposed Scheme comprises a reinforced earth embankment that will be able to be constructed entirely from the R148 Chapelizod bypass, thus minimising the impact on the existing trees and planting.

While the provisions of the new bus stops on the R148 Chapelizod Bypass was supported by some submissions made in the three rounds of public consultation, there were no submissions that specifically commented on the layout of the ramps and steps. However, following the third round of public consultation, the BusConnects Infrastructure team identified some concerns in respect of the visual impact of the proposed ramps on properties in Chapelizod Court. As a result, consideration was given to a further alternative design option that moved the ramps and steps to the southern side of Chapelizod Hill Road. The principles of this alternative maintained a series of short ramps that interacted with the steps at each return. This solution reduced the overall height, and hence length of the ramps as the height of the R148 Chapelizod Bypass reduces in a southerly direction. This had benefits for people using the ramps as well as requiring a reduced area and hence loss of trees and vegetation.

In addition to these end use operational benefits, it was considered that the alternative design proposal would be better in terms of a reduced landscape and visual impact compared to the draft Preferred Route Option layout. It was also concluded that there would be no significant difference between the alternatives in terms of air quality, noise and biodiversity. Therefore this alternative design of the ramps and steps has been included in the Proposed Scheme.

3.4.4.6 South Circular Road Junction

The draft Preferred Route Option presented at the second and third round of public consultations included some modest modifications to the existing layout of the gyratory junction between the R148 Con Colbert Road / St John's Road West and the R111 South Circular Road. These modifications comprised the inclusion of continuous bus lanes along the R148 in both directions, while maintaining the existing number of lanes for general traffic. As a consequence the length of some of the pedestrian crossing movements were increased.

A large number of submissions to the third round of public consultation raised concerns about the quality and safety of the pedestrian and cyclist facilities through the junctions in all directions. In response to this, and as part of the development of the detailed traffic modelling for the Proposed Scheme, a number of potential design alternatives of this complex interchange were considered, with a view to improving the facilities for pedestrians and cyclist, while providing the necessary bus priority and maintaining adequate capacity for general traffic.

Detailed analysis was undertaken on the alternative proposals for various linked traffic signalled junctions in the gyratory arrangement, including options for the removal of some of the through lanes for general traffic in both north-south and west-east directions. The conclusion of this assessment identified an alternative layout that would provide much improved pedestrian and cyclist facilities, with shorter crossing lengths for vulnerable users and an enhanced urban realm environment through additional hard and soft landscaping. The alternative reduced the number of lanes for general traffic while providing the necessary bus priority and adequate capacity for general traffic. This alternative layout has been included in the Proposed Scheme.

3.4.4.7 Bus Stops at Heuston Station

The draft Proposed Route Option presented at the second round of public consultation included the existing bus stops on St John's Road West opposite the southern entrance to Heuston Station retained largely in their existing format. Subsequent to this, as part of the development of design proposals of the Proposed Scheme, the size and layout of all bus stops along the corridor were assessed in terms of future forecast bus services. With Heuston Station being an important public transport interchange serving cross country rail services, Luas services and the Proposed Scheme, it was determined that a significant improvement was required to the existing bus stop provision. The bus stop assessment concluded that in order to serve adequately the mixture of Dublin bus services and regional bus services that use the corridor the layout of the bus stops should incorporate three bus bays situated in a layby.

A number of design alternatives were considered to satisfy this requirement. In the inbound direction, space was available in the area of the existing bus stop by reallocating the existing road space. However, in the outbound direction there was no such existing road space available and alternatives were explored involving utilising the front lawned area of the Health Service Executive's Dr Steevens' Hospital. Key considerations were the presence of a mature tree at the western end of the hospital lawn and the important view from Heuston Station of the northern façade of the hospital. The provision of a three bay layby bus stop arrangement could not be achieved without the loss of this tree. Therefore, an alternative arrangement was developed with a new two bay bus lay by in front of the hospital and the existing single in-lane bus stop in front of the Revenue Commissioners building retained.

A landscaping and urban realm proposal was developed for the new bus layby in recognition of the importance of the facade of Dr. Steevens' Hospital. The paving lines were designed to follow the building lines to reinforce the central entrance. The bus shelter was located to the side of the central entrance, so as not to obstruct the approach to or the views of the historic doorway. It was concluded that while the alternative proposals would have an adverse impact on Dr Steevens' hospital, the operational needs at this location were important enough to justify the impact, recognising that the impact of the bus stops had been minimised as far as possible by a reduction in scale, and by the provision of a sensitive landscaping proposal. Therefore, the alternative bus stop arrangements has been incorporated into the Proposed Scheme.

3.5 Conclusion

The Proposed Scheme has been the subject of a systematic and comprehensive assessment of alternatives during the course of its development, informed by extensive engagement with residents, businesses, the local authorities and other interested stakeholders, public representatives and the general public.

As described in this Chapter, a significant range of alternatives have been considered at three levels:

- Strategic alternatives, particularly with regard to the GDA Transport Strategy;
- Route alternatives; and
- Design alternatives, incorporating detailed local level design development.

The assessment of alternatives took account of environmental impacts, alongside other relevant factors including the economy, safety and accessibility at appropriate stages.

It is considered that the examination of alternatives presented in this Chapter meets and exceeds the requirements of the EIA Directive and Section 50(2)(b)(iv) of the Roads Act (as amended), which states that an EIAR must contain '*a description of the reasonable alternatives studied by the road authority or the Authority, as the case may be, which are relevant to the proposed road development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed road development on the environment*'.

The Proposed Scheme is described in full in Chapter 4 (Proposed Scheme Description).

3.6 References

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