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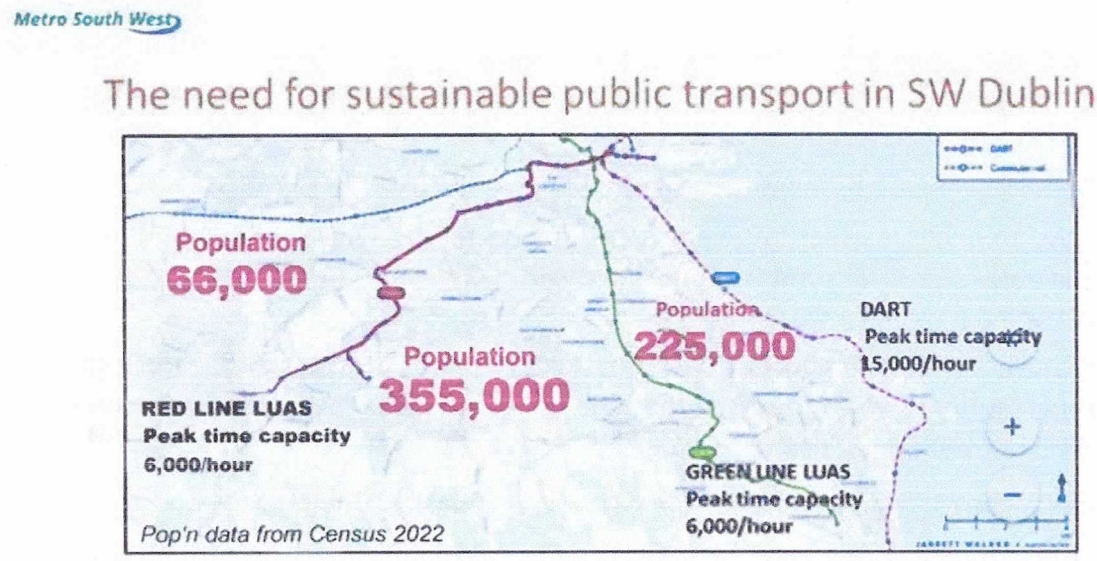
Metro South West Group Submission to the Oral hearing of An Bord Pleanála into the *MetroLink* proposal from Transport Infrastructure Ireland

Good morning Inspector. I am Seán Ward and I am joined by our transport expert, Professor Austin Smyth to my immediate left, and by Brendan Heneghan and Pauline Foster to my right.

The Metro South West Group represents over 40 residents' associations between the Red and Green Luas lines. This area has a population of 355,000 according to the 2022 Census, but no fixed rail link[1].

We welcome the opportunity to make this presentation to An Bord Pleanála about the southern part of *MetroLink*.



Narrow streets on bus corridors in SW Dublin: only metro can deliver capacity and speed

South West Dublin is characterised by a large population and narrow streets. The three bus corridors which have been identified by the NTA each have long narrow stretches with room for only one vehicle in each direction. The contrast with South East Dublin is significant, where there is not only a Coastal DART and Green Luas but also two wide roads with room for four lanes of traffic all the way into the city.

It is a serious concern to us that TII simply failed to address many of our points in its reply to our submission. This will become clear today in our oral presentation.

The Metro South West Group presents two core propositions to An Bord Pleanála, together with some other observations.

[1] See Annex 1.

First is that the Southern stump of *MetroLink* should not be pointed towards Charlemont, Manders Terrace and South East Dublin. Rather, it should come no further south than St Stephens Green to facilitate possible future extensions, including a future extension to South West Dublin.

Second is that, once the continuation of *MetroLink* to Sandyford was shelved, TII should have evaluated all the feasible options for a south city terminus, rather than simply going as far as they could along the Green Luas Line.

1 Our first core proposition:

MetroLink should come no further south than St Stephens Green

In support of our contention that the future continuation of *MetroLink* to the South West should have been examined, we explained in our submission why buses and Luas could not provide the solution for South West Dublin and we highlighted the numerous flaws in a metro feasibility study which was conducted by the NTA. Accordingly, our submission to An Bord Pleanala included:

- Firstly, an analysis which showed that buses on their own would fall far short from being able to provide sufficient public transport capacity in South West Dublin due to the narrow road infrastructure[2].
- Secondly, our submission also included the results of previous studies of Luas On-Street solutions, which reported that the narrow streets in South West Dublin made Luas On-Street impractical[3].

None of this analysis has been disputed by TII in their response to our submission. Moreover, our analysis is consistent also with that produced by the Dublin Transportation Office in a document entitled *A Platform for Change,* that was published in 2001. That report recommended a metro solution for South West Dublin. Why has all of this analysis been ignored?

In advance of the *Transport Strategy for the Greater Dublin Area 2022-2042*, the NTA carried out what the Metro South West Group have always considered a very poor quality feasibility study. In our submission to An Bord Pleanála, we listed several flaws in the NTA/Jacobs *Metro to Knocklyon Feasibility Study*[4]. Remarkably, all of these flaws had a similar effect – of reducing the estimated Transport User Benefits and the Benefit to Cost Ratio. None of our critique has been disputed by TII in their response. A key deficiency is that the NTA failed utterly to consult with any of the local interest groups, despite being fully aware of our desire to participate. It is clear from other witnesses here that, like the NTA, TII has also failed to engage with communities.

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[2] MSWG submission to An Bord Pleanala, Appendix, Chapters 3-4.
[3] Ibid. Paragraphs 4.14-4.16.
[4] Ibid. Chapter 5.

Notwithstanding the flaws in the *Feasibility Study*, however, TII has persisted with its plan to point the southern stump of *MetroLink* towards Charlemont, Manders Terrace and South East Dublin.

We believe that the flawed *Metro to Knocklyon Feasibility Study* has played an important role in diminishing the perceived importance of continuing *MetroLink* to South West Dublin in the eyes of TII. It would appear that the dismissal of a metro to South West Dublin has been central to the TII decision not to 'future proof' its plans. To address the indifferent approach of TII towards the possible continuation of *MetroLink* to South West Dublin, the Metro South West Group felt obliged to ask Professor Austin Smyth to carry out an audit of the *Metro to Knocklyon Feasibility Study*. Profesor Smyth has confirmed our concerns about serious flaws in the *Feasibility Study*. Professor Austin Smyth will now address the Bord.

PROFESSOR SMYTH SPEAKS HERE.

It is clear from Profesor Smyth's report that there is a need to revisit continuing *MetroLink* to South West Dublin before a decision is made by An Bord Pleanála to allow *MetroLink* to head towards Charlemont and Manders Terrace and thereby compromise the economic benefits of subsequently continuing *MetroLink* to South West Dublin.

As Professor Smyth has reported, the optimum route for serving South West Dublin – subject to further evaluation – would serve Portobello/Rathmines to Tallaght. However, TII proposes to send *MetroLink* to Manders Terrace.

Looking at this map, we say that any sensible metro route to the South West should serve Portobello/Rathmines. The red 'X' on the right is Manders Terrace, below which TII proposes to park the Tunnel Boring Machine. The red 'X' on the left is the clock on the Rathmines Town Hall, in the middle of Rathmines.

If *MetroLink* goes to Charlemont and the Tunnel Boring Machine is entombed under Manders Terrace, it may well be possible in a Phase 2 project to continue *MetroLink* to Terenure and beyond. **However, it would not be possible in the future to 'double back' and serve Portobello and Rathmines.**

The importance? Portobello and Rathmines are densely populated and they have many attractions, including third level colleges, schools, library, cinemas, swimming pool, etc. A feasibility study for the conversion of Cathal Brugha Barracks to housing is currently underway.

Duplicating the Luas Green line – by bringing *MetroLink* to Charlemont – would provide negligible Transport User Benefits, as residents in that area already have the Luas. Moreover, the Charlemont area has few trip attractors. However, bypassing Portobello/Rathmines (as is now proposed by TII) would reduce significantly the potential Transport User Benefits of continuing *MetroLink* to South West Dublin as a Phase 2 project.

Our submission explained how continuing *MetroLink* to Charlemont and entombing the Tunnel Boring Machine under Manders Terrace would deplete the benefits of the future continuation of *MetroLink* to South West Dublin[5]. TII has not disputed this analysis.

We wholly reject the contention that a Charlemont terminus keeps all the options for the south city open. Indeed, TII might explain to An Bord Pleanála how connectivity to Portobello, Rathmines or Harold's Cross can be achieved from Manders Terrace.

Now we move on to our second core proposition., which will be explained by Pauline.

[5] Ibid. Chapter 6.

2 *Our <u>second</u> core proposition:*

Once the continuation of *MetroLink* to Sandyford was shelved, TII should have evaluated <u>all</u> the feasible options for a south city terminus.

It has been argued by persons in their submissions to An Bord Pleanála that a city centre terminus should not be at Charlemont. Various alternative solutions have been proferred: terminate at O'Connell St North, Tara Street, St Stephen's Green East, St Stephen's Green West.

We believe all of these should have been examined in great detail along with the proposition of terminating at Charlemont, a place which is not in the city centre. We believe that the Aarhus Convention applies to this project, and that it requires the assessment of alternatives; this simply has not been done.

We would like to address one particular variant. In assessing the city centre, particular attention should have been given to the Metro North configuration for the South City terminus. Call this the Metro North Option.

Deputy Jim O'Callaghan stated, that the Metro North O'Connell Street station Option, located under O'Connell Bridge, had the significant advantage of having been previously approved by An Bord Pleanála; accordingly, it deserves – and did deserve prior to the application for a Railway Order – particular attention and scrutiny, as it would provide an entry and exit north and south of the quays, on Bachelors Walk and Aston Quay

The Metro North Business Case concluded that the interconnection with DART would involve a 'a 'short walk' of around 200m to the Tara Street DART station. However, this 'short walk' would require passengers to cross three busy streets, Westmoreland Street, D'Olier Street and Tara Street.

The following could be a solution. On exiting Tara Street DART station, there could be al METRO signage above an escalator – bringing passengers below street level, to a pedestrian tunnel leading directly to the *MetroLink* station under O'Connell Bridge. This 200m pedestrian tunnel could be located under Burgh Quay. If a 200m walk underground is considered to be too long, travellators could be installed. This pedestrian tunnel could also facilitate switching from both DART and *MetroLink* to the Luas Green Line on Westmoreland Street and vice versa.

From a passenger perspective, this type of pedestrian underground interconnection is comparable to many interconnections, to be seen in metro systems across Europe.

Furthermore, as proposed under the approved Metro North Scheme, *MetroLink* would continue to **St Stephens Green West,** where the station would be adjacent to the Green Luas stop. An Bord Pleanála has previously given its approval to both the Metro North station at St Stephens Green West and the route to it. The interconnection between *MetroLink* and the Green Luas stop would be very straightforward at St Stephens Green West. A short 'run off' beyond this *MetroLink* station for the trains would mark the end of the project – pending a

full review of the options for the south of Dublin, including continuing *MetroLink* to South West Dublin via Portobello/Rathmines.

Again, for passengers, this simple interface between ***MetroLink* and the Green Luas Line** would be far superior to the proposed interchange at Charlemont.

Benefits from a passenger perspective

We say that this Metro North Option has many benefits from a passenger perspective. The substitution of the previously approved and modified Metro North proposal would offer passengers the following six interchange benefits:

(i) A good interchange with the Luas Red Line on Abbey Street, with a 100m walk on the surface; this is currently sadly lacking in the present plan and is an obvious defect.
(ii) Good interchange with DART at Tara Street (c.200m uninterrupted walk underground).
(iii) Good interchanges with numerous buses along both quays and O'Connell Street - lacking in the current plan.
(iv) Good interchange with the Green Luas Line on St Stephens Green West.
(v) Good interchange with the Green Luas Line on Westmoreland Street and O'Connell Street.
(vi) Eliminate the cumbersome and convoluted proposed interchange with the Green Luas at Charlemont.

Other benefits

There are many other benefits from the Metro North Option:

(i) It eliminates the demolition of apartments etc. and other disruption adjacent to Tara Street.
(ii) It avoids the disruption and damage at Trinity College.
(iii) It avoids the disruption along the route from St Stephens Green to Manders Terrace, including around Charlemont.
(iv) Locating the *MetroLink* station at St Stephens Green West would facilitate its future integration with DART Underground.

Cost reductions

The additional **capital** cost of the proposed 200m pedestrian tunnel under Burgh Quay and a short escape shaft would be far outweighed by:

(i) Two fewer stations to be excavated, at Tara Street and Charlemont.
(ii) Saving on tunnelling, tracks etc. due to reducing the length of *MetroLink* by c. 1.2kms.
(iii) The proposed demolition of apartments adjacent to Tara Street, and subsequent compensation, is avoided as are all other landowner issues south of the Liffey.

Conclusion

This variant of the Metro North proposal would:

- Be much better for passengers,
- Be much less costly for the Exchequer,
- Entail less damage and disruption, and
- Ensure that the future extension of *MetroLink* towards South West Dublin is not compromised without proper evaluation.

Accordingly, this variant of the Metro North Option should have been considered and evaluated by TII and the results of this evaluation should have been presented to An Bord Pleanála.

I'll now hand you over to Brendan, who will speak about some other issues in our submission which have not been adequately addressed in the TII response.

3 *Other issues which have not been addressed adequately by TII's response*

We outline now two other issues of concern which are contained in our written submission to An Bord Pleanála and which have not been addressed adequately if at all by TII in their response:

1) The precise location of a station in St Stephens Green, and
2) The serious drawbacks with Charlemont.

The adequacy of St Stephens Green as an interchange

Our submission argued that locating a *MetroLink* station at Tara Street would not preclude having a final terminus at St Stephens Green West. We disputed the NTA assertion, which was made to the Oireachtas Committee on Transport, that:

> *"The curves involved in coming through Tara Street Station, which was a critical connection for us, and then getting down to Charlemont would not allow us to go to the other side of St. Stephen's Green"*

but without giving any measurement for this curvature[6]. In its submission to An Bord Pleanála, TII stated that:

> *"The eastern side of St. Stephen's Green was identified as the optimum location for the MetroLink station as it would best serve passenger demand from the retail, commercial and cultural trip attractors in the vicinity. Further, the alignment from Tara Station (where MetroLink interchanges with DART and Irish Rail services) towards its terminus at Charlemont imposes turning constraints on the tunnel boring machine (TBM) that favour the eastern side of St. Stephen's Green as an appropriate location."*[7]

But, TII has continued to avoid providing their estimate for the radius of this curvature from Tara St to St Stephens Green West.

In our submission, we quoted an eminent railway engineer who estimated that the radius of curvature from the proposed *MetroLink* station at Tara Street to a possible location on the west side of St Stephens Green would be approximately 500m, which would be completely unremarkable as many metro systems around the world have stretches of tunnel with a radius of curvature much smaller than this. The BART in San Francisco and the Central Line of the London Underground (between White City and Shepherds Bush) are just two examples[8].

In its response to our submission, TII still has not given An Bord Pleanála its estimate for this radius of curvature.

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[6] Oireachtas Committee of Transport, 4 May 2022.
[7] TII submission to An Bord Pleanála, Paragraph 2.2.2, Appendix A7.5
[8] MSWG submission to An Bord Pleanala, Appendix, Paragraphs 7.1-7.4.

The drawback of Charlemont as an interchange for passengers

Our submission to An Bord Pleanála went into great detail regarding the unsuitability of Charlemont. In our view the response of TII is entirely inadequate. In the short time available to us here, we will deal with only one aspect: the TII proposal that 30 North-bound Luas trams will arrive in Charlemont, but only 24 will proceed to St Stephens Green, due to a lack of road space in Adelaide Road and Harcourt St.

In our submission, we queried the necessity for this arrangement and pointed out that TII had supplied insufficient detail as to how this arrangement could operate safely, if at all. We set out hypothetical ways in which the turn back of 6 trams per hour could be implemented[9]. In their response, TII still has not provided any detail as to how or where the turn back is proposed to occur. As well as practical problems with this proposal, there are very serious safety issues, which are set out in our submission. For example, if 6 in-bound trams per hour simply reverse southwards from Charlemont, they will be departing from the wrong platform. Many south-bound passengers transferring from *MetroLink* will surely seek to cross the Luas tracks to access these empty trams. Similarly, many south-bound Luas passengers on crowded trams may elect to leave the crowded tram at Charlemont and transfer to a reversing and empty south-bound tram. **These are highly dangerous prospects**.

Several other contributors to this oral hearing will deal with the TII response to other shortcomings in the its proposal to bring *MetroLink* to Charlemont. We will not detain you Inspector, save to say that we support the analysis of these contributors.

I now hand you back to Seán, who will speak about the possible decisions which are open to An Bord Pleanála.

[9] Ibid. Paragraphs 7.22-7.23.

4 *Different decisions which are open to An Bord Pleanála*

We would finally like to address what you, the Bord, can consider. There are many different decisions which are open to An Bord Pleanála. Either grant or refuse a Railway Order for the *MetroLink* proposal as submitted; or alternatively, approve the project with modifications. We are absolutely clear that all of this project should proceed largely as proposed on the North side of Dublin. Therefore, we believe that An Bord Pleanála should neither approve nor reject the *MetroLink* proposal in its entirety. Rather, it should approve the project with modifications to the southern end of *MetroLink*.

Three possible decisions on modifying the southern end of the *MetroLink* proposal are outlined as a hierarchy, starting with the most flexible and finishing with the least flexible. All of these would enable early Government approval to commence the project at Estuary.

I. Grant a Railway Order as far south as Parnell Square East. In the meantime, TII could then review all the options for the southern end of *MetroLink*, including reaping the benefits of incorporating most of the Metro North Option, which we have alluded to earlier. Continuing to Portobello/Rathmines or Charlemont could also be examined.

II. Grant a Railway Order as far south as Tara St. Similarly, TII could then review all the options from Tara St., including terminating at Tara St., and either St Stephens Green, West or East. Continuing to Portobello/Rathmines or Charlemont could also be examined.

III. Grant a Railway Order as far south as St. Stephens Green East. In the meantime, TII could then review all the options from St Stephens Green East, including terminating at St Stephens Green East, Portobello/Rathmines or Charlemont.

Thank you, Inspector, for your attention.

Annex

POPULATION BETWEEN THE RED AND GREEN LUAS LINES 2022 CENSUS

The following electoral divisions are wholly or predominantly between the Green Luas and Red Luas lines

In Dublin City (132,713)

Crumlin A to F 19,287

Kimmage A to E 15,207

Merchants Quay A to F 18,460

Rathfarnham 5,768

Rathmines East C 3,484

Rathmines West A to F 22,667

Royal Exchange A and B 7,276

St Kevins 5,732

Terenure A to D 10,391

Ushers B to E 10,221

Walkinstown A to C 7,442

Wood Quay A and B 6,778

In South Dublin (154,106)

Ballyboden 5,246

Bohernabreena 5,672

Edmondstown 5,685

Firhouse Village/Knocklyon/Ballycullen 26,286

Rathfarnham 17,508

Tallaght (all divisions except Fetter cairn and Belgard) 68,052

Templeogue 13,147

Terenure 12,510

In Rathdown (67,886)

Ballinteer 15,659

Churchtown 8,515

Dundrum 19,171

Glencullen 23,596

Tibradden 945

Ballinteer consists of Broadford, Ludford, Marley, Meadowbroads, Meadowmount and Woodpark divisions

Churchtown consists of Castle, Landscape, Nutgrove and Orwell divisions. Other divisions split by Luas not included

Dundrum consists of Balally, Sandyford, Sweetmount divisions. Other divisions not included

Rathfarnham consists of Ballyroan, Butterfield, Hermitage, St Enda's and Village divisions.

Tallaght consists of Avonbeg, Glenview, Jobstown, Killinardan, Kilnamanagh, Kiltipper, Kingswood, Millbrook, Oldbawn, Springfield and Tymon divisions. Divisions largely to the north of Luas Red are Belgard (1.635) and Fettercairn (11,335) not included in these figures

Templeogue consists of Cypress, Limekiln, Orwell , Osprey and Village divisions

Terenure consists of Cherryfield, Greentrees, Kimmage Manor and St James divisions

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Review and Audit of the NTA/Jacobs Metro to Knocklyon Feasibility Study (2021)

in conjunction with

MetroLink: Estuary through Dublin Airport and City Centre to Charlemont Scheme PBC

DRAFT*

Report

prepared by

Professor Austin Smyth

Transport Analysis & Advocacy Ltd

on behalf of

Metro South West Group (MSWG)

March 2024

Review of the NTA/Jacobs Metro to Knocklyon Feasibility Study (2021) in conjunction with MetroLink: Estuary through Dublin Airport and City Centre to Charlemont Scheme PBC

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'Extract from *Jacobs Report....eg* 'The study was undertaken to .....'

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Re. section of Jacobs Report referred to

Quality Assurance concern re Jacobs Report .....

Preface

Transport Analysis & Advocacy Ltd (Registered Office: 631 LISBURN ROAD, 631 LISBURN ROAD BT9 7GT) has been instructed by its client **Metro South West Group (MSWG)** to make this observation on its behalf. We have been duly authorised by MSWG to make this submission. *We have received certain factual information from MSWG related to the corridor and services on it and have been instructed that we can rely on that information without the need for full verification.*

Report Author: Professor Austin Smyth

Professor Austin Smyth has forty years experience in transport consultancy and research worldwide. He has acted as lead economist/project manager in securing in the region of €2,000 million investment in transport infrastructure in the UK, the Republic of Ireland and internationally.

Austin has experience of working for a variety of public and private sector clients in various EU States, Russia and Eastern Europe as well as North America, the Middle East and Thailand. He has advised Governments, Devolved Administrations and Local Authorities, as well as public transport operators on urban rail systems and intercity rail systems in the UK, the Republic of Ireland, USA, The Middle East, Russia and Ireland. Professor Smyth has been at the forefront for developing both bus and rail based systems in the UK, Ireland and internationally. He has specialised in conventional bus systems, BRT and LRT systems.

Professor Smyth's special fields of competence and technical experience includes: The economics and planning of public transport systems with particular reference to bus and rail projects and systems; economic appraisal techniques; multi criteria analysis, cost benefit analysis and other appraisal procedures; analytical issues relating to impact assessments, health and safety, and other policy initiatives; the contribution of innovative funding including PPP/PFI and bonds to infrastructure development; adviser on transport modelling to a variety of UK government agencies and public/private sector clients in the UK, mainland Europe and the United States ; He is an expert on discrete choice modelling particularly employing stated preference techniques; econometric techniques, land use/spatial allocation modelling procedures.

He has been an Examining Inspector (Planning Inspectorate England and Wales) (formerly Registered Commissioner to the UK's Infrastructure Planning Commission (IPC) 2010 to 2018. He has represented a number of bodies as Expert Witness at hearings held by the Civil Aviation Authority (CAA) and by the PAC in relation to Public Inquiries into Major Transport Strategies.

Report Author: Edward Humphreys

Edward Humphreys has over 45 years experience in transport policy, economics and forecasting as a consultant to governments, state agencies, private corporations and international institutions including the EU. He has particular experience in strategy development, policy, forecasting and project appraisal. He has managed many assignments in rail passenger, rail freight and in light rail/Metros. These include rail strategy development, electrification studies, a wide range of rail freight forecasting and appraisals, and urban rail development work in several countries including Ireland. In the early 1990s he was an advisor to the House of Commons Transport Select Committee on light rail and Channel Tunnel matters.

He has very extensive experience in transport network strategy and rail policy development and in appraisal at all levels. He led the Hong Kong Rail Development Study, **the Dublin Suburban Rail Strategy**, the Singapore Mass Transit Strategy development and others. The key to such studies is the careful specification of objectives in their wider policy context and the development of MCA-based appraisal with stakeholder involvement. His work in **the Republic of Ireland** includes **the Dublin Suburban Strategy** including **the feasibility and forecasting for DART rail tunnel options.** He led the "Case for Rail" – a high profile report for the Strategic Rail Authority on the benefits of rail for the GB economy and directed major work for the SRA on the East Coast Main Line Route Strategy, rail freight strategy work for Transport for London, on coal and oil markets for rail and on cost allocation and delay audits on rail freight for a major operator.

1 Introduction

1.1. The National Transport Authority requested Jacobs consultancy to undertake a feasibility study for a possible Metro line along the city centre to Knocklyon corridor.

1.2. This study was to include an assessment of an indicative route(s), including indicative station locations, and investigate its feasibility from a technical, environmental, transport planning, demand and economic point of view.

1.3. This study did not provide for identification of a preferred route for a possible Metro line on the corridor, nor the suggestion of the preferred design on any section of the alignment considered. However, should the proposed Metro be regarded feasible and worthy of advancement, a further route option selection and design process would be required to advance specific proposals.

1.4. This feasibility study was however charged with identifying a workable option within the study corridor based on the proposal put forward by the Metro South West Group during the public consultation on both MetroLink and BusConnects. It was envisaged a Metro would serve Harold's Cross / Rathmines, Terenure, Rathfarnham, and Knocklyon.

1.5. The overall goal of the current MetroLink scheme going through the Oral Hearings stage of the planning process is 'to provide a safe, high frequency, high capacity, fast, efficient and sustainable public transport service connecting swords, Dublin Airport, Irish Rail, DART, Luas, Dublin Bus and the city centre'.

1.6. The stated objectives are

- Cater for the growing travel demand along the corridor;
- Reduction of urban congestion;
- Facilitate connection to attractor nodes;
- Provision of interchanges and 'Park and Ride' improving transport integration;
- Attractive and accessible to all users;
- Support environmental sustainability;
- Support economic development; and,
- Be segregated from other transport modes for optimal service.

1.7. During the course of public consultation on the full MetroLink proposal from Swords to Sandyford, an alternative alignment on the southside of Dublin was proposed for consideration. It would serve Harold's Cross/Rathmines, Terenure, Rathfarnham, and Knocklyon.

1.8. The rationale for this proposal is that it would serve a sector of the Dublin Metropolitan Area which would serve a sector of the Dublin Metropolitan Area which currently suffers from a significant public transport deficit; it would cause less disruption to transport services (Luas Green line) on the southside during its prospective reconstruction as part of the Metrolink scheme; and it would have less permanent adverse impacts on the urban environment and on accessibility for residents and businesses than the upgrade of the Luas Green Line.

1.9. Arising from concerns felt by the **Metro South West Group (MSWG)** Transport Analysis & Advocacy has been requested to prepare a report on its behalf of MSWG setting out the findings of an Audit of the Jacobs Metro to Knocklyon Feasibility Study report and other matters that might arise during the course of the review and table a series of recommendations for the MSWG to present to An Bord Pleanála in its consideration of: NA29N.314724 MetroLink: Estuary through Swords, Dublin Airport, Ballymun, Glasnevin and City Centre to Charlemont, Co. Dublin.

Conclusion

A feasibility study entitled Metro to Knocklyon was prepared by Jacobs for NTA in 2021. The rationale behind this is to address a sector of the Dublin Metropolitan Area which currently suffers from a significant public transport deficit This is an audit of that feasibility study based on concerns felt by Metro South West Group (MSWG).

2 Proposal Context

2.1 South West Dublin suffers from major deficits in public transport and road infrastructure. It has been argued BusConnects will fall far short from providing sufficient public transport in South West Dublin. Having carried out extensive analysis, the Metro South West Group (MSWG) has concluded that MetroLink, in a Phase 2, should continue to South West Dublin to serve the needs of this population.

2.2 Following analysis and campaigning by the Metro South West Group (MSWG), and prior to the last general election, all of the political parties promised that the feasibility of continuing MetroLink to South West Dublin would be evaluated. In response, the NTA, together with Jacobs produced the **Metro to Knocklyon Feasibility Study, 2021**. This Report rejected the continuation of MetroLink to South West Dublin.

2.3 Under pressure from public representatives and the Minister for Transport, the NTA has agreed to revisit the issue of where MetroLink should go in South Dublin.....but only in towards the end of this decade. At that point however, MSWG contends many important transport decisions will

have been made and major projects will be underway or completed. Therefore an indicative estimate of the costs and benefits of continuing MetroLink to Tallaght is required now.

2.4 The MSWG has raised its concerns with An Bord Pleánála, in relation to Case reference: NA29N.314724 MetroLink: Estuary through Swords, Dublin Airport, Ballymun, Glasnevin and City Centre to Charlemont, Co. Dublin, currently before the board.

2.5 The MSWG submission wholly relates to that portion of the proposed Metro Link beyond St Stephen's Green.

2.6 The MSWG however, has requested An Bord Pleanala should defer the authorisation of the section of MetroLink beyond the St Stephen's Green, other than to create a turning section similar in length to that which is currently proposed beneath Manders Terrace.

2.7 The MSWG contend decisions made now will affect the provision of necessary rail infrastructure, for South West Dublin for generations to come. The specific reasons cited for requesting this deferment include:

- Limitations of Charlemont terminus for radial extensions to south city and the consequences for south west Dublin.
- Failure of the NTA to consider an alternative routing of the terminus, notably towards Rathmines, as outlined by MSWG.
- Potential Environmental/Climate Action benefits of an alternative extension route.
- An inadequate plan for the supply of Public Transport to SW Dublin and the critical need, at this juncture, for correct decisions to be made in relation to the MetroLink trajectory into South Dublin in the future.
- Many practicalities of linking MetroLink with the Luas Green Line at Charlemont have not been addressed.
- Breach of Aarhus Convention.
- Extending MetroLink beyond St. Stephens Green to Charlemont and Manders Terrace is unnecessary and premature.

2.8 Moreover, the MSWG argues the NTA/Jacobs Metro to Knocklyon Feasibility Study Report contains a number of limitations, including:

- *The Study was not independent;*
- *Continuing MetroLink directly from St Stephens Green to South West Dublin was excluded from the analysis;*
- *Continuing MetroLink to Tallaght was excluded from the analysis;*
- *The buffers around stations assumes that only walkers would use the metro;*
- *There was no provision for Park and Ride, Cycle and Ride nor feeder buses;*
- *There was no provision for capturing traffic from the N81 and the M50;*
- *Direct use should have been made of POWSCAR data;*

- *Environmental benefits were excluded from the analysis.*

2.9 The MSWG goes on to contend *BusConnects* and associated infrastructure works are inadequate in providing sufficient public transport in South West Dublin. On the basis of this MSWG claims it is the interests of:

- The general public/taxpayers;
- Residents and businesses of South West Dublin;
- Residents and businesses along the proposed *BusConnects* corridors;
- Visitors to South West Dublin;

that weaknesses in the NTA/Jacobs Study are identified and addressed in the near term.

Conclusion

South West Dublin suffers from major deficits in public transport and road infrastructure. The feasibility study for the area was promised in the 2020 general election. It is the case of MSWG that the decision on Metrolink impacts on the South West Dublin deficit. MSWG has made a submission wholly related to that portion of the proposed Metrolink beyond St Stephen's Green and is saying that a decision should be deferred on that section pending completion of a quality assured transparently independent feasibility study of a Metro serving South West Dublin that extends to Tallaght. This is required to be wholly consistent with the methodology, data and underlying economic demographic and development assumptions underpinning the Metrolink Estuary to Charlemont route's business case.

3 Terms of Reference for Audit and Review

The NTA has agreed to revisit the issue of where MetroLink should go in South Dublin some 4 years from now. MSWG argues that an indicative estimate of the costs and benefits of continuing MetroLink to Tallaght is required now. Therefore the terms of reference for this commission encompass reviews of:

1. The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021.
2. The benefit-cost appraisal of the MetroLink project, from Estuary to Manders Terrace in Ranelagh: MetroLink: Preliminary Business Case, Appendix I
3. The Transport Strategy for the Greater Dublin Area 2022-2042 and the associated Strategy Development and Modelling Report, November 2021 insofar as they relate to the supply and demand for public transport in south west Dublin as well as;
4. the MSWG submission to An Bord Pleanála and associated documents .

The original terms of reference also call for;

(i) an indicative estimate of the impact on costs and benefits at (2) if MetroLink proceeded from Tara Street via a station in (probably the south west corner of) St Stephens Green to a new station in the Portobello area with the Tunnel Boring Machine (TBM) being parked under Cathal Brugha Barracks in Rathmines.

(ii) using the unit metrics at (1), an indicative estimate of the costs and benefits of continuing MetroLink as a 'Phase 2 project' from Cathal Brugha Barracks to Tallaght, to include Park and Ride and Cycle and Ride - at locations such as Spawell (or Knocklyon) and Dodder Valley Park - and feeder buses as well as assessment of environmental benefits.

(iii) using the unit metrics at (1), an indicative estimate of the costs and benefits of joining Tallaght to Manders Terrace as a 'stand-alone metro project' subsequent to the TII MetroLink project, to include Park and Ride and Cycle and Ride - at locations such as Spawell (or Knocklyon) and Dodder Valley Park - and feeder buses as well as assessment of environmental benefits.

MSWG on behalf of TAA requested a wide range of detailed information on two successive occasions underpinning the Jacobs report (Metrolink to Knocklyon Feasibility Study Report, Jacobs for NTA , July 2021). While MSWG did receive a reply to the first request and was provided with some information this response provided insufficient information on which to undertake the full technical assessment on its own.

In the light of the information sought by MSWG from the NTA and not being made available to it and the requirement to focus the available resources to an in depth investigation of the Metrolink Preliminary Business Case as a source of data to benchmark the Jacobs Metro to Knocklyon Feasibility Study report. The issues referred to are not dealt with explicitly in this report. However, items (ii) and (iii) are subsumed within this report under an expanded investigation of alternatives to serve Tallaght. **The issue of a direct link between Rathmines (and beyond) to St Stephen's Green is addressed in a separate communication to this document.**

Conclusion

MSWG say that an indicative estimate of the costs and benefits of continuing Metrolink to Tallaght is required now and has set a terms of reference for TAA.

4 Study Design: Evidence and Data Sources

4.1 In developing a study design and work programme to address these objectives TAA has undertaken a preliminary trawl of potentially relevant information and data sources, including the documents cited in the terms of reference at 3 above.

4.2 Our initial view on these sources is that while sources 2 and 3 appear to meet the broad requirements to address the requirements of the terms of reference source 1, **The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021** is inadequate to meet the requirements for (ii) and (iii) and also poses potential inconsistencies with discharging (i).

4.3 Our initial view of the **NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021** is that it is somewhat superficial, providing little more than a summary of selected aspects of what would be expected from a full feasibility study. Preliminary observations include:

- potentially poor choices for locations of stations;
- ·a focus exclusively on boardings rather than trips;
- an absence of detailed mode split and mode shift data and analysis;
- no quantification of off-peak travel;
- a lack of detail and disaggregated information and data related to the economic costs and benefits; and
- no apparent analysis of through running from St Stephens Green.

To undertake the substantial work required to meet adequately the terms of reference, that could result in an altered route, revised benefit to cost ratios and other performance indicators for a Metro scheme it was considered necessary to gain access to the data and analysis underlying the NTA/Jacobs Feasibility Report, **as supplied to MSWG.**

Conclusion

TAA has concluded that the "Knocklyon" feasibility study report that has not been quality assured, is both inadequate to conduct a proper review and is somewhat superficial, providing little more than a summary of selected aspects of what would be expected from a full feasibility study.

5 Study Design: Methodological Overview

5.1 It was intended the main programme of work would include in-depth reviews of **the NTA/Jacobs Feasibility Report**, including crucially the detailed technical and working reports supporting the summary case set out in the NTA/Jacobs Feasibility Report. It was also envisaged these reviews would encompass:

- The approach to economic appraisal, the techniques, data and assumptions employed in appraising the case for a metro scheme to serve South West Dublin, including consistency with the approach applied to the economic appraisal of the MetroLink project, (Estuary to Manders Terrace);

- The need for a metro scheme involving consideration of;

- ➢ public transport adequacy and quality of service in the corridor relative to other corridors in the GDA;
- ➢ robustness of corridor alignment choice;
- ➢ alternatives to the scheme assessed, encompassing route and mode alternatives, demand management options, and technological advances;
- ➢ the economic case for a metro scheme for the South West corridor compared to similar schemes planned or in process of delivery to serve other corridors. This will include consistency with Estuary – Charlemont Metrolink estimates for;
  - costs
    - ➢ capital
    - ➢ O&M costs
  - demand projections
- ➢ benefits including wider economic benefits and environmental impacts
- ➢ consistency with evidence from review of industry and literature re above.

- Consideration of scheme impact assessment and transport and traffic modelling tools, including the scheme transport modelling system employed; these could include:

  - ➢ The Regional Modelling System, Local Area Models, Micro-Simulation Model, Junction Design Models.
  - ➢ Data Inputs including data collection and collation, establishment of baseline conditions, bus journey times, traffic count data, population related indicators; and
  - ➢ Model Calibration and Validation.

In particular it was intended we would review elements of the travel demand modelling methodology, its assumptions and outputs as these relate to trips by rail, bus, private car or cycling as well as the timeliness of the data employed in generating forecasts. We would consider the appropriateness of the travel demand models applied to generating the corridor travel demand forecasts for 'Do Nothing', 'Do Minimum' and 'Do Something' Scenarios reflecting implementation of the corridor infrastructure.

To realise the objectives of that phase of the provisions of the agreement between TAA and MSWG, it was deemed necessary to initiate a preliminary examination of a limited set of 'relevant' documents collated by the MSWG and Professor Smyth and a series of site visits to the corridor and Jacobs proposed station locations and sites. This has informed refinement of the design of the main work programme.

5.2 The report is intended to provide conclusions on:

- The overall efficacy of the scheme.
- The impacts for selected stakeholders including residents, public transport users and car users, and wider economic benefits to society.

The report will also table observations on alternatives to the existing NTA Metro scheme should the investigation highlight uncertainties linked to the current proposal and/or reveal opportunities to investigate options that might yield overall improved net levels of economic outcomes.

5.3 The programme of work has been informed by access to a range of published sources including:

- Department of Public Expenditure and Reform, Major Projects Advisory Group Review of the NTA's Metro Preliminary Business Case.
- EU Joint Assistance to Support Programmes for European Regions Guidance Note 3 on the Metro Preliminary Business Case.
- National Transport Authority: Greater Dublin Area Transport Strategy 2016 – 2035
- National Transport Authority: Metro Cover Note to Preliminary Business Case
- National Transport Authority: Greater Dublin Area Transport Strategy 2022-2042

It also draws on other evidence relating to the projected travel by rail, light rail, bus, cycle trips and car trips and the literature relating to transport and traffic forecasting models as appropriate.

Conclusion

It was the intention that TAA's review of the feasibility study would include a wide range of tasks, including review of the scheme options, identification of alternatives to the scheme options set out in the report, costings, forecasts of travel demand and the economic appraisal. The review is informed by the relevant government strategies.

6 The Need for the Proposed Scheme

Overview of the Context and Transport Need for the Proposed Scheme

6.1 **'Appendix A. Planning and Policy Background'** that is set out in the NTA/ Jacobs Feasibility Study sets out the context and transport need for Metrolink between the city centre and Dublin Airport/North Dublin. It provides an overview of the relevant National, Regional and Local land-use and transport planning policy as the context for the Metro. Appendix A sets these out at a progressively finer level of detail from the national level down to a local level.

6.2 It is claimed Metro is supported by a wide ranging series of National land-use and transport planning policy and plans, including:

- Smarter Travel – A Sustainable Transport Future (DoT 2009),
- Building on Recovery: Infrastructure and Capital Investment 2016-2021; this Capital Plan presents the Government's framework for infrastructure in Ireland over the period 2016-2021 and acknowledges that 'the single largest project will be a new metro link in Dublin';
- The Draft National Planning Framework ('Ireland 2040 Our Plan') released in September 2017, a long term, 20-year National Plan which seeks to provide a 'spatial expression of government policy' and provide 'a decision-making framework from which other plans will follow – such as Regional Plans, City and County Development Plans'.
- The National Development Plan (2018 – 2027) that sets out the investment priorities that will underpin the successful implementation of the new National Planning Framework (NPF).
- The 'Strategic Investment Framework for Land Transport' (DTTaS 2015); • The 'Climate Action and Low Carbon Development Act 2015'.
- The 'National Mitigation Plan' (DCCAE 2017); and
- The 'Climate Action Plan' (DCCAE 2019).

6.3 At a regional planning level, it is argued Metro is supported by the following land-use and transport planning policy and plans:

- GDA Regional Planning Guidelines (RPGs) 2010–2022 - The Regional Planning Guidelines (RPGs) for the GDA 2010–2022 is a policy document which "aims to direct the future growth of the Greater Dublin Area over the medium to long term and works to implement the strategic planning framework set out in the National Spatial Strategy (NSS) published in 2002".
- The RPGs specifically acknowledge the importance of Metro North in serving the airport through the provision of "a high capacity, high speed connection from the airport to the city centre, feeding local, regional and national public transport hubs, improving the connectivity and operation of the airport"; as well as a role "providing opportunities to develop new integrated economic development areas or regenerate existing sites and to broaden sectoral business opportunities at strategic locations";
- The Greater Dublin Area Transport Strategy (2016-2035), when the Feasibility Study was produced then under review identified Metro as a vital component of the overall, integrated public transport network for Dublin; The GDA Transport Strategy and the RPGs are required under legislation to be consistent with each other.

6.4 At a local planning level, the planning context for Metro is set out within the Dublin City Council Development Plan (2016–2022) and the South Dublin County Council Development Plan (2016–2022). The NTA's Greater Dublin Area Transport Strategy (2016-2035) also provides context for Metro and the Ballycullen-Oldcourt Local Area Plan (2014) is relevant to a portion of the proposed route.

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021 Appendix A. Planning and Policy Background

Observations and Commentary

While the Jacobs Metro to Knocklyon Feasibility Study does not set out explicitly a test to determine the need for a Metro scheme it is important to consider the arguments for it in the context of current and near term background demographic, economic and planning conditions as well as the potential of alternatives.

Both the previous and updated GDA Transport Strategy commit to provide continuous bus priority, as far as is practicable, along the core bus routes, with the objective of supporting a more efficient and reliable bus service with lower journey times, increasing the attractiveness of public transport in these areas and facilitating a shift to more sustainable modes of transport.

The Proposed BusConnects Scheme connecting Templeogue / Rathfarnham to City Centre serves a significant public transport demand between these locations. There are a number of high frequency public bus services along the routes to be improved by the Proposed Scheme.

The submission made by the NTA to An Bord Pleanála in support of the BusConnects network revamp for the Templeogue/Rathfarnham – Dublin City Centre Corridor, one of two that could be served by a Metro, argued the existing public transport system does not currently have sufficient capacity to cater for large volumes of additional users. It goes on to state 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.

The projected growth forecasts for bus travel in the Templeogue/Rathfarnham – Dublin City Centre Corridor, with this corridor up 123% in the AM Peak Hour in the number of people travelling by bus, for the 'BusConnects' opening year' 2028 are remarkable, particularly when it is noted these are in response solely to time savings/service punctuality improvements attributable to the Core Bus Corridor Infrastructure Works (the CBC Infrastructure Works) in the Templeogue/Rathfarnham City Centre corridor. The 123% increase excludes the impact of any other main elements of the BusConnects Dublin programme as they apply to the Templeogue/Rathfarnham City Centre corridor.

We are unaware of any evidence of an outturn increase in bus patronage in Ireland or the United Kingdom attributable to any similar programme of infrastructure works to separate buses and cyclists from other traffic, developing interchange hubs, and improving pedestrian facilities around bus stops. Moreover, the projections also point to a 74% increase in TOTAL AM peak hour trips in

the defined corridor attributable totally to the bus and cycle infrastructure works and associated traffic management measures.

For this corridor however, illustrative timetables for the A spine routes under the BusConnects network revamp offer little change overall in the public transport carrying capacity in the Templeogue/Rathfarnham – Dublin City Centre Corridor compared to existing arrangements.

The projected 30% scale of the reduction in private vehicle use projected by NTA's consultants can therefore be interpreted as 'effectively constraining people from making journeys by car and requiring them to use other modes, in this corridor. The EIAR also acknowledges the Proposed Scheme will likely lead to redistribution of trips in certain locations in the corridor.

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 *(Environmental Impact Assessment Report (EIAR) Main Report Volume 2 of 4 Chapter 3 Page 8).*

A submission on behalf of **Terenure & Templeogue Sustainable Community Association CLG** demonstrates the operational capacity of buses in this corridor will be insufficient, not withstanding the BusConnects Core Bus Corridor Infrastructure Works (the CBC Infrastructure Works) in the Templeogue/Rathfarnham City Centre corridor, to cope with the projected demand under real world conditions.

The Environmental Impact Assessment Directive requires consideration of reasonable alternatives. Article 5(1)(d) of Directive 2011/92/EU as amended by Directive 2014/52/EU ("the EIA Directive") requires that an 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'. Annex IV to the EIA Directive, provides that the EIA 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 for selecting the chosen option, including a comparison of the environmental effects".

What could be the alternatives? – See below

What could be the alternatives?

The Transport Strategy for the Greater Dublin Area (GDA) Transport Strategy 2016 – 2035 (replaced by the (GDA) Transport Strategy 2022-2042) built on the 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 Luas studies published in 2008 as well as analysis of a 2011 Draft Transport Strategy.

It argues bus-based transport is the appropriate public transport mode for passenger demand levels of up to about 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.

The development of the 2016 – 2035 GDA Transport Strategy considered the likely public transport passenger demand levels across the region using the NTA's transport model. That consideration also took into account various other studies, including an investigation into a potential light rail scheme within the area of the Templeogue/Rathfarnham to City Centre Core Bus Corridor Scheme. Projected passenger flows however, were within the capacity of bus transport and did not reach the threshold for provision of higher capacity rail solutions.

Nevertheless the Environmental Impact Assessment Report (EIAR) Main Report Volume 2 of 4 Chapter 3 Page 8) submitted in support of the Templeogue/Rathfarnham to City Centre Core Bus Corridor Scheme did consider the case for Bus Rapid Transit (BRT), Light Rail, Metro and Heavy Rail alternatives to the proposed scheme.

Observations, Commentary and Issues

The EIAR tabled the claim bus-based transport is the appropriate public transport mode for passenger demand levels of up to about 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. It also noted in developing the 2016 – 2035 GDA Transport Strategy projected demand levels provided the basis for choice of modes. While the evidence from an investigation into a potential light rail scheme within this corridor suggested numbers for which Light Rail Transit (LRT) could be appropriate projected passenger flows were also within the capacity of bus transport and LRT was rejected.

TAA in its report on behalf of **Terenure & Templeogue Sustainable Community Association CLG** expressed the opinion the decision to reject both BRT and LRT was premature and certain objections to BRT for instance are not sustainable based on actual experience of its implementation and operational performance in other locations.

Nevertheless, the constraints of the highway geometry and capacity of the highways in South and South West Dublin point to the potential of a light rail system such as LUAS not being fully realisable for the same reason the absence of any entirely separate track alignment from the highway network. **It is in this context assessing the potential for extending Metrolink to serve South West Dublin seems both logical and realistic.**

Key Features of the Alternatives and their Potential Application to the Templeogue / Rathfarnham to City Centre BusConnects South West Corridor

Selected Extracts from *(Environmental Impact Assessment Report (EIAR) Main Report Volume 2 of 4 Chapter 3 Page 8).* This review draws substantially on the content of Chapter 3 To facilitate cross referencing to the Jacobs Report EIAR the section numbering employed in the EIAR is retained from Chapter 3 of the EIAR.

3.2.4 Bus Rapid Transit (BRT) Alternative

Bus Rapid Transit (BRT) has various manifestations worldwide. Definitions of BRT range from a Quality Bus Corridor (QBC) to 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, one of which was the Clongriffin to Tallaght. Prior to the completion of these studies, the prior 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 prior 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.

3.2.5 Light Rail Alternative

It was concluded that a bus-based transport system would be the proposed public transport solution in the corridor of the Proposed Scheme. It was considered that there would be insufficient demand to justify the provision of an additional light rail alternative above what is proposed above, particularly given the low to medium density nature of development in this corridor. According to the Environmental Impact Assessment Report (EIAR) submitted in support of the Templeogue/Rathfarnham to City Centre Core Bus Corridor Scheme a light rail option compared to the Core Bus Corridor proposal would be more impactful in terms of construction impacts.

3.2.6 Metro Alternative

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. The prior GDA Transport Strategy identified that a metro solution would not be economically justified within the area covered by this corridor. According to the Environmental Impact Assessment Report (EIAR)

submitted in support of the Templeogue/Rathfarnham to City Centre Core Bus Corridor Scheme environmentally the metro option compared to the Core Bus Corridor proposal would be more impactful in terms of construction impacts, including more land take and potentially involve demolition of buildings at pinch-points.

3.2.7 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.

.....The prior GDA Transport Strategy did not consider that a new heavy rail solution would be required along this corridor and would not be economically justifiable.....

Conclusion

The "Knocklyon" feasibility study sets out the context of a possible need for metro in south west Dublin but not explicitly. It sets out the hierarchy of planning policy documents from national to local documents. These however largely conclude that buses are the solution for the area and dismisses metro, BRT and light rail. TAA believe that the dismissal of the other alternatives including metro in many of these were not adequately assessed.

7 Proposed Scheme: Outline description and station options

This is an extract from the Executive Summary of The Jacobs Metro to Knocklyon Feasibility Study Report dated 16th July 2021 01I 1 published by the National Transport Authority as TBF 032.

'Executive Summary

The study was undertaken to consider the feasibility and suitability of a Metro system for serving the transport demand along the corridor from the city centre to Knocklyon in the south-west of the county.....'

The first task set out in the Jacobs Metro to Knocklyon Feasibility Study Report Executive Summary identifies

'potential stop locations through a Multi Criteria Analysis' *to form* 'potential Metro Alignments which are considered broadly representative of the range of potential Metro options for serving the transport corridor from Central Dublin to Knocklyon via Rathmines and Terenure.

Both alignments share an origin point at Ballycullen in the south, run northbound through the southern suburbs of Terenure and Rathmines before continuing northbound towards the city centre, a higher employment area.

The first (Charlemont alignment) then continues to back west to integrate with MetroLink at Charlemont. The second (St. Stephen's Green link) continues north from Rathmines to link up with the current Metrolink alignment at an interchange point.

Prior to the demand forecasting and economic appraisal, a comparative Multi Criteria Analysis to identify indicative stop locations was undertaken against the objectives.'

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Executive Summary

Observations, Commentary and Issues

The Jacobs Metro to Knocklyon Feasibility Study Report indicates a Multi Criteria Analysis (MCA) was applied to identify potential stop (station) locations. Stop (station) location options were to be identified and preferred locations selected on the basis of an MCA.

In this section of this submission we review the process by which stop (station) location options were identified and preferred locations selected to ensure consistency of the methodology set out with what was implemented and reported in the Jacobs Feasibility Study Report by reference to Sections 2 and 3 , and Appendix B and Appendix C of the report.

Chapter 2. Definition / Identification of the study area / corridor

2.1 Overview of Proposed Route Options

On the basis of selecting preliminary choices for potential station locations and implied sections of tunnel linking these 'route options were put forward and subsequently developed further for a feasibility study. While both route alignment options have a common origin at Knocklyon, their linkage to the city centre differs. Option A provides through running at Charlemont and continuing on the MetroLink alignment. Option B provides for a linked option to St. Stephen's Green, bypassing Charlemont station'.

Having identified these implied alignments 'a station location Multi Criteria Analysis (MCA) was prepared to analyse different options for stopping locations along the proposed Metro to Knocklyon alignment'.

Table 2-1: Details of options for each proposed Station location

Area	Stop Options	Location Details
Rathmines	Option A1 Harold's Cross	Harold's Cross Park
	Option A2 Rathmines	Grounds of St. Louis' Convent
Terenure	Option B1 Terenure	CYM Sports Club
	Option B2 Terenure	Rathgar Tennis and Bowling Club
Rathfarnham	Option C1 Rathfarnham	Grounds of Rathfarnham Castle, lands close to the northern entrance
	Option C2 Rathfarnham	Open lands to the north east of Woodview Cottages
Ballyboden	Option D Ballyboden	Coláiste Éanna Sports Grounds
Knocklyon	Option E Knocklyon	Open private lands to the north of Scholarstown Road zoned for development
Ballycullen	Option F Ballycullen	Lands zoned for development

The proposed options are shown in Figure 2-1, within a 600m buffer zone.

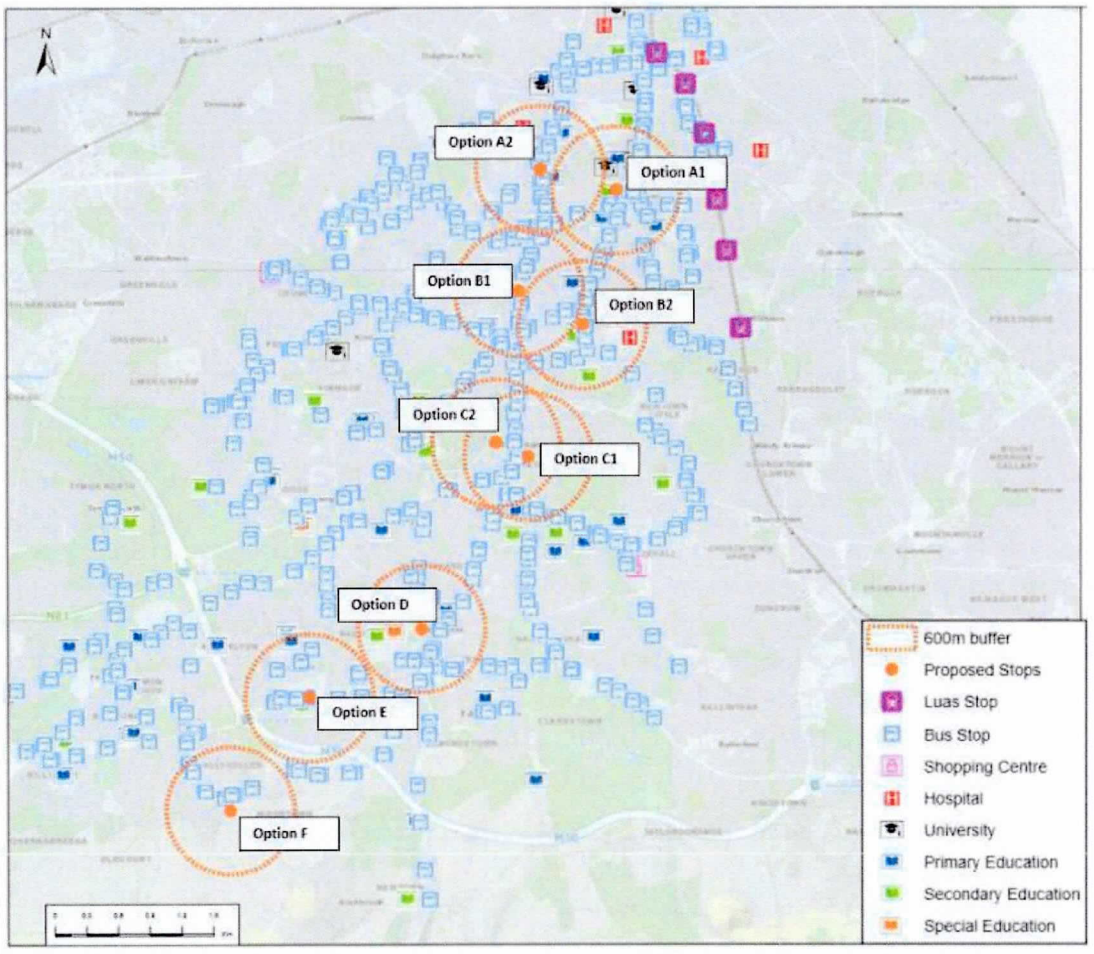


Figure 2-1: Identification of Potential stop locations for metro to Knocklyon Alignment within a 600m buffer zone

The following are extracts from the Jacobs Feasibility Report that set out the process intended to be followed by Jacobs to fulfil the task of application of a Multi Criteria Analysis to the selection of the preferred station locations.

'2.2 Analysis of Proposed Stations

Proposed station locations analysed in this section are based on the Assessment of Alternative Alignments that was undertaken for MetroLink, prepared by the National Transport Authority. This included undertaking a Multi Criteria Analysis for the alignment options, as well as each of the proposed station locations in order to be consistent with what was done previously for the MetroLink project. Each station location will be analysed within the context of development plan zoning, observations from site visits, the surrounding catchment including population figures and key attractors, and the possibility of interchange with other modes of public transport. As such, each station will be assessed on its ability to fulfil the objectives of the full MetroLink scheme.

2.3 Assessment of Station Options

Each proposed station location has been assessed on its ability to meet the objectives of the full MetroLink scheme, such as public transport interchange, connection to attractor nodes and accessibility.

Option A1 Harold's Cross is located in an area with lesser used centre than Rathmines, with a limited mix of land uses and minimal pedestrian footfall. As a result, the location may not be attractive and accessible for all users.

However, Option A2 Rathmines is in close proximity to Rathmines local centre. As such, Rathmines is zoned as a Key District Centre under the Dublin City Development Plan 2016-2022.....

The proposed location would facilitate connection to a greater number of attractor nodes than Option A1 Harold's Cross and .....therefore, Option A2 Rathmines is the preferred stop.

Option B1 Terenure is located near a number of attractor nodes .....in the south, and a number of services to the north of the site. The area has high accessibility as there is a provision of bus lanes, cycle lanes and a taxi rank.....and ....provides interchanges with other modes of public transport, making it attractive and accessible for more users in the area. In comparison, Option B2 Terenure is also located in close proximity to a busy local centre, however there is a limited provision for interchange with other modes of public transport as no bus or cycle lanes are provided .....As this station is only accessible via two small streets, it does not facilitate connection to attractor nodes as it is hidden from the main street. .....Therefore, Option B1 Terenure is the preferred stop in this area.

Option C1 Rathfarnham is located at Rathfarnham Castle and Playground which is a key trip generator in this area, as well as being close in proximity to Main Street, which includes a number of cafés, restaurants, shops and other services.....The proposed station location also provides for interchange with other modes of public transport and ....there is a car park available close to the site, therefore making the station attractive and accessible to all users. Option C2 Rathfarnham is located within the Dodder Flood Zone, under the Dublin City Development Plan 2016-2022, and therefore new development in this area would be restricted without providing a detailed flood risk assessment. Additionally, there are limited attractor nodes....There is no bus lane present and there are no existing bus stops .....As a result, Option C1 Rathfarnham is the preferred stop in this area.'

'Option D Ballyboden is surrounded by a number of attractor nodes as there are several schools and colleges in the area, as well as local commerce. .....This location also provides for interchange with other modes of public transport .....Option D Ballyboden is the preferred location in this area, with no other options considered.

Option E Knocklyon is proposed to be in an area zoned for development under the Dublin City Development Plan 2016-2022, and therefore a station at this location would cater for the growing travel demand in the area. Due to the station's proximity to several schools and ..Knocklyon Shopping and Community Centres, this location would also facilitate connection to attractor nodes.... Option E Knocklyon is the preferred location in this area, with no other options considered.

Option F Ballycullen is proposed to be located in an area zoned for development under the Ballycullen-Oldcourt Local Area Plan, however it is situated in proximity to a limited number of trip attractors. Similarly, it is not served by sufficient public transport and therefore does not facilitate interchange, making it inaccessible for many users....No other options have been considered for this location. Table 2-2 summarises the preferred stop for each area.'

Table 2.2 is an extract from the report

Table 2-2: Summary of Preferred Station at Each Location along MetroLink to Knocklyon Alignment

Station	Station Option	Preferred Station
Station A1 Harold's Cross	Station A2 Rathmines	**Station A2 Rathmines**
Station B1 Terenure	Station B2 Terenure	**Station B1 Terenure**
Station C1 Rathfarnham	Station C2 Rathfarnham	**Station C1 Rathfarnham**
Station D Ballyboden	-	**Station D Ballyboden**
Station E Knocklyon	-	**Station E Knocklyon**
Station F Ballycullen	-	**Station F Ballycullen**

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Chapter 2 - Appendix B

Observations, Commentary and Issues

Appendix B entitled **'Identification of Study Area'** provides 40 pages of details for each of the potential station locations assessed and referred to in Chapter 2 above, although it is not cited anywhere in the Main body of the Jacobs Metro to Knocklyon Feasibility Study Report.

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Appendix B

Observations, Commentary and Issues

Here are some extracts with examples from Appendix B and the basis on which choices of station location for the appraisal undertaken by the NTA /Jacobs were ultimately based. This has been

included to inform understanding of the basis on which the preferred station locations were selected by the consultants.

B.1 Option A1 Harold's Cross Option A1 Harold's Cross station is proposed to be located east of Rathmines at Harold's Cross Park, as shown in Figure B-1. It is a largely residential area served in the north, east and west by Harold's Cross Road (R137) and by a small access street in the south. 2016 population data records a population of 11,335 people within the adjacent electoral divisions. The area is not listed within Dublin City Development Plan 2016-2022 zoning.
The proposed station is mainly surrounded by a mix of semi-detached and terrace houses with some local commerce.....Our Lady's Hospice and Care Services is also close to the proposed location. The limited mix of land uses around the proposed station is set up for a lesser used local centre than Rathmines (see Figure B-5)

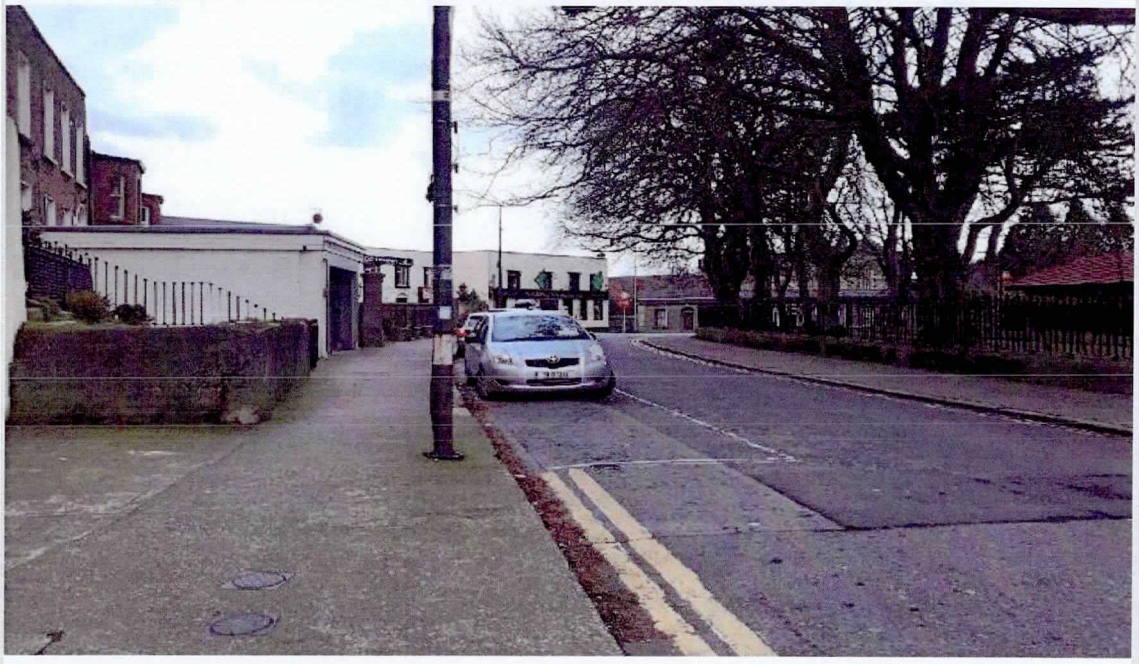


Figure B-2: Access Street south of Harold's Cross

Figure B-2: Access Street south of Harold's Cross
The area is served by the R137, which is a two-way single carriage way that includes a bus lane and shared cycle lane, with a number of bus stops along Kimmage Road Lower and Harold's Cross Road, allowing for options for interchange with bus services (see Figure B-6). Heavy car usage observed to the north and east of Harold's Cross Park with few pedestrians as junction layout north of park is not pedestrian friendly.

Figure B-6: Bus Stop at Harold's Cross Rd (west)

B.1.1 Option A2 Rathmines

Option A2 Rathmines is proposed to be located at the grounds of St. Louis' Convent in Rathmines, as shown in Figure B-7. The area is largely residential to the north, west and south of the station, with Rathmines centre to the east. The area is served by Charleville Road to the north and east, Grosvenor Road and Rathgar Road to the south, and Grosvenor Place to the west.

Figure B-8: Charleville Rd north of the station

..... Rathmines is zoned as a Key District Centre, with a core aim of the strategy seeking to develop sustainable urban villages, including Rathmines. As such, the proposed station is located within a mix of semi-detached houses and apartments. St. Louis' High School is within the grounds of the station, which is also in close proximity to Rathmines town centre where there are a number of cafés, restaurants, shops and other services.

The area is served by Grosvenor Road and Rathgar Road (R114) to the south, which are two-way single carriageways which merge to become Rathgar road (R114). Rathgar Road includes a shared bus and cycle lane northbound which merges into an advisory cycle lane, and a mandatory cycle lane southbound.

Option A2 Rathmines suitably meets a number of the full MetroLink objectives. As it is an area of heavy car use and limited bus lanes, the provision of a MetroLink station could reduce levels of urban congestion in the area, also supporting environmental sustainability in this way. As this location is in close proximity to Rathmines town centre, it facilitates connection to attractor nodes in the area, therefore being attractive and accessible to all users.

B.1.2 Option B1 Terenure

Option B1 Terenure is proposed to be located within the grounds of CYM Sports Club on Terenure Road North, as shown in Figure B-11. The area is largely residential to the north, east and west beyond Terenure Sports Club, with Terenure town centre to the south of the proposed location and limited services available to the north. .....
The station is proposed to be located within the CYM Sports Club, which is surrounded by a number of cafés, restaurants, shops and other services north of the site and in Terenure town centre to the south.

The area is served by Terenure Road North (R137) which is a two-way single carriageway with advisory cycle lanes present in both directions. South of Eagle Hill Avenue the southbound advisory cycle lane merges to become a shared bus and cycle lane to accommodate existing bus stops along Terenure Road North. A taxi rank and shelter are also available nearby to the south of the proposed location.
Based on these observations, Option B1 Terenure facilitates connection to few key attractors due to the limited transport public transport services in the area, however it might support economic development by encouraging people to travel to this area. The proposed location does provide integration with bus services and the nearby by car parking could be used as a 'Park and Ride' facility.

B.2 Option B2 Terenure
Option B2 Terenure is proposed to be located on Orwell Road, close to Rathgar Tennis and Bowling Club, as shown in Figure B-15. The area is largely residential to the east, west and south, with some local commerce present in the north along Orwell Road. .....
There is a busy local centre north of the site with cafés, restaurants, shops and other services available.

Considering the full MetroLink scheme objectives, Option B2 Terenure provides some interchange with other modes of public transport and is located within a busy town centre. As such, the station may support the economic development of this area. The proposed station is hidden from the main street and can only be accessed by two small streets, therefore is not accessible for all users and does not facilitate connection to attractor nodes in the nearby area.

B.2.1 Option C1 Rathfarnham
Option C1 Rathfarnham is proposed to be located at the grounds of Rathfarnham Castle close to the northern entrance on Castleview/Castleside Drive, as shown in Figure B-18. There are low density residential areas to the north and south of the site, with Castle Golf Club to the east, and Rathfarnham local centre to the west. .....

Rathfarnham Castle and Playground provide key trip generators in the area, as well as the close proximity to Rathfarnham Main Street, which includes a number of cafés, restaurants, shops and other services (see Figure B23).

The area is served by Rathfarnham Road (R114) to the west of the proposed station location, which is a two-way single carriageway with a shared bus and cycle lane northbound and southbound.
Option C1 Rathfarnham suitably meets the objectives of the full MetroLink scheme as it facilitates connection to attractor nodes such as Rathfarnham Castle and the town centre, thus supporting economic development in these areas. The proposed station location also provides for interchange with other modes of public transport and whilst there is not a specific 'Park and Ride' designation there is a car park available close to the site, therefore making
the station attractive and accessible to all users.

B.2.2 Option C2 Rathfarnham
Option C2 Rathfarnham is proposed to be located in the open lands to the north-east of Woodview Cottages along the R112, as shown in Figure B-24. The station is proposed to be situated in a low-density residential area, with local commerce east of the site, and Bushy Park and the River Dodder to the west. The area is served by the R112, with pedestrian access to Woodview Cottages and Church Lane, leading to Main Street Rathfarnham. .....Under the Dublin City Development Plan 2016-2022, this area is located within the Dodder Flood zone as shown in Figure 8, where new development is restricted in green areas without providing a detailed flood risk assessment.....
.....
Option C2 Rathfarnham does not suitably meet the objectives of the full MetroLink scheme as it does not facilitate connection to attractor nodes and therefore does not fully support economic development in the area.....

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Appendix B

Observations, Commentary and Issues

NOTE Option A in Figure 4-1 and Option B in Figure 4-2 in Chapter 4 of the Jacobs/NTA Main Report refer to Station Rathfarnham Castle C2 modelled for demand. This is labelled as C1 in Chapter 2 Definition of Study Area /Corridor the station assessed under MCA

B.2.3 Option D Ballyboden
Option D Ballyboden is proposed to be located at Coláiste Éanna Sports Grounds, as shown in Figure B-30. The proposed station is located in a residential area, with two schools and some local commerce surrounding the site. The area is served by Ballyboden Road (R115) along the eastern boundary of the site, Ballyroan Road (R817) to the north, and Ballyboden Way to the south. Hillside Park, Owendoher Lodge and Taylor's Crescent are also in close proximity to the site.

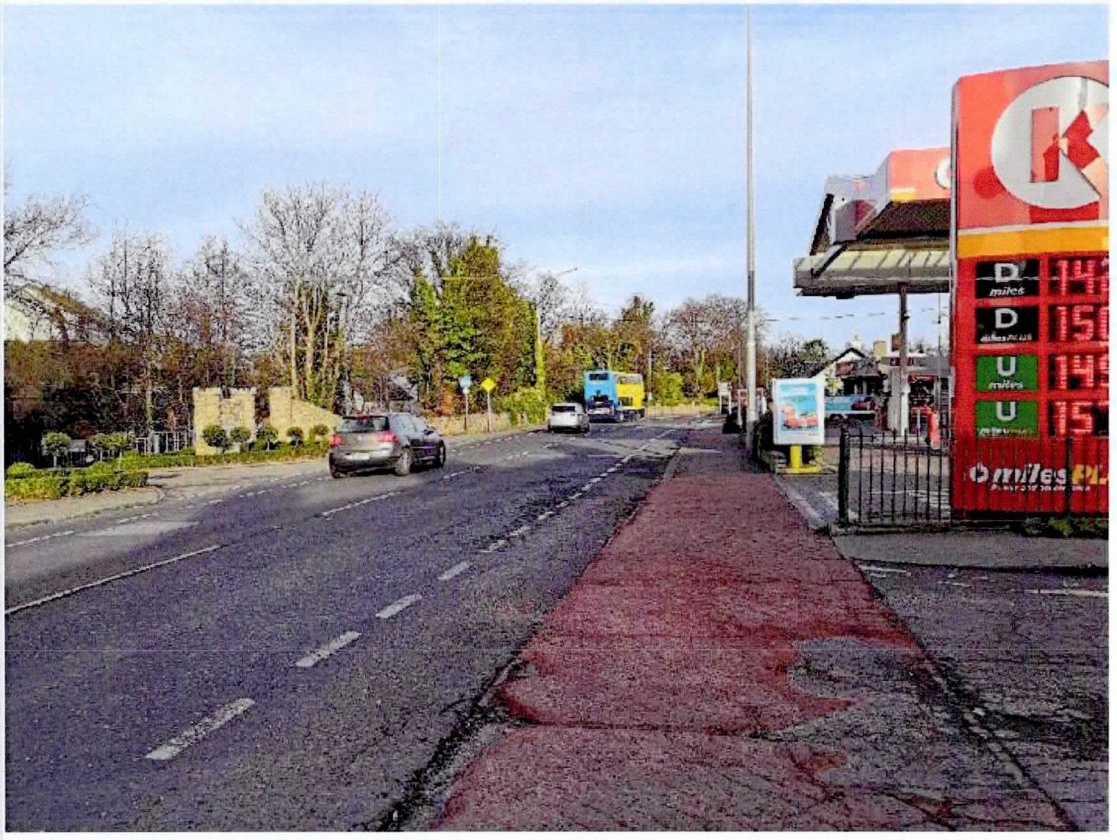


Figure B-32: Ballyboden Rd (viewing north)

Figure B-33: Ballyroan Rd (east of the proposed site)

The area is largely residential with a mix of single, duplex and semi-detached houses present. Coláiste Éanna School and Sports Grounds, Christian Brothers Secondary School, Kids Inc Creche and Montessori, Ballyroan Boys National School, Sapling Rathfarnham and Sancta Maria College are also in the area, with local commerce present to the east of the site along Ballyboden Road.

The area is served by Ballyboden Road (R115), which is a two-way single carriageway with pedestrian footpaths, an advisory cycle lane present in both directions, and existing bus stops. Ballyroan Road also has advisory cycle lanes and pedestrian footpaths present in both directions. There are raised cycle lanes and pedestrian footpaths present in both directions on Ballyboden Way.

Option D Ballyboden suitably meets a number of the objectives of the full MetroLink scheme. Further residential development has taken place at Owendoher Grove, and on Scholarstown Road, south of Ballyboden Way, and therefore the proposed station location would cater for the growing travel demand in this area. Due to the number of schools, colleges and local commerce in the area, this location would facilitate connection to attractor nodes, and also support economic development in the area. This location also provides for interchange with other modes
of public transport due to the presence of existing bus stops, with the availability of cycle lanes and pedestrian footpaths making it attractive and accessible to all users. This location therefore supports environmental sustainability by reducing the need for the private car.

B.2.4 Option E Knocklyon

Option E Knocklyon is proposed to be located at open private lands to the north of Scholarstown Road, as shown in Figure B-34. The area is largely residential in all directions, with St. Colmcille's Community School south of the site and Knocklyon Shopping and Community centres in the north. The area is served by Scholarstown Road to the west and south of the site, leading to Ballyboden Way and Templeroan Road in the east, and Knocklyon Road in the north.

Figure B-35: Proposed site location

.....The proposed station location is in close proximity to Knocklyon Shopping Centre and Knocklyon Community Centre, as well as St. Colmcille's Junior and Senior National Schools at the north of the site. The east, south and west of the site are predominantly residential areas with a mix of single and semidetached houses. The area is served by Knocklyon Road at the north of the site, which is a two-way single carriageway, with no bus or cycle lanes present.....

Option E Knocklyon suitably meets a number of the objectives of the full MetroLink scheme. As this area is zoned for development, a station at this location would cater for the growing travel demand in the area. ..... Due to the station's proximity to several schools and Knocklyon Shopping and Community Centres, this location would also facilitate connection to attractor nodes, making the station attractive and accessible to all users.

B.2.5 Option F Ballycullen

Option F Ballycullen is proposed to be located in lands zoned for development under the Ballycullen-Oldcourt Local Area Plan, as shown in Figure B-37. The proposed site is located in a predominantly residential area with Woodstown Shopping Centre at 1km to the north. ....the area is zoned for development under the Ballycullen-Oldcourt Local Area Plan. The proposed stop is mainly surrounded by detached and semi-detached houses. Other land uses include a Lidl, the Woodstown Shopping Centre and the Primacare Medical Centre, all within 1km from the proposed location.

Figure B-38: Proposed site location

Woodstown Avenue is a two-way single carriageway without bus or cycle lanes present. A pedestrian footpath is only provided on the northern side of the road. Stocking Avenue immediately adjacent to the north of the proposed stop is a two-way single carriageway with no bus lanes and cycle lanes that are shared with the pedestrian paths in both bounds. .....There are 3 bus stops present on Ballycullen Road to the west of the proposed station. .....

Chapter 3

Multi Criteria Analysis 3.1 Methodology The Multi Criteria Analysis (MCA) evaluates the six stations options proposed for the alternative Metrolink alignment towards Knocklyon and Ballycullen. The preferred station options are those defined in Appendix C and comprise:

1) Station A2 Rathmines
2) Station B1 Terenure
3) Station C1 Rathfarnham
4) Station D Ballyboden
5) Station E Knocklyon
6) Station F Ballycullen

The options are evaluated based in the following criteria, which also align with the overall objectives of the Metrolink project, as shown in Table 3-1.

Table 3-1: Assessment Categories and Objectives

Category 1: Economy	**Impact on economic growth and competitiveness**
	- Population catchment - Reduction of urban congestion
Category 2: Integration with Government Policies	**Compatibility with government policies**
	- Existing / proposed zoning and plans - Approved planning applications - Local, regional and national transport objectives
Category 3: Integration of Transport Networks	**Integration of transport networks**
	- Station proximity to a park and ride facility - Station proximity to bus stop(s)
Category 4: Accessibility and Social Inclusion	**Social deprivation, geographic isolation and mobility / sensory deprivation**
	- Station proximity to an urban centre
	- Station proximity to key attractor(s) - Station proximity to a direct access from main road - Conditions of pedestrian and cycling infrastructure
Category 5: Environment	**Water, air, noise and architectural impacts**
	- Water and flooding - Air quality and noise sensitive receptors - Cultural heritage
Category 6: Safety	**Number of transport related accidents**
	- Reduction of number of cars

3.2 Multi Criteria Analysis Summary

From undertaking a detailed multi criteria analysis of the potential station locations, the findings show that for the majority, the objectives have been met, especially for Safety on the proposed alignment due to the potential reduction in car usage.

Objectives have been partially met in terms of integration with policy and transport connections, as the majority of interchange will occur closer to the city centre, e.g. Rathmines and the opposite the further away from the city centre the alignment is, e.g. Knocklyon.

Overall, the objectives have been met at different levels depending on location. As the level of how the objectives are being met change as the potential stations move outbound from the city centre, it may be worth future exploration of how to better address the objectives of the suburbs in the south-west.

We acknowledge that a previous study, although not part of an option selection process, into the feasibility of a future LRT line in this part of the city was done in the past. This was ruled out due to space constraints along the route, however we must be cognisant of the fact that other options could be available to investigate in this part of the city.

The preferred stop locations will form routes that will be brought forward to a more detailed transport demand and economic appraisal.

Table 3-2: MCA Summary of proposed stops

	Stop A2 Rathmines	Stop B1 Terenure	Stop C1 Rathfarnham	Stop D Ballyboden	Stop E Knocklyon	Stop F Ballycullen	Full Route
Category 1: Economy							
Category 2: Integration (policies)							
Category 3: Integration (transport)							
Category 4: Accessibility and social inclusion							
Category 5: Environment							
Category 6: Safety							
All Categories							

Colour Key	Description
	Fully addresses objectives
	Addresses objectives well
	Partially Addresses objectives
	Addresses objectives poorly
	Does not address objectives

Chapter 3

Observations, Commentary and Issues

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 following criteria:

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.

In this case **MCA technique was applied in its formal application only to Preferred Station List Option and not additionally to other Station Options as implied would be the case in opening section of feasibility report.**

Appendix C. Multi Criteria Analysis

C.1 Population Catchment

Population catchment within 1km was estimated for each of the station locations selected in Section 2.3. Estimations were made using ArcGIS modelling tools and Census Data 2016, therefore they do not include future population growth in areas set for further development such as Ballycullen. Results are shown in Table C-1.

Table C-1: Population within 1km from the stations

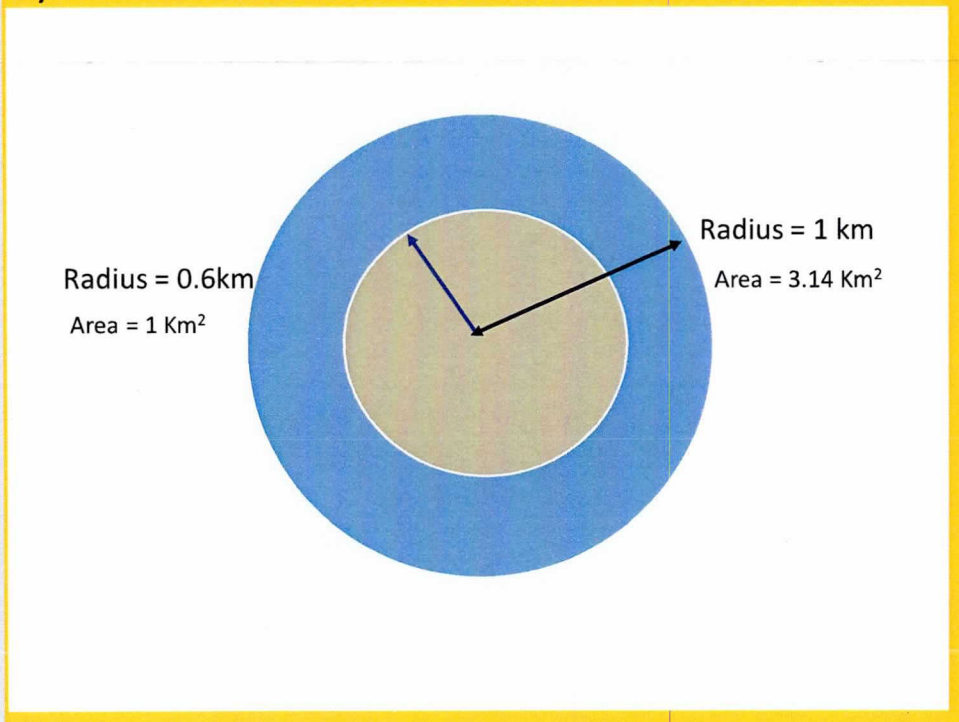
Station	Estimated Population within 1km catchment area	Population density (gross)
Station A2 Rathmines	14,760 inhabitants	47 inhabitants/hectare
Station B1 Terenure	11,997 inhabitants	39 inhabitants/hectare
Station C1 Rathfarnham	4,969 inhabitants	16 inhabitants/hectare
Station D Ballyboden	4,721 inhabitants	15 inhabitants/hectare
Station E Knocklyon	6,402 inhabitants	21 inhabitants/hectare
Station F Ballycullen	6,034 inhabitants	20 inhabitants/hectare
Full alignment (does not equal sum of the above)	**46,316 inhabitants**	---

Errors in Table C-1

In estimating the population density of the catchment area of each stion location specified in table C-1 the consultants appear to have demonstrated a lack of quality control in generating their

calculations. This can be demonstrated by comparing their estimates of population and population density with values taken directly from the CSO Census and employing the census radius tool to estimate population within defined radius values and deriving the correct density value by employing the simple $A = \pi r^2$ formula.

Key Illustrative Definitions: 1km Catchment Area v Area = 1Km² v Radius = 1 km



For example in Table C-1 A2 Rathmines the consultants present the data as being for an areas within 1km. In section of the census data indicates the value of 14760 does not relate to a 1km catchment area.

By employing the 2016 Census data and the 'radius tool' this enables users to provide populations within a 1km catchment area. The actual population for a 1 km catchment area according to the official 2016 census can be calculated as 29526.

A comparison with census data points to the value in Table C-1 derived from the ArcGIS analysis relating to population levels within a 1 Km² i.e. within a 0.6km catchment area (noting based on the simple $A = \pi r^2$ formula this equates to a population within 1 Km² catchment area).

The consultants then divide that population total by area defined by a 1km catchment ie 3.141 Km² and then by 100 to reduce to a per hectare population density estimate.

There is a complete mismatch between the size of are to which the quoted population relates i.e. 1Km² and the area which this population is divided by (i.e. 3.14 Km²) to yield their population density per Km² .

This error is then continued through the population density per hectare (ha) in Table C-1.

There appears to have been a basic error made by the consultants in dividing the population quoted that relates to population within 1 Km^2 by an area of 3.141 Km^2 . This error is then carried through the remainder of the calculations. In the case of A2 Rathmines this means the quoted population of 47 inhabitants per hectare should actually be 148 inhabitants per hectare .

This can be illustrated by the simple formula and calculations below:

eg in Table C-1 A2 Rathmines population = 14760 . *(The value is considerably smaller than the CSO official data for a 1km catchment are that is in excess of 29000).* This is divided by 3.141 and then by 100 = 47 inhabitants per hectare (ha).

The calculation appears to be $\frac{14760}{3.141 \times 100}$ = 47 inhabitants per hectare

In reality the calculation should be $\frac{14760}{1 \times 100}$ = 148 inhabitants per hectare

These errors appear to have been replicated for the estimated populations and population densities within 1km catchment area for all station locations cited in Table C-1 .

The Metro to Knocklyon Feasibility Study calculations and density estimates have been checked against the values obtainable from the CSO Census radius tool and this confirms this error in the formula employed to calculate densities applies to each station location in Table C-1

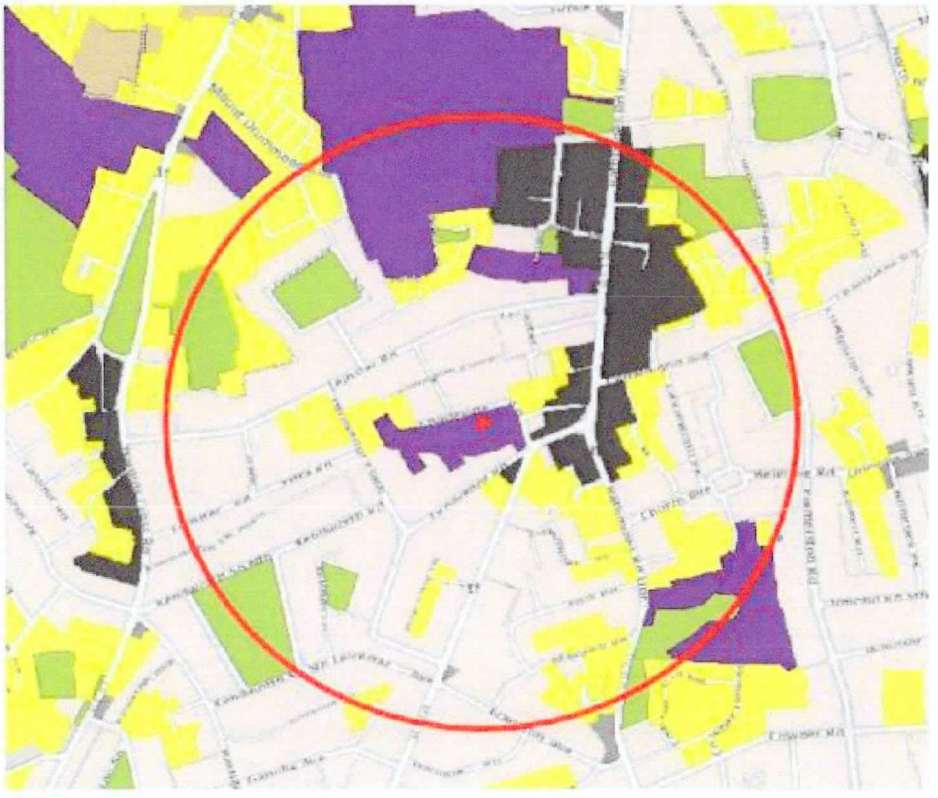
The effect of these errors is to report densities that are one third of the true population densities for the station catchments by more than 66%.

Here are the original quoted and corrected densities per hectare for the preferred station locations

Station location	Jacobs Original Estms (Error) 'Population in 1km* catchment area' **actual is **0.6km** catchment area*	Jacobs Original Estms (Error) Population density Inhabitants per ha	**Jacobs Estms Corrected Population density Inhabitants per ha**
A2 Rathmines	14760	~~47~~	**148**
B1 Terenure	11997	~~39~~	**119**
C1 Rathfarnham	4969	~~16~~	**50**
D Ballyboden	4721	~~15~~	**47**
E Knocklyon	6402	~~21~~	**64**
F Ballycullen	6034	~~20~~	**60**

It is unclear whether these errors have permeated further stages of the analysis and estimates of the demand for travel by a Metro to Knocklyon alignment. This question will need to be addressed by the consultants who prepared the feasibility report. We come back to this below under **Commentary** .

C.2.1 Station A2 Rathmines



Zone Z15: Community and Institutional Resource Lands (education, recreation, etc.)
Zone Z1: Sustainable Residential Neighbourhoods
Zone Z9: Amenity/Open Space Lands/Green Network
Zone Z4: District Centres
Zone Z6: Employment/Enterprise Zones
Zone Z2: Residential Neighbourhoods (Conservation Areas)
Zone Z3: Neighbourhood centres

Figure C-1: Land Use Zoning at proposed site

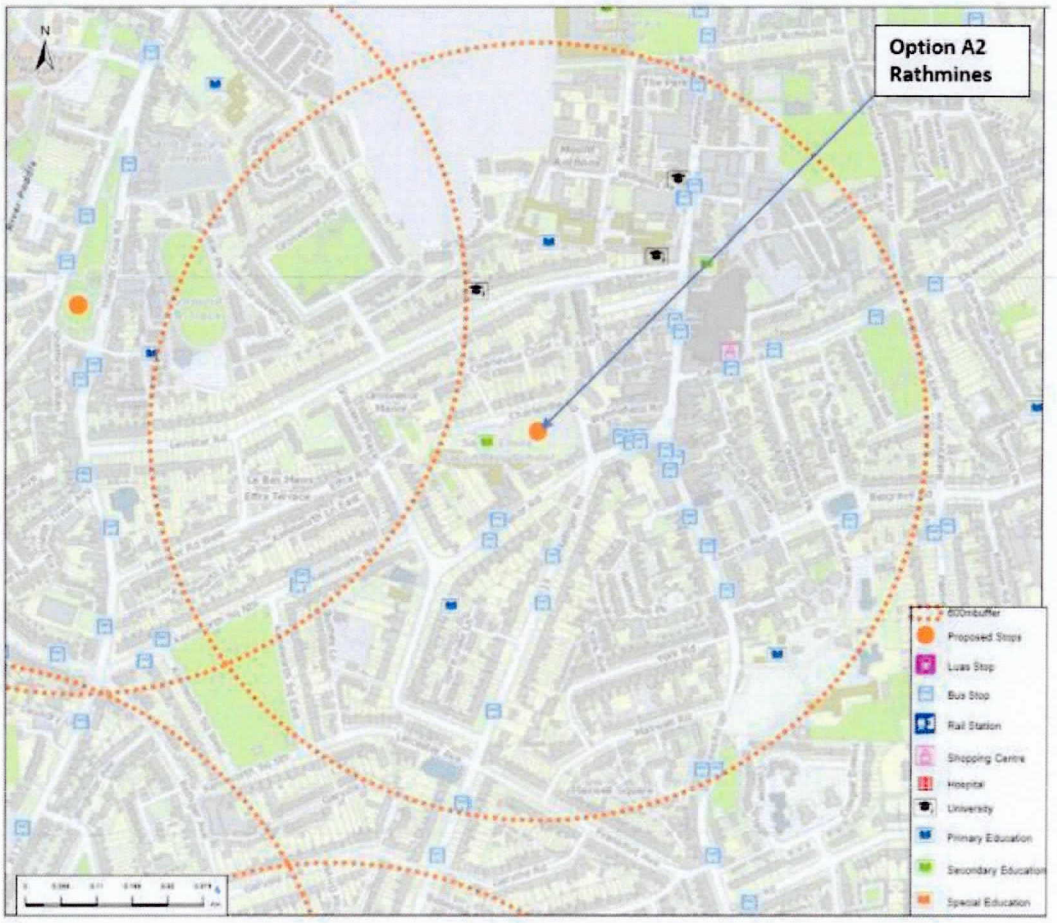


Figure B-7: Location of Option A2 Rathmines within 600m buffer zone

NOTE
Figure C-1 is taken from Appendix B
Figure B-7 is taken from Appendix C

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Chapter 3 and Appendices B and C

Observations, Commentary and Issues

The errors identified in the calculations of population density have been carried through in the selection and assessment of the preferred stations and in particular the potential demand for use of the Metro route serving those stations. It is unclear and unknown to use whether these errors

have fed through to the modelling and forecasting of ridership of the Metro to Knocklyon scheme. This question will need to be addressed by the consultants who prepared the feasibility report. However, what is evident is in a qualitative assessment of the preferred locations as presented the feasibility report it may well have created an impression of reduced ridership over what would be expected with densities that would be some 200% greater than presented in the document.

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Appendix B

Observations, Commentary and Issues

TAA has undertaken its own high level assessment of the market potential for each prospective location set out in the Jacobs Feasibility Study Report. This has involved 'on the ground' inspections and walking/inspecting the local neighbourhoods for each potential station location.

It encompasses consideration of the:

- Area
- Station/Stop Options
- Location Details Jacobs Station Location Accessibility Rating
- Land Use Types - Trip Generator/ Trip Attractors
- Scale of Attractors
- Pop in 1km catchment area – **NOTE** ***this refers to a radius of 1km and an area of 3.14 Km²***
- Pop Density Inhabis per ha
- Potent Pax Numbers
- Overall Performance

This high level assessment is summarised and presented in **Table A** below.

This assessment of market potential has encompassed not only the preferred station locations but also those rejected in the Jacobs Feasibility Study.

The factors specified include those set out in the feasibility study. The table includes the corrected passenger density estimates within a 1km catchment area (Area = 3.14 Km^2). This assessment extends these to address the potential passenger use of each station in a simple qualitative comment and overall performance in terms of their likely contribution to the efficacy of the overall scheme by use of an illustrative rating indicator.

The assessment of potential passenger performance reflects not only the key consideration of the trip generators, including population in the station catchment area of station as reflected in population total and density, but also the scale of trip attractors including employment locations, offices, retail and recreational/leisure facilities.

Table A highlights the contrast between Rathmines Option A2 adjacent to Rathmines village centre and the other prospective station locations (with the possible exceptions of Rathmines Option A1

Harolds Cross and Terenure Option B1 Terenure near village centre and perhaps Terenure Option B2 Rathgar). However, in both the cases of Rathmines Option A1 and Terenure Option B2 these were tabled as alternatives to Rathmines Option A2 and Terenure Option B1 and perform significantly less well in particular because of the limited scale of local trip attractors.

Therefore, the assessed performance of station locations tends to decline the further south distant from the city centre the station location chosen by the consultants. Thus the case for stations at Rathfarnham, Ballyboden , Knocklyon and Ballycullen tends to get weaker unless it is part of a route that serves a much larger station with strong attractors and trip generators.

Ballyboden and Knocklyon are set in typical suburban developments of their time with few trip attractors except for schools and related facilities. Knocklyon is close to a new but small residential complex with a small shopping parade. Particularly in the case of Ballycullen the prospective station location is characterised by typical low density suburbs with the suggested site having no trip attractors of any significance.

Overall, many of the suggested sites are set within relatively small populations within easy access to the suggested site, sometimes in what are currently unattractive, undeveloped or brownfield sites and in almost all cases the prospective station locations/site fail to take advantage of the fact that Metro would be largely underground and would not impose a large footprint at surface level. In many cases much more attractive sites could be found for instance in the case of Rathmines Village near the Leisure Centre and Town Hall.

Previous investigations of improved transport links serving SouthWest Dublin have incorporated routes to serve Tallaght. In calling for a Metro feasibility study to serve the corridor it had always been anticipated the Jacobs study would incorporate a link from inner central Dublin to Tallaght. It came as surprise to find that the assignments selected stopped well short of that and ended in what could be anticipated to be prospective station locations with unpromising performance in terms of passenger throughput. MSWG have proposed any Metro in the corridor should reach Tallaght. This is very likely to increase the passenger loadings very substantially and provide opportunities for surface alignment.

TAA has identified two additional routes to Options A and B in the Jacobs study denoted as Option C and Option D both terminating at Tallaght. More details of these are set out in Section 7 of this document and the station they allow for are examined in an extend high level assessment of Potential Travel Demand /Net Economic Benefit Performance in Section 9.

TABLE A Jacobs Metro Feasibility Proposed Station Locations - Assessment of Potential Travel Demand and Net Economic Benefit Performance

Area	Stop Options	Location Details	Jacobs Station Location Accessibility Rating	Land Use Types - Trip Generator/ Trip Attractors	Scale of Attractors	Pop in 1 km catchment area – radius of 1 km and area	Pop Density Inhabis per Km^2	Pop Density Inhabis per ha	Potent Pax Nos.	Perfm

						3.14 Km²				
Rathmines	Option A1 Harold's Cross	Harold's Cross Park Option A2	Reasonable	Mixed – Mainly Trip Generator	Limited	28,216	8,986	90	M'dest	+/++
Rathmines	Option A2 Rathmines Grounds of St. Louis' Convent	Grounds of St. Louis' Convent Rathmines	Poor	Mixed – Trip Generator AND Substantial Trip Attractors	Substantial	32,480	10,343	103	Sign	+++
Terenure	Option B1 Terenure	CYM Sports Club	Could be better	Mixed – Trip Generator AND TRIP Attractors	Some	25,059	7,981	80	M'dest	+/++
Terenure	Option B2 Terenure	Rathgar Tennis and Bowling Club	Poor	Mixed – Trip Generator AND TRIP Attractors	Limited	24,528	7,811	78	M'dest	+
Rathfarnham	Option C1 Rathfarnham	Grounds of Rathfarnham Castle, lands close to the northern entrance	Could be better	Mixed – Trip Generator AND TRIP Attractors	Some – not immediate	15,137	4,821	48	L'mted	0/+
Rathfarnham	Option C2 Rathfarnham	Open lands to the north east of Woodview Cottages	Poor	Trip Generator – very limited	Almost none immediate	14,252	4,539	45	L'mted	0 /+
Ballyboden	Option D Ballyboden	Coláiste Éanna Sports Grounds	Poor Limited by LU patterns/ low density	Mainly Trip Generator	Very limited	18,782	5,981	60	Very L'mted	-/0
Knocklyon	Option E Knocklyon	Open private lands to the north of Scholarstown Road zoned for development	Poor Limited by LU patterns/ low density	Mixed (limited) – Mainly Trip Generator AND limited TRIP Attractors	Local Centre linked to new Dev	18,796	5,986	60	L'mted/ Modest	-/+
Ballycullen	Option F Ballycullen	Lands zoned for development	V poor Limited by LU patterns/ topography	Mainly Trip Generator	None	12,386	3,945	39	L'mted	--/-

Conclusion

The "Knocklyon" feasibility study indicated two possible routes, Options A and B. Option A is an extension (of Metrolink) from Charlemont to Ballycullen. Option B is a stand alone line from St Stephen's Green to Ballycullen.

The feasibility study report identifies potential stations, with two alternatives examined in each of Rathmines, Terenure and Rathfarnham, with an ultimate destination of Ballycullen. It analyses those stations in detail; however one station Iveagh is identified but not analysed at all.

We conclude in selecting many of the prospective station locations and sites those chosen will undoubtedly generate relatively low passenger demand and contribute to a poor Benefit Cost Ratio. These sites are affected by small populations served, low density and relatively few trip producers and attractors, and affording poor local accessibility including poor bus connectivity. We argue there are station options in south west Dublin situated on route Options C and D that could offer considerably greater potential passenger demand.

8 Proposed Scheme: Option Costs

In this section of our report we set out the capital costs attributable to the Metro to Knocklyon scheme as reported in the **Jacobs Metro to Knocklyon Feasibility Study** report (2021) before undertaking a review of the robustness of the costs and consistency with which they have been estimated in comparison with the Metrolink costs reported in the Metrolink PBC and supporting documents including Appendices F Scheme Costs and Appendix L Cost Forecasting Methodology. We have concentrated on capital costs as the O&M costs of the extensions are unlikely to be a major factor in the business case

This is a key section of the Proposed Scheme that reflects concerns that the costing process and risk/optimism bias assumptions applied in the Jacobs Metro to Knocklyon Feasibility Study are not consistent with those applied to MetroLink: Estuary through Swords, Dublin Airport, Ballymun, Glasnevin and City Centre to Charlemont PBC, including Appendices: F Scheme Costs and Appendix and L Cost Forecasting Methodology.

This commentary focuses on two elements, a critique of the assumptions and methodology applied to and the costings for the Metro South West alignment and a comparison of how the Jacobs Feasibility Study and the Metrolink cost estimation element of the Metrolink PBC address the issue of risk and optimism bias, especially in relation to costs. These are considered separately below.

We also provide outline costs for two alternative alignment designed to serve Tallaght.

Technical information from the NTA

The scheme developed in outline in the Jacobs report (Metrolink to Knocklyon Feasibility Study Report, Jacobs for NTA , July 2021) is a Metrolink extension from Central Dublin to Ballycullen. The Jacobs report provides very little information on the proposed alignment or the cost forecasts. Their report is mainly devoted to station location opportunities and options. They applied a demand forecasting model to a through-running option (A: Estuary-Ballycullen) extending Metrolink (Estuary-Charlemont) from Charlemont to Ballycullen and to a separate line terminating at St Stephens Green from Ballycullen (Option B).

MSWG on behalf of TAA requested a wide range of detailed information on two successive occasions underpinning the Jacobs report (Metrolink to Knocklyon Feasibility Study Report, Jacobs for NTA , July 2021).

Jacobs report the costs of the extension but no details of cost build-up is provided, although this may be included in the final version of their report which we have not seen. This was not provided despite

our request for more detailed quality assured information and data. Their report gives no information on the lengths of the Metrolink extensions or the number of trains likely to be needed.

We have also received copies of slides from a presentation of the concept design of two Metrolink alignments in SW Dublin. These provide vertical profiles and civils design assumptions of two alignment options, both of which are Metro lines that are assumed not to run through to Metrolink north. The NTA/TII have also provided the cost detail spreadsheets for two similar options (CostEstimateAssumptions-Southern Extension Options, April 2021).

Without being given access to the comprehensive data and information requested by TAA from the NTA we were forced to rely upon the costing methodology applied in the Metrolink PBC as the primary source for assessing the Options in the Jacobs feasibility study. The Metrolink Preliminary Business Case report and its associated 14 technical appendices was also available. (Metrolink Preliminary business Case 2/2021, TII/NTA, with cover note, 2022).

Chapter 5. Cost Estimate (**Jacobs Metro to Knocklyon Feasibility Study, 2021)**
A joint costing exercise was undertaken to support a consistent value for money appraisal for the various Metro options being considered as part of the Metro to Knocklyon and the Metro UCD to Sandyford studies and costs were developed using a shared estimation approach for both sets of project options.
As outlined below, these estimates capture the full range of key factors to allow for a comprehensive estimation of the Net Present Value of the costs, reflecting a specific understanding of the separate impacts of:

- Capital costs
    - Direct and indirect costs
    - Contractor overhead profit and insurance
    - Client costs
    - Land and property
    - Risk allowances
- Operations and maintenance costs
- Assumed expenditure profiles
- Interface with MetroLink construction

5.1 Capital costs
Following review of the route options with the estimation team, initial capital costs were estimated for each option on the basis of the quantities of basic units. These included:

- Station underground (open cut or mined)
- Station surface
- Vents/Escape shafts
- Metres of single bore twin track tunnel etc.
- Metres of track
- Numbers of trains
- Location of and access to the maintenance depot
- Location of operation control centre and alternative spare
- Park-and-ride facility

- System wide installations (track, fencing, power supply, comms, signalling, etc.)

Where appropriate item costs were adjusted to control for factors such as:

- Urban or suburban settings (stations)
- Station depth
- Adjacency to railway lines
- Likely utilities

5.2 Application of risk and optimism bias

Reflective of the very early stage of project development and the correspondingly low level of engineering detail available at this stage a Quantified Risk Assessment (QRA) has not been undertaken at this point. Reference Case Forecasting has instead been used to adjust for risk and optimism bias. As reported in the UK Government's Transport Appraisal Guidance, analysis by Oxford Global Projects recommends different optimism bias uplifts for different projects at different stages of the project lifecycle. These are summarised in Table 5-1 for the earliest stage of project development.

Table 5-1 Not cited in Report

Table 5-1: Recommended optimism bias uplifts for different projects at different stages of the life of a transport

Category	Item	Stage 1 (Project Definition)
Roads	Motorway, trunk roads, local roads	46%
Rail	Metro, Light rail, Guided buses on tracks, line upgrades, high speed rail	56%
Fixed links	Bridges and Tunnels	55%
Building projects	Stations and Terminal buildings	70%
IT projects	IT system development	69%
Land and property	Property purchases	33%
Rolling stock (new procurement)	Powered and unpowered vehicles	61%

As a complex project blending elements of Rail, Fixed link, land and property and rolling stock a blended allowance of 65% was applied to the total cost estimate. Although cautious, this is considered reasonable at this stage in the process, given the proportion of costs attributed to station construction, signalling and Rolling stock.

An initial cost was then built up for each option through application of previously developed library rates. This was then uplifted on an item by item basis to account for preliminary costs and then using global factors for contractor overheads, profits and bonds and sureties. Further allowances for client costs (indirect costs and land and property) were estimated for each option through comparison with the MetroLink scheme. Reflective of the low level of engineering detail available at this stage in the project development process a risk allowance of 65% was applied to the total cost estimate.

The NTA cost management guidelines around contingency and other benchmarking criteria were considered as part of this study and was reflective of the level of design available.

The cost build-up for the two route options is summarised in Error! Reference source not found. and Error! Reference source not found in the feasibility report or made available to us upon request to the NTA. These costs are presented in Quarter four 2019 Euros, and are exclusive of VAT, which is addressed as part of the conversion to Net Present Costs. Regarding the difference in subtotal amounts between the two options, option presents a higher subtotal amount due to additional construction and infrastructure requirements in creating separate, longer tunnelling and also the construction of a large turnback facility at St. Stephen's Green to facilitate this option.

Table 5-2 and Table 5-3 Not cited in Report

Table 5-2: Metro Knocklyon, Ballycullen to Charlemont (through running), capital costs (factor costs, Q4 2019 prices, nearest €100,000).

Category	Item	Total (EUR) (Q4 2019)
Capital costs	Tunnels & Intervention shafts	549,900,000
	Subsurface stations	904,200,000
	Rolling stock	149,800,000
	Other	384,600,000
	Total	1,988,500,000
Client costs	Indirects	285,400,000
	Land and property	189,900,000
Sub-total		2,463,800,000
Risk & Optimism Bias	65%	1,601,500,000
Total		4,065,300,000

Table 5-3: Metro Knocklyon, Ballycullen to St Stephen's Green (linked), capital costs (factor costs, Q4 2019 prices, nearest €100,000).

Category	Item	Total (EUR) (Q4 2019)
Capital costs	Tunnels & Intervention shafts	612,100,000
	Subsurface stations	1,266,500,000
	Rolling stock	217,600,000
	Other	647,700,000
	Total	2,743,900,000
Client costs	Indirects	393,700,000
	Land and property	269,000,000
Sub-total		3,406,600,000
Risk & Optimism Bias	65%	2,214,300,000
Total		5,620,900,000

5.3 Operations and maintenance

Independently to the capital cost estimation process, an allowance for operations and maintenance (O&M) costs of the proposed Metro Knocklyon route options was developed to capture the potential O&M costs over a 60-year operational time horizon. For both the Metro Knocklyon and Metro UCD to Sandyford route options a total allowance of €600m (in 2011 prices and values) across the 60-year period is proposed as approximately representative with reference to the equivalent MetroLink projections.

5.4 Expenditure profile

To allow estimation of the present value of the capital and O&M costs, expenditure profiles were developed support this.

5.4.1 Capital expenditure profile

For both proposed routes a four-year construction programme ending in 2030 was assumed with equal expenditure assumed in each year. At this stage, this assessment should be considered highly preliminary, and is proposed solely for the purpose of evaluating the present value of the costs.

5.4.2 O&M expenditure profile

Rather than following a pro-rata estimate of €10m per annum, O&M expenditure was assumed to increase over the 60 year operation period, as the age of the assets increases, from €6.6m in the 1st year to €13.8m in year 60.

5.5 Construction price inflation

The potential impacts of Covid-19 and construction of MetroLink on construction prices are considered an area of significant uncertainty and remain to be confirmed.

Whilst a project of a scale of the MetroLink construction might be expected to drive increases in construction costs, this has not been quantified, and any impact would also be influenced by the timing of these proposals. Conversely, the schemes proposed may be in a position to benefit from efficiencies and lessons learned during the delivery of MetroLink. No specific allowance has been made for the separate impacts of these issues, which are considered to fall under the overall allowance for Risk and Optimism bias.

5.6 Present value of costs

For use in the value for money appraisal, the costs have been adjusted for presentation in a 2011 market price basis and value, this has been undertaken in line with Transport Infrastructure Ireland's Project Appraisal Guidelines (PE-PAG-02030).

The capital and O&M costs are provided on a factor cost basis, for conversion to market cost basis for comparison with the potential user benefits, an uplift of 1.183 has been applied.

As per TII guidance the present value year has been taken as 2011, the capital costs have been deflated to 2011 values based on the observed Consumer Price Index for the period 2011- 2019. O&M costs were originally estimated on a 2011 basis.

Future year capital and O&M costs are similarly discounted to 2011 values with discount rates as per TII guidance of 4% for years 1-30 and 3.5% for years 31-60.

Table 5-4 Not cited in Report

Table 5-4: in Costs in (2011 Prices and Values, nearest €100,000).

Category	Option A Metro Knocklyon, Ballycullen to Charlemont (through running)	Option B Metro Knocklyon, Ballycullen to St Stephen's Green (linked)
Construction Cost	€2,257,000,000	€3,120,700,000
Operating Cost	€105,500,000	€105,500,000
Total Cost	€2,362,500,000	€3,226,200,000

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Chapter 5

Observations, Commentary and Issues in Jacobs Chapter 5

The Metrolink Scheme and South West Dublin Options

The Main Metrolink Scheme. The scheme that is the subject of a Railway Order application this year is a "light" metro running from Estuary/M1 P+R via the Airport and Tara Street to Charlemont. It will have 16 stations (11 underground) and about 11.7 km of tunnel alignment. A depot is planned at Dardistown, just south of the airport. Automatic operation is recommended with platform screen doors at all stations.

The scheme ends at Charlemont but there has been a clear intention to extend the Metro south via the existing LUAS Green Line to Sandyford, where there is a LUAS depot, or to Brides Glen. LUAS now extends to Brides Glen but there are concerns that LUAS will lack the capacity needed in the long term- hence the Metro proposal. It seems that LUAS would be cut back, possibly to operate Charlemont – Broombridge or Charlemont-Finglas if the extension now proposed is constructed. Therefore, the Metrolink scheme involves major changes to LUAS. Questions about whether a new LUAS depot will be needed once its northern access to Sandyford is lost and how long rail service between Charlemont and Sandylands will be suspended for construction, need answering.

The SW Metro Options. The Jacobs feasibility study examines two options: A – Charlemont to Ballycullen with 6 new stations served by Metro trains running through, and Option B -St. Stephens

Green to Ballycullen with 8 new stations operated as a separate line from the Main Metrolink Scheme. These two options were examined for station locations and demand forecasts were undertaken. There is no assessment of the operating feasibility of Metro in south Dublin with two branches (towards Sandyford and to the southwest). It is not clear if the constraints this would put on the level of service on each branch could be accommodated. Therefore, it is not possible to establish the feasibility of a SW Metro as a branch of an extended Metrolink towards Sandyford. This would require scrutiny of forecast flows on prospective Metrolink extensions to the south/south-east.

The costs of options A and B are summarised in the Feasibility Report but not given in detail. A spreadsheet file was provided with the build-up of costs. However, this appears to relate to Metro Alignments in South and South West Dublin that do not match the Feasibility Report Options, although they may have been developed to do so.

The spreadsheet appears to support the PowerPoint presentation of two SW Dublin Metro options labelled I and II. Alignment Option B corresponds closely to Option I, with 8 stations between St Stephens Green (SSG) and Ballycullen and operation separate from the Main Metro scheme. It would offer interchange at SSG with the main scheme but requires a new depot in the Ballycullen area.

Option II does not match option A. The latter (Option A) envisages through running (e.g. Airport-Ballycullen) and would have only 6 new stations in SW Dublin. This option may not need a depot in SW Dublin if Dardistown can accommodate the trains required.

Comparing Costs - Metro Main Scheme and SW Dublin Options

The inconsistencies noted above make comparison more difficult. Added to this the "quantities" used in the costing of the main scheme are not available. Despite repeated requests for this and other information and a polite response from the NTA Deputy CEO stating significant amounts of relevant data and analyses do not exist these must have been used in the costing work but are not explicit. Nevertheless we have come up with another solution in the absence of adequate information being made available to us by the NTA, we have been able to compare the costs given in the Jacobs report and in the cost estimate spreadsheet for SW Dublin and these are summarised in the table. Costs are undiscounted at € 2019 Q4 prices (millions) and exclude VAT.

Cost Category	Jacobs Option A	Jacobs Option B	PowerPoint Option I	PowerPoint Option II
Tunnels and shafts	549.9	612.1	569.9	
U Stations	904.2	1266.5	904.2	
Trains	149.8	217.6	149.8	
Other costs	384.6	647.7	280.0	
Construction total	1988.5	2743.9	1903.9	1638.5
Indirect	285.4	393.7	273.3	
Land + property	189.9	269.0	186.7	
Total before Risk	2463.8	3406.6	2363.9	2034.2

Note: costs of PowerPoint option II are not detailed as they appear to have little relevance.

The costs in the table exclude risk and Optimism Bias. We expect these costs to be exceeded if the Metro SW extension were constructed. However, we have excluded risk and bias from this section (see below regarding risk and bias).

The Metrolink summary costings in the Preliminary Business Case talk of Risk Assessment and its valuation but do not mention Optimism Bias, whereas the Jacobs SW Dublin Metro Feasibility Report includes Optimism Bias but does not discuss risks.

Our preliminary review shows some inconsistencies which are summarised as follows....

- Option A in the Jacobs work was expected to correspond to a PowerPoint option but does not because both PowerPoint options assume no through running, so comparison is not possible.
- The total costs of Jacobs option A are very similar to the total for PowerPoint option I. They differ in detail but not by much, some of the cost category totals are the same leading to concerns that costs have become mixed up.
- The scope of Jacobs option B corresponds well to PowerPoint option I. Both have 8 Underground stations and no through running. However, the costs are very different so that it seems that the source of Jacobs cost was different or errors have occurred.
- The costs of trains in PowerPoint option I is €149.8m and the spreadsheet advises that this represents 19 trains. The cost of trains in Jacobs option A is the same even though it is a through running option which should require fewer trains than a shuttle. The cost of trains seems high at an implied €7.88m each for a 60 metre train.
- In the PowerPoint options, a depot is assumed at Ballycullen for which the costs are unclear. For a through-running scheme, it should be possible to dispense with such a depot, at least in early years, providing there is expansion room at Dardistown. Therefore, the inclusion of de pot costs is probably unwarranted.

We conclude that there is no clear correspondence between the PowerPoint options and those in the Jacobs Metro to Knocklyon Feasibility report. Nor is it possible to confirm that the Jacobs SW Metro extension costs are consistent with those in the Metrolink preliminary business case.

We had hoped to compare the costs of a SW Dublin Metro extension with those of the Metrolink scheme but this is not possible without adequate access to the build-up of costs or the cost rates used in costing Metrolink.

Although no comparison of the SW Dublin Metro options and Metrolink can yet be made, there are some indications from the JASPERS Report of 2022. An extract from that report states that....

"The Project's Unit Costs at 2017 prices (including civil works, equipment, rolling stock and contingencies) are equal to an equivalent of €322m per kilometre or €260m per metro-set, which exceed costs for systems serving a similar passenger demand across Europe (€ 122m or € 60m respectively).
Using a separate database, the comparable unit cost for a subset of projects in Germany, Belgium and Denmark suggests a unit rate in the region of €280m/km, although this assumes full construction in tunnel, and would likely be €220m/km to

€240m/km when using the same split between above/below ground as Metrolink."

On the basis of average costs/km suggested by JASPERS, it is possible to give indicative costs for a Metro line and for a line from Charlemont to Tallaght via Knocklyon. Whereas the costs of an extension from Charlemont to Ballycullen (Option I in the PowerPoint presentation) can be taken as relevant subject to confirmation with TII/NTA. This is unsatisfactory because detailed build-up is needed to ensure that costs on the common section are consistent.

Assuming the costs of **Charlemont-Ballycullen** scheme as set out in the costing spreadsheet for Option I which is €2.4bn before risk allowance/optimism bias, this points to an average of €224m/km which is in the range given by JASPERS. Deducting the cost of trains and stabling and turnback facilities not needed on a through line, we have €2.4bn total cost minus €106.6m which is €2.257bn for a 10.7km line i.e. €211m/km of new construction, all underground.

The Base capital costs estimated for Metrolink in 2021 were €5468m at 2019 prices (€5.8 billion by July 2022). The Metrolink scheme is for 19.4km of route, the total cost/km is €282m/route km. This excludes risk allowance but includes the full cost of the depot at Dardistown and 26 trains. Therefore, we would expect the cost/route km of construction to be lower than €282m but it is difficult to find a figure that could be used for checking SW Dublin scheme costings.

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Chapter 5

Observations, Commentary and Issues

Addressing Risk and Optimism Bias – The Metrolink Approach compared to the Jacobs SW Feasibility Study

MetroLink has three major cost components; delivery costs, operating costs and renewal costs.

Delivery cost forecast

Given its uniqueness including its scale for Ireland it is noted that for MetroLink, a comprehensive approach is being employed to the costing and its forecasting methodology.

This includes 'Internal bottom up cost forecasting' for the direct works cost of constructing MetroLink, identifying individual work packages and considering the inputs to deliver the work package in terms of labour time and materials, equipment costs and the cost drivers and unit prices of various work activities. Additionally, TII has included forecasts for its costs (authority costs) and property acquisition costs. The authority costs have been based on the resources required and assumptions of the recommended project management model for delivery of the project. The property acquisition cost forecast has been assessed in accordance with the general

scope of entitlement of potential claims to statutory compensation, on a plot by plot basis. The forecasting process involved TII direct experience of largescale complex Irish infrastructure, three independent property valuation firms with experience in the Dublin property market, and Transport for London (Operational Property) peer review and verification of the approach and methodology deployed consistent with international large-scale public transport projects.

Benchmarking

Top down and bottom up benchmarking processes were employed to develop the direct works cost and by both of the independent cost forecasting firms during the preparation of their estimates. Bottom up benchmarking was utilised to inform a selection of the unit costs and productivity rates. While top down benchmarking was utilised to review key aspects of the estimate the outputs of the top down benchmarking activities were captured in estimate reports with the comparison benchmarks being drawn from in-house data and published information, including from 'Benchmarking tunnelling costs and production rates in the UK', prepared by the United Kingdom Government's Infrastructure and Projects Authority (IPA) and the Infrastructure Cost Review prepared by the UK HM Treasury.

External independent cost forecast verifications

Two additional independent and separate shadow direct works cost forecasts were undertaken, by two independent cost forecasting firms, to test for potential additional variability in the assumptions or approach used for the direct works cost forecast. This verified the robustness of the direct works cost forecast and identified areas for further examination and refinement.

Risk assessment

International experience points to almost no large infrastructure projects being delivered at the forecast base cost figure. Large projects are exposed to a range of risk factors that can impact on their delivery. Therefore a risk allowance is typically incorporated into the delivery cost of a project.

Risks and their associated impacts are estimated typically by two methods; quantified risks can be assessed individually using Quantified Risk Assessment, and by use of Reference Class Forecasting. Both a comprehensive Quantified Risk Assessment and Reference Class Forecasting have been employed for the current MetroLink scheme to validate the project delivery budget range.

In the case of Metrolink Quantified Risk Assessment was the primary tool. Applied with care and based on in-depth estimation and robust data it is likely to offer the greatest precision in estimating the likelihood and impacts of the risks should they materialise.

Reference Class Forecasting analyses the cost outcomes of completed projects of a particular type or "class" of project to establish risk allowances to apply to projects. These are sometimes referred to as reflections of and estimates for the so called Optimism Bias. Reference Class Forecasting has been employed in the case of MetroLink to validate the project delivery budget range. In the case of MetroLink Reference Class Forecasting has had no perceptible effect on costing. While its findings pointed to a risk premium in the region of 60-70% these findings did

not lead to any attributable change to the capital and related delivery costs attributable to MetroLink. This is in marked contrast to the Jacobs South West Metro Feasibility Study that adopted a 65% risk premium to the costs it estimated for the scheme options.

Risk appetite

The level of risk allowance to add to a base cost is dependent upon the degree of certainty required in relation to delivering a project within a specific budget – the so called risk appetite. Risk appetite will be a function of the project owner's experience in undertaking similar projects. A history of successful project undertakings can lead to potential optimism bias in the presentation of costs and risks, particularly as part of economic and financial appraisals, in an effort to achieve project approvals.

In the case of Ireland the Public Spending Code, 2019 attempts to minimise the risk of optimism bias, while at the same time avoiding undue allowance for the costs of risks.

By their very nature the level of uncertainty associated with particular outcomes increases with the value of the risk allowed for in advancing the scheme. The lower the allowance for risk the less likely that the outcome will be the base cost of delivery plus that risk value allowance. This level of uncertainty can be represented in terms of the probability of its occurrence. Thus the larger the value of the risk the higher the probability that the outcome will be no greater than the value of that risk premium plus the base delivery cost.

Moreover, the degree of uncertainty related to very large projects makes use of cost forecast ranges rather than a single estimate prudent. For instance, the risk adjusted cost that provides a 50% probability that the overall outturn cost will be at or less than that figure (and a 50% probability that the overall outturn cost will be greater) is known as a "P50" figure. Similarly, a P80 cost forecast represents the estimate level at which there is an 80% probability that the overall outturn cost will be at or less than the stated figure. And a P30 cost forecast gives a 30% probability of the overall outturn cost being at or lower than the estimated amount.

For MetroLink, the estimated P50 risk allowance for example, using Reference Class Forecasting, and having regards to a completed Quantified Risk Assessment, equates to a premium of 30% over the base delivery cost. This is also equivalent to an anticipated Optimism Bias of 30%. A range of costs forecasts associated with probabilities from P30 to P80 is viewed as an appropriate range for cost forecasting and budgeting purposes.

MetroLink's Quantified Risk Assessment and Reference Class Forecasting results were presented to an Expert Judgement Group, who confirmed that a P80 Quantified Risk Assessment risk allowance represented a best practice number for utilisation in the financial and economic appraisal of the project.

TII considers the Quantified Risk Assessment P80 risk allowance as an appropriate client appraisal value for utilisation in economic and financial appraisals. TII also considers the P50 risk allowance is likely to represent the most appropriate management target budget.

It is important to note the MetroLink base cost plus the risk allowance, represents the cost of the project in current day values. This is the cost of the project in the absence of inflation.

Delivery cost summary

For MetroLink, the total preliminary cost forecast ranges from a low of with a 7% risk allowance, offering a 30% confidence in budget adherence with a low inflation forecast, to a high with a 55% risk allowance, offering an 80% confidence level and high inflation forecast.

Management Target (Stretch and Base)

To drive efficiency and promote value for money objectives for the taxpayer however, TII's budgeting provides for an internal project budget expectation of a 30% allowance for risk that reflects the P50 risk assessment, (50% risk value allowance), together with the medium inflation assessment.

While this is the established management base target, management will seek out opportunities to achieve the stretch target of P30 with low inflation.

Prudent Client Appraisal Value

While P30 Low and P50 Medium reflect TII's goals for delivering MetroLink, as a prudent client, TII has applied the P80 High allowance in its estimation of the overall delivery costs for the purposes of evaluating the economic benefits of the project. Employing the P80 risk allowance was confirmed as appropriate for this purpose by an Expert Judgement Group.

The Metrolink Approach compared to the Jacobs SW Feasibility Study – Implications for Economic Appraisal performance

It is noted that for the case of the Metro to South West Dublin scheme as specified in the Jacobs Feasibility Study a risk allowance of 65% was applied to the total cost estimate. This provided the cost input to the economic appraisal for the scheme.

In contrast for MetroLink, a 7% risk allowance, offering a 30% confidence in budget adherence, a premium of 30% over the base delivery cost, offering a 50% confidence in budget adherence to a high with a 55% risk allowance, offering an 80% confidence level in budget adherence are deemed to reflect an appropriate range for cost forecasting and budgeting purposes. For the economic appraisal a 55% risk allowance equivalent to an anticipated Optimism Bias of 55% is viewed as appropriate. The Management Target ***expectation t***o drive efficiency and promote value for money objectives provides for an internal project budget expectation of a 30% risk allowance.

The implications for these variations are for the economic appraisal for the Sout West scheme to be inconsistent with the test applied in the case of the current Metrolink scheme and to result in lower performance (Benefit Cost ratio) than would otherwise emerge for the former if the Metrolink assumptions are applied.

Metro Extension Charlemont – Tallaght.

Proposals for a Metro extension to Tallaght have been made and tabled by the MSWG. A line from the city centre to Tallaght through SW Dublin was included in the network proposals in "A Platform for Change" published by the Dublin Transportation Office, the predecessor to the NTA in 2001.

If a Metro line serving SW Dublin could also serve Tallaght, it is very likely to increase the passenger loadings very substantially and provide opportunities for sections of surface alignment. This would reduce the average cost of construction, potentially increasing the economic performance of the scheme. We have identified two potential alignments to serve Tallaght.

Metro to Knocklyon Capital Costs Options A – D and I and II

Source	Jacobs Option A	Jacobs Option B	PowerPoint Option I	PowerPoint Option II	TAA Option C	TAA Option D
Total €bn before allowance for Risk	2463.8	3406.6	2363.9	2034.2	2760.0	2220.0 – 2520.0

Costs are undiscounted at € 2019 Q4 prices (millions) and exclude allowance for risk/optimism bias and VAT.

Note: costs of PowerPoint option II are not detailed as they appear to have little relevance.

The Option C alignment would offer through running from Charlemont (or a suitably located St Stephens Green station) with an underground junction formed to enable Metro to operate in future towards Sandyford. It would then run in tunnel via stations at Rathmines, Terenure, Rathfarnham and Ballyboden to Knocklyon. Beyond there we envisage that Metro could turn north and rise to the surface in the area of Junction 11 on the M50/N81, then along the River Dodder to run and on the surface or elevated beside, or in the median of, the N81. The line would terminate at a station serving Tallaght centre with bus and Luas interchange. This would mean about 12.5km of new construction.

The implied cost of this line would be 12.5km x €211m giving €2,637m plus trains. An initial outline cost of trains can be obtained by applying the average speed of Metrolink trains on the initial line including stops to give a rough running time and assuming a peak headway of 5 minutes. The average speed of Metro trains on Metrolink north is not given in the PBC but can be inferred assuming 23 trains in peak service at 3 min headway over the 19.4km line. Average speed would be 33-35kph. Assuming 33kph, the 12.5km Tallaght line would require 10 trains for peak service plus a train as engineering spare, a total of 11 trains. These would cost €1.09m each using the TII/NTA cost spreadsheet cost per train for option I (€20,625,000/19 trains, 2019 prices). This gives an initial cost for the extension of €2.64bn + €0.12bn= €2.76bn.

Another option alignment to serve Tallaght (Option D) would offer through running from Charlemont (or a suitably located St Stephens Green station) with an underground junction formed to enable Metro to operate in future towards Sandyford. It would then run in tunnel via stations at Rathmines, Terenure, Rathfarnham or Templeogue from where we envisage it would run southwest with a potential station to serve a P&R facility around Spawell and rise to the surface in the area of Junction 11 on the M50/N81, then along the River Dodder to run and on the surface or elevated beside, or in

the median of, the N81. Tallaght could be served by two stations , one in the Glenview area a station and a station serving Tallaght centre with bus and Luas interchange. This would mean about 11km new construction with two fewer stations than for Option C or the same number with Spawell and Tallaght (Glenview) constructed. It is estimated the initial cost for this option would be €2.1bn + €0.12bn to €2.4bn + €0.12bn = €2.22bn to €2.52bn.

Conclusion

The "Knocklyon" feasibility study analyses the capital costs of the projects. It however contains little supporting detailed information and we have not been able to source same. We have therefore used the costing methodology employed in the Metrolink (Estuary to Charlemont) Preliminary Business Case to benchmark the "Knocklyon" scheme costs and check for consistency with Metrolink in estimating costs. We identify some key differences in costing assumptions applied to the "Knocklyon" compared to Metrolink and conclude if the latte's methodology were applied consistently the cost of "Knocklyon" metro would be less than reported.

MSWG have proposed the metro extends to Tallaght. This is very likely to increase the passenger loadings very substantially and provide opportunities for surface alignment. We have identified an Option C and Option D both terminating at Tallaght. Both represent extensions of Option A specified in the feasibility report. We estimate that Option C could be delivered for €2.76 billion and option D could be delivered for €2.52 billion.

9 Projected Demand for Travel by Metro in the City Centre to Knocklyon Corridor: Assessment of the projections and the forecasting tools employed in the Jacobs Feasibility Study Report

9.1 In this section of our report an overview is provided of the methodology employed in the **Jacobs Metro to Knocklyon Feasibility Study report** to generate forecasts of travel demand attributable to the Metro to Knocklyon scheme (see Chapter 6 and Chapter 4 in report). A summary of key features of the projected travel demand is also set out in this section of our report before offering an outline and some comments on the forecasting tools and the likely robustness of the projections.

9.2 Forecasts of travel demand for the Metro to Knocklyon Feasibility Study were estimated using the National Transport Authority's (NTA) Regional Modelling System, developed in collaboration with SYSTRA and Jacobs Engineering Ireland. The National Transport Authority's Regional Modelling System comprises the National Demand Forecasting Model, five large-scale multi-modal regional transport models covering the entire national transport network of Ireland. Among the five regional models focussed on the travel-to-work areas of the major population centres in Ireland, the Eastern Regional Model (ERM) was employed to generate forecasts of travel demand change attributable to the metro scheme including its variants. **More details are set out below.**

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

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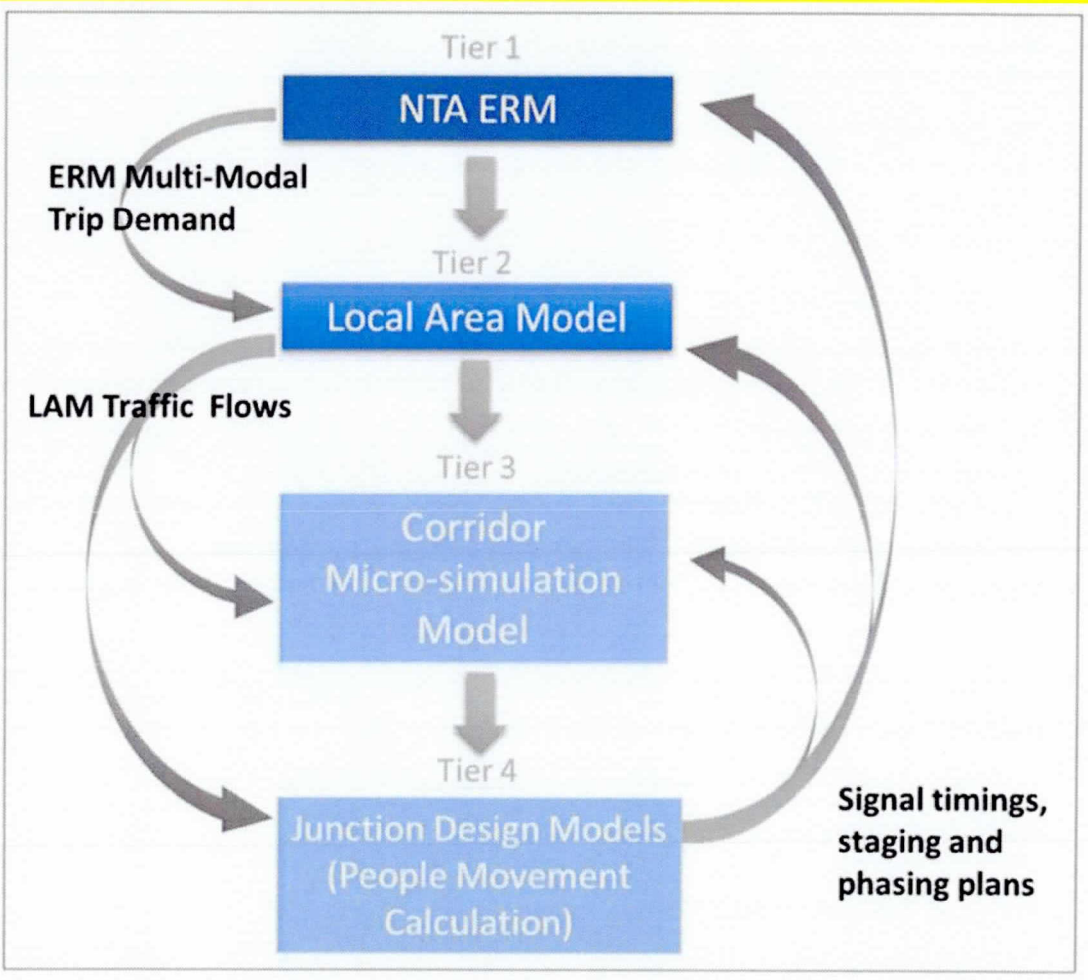
NTA's East Regional Model (ERM)
In Ireland four tiers of transport modelling are typically employed in generating forecasts of travel demand and providing key inputs to the economic appraisal.
• Tier 1 (Strategic Level): The NTA's East Regional Model (ERM) is the primary tool which has been used to undertake strategic modelling of the Proposed Scheme and has provided the strategic multi-modal demand outputs for the proposed forecast years;
• Tier 2 (Local Level): A Local Area Model (LAM) is a subset model created from the ERM and contains a more refined road network model used to provide consistent road-based outputs to inform the TIA, EIA and junction design models. This includes information such as road network speed data and traffic redistribution impacts for the Operational Phase. The LAM also provides traffic flow information for input to micro-simulation model and junction design models and has been used to support junction design and traffic management plan testing;

• Tier 3 (Corridor Level): A micro-simulation model of the full 'end to end' corridor has been developed for proposed schemes to support the ongoing development of junction designs and traffic signal control strategies and to provide bus journey time information for the determination of benefits of the Proposed Scheme; and

• Tier 4 (Junction Level): Local junction models have been developed, for each junction along the Proposed Scheme to support local junction design development. These models are informed by the outputs from the above modelling tiers, as well as the junction designs.



It is unclear however, from the documentation provided, whether the extent to which the generation of demand forecasts and associated inputs to economic appraisal have employed all stages

Summary of Transport Modelling employed in generating projections for the Metro to Knocklyon scheme as set out in Chapter 4 of the **Jacobs Metro to Knocklyon Feasibility Study report**

4. Transport Modelling

4.1 Future Transport Context

The performance of the proposed options has the potential to be highly influenced by the wider transport context including public transport enhancements in the adjacent local area.

The potential interfaces and interactions with other schemes are discussed further in the context of the modelling scenario assumptions.

4.2 Do Minimum Public Transport Network

The following schemes are assumed in the 2030 Do-NDP based scenario.

4.2.1 MetroLink

The MetroLink scheme is included in full in the 2030 Do-NDP scenario, with the assumption of a 2-minute (30 tph) headway

4.2.2 BusConnects

- Radial Core Bus Corridors
- BusConnects Fares / Ticketing
- BusConnects Routes and Services

4.2.3 Park and Ride

- Rail and Bus based P&R provision (partial implementation by 2028)

4.2.4 Rail

- Interim DART Expansion (Pelletstown & Kishogue only)

4.2.5 Other

2030 assumptions regarding Cycling, National Roads, Regional and Local Roads and Demand Management remain as per the 2030 Do-NDP scenario.

4.3 Do Something (Metro Extensions)

Two metro schemes have been considered:

A – "Through running" (AAG): Metro Estuary – Ballycullen (Extension of Metrolink to the South)

B – "Linked St. Stephen's Green" (AAK): Metro St. Stephen's Green – Ballycullen (Separate Metro line connecting to MetroLink)

NOTE Option A in Figure 4-1 and Option B in Figure 4-2 are refer to Station Rathfarnham Castle C2 modelled for demand. This is labelled as C1 in Chapter 2 Definition of Study Area /Corridor the station assessed under MCA Plus Figure 4-2 contains an additional station labelled Iveagh not far from Portobello. It is unclear whether this was modelled at all.

The alignments for both schemes are represented in Figure 4-1 and Figure 4-2.

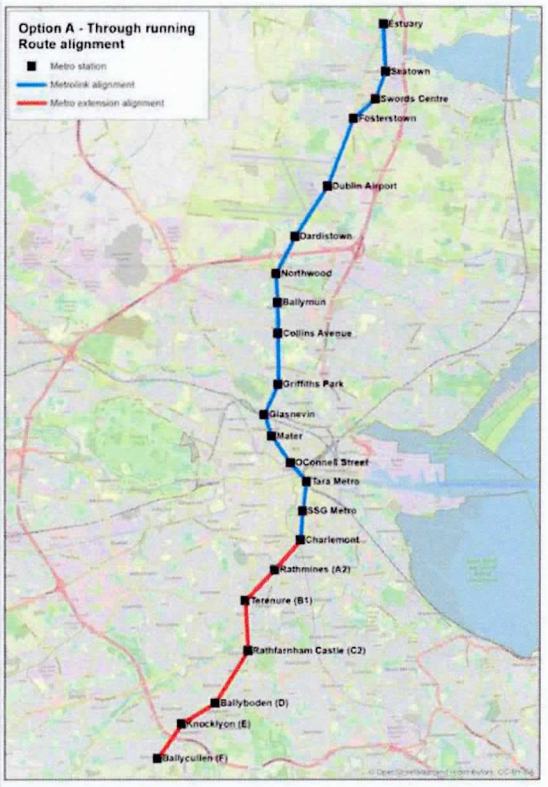


Figure 4-1: Option A through running alignment

Figure 4-2: Option B linked SSG alignment

4.4 Model Runs

'the' suggests it is unclear if any other years actually modelled

Below is a list of the model runs and their related scenarios, as well as the modelled year.

Table 4-1: Model Run ID's

Run ID	Scenario	Modelled Year	metro
AAF	Do Minimum	2030	Estuary - Charlemont
AAG	A – Through running	2030	Estuary - Ballycullen
AAK	B – Linked SSG	2030	Estuary – Charlemont + SSG - Ballycullen

4.5 Passenger Flow Comparisons

Metro line loadings for the AM, LT and PM peak in 2030 with Metro to Knocklyon in place using the through running alignment at Charlemont (AAG) and the linked alignment at St. Stephen's Green (AAK) for Northbound and Southbound are shown in Figures 4.3 – 4.8 below. Both the AAG and AAK scenarios are represented on the same chart to facilitate comparison.

From the results of the model runs using the Eastern Regional Model, the through running option Estuary to Ballycullen generates higher passenger flows than the linked option to St. Stephen's Green across all time periods and in both directions. The reason for the difference in flows is due to the need for passengers to interchange with the linked option at St. Stephen's Green, making longer journeys faster and therefore more attractive. Apart from the peak directions (AM inbound and PM outbound), passenger flows on the extended section from Charlemont to Ballycullen are below 2,000 passengers per hour.

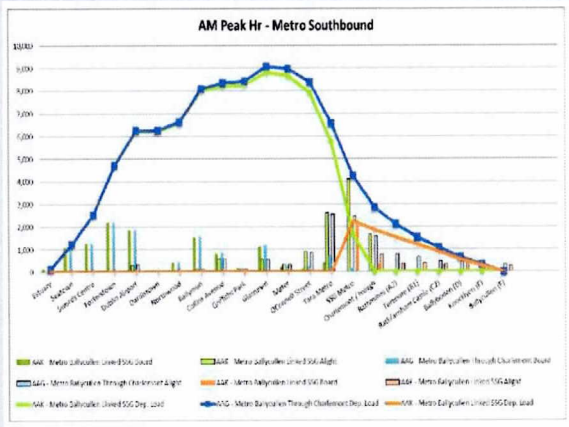


Figure 4-3: Passenger flows AM peak southbound

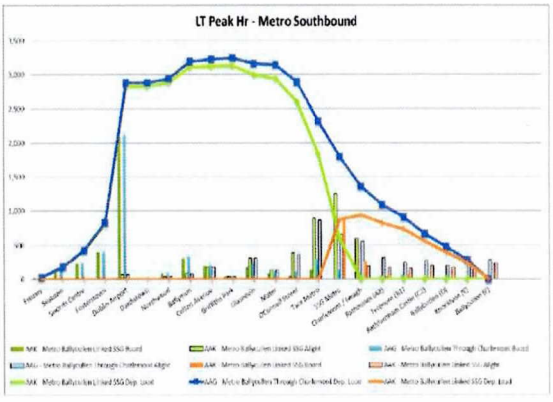


Figure 4-4: Passenger flows LT peak southbound

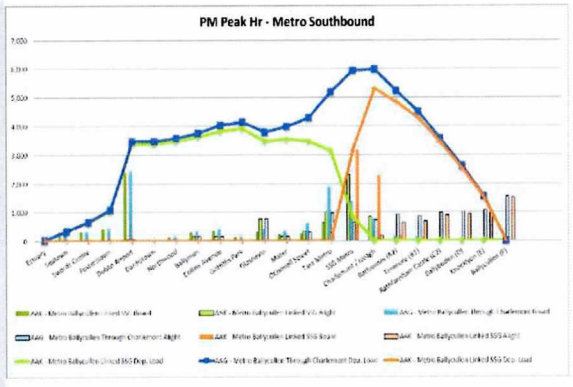


Figure 4-5: Passenger flows PM peak southbound

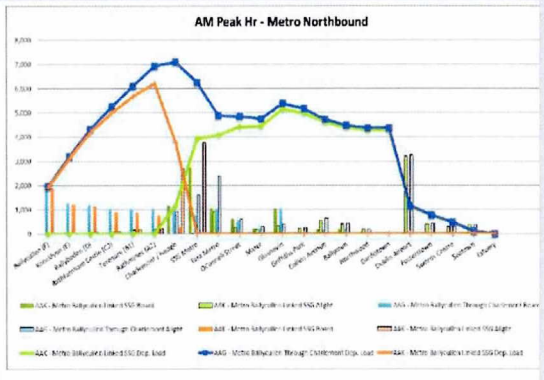


Figure 4-6: Passenger flows AM peak Northbound

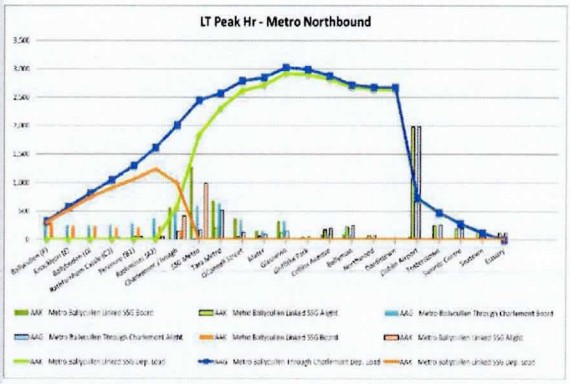


Figure 4-7: Passenger flows LT peak Northbound

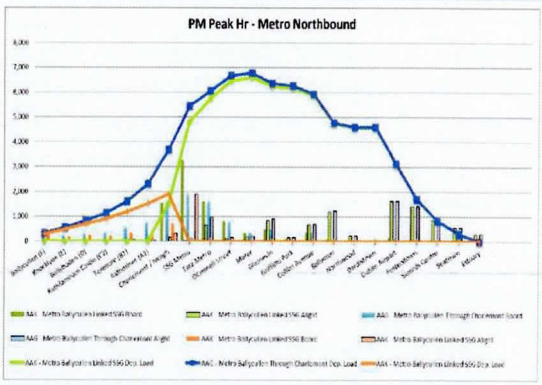


Figure 4-8: Passenger flows PM peak Northbound

4.6 Transport Demand and Mode share

Total modelled PT passengers per mode (boarding's) for the AM peak hour are summarised in Table 4-2. Model run results show that the Metro extension to Ballycullen (AAG) increases the overall number of metro boarding's for the AM peak by circa 9,000 passengers compared to the Do Minimum. Half of that increase is coming from switching from the other PT modes:

- 3,000 from urban bus
- 1,300 from Luas

The separate metro line linked at St. Stephen's Green (AAK) generates more metro boarding's (12,000+) than the option from Ballycullen to Charlemont (AAG). This is mostly due to transfers at St. Stephen's Green between the two metro lines. Removing these intra-metro system transfers and the difference in terms of boarding's with the Do Minimum is similar to the option of Ballycullen to Charlemont.

Table 4-2: AM PT boarding's per mode

Mode	Do Minimum	Through Running (AAG)	Difference AAG/Do Minimum	Linked (AAK)	Difference AAK/Do Minimum
DART	27,803	27,727	-76 (-0.27%)	27,587	-217 (-0.78%)
HEAVY RAIL	18,344	18,356	11 (+0.06%)	18,299	-45 (-0.25%)
LUAS	23,456	22,193	-1,263 (-5.38%)	22,593	-863 (-3.68%)
URBAN BUS	88,805	85,820	-2,984 (-3.36%)	85,546	-3,259 (-3.67%)
OTHER BUS	15,860	15,840	-20 (-0.13%)	15,828	-32 (-0.2%)
METRO	16,728	25,565	8,837 (52.82%)	28,840	12,112 (+72.4%)
TOTAL	**190,996**	**195,501**	**4,504 (2.36%)**	**198,693**	**7,697 (+4.03%)**

The assigned Public Transport flow difference between the Do Minimum and the Do Something show a similar pattern in for both Options A and B and for both time periods (AM & PM peak):

- Transfer of 300 passengers per hour from the Luas Green Line (AM inbound – PM outbound)
- Transfer of 300 passengers per hour from the Luas Red Line (AM inbound – PM outbound)
- Transfer of 800 – 1,000 passengers per hour from bus services along the corridor of Templeogue – Terenure – Rathmines

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The projections for Metro quoted in Chapter 4 of the Jacobs Metro to Knocklyon Feasibility Study report warrant detailed inspection and review of the evidence, including the basis of its estimation.

In the case of forecasting modal shift to Metro for instance, we note the East Regional Model (ERM) is the primary tool which yields strategic multi-modal demand outputs for the opening year and subsequent forecast years for both the Metro to Knocklyon scheme options and the current Metrolink project.

We note the significant differences between the forecasts for the Metro to Knocklyon and Metrolink. Our own initial review of these suggests this divergence in passenger projections between the medium/longer term forecasts for ridership of Metrolink and the Knocklyon scheme is to a significant extent related to as yet unfulfilled projections of population and development in the Metrolink corridor towards the northern outskirts of Dublin and the uncertainty surrounding their outturn.

Additionally, Figures 4.3 to 4.8 reproduced above from the Jacobs Feasibility Study report demonstrate Metrolink passenger carryings are dominated by the city centre and Dublin Airport. These passenger boardings/alightings at Dublin Airport point to highly optimistic projections of Metrolink passengers travelling to/from Dublin Airport, given the geographical pattern of access trips to/from the airport and the cap on airport passenger numbers in place at Dublin Airport. There will be considerable uncertainty surrounding projections for passengers travelling to/from Dublin Airport not only because of the volatility of air travel in the current and anticipated regulatory environment surrounding air travel against the backdrop of climate change, but also question marks over the appropriateness of the ERM system for airport access travel.

A key element to forecasting changes in travel behaviour is the scale of improvements that are expected to result from implementation of the Proposed Scheme. These improvements provide an input to the demand forecasting suite of transport and traffic models.

Our initial investigation of the implied model responses to projections seems to suggest these may not be wholly consistent with the relevant elasticities employed in the strategic ERM model implemented in this case. Thus there are questions of consistency with the process by which demand forecasts have been generated for the Metro to Knocklyon scheme options tabled by Jacobs and the implementation of the programme employed to generate the projections for Metrolink .

Any doubt about the accuracy of these large forecast changes in travel behaviour pose questions about the robustness of transport models employed to generate those forecasts and the validation and reliability of model parameters. It should be noted any questions over the forecasts also raises questions about the robustness of the economic appraisal and any subsequent business case tabled in support of the investment.

Important questions arise concerning the robustness of the forecasts generated by the forecasting tools employed. Addressing questions about the robustness of these projections would require in-depth review of the validation performance of the models, as well as application of realism testing and sensitivity testing.

Nevertheless a prerequisite for reviewing the robustness of any transport models employed to generate demand forecasts and the validation and reliability of model parameters are input values for, for instance, fares journey time, service level and reliability.

We also note the JASPERS observations with regard to Metrolink in its Guidance Note May 2022: *'Our review highlights a strong underlying potential for substantial passenger demand on the Metrolink corridor. .....Nevertheless, this outcome might only be achieved with the introduction of strong supporting measures .....such as an integrated ticketing solution, the reorganization of other public transport to complement the service provided by metro (e.g. in Swords), consolidating the role of metro and avoiding competitive bus services, as well as strong car restraint measures in the City Centre and at Dublin Airport.'*

JASPERS stresses 'Whilst the high demand forecasts reported by the ERM might be achieved or exceeded with the introduction of such measures, we note that these have not been explicitly included in the scenario testing. Even so, there remain a number of uncertainties regarding the demand forecasting. The long term response to COVID, the impacts of DART+ and BusConnects, optimistic airport demand forecasts with overestimated peak loadings, in addition to the ambitious long term population and demographic forecasting beyond 2040 all suggest some limited overestimation of the demand forecasts'.

JASPERS also highlights *'The relevance of the peak hour demand is especially relevant on the critical section of the line where the passenger flow of 15,000 passengers per hour in 2060 defines the system capacity (i.e. the delivery of a full specification metro solution). As such, a reduction in the peak flow (either through a reduction in overall demand or a flattening of the peak profiles) on this critical section is related to the question of overall system specification. A light rail type solution has been examined and can deliver a cost reduction of 20%, although MetroLink would operate on the upper limits of the passenger capacity of such a system'.* (A.1.5. Is the projects needs/demand analysis robust?)

MPAG in its consideration of the JASPERS Guidance Note acknowledges:

'Modelling undertaken by JASPERS suggests that demand for the proposal is potentially overestimated. Based on a demand benchmarking exercise, JASPERS estimated an opening year demand of 40m - 45m which contrasts with the modelled opening year demand of 53m used in the analysis underpinning the business case. ....the NTA and TII .....remain confident that the demand modelling and its associated outputs undertaken for MetroLink remain robust. The demand modelling for MetroLink also excludes the potential impact of demand management measures .....' (Para 3.6).

Nevertheless MPPAG calls for ' (Para 3.7) Further clarity within the project documentation... on how the demand modelling is aligned with the population and employment projections of the National Planning Framework. Further detail is required on how the regional population and employment projections are distributed at a local level'.

Our own review of demand projections for the Metro to Knocklyon scheme options and the projections for Metrolink has identified question marks over the consistency with which the demand projections have been arrived at. This has been informed in part by consideration of the

background demographic , employment scales and distributions as well as the characteristics of key trip attractors and generators including in particular Dublin Airport.

We have noted above JASPERS warnings about a '*number of uncertainties regarding the demand forecasting.....(including)..... optimistic airport demand forecasts with overestimated peak loadings, in addition to the ambitious long term population and demographic forecasting beyond 2040 all suggest some limited overestimation of the demand forecasts'.*

As indicated above we concur with the specific points raised by JASPERS and their relevance for consideration not only of Metrolink but also the Metro to Knocklyon scheme. These include the issues of uncertainty over future demographic development and economic growth projections, the extent of dependence of Metrolink on Dublin Airport users given the circumstances and environmental challenges to the growth facing the airport as well as the spatial patterns of its users.

These uncertainties feed into the forecasting process with relevance for the data and behavioural input assumptions to the ERM process and the validity and reliability of model parameter values and projections.

We would also emphasise that our analysis and consideration of the 'implied' alignments assessed in the Metro to Knocklyon scheme as set out in the Jacobs feasibility study report does clearly point to the urgent need for a reassessment of the scheme but with a focus on alignments that serve Tallaght directly, thereby offering by far the greatest potential for passenger demand, economic viability, and value for money.

It is evident from our analysis of the potential market conditions exhibited in the Jacobs study that they reflect a choice of locations for stations that in many cases are destined to among the least attractive for generating passenger demand in South West Dublin.

Table B offers an assessment of potential travel demand /net economic benefit performance for the Jacobs Metro Feasibility Study proposed station locations **and an expanded series of prospective stations on potential routes Options C and D that would serve Tallaght**. This highlight the significance Tallaght Central in particular would have for ridership of a Metro route to serving southwest Dublin. The implications for the BCR are considered in the next section of this report.

This assessment excludes a potential major Park + Ride facility at Spawell to draw car users from the M50 to access the new metro route. This could be at least as significant in terms of impact on car use as the facility at Red Cow P+R . It would also offer excellent access to/from buses on Templeogue -City corridor.

Table B Jacobs Metro Feasibility Proposed Station Locations and Additional Stations in Tallaght - Assessment of Potential Travel Demand /Net Economic Benefit Performance

Area	Stop Options	Location Details	Jacobs Station Location Accessibility Rating	Land Use Types - Trip Generator / Trip Attractors	Scale of Attractors	Pop in 1 km catchment area – radius of 1 km and area 3.14 Km^2	Pop Density Inhabis per Km^2	Pop Density Inhabis per ha	Potent Pax Nos.	Perfm
R'thmines	Option A1 Harold's Cross	Harold's Cross Park Option A2	Reas'nble	Mixed – Mainly Trip Generator	Limited	28,216	8,986	90	M'dest	+
R'thmines	Option A2 Rathmines Grounds of St. Louis' Convent	Grounds of St. Louis' Convent R'hmines	Poor	Mixed – Trip Generator AND Substantial Trip Attractors	Subst'tial	32,480	10,343	103	Sign	++/ +++
Terenure	Option B1 T'nure	CYM Sports Club	Could be better	Mixed – Trip Generator AND TRIP Attractors	Some	25,059	7,981	80	M'dest/ sign	+/++
Terenure	Option B2 T'nure	Rathgar Tennis and Bowling Club	Poor	Mixed – Trip Generator AND TRIP Attractors	Limited	24,528	7,811	78	M'dest	+
Rathf'rhm	Option C1 R'f'nham	Grounds of Rathfarnham Castle, lands close to the northern entrance	Could be better	Mixed – Trip Generator AND TRIP Attractors	Some – not imm'diate	15,137	4,821	48	L'mted	0
Rathf'rhm	Option C2 R'f'nham	Open lands to the north east of W'dview Cottages	Poor	Trip Generator – very limited	Almost none imm'diate	14,252	4,539	45	L'mted	0
B'llybod'n	Option D B'llybod'n	Coláiste Éanna Sports Grounds	Poor Limited by LU patterns/ low density	Mainly Trip Generator	Very limited	18,782	5,981	60	L'mted	-/0
Knocklyon	Option E Knocklyon	Open private lands to the north of Scholarstown Road zoned for devlpmnt	Poor Limited by LU patterns/ low density	Mixed (limited) – Mainly Trip Generator AND limited TRIP Attractors	Local Centre linked to new Dev	18,796	5,986	60	L'mted/ Modest	0/+

Ballycull'n	Option F Ballycull'n	Lands zoned for dev'lpmnt	V poor Limited by LU patterns/ t'p'graphy	Mainly Trip Generator	None	12,386	3,945	39	Very L'mted	--/-
Tallaght	Tallaght East	Tallaght Bypass/Gl enview direction	Good local access to Tallaght centre Relatively poor pt access good access via M50 for private transport	Mainly resid'ntial trip generator	Limited	17039	5424	54	L'mtd/ Modest	0/+
Tallaght	Tallaght Central	The Square Major Shopping Leisure Arts Technical University Hospital and Office Employm ent location	Quite good with LUAS to/from City Centre and Citywest Local bus services and road access high car depend'cy	Very substantia l Trip Attractor and Trip Attractors – arguably largest in South Dublin overall populatio n c80,000	Very large scale – one of GDA's main hubs and centres of growth	16761	5336 *Adjacent areas within less than 1 km 6152-8068*	53* *Adjacent areas within less than 1 km 62-81*	Very subst'ntial	+++++

Conclusion

The "Knocklyon" feasibility study examined potential traffic demand. Only demand modelling for 2030 is reported. We do not consider that the figures as stated for "Knocklyon" is consistent with Metrolink (Estuary to Charlemont) projections, as the latter includes as yet unfulfilled projections of population and development in the Metrolink corridor and arguably unrealistic projections of airport passengers.

We note the significant differences between the forecasts for the Metro to Knocklyon and Metrolink. Our own initial review of these suggests this divergence in passenger projections between the medium/longer term forecasts for ridership of Metrolink and the Knocklyon scheme is to a significant extent related to as yet unfulfilled projections of population and development in the Metrolink corridor towards the northern outskirts of Dublin and the uncertainty surrounding their outturn levels.

Additionally, the Jacobs Feasibility Study report demonstrates Metrolink passenger carryings are dominated by the city centre and Dublin Airport. The latter reflects highly optimistic projections of Metrolink passengers travelling to/from Dublin Airport, given the geographical pattern of access trips to/from the airport and the cap on airport passenger numbers in place at Dublin Airport. There will be considerable uncertainty surrounding projections for passengers travelling to/from Dublin Airport not only because of the volatility of air travel in the current and anticipated

regulatory environment surrounding air travel against the backdrop of climate change, but also question marks over the appropriateness of the ERM system for airport access travel.

Thus there are questions of consistency with the process by which demand forecasts have been generated for the Metro to Knocklyon scheme options tabled by Jacobs and the implementation of the programme employed to generate the projections for Metrolink .

We also note the JASPERS observations with regard to Metrolink in its Guidance Note May 2022. *JASPERS stresses 'Whilst the high demand forecasts reported by the ERM might be achieved or exceeded with the introduction of such measures, we note that these have not been explicitly included in the scenario testing. Even so, there remain a number of uncertainties regarding the demand forecasting. The long term response to COVID, the impacts of DART+ and BusConnects, optimistic airport demand forecasts with overestimated peak loadings, in addition to the ambitious long term population and demographic forecasting beyond 2040 all suggest some limited overestimation of the demand forecasts'.*

MPAG in its consideration of the JASPERS Guidance Note calls for ' (Para 3.7) Further clarity within the project documentation... on how the demand modelling is aligned with the population and employment projections of the National Planning Framework. Further detail is required on how the regional population and employment projections are distributed at a local level'.

We concur with the specific points raised by JASPERS and their relevance for consideration not only of Metrolink but also the Metro to Knocklyon scheme. These include the issues of uncertainty over future demographic development and economic growth projections, the extent of dependence of Metrolink on Dublin Airport users given the circumstances and environmental challenges to the growth facing the airport as well as the spatial patterns of its users.

These uncertainties feed into the forecasting process with relevance for the data and behavioural input assumptions to the ERM process and the validity and reliability of model parameter values and projections.

We would also emphasise that our analysis and consideration of the 'implied' alignments assessed in the Metro to Knocklyon scheme as set out in the Jacobs feasibility study report does clearly point to the urgent need for a reassessment of the scheme but with a focus on alignments that serve Tallaght directly, thereby offering by far the greatest potential for passenger demand, economic viability, and value for money.

10 Economic Appraisal of the City Centre to Knocklyon Metro scheme options: A Review of the findings and the methodological implications for the efficacy of a Metro to serve South West Dublin.

In this section of our report an overview is provided of the findings of the economic appraisal for the two Options for the Metro to Knocklyon specified in the **Jacobs Metro to Knocklyon Feasibility Study report**. This section also includes a comparative review of the application of the appraisal tools to the Metro to Knocklyon scheme and their application to the Metrolink Estuary to Charlemont scheme as reported in the Appendix I to the Metrolink Preliminary Business Case.

Chapter 6 **Jacobs Metro to Knocklyon Feasibility Study report extract**

6. Economic appraisal
6.1 Introduction

A Public Transport User Benefits appraisal of the Dublin MetroLink (Metro extension to Knocklyon), scheme has been completed as part of the feasibility study. This appraisal has been conducted to identify the user benefits expected from scheme implementation.

The Public Transport appraisal has been split into two distinct sections, corresponding to the two options described in the Transport Modelling chapter of the report: Option A "Through Running" (Metro Estuary-Ballycullen) Extension to the South and Option B "Linked St Stephen's Green" (Metro St Stephen's Green-Ballycullen) as a separate metro line to Metrolink.

While the appraisal will foremostly provide an indicative value of user benefits expected from scheme implementation, comparisons between the two options will aid option selection. The appraisal of each alignment option has followed the same defined process.

The transport modelling outputs which underpin the economic appraisal have been produced using the National Transport Authority's (NTA) Regional Modelling System. The Eastern Regional Model (ERM) has been used for this appraisal. The appraisal has been conducted using the TUBA v1.9.4.

As specified in the economics file, the ERM, and Irish guidance, impacts will be modelled in four distinct time periods: AM, LT, SR and PM.

A *spatial* sectoring file was used to aid analysis of the scheme impacts. The five sectors used for this analysis are shown in Figure 6-1 and in Table 6-2.

Table 6-2: Sectors

Sector Number	Description
1	Reference Metro
2	Metro Expansion
3	Rest of Dublin
4	Rest of GDA
5	External

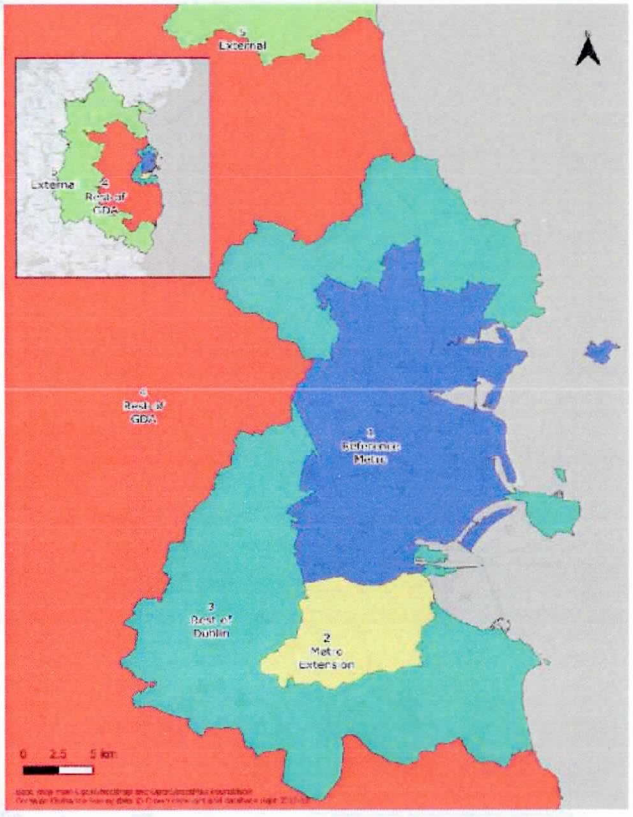

Figure 6-1: Sector Map

To align with the construction plan, the Public Transport User benefits appraisal has assumed a first year of 2030, with modelled years of 2030 and 2045. In line with PAG guidance, a 60-year appraisal period has been considered, meaning 2089 has been used as the horizon year.

This is unclear if 2060 has been modelled

6.2 Option A Through Running – Metro Estuary – Ballycullen Extension to the South

6.2.1 Introduction

Section 6.2 discusses the user and provider impacts expected to occur as a result of the Metro Estuary to Ballycullen MetroLink development, Southern Extension..... Option A is expected to provide connectivity from Ballycullen to the city centre, via Charlemont as part of a through service from Estuary to Ballycullen. It is expected to provide a total of €1.99bn (2011 prices and values) benefits over the appraisal period. This includes benefits through improved accessibility to and from the city centre via public transport, and benefits for highways users from decreased congestion as a result of modal shift away from private road vehicles.

Figure 6-2 illustrates the total combined Public Transport and Highways impact of the proposed scheme for trip origins. Positive benefits can be seen in the two sectors covering the entire alignment (Reference Metro and Metro Extension). Residents along the alignment will now have access to MetroLink, improving city centre access. The Rest of Dublin Area to the west of the main route corridor experiences origin benefits as a result of the proposed scheme in a similar scale compared to the two central sectors. Further, the Rest of GDA Area is expected to experience disbenefits as a result of the scheme.

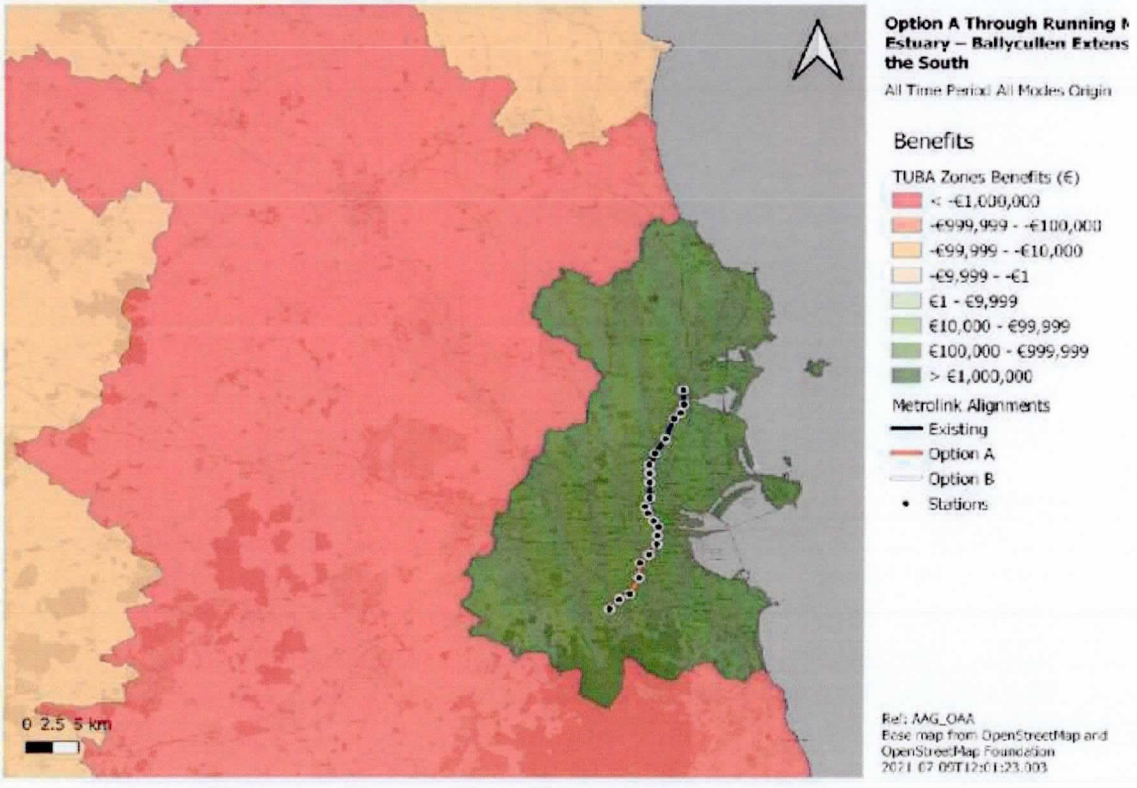

Figure 6-2: Total monetised user impact (€), all times periods, 2045, origin, 2011 prices and values.

Figure 6-2: Total monetised user impact (€), all times periods, 2045, origin, 2011 prices and values.

Figure 6-3 illustrates the total combined Public Transport and Highways impact of the proposed scheme for trip destinations. It shows a similar distribution of impacts to Figure 6-2. Particularly, large benefits are expected to accrue for residents within the two central sectors. The majority of Dublin experiences net benefits as a result of the proposed scheme. This is likely to be due to users benefitting from improved city centre access following the extension of the southern section of the MetroLink.

The Rest of GDA sector is expected to experience disbenefits as a result of the proposed scheme. As outlined below these impacts are primarily driven by impacts on highway users. Congestion at a number of the junctions on the M50 is a known future issue with the modelling of these being potentially sensitive to relatively small demand changes.

This is unclear and explanation is vague

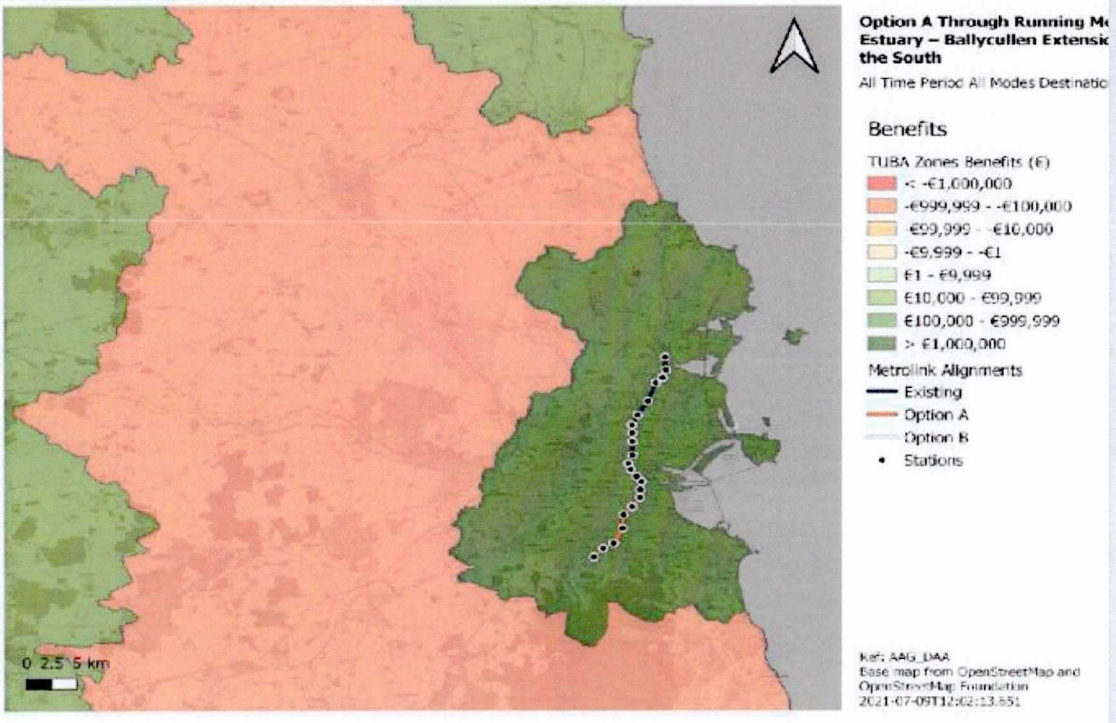

Figure 6-3: Total monetised user impact (€), all time periods, 2045, destination, 2011 prices and values.
Further detail, disaggregated by journey type, is provided in Table 6-6 of this report.

6.2.2 Public Transport

Figure 6-4 illustrates the Public Transport impact of the proposed scheme for AM trip origins. This primarily considers the benefits arising for commuters travelling to work, mapped by their origin.

Generally, there are widespread low-level benefits across Dublin. The central sectors experience benefits of greater than €1m. The areas to the west of the scheme corridor experience the lowest benefit. Residents of these areas must travel the furthest to reach the scheme.

Figure 6-5 illustrates the Public Transport impact of the proposed scheme for PM trip destinations. The general distribution of impacts is widespread, with benefits experienced in all sectors. The highest benefits are received in the two central sectors.

Both the Rest of Dublin and Rest of GDA Areas experience benefits but in a lower range compared to the central areas. Residents of these areas have to travel the furthest to reach the scheme.

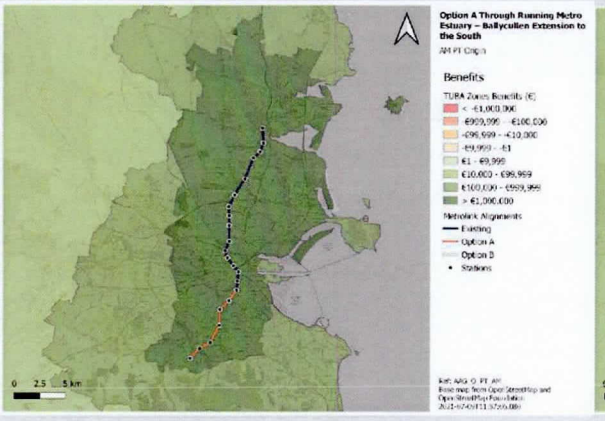

Figure 6-4: Total monetised user impacts (€), , origins, AM, 2045, 2011 prices and values.

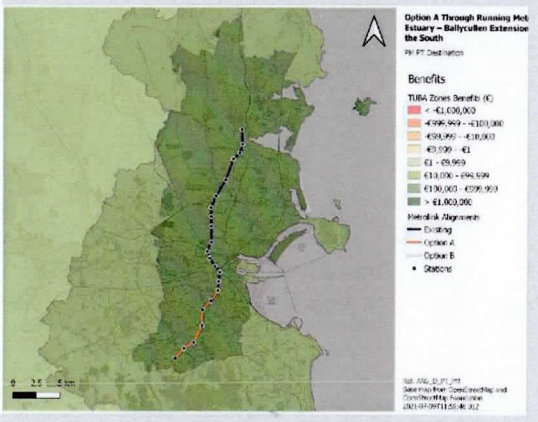

Figure 6-5: Total monetised user impact (€), PM, 2045, destinations, PM, 2045, destinations, 2011 prices and values.

Table 6-3 shows the distribution of monetised public transport user time impacts by trip purpose. All five trip purposes receive a net monetised user time benefit as a result of the Option A Alignment. Leisure trips receive the greatest benefit with aggregate user benefits of €736,200,000 (2011 prices and values) across the 60-year appraisal period. Large benefits are also received by business and commuting users, while slightly smaller benefits are received by the educational and retired user groups.

The 'User Charges' column in Table 6-3 indicates the welfare change for Public Transport users from the change in fare payments. A negative user charge value is expected for all trip purposes as a result of the Option A Alignment. The greatest disbenefit is expected for leisure trips, which sees disbenefits of over -1,500,000 (2011 prices and values).

As this is a public transport scheme there are no vehicle operating costs considered within this part of the appraisal because public transport users do not perceive them. Any costs associated with the additional Metro vehicles required to operate the scheme and their operations are captured within the costs estimates.

Table 6-3: Total monetised user impacts by **trip purpose** Table 6-4: Total monetised user impacts **by time period**
60-year Appraisal Period (2011 Prices and Values, nearest €100,000)

Trip Purpose	User Time impacts (€)	User Charges (€)
Business	426,200,000	-600,000
Commuting	311,800,000	-1,000,000
Leisure	736,200,000	-1,500,000
Education	-	-
Retired	-	-

Time Period	User Time impacts (€)	User Charges (€)
AM	392,200,000	-1,900,000
LT	590,200,000	-200,000
SR	156,300,000	-
PM	335,400,000	-1,000,000

Table 6-4 shows the total monetised public transport user impacts accrued across the 60-year appraisal period disaggregated by time period. All four time periods are expected to receive net benefits over the 2030-2089 appraisal period. The 'User Charges' column in Table 6-4 indicates the welfare change for Public Transport users from the change in fare payments. A negative user charge value is expected for all time periods as a result of the Option A Alignment.

Table 6-5 shows the change in operator revenue and indirect tax revenue as a result of the proposed scheme, disaggregated by time period. All four time periods are expected to see an increase in operator revenue as a result of the proposed scheme. This is because of an increase in MetroLink patronage for all time periods, with more people willing to use the scheme as a result of the proposed improvements. The greatest increase in operator revenue is experienced in the LT time period, with over €97,000,000 (2011 prices and values) increase in revenue. The increase in operator revenue in the AM and PM time periods is broadly similar. A reduction in indirect tax revenue can be seen for all time periods, with the greatest reduction in the LT time period (over €11,000,000) (2011 prices and values). Indirect tax revenues are expected to fall as a result of the proposed scheme due to the increase in public transport patronage. Increased public transport usage is causes a re-allocation of expenditure towards public transport. As consumers spend a greater proportion of their income on public transport (which is not taxable) and less on alternative, taxable, consumption, indirect tax revenue falls.

Table 6-5: Total monetised provider impacts and changes in indirect tax revenues by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	Operator Revenue (PT fares) (€)	Indirect Taxes (€)
AM	54,200,000	-7,900,000
LT	97,400,000	-11,900,000
SR	21,500,000	-3,100,000
PM	49,900,000	-7,100,000

6.2.3 Highways

Figure 6-6 illustrates the Highways impact of the proposed scheme for AM trip origins. This primarily considers the benefits arising for commuters travelling to work, mapped by their origin. The two central sectors see benefits on a similar scale, with the Rest of Dublin Area expected to experience lower benefits. The Rest of GDA area is expected to experience disbenefits as a result of the scheme.

This explanation for this is vague and unconvincing

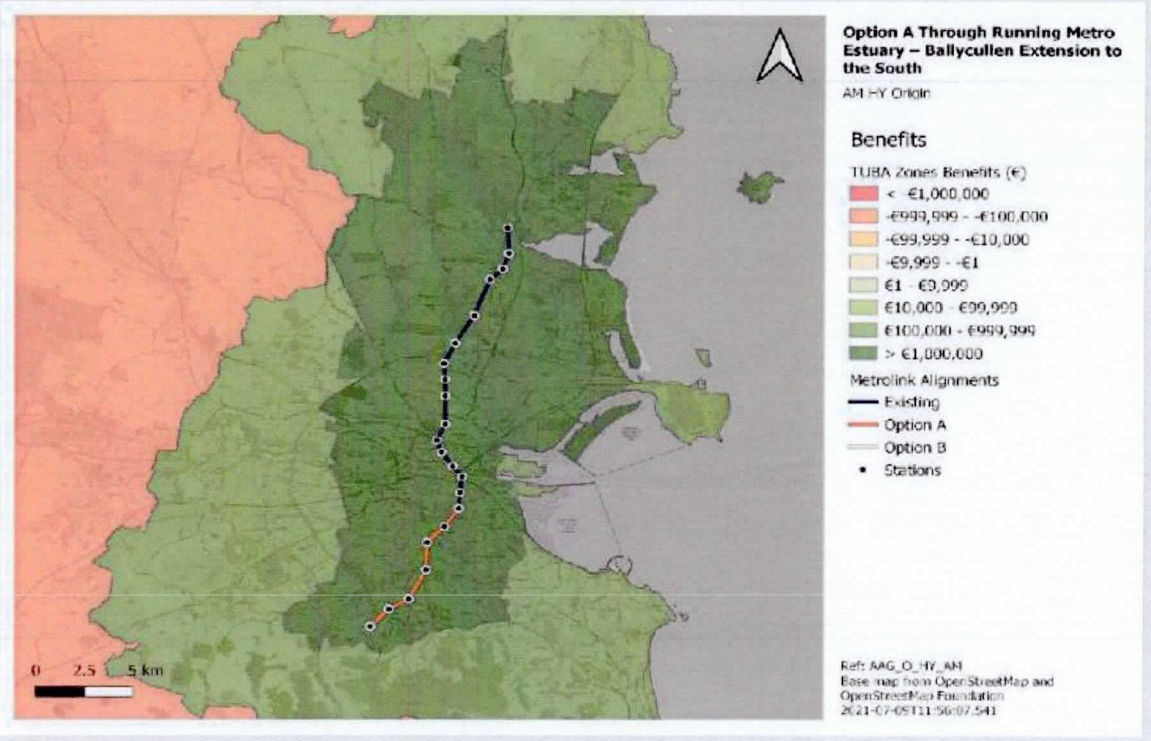

Figure 6-6: Total monetised user impact (€), AM, 2045, origins, 2011 Prices and Values.

Figure 6-7 illustrates the Public Transport impact of the proposed scheme for PM trip destinations.

This is clearly wrongly labelled – refers to highway impact

The distribution of impacts is similar to the AM Highway Origins map in Figure 6-6. However, the Metro Expansion Area south of the city centre is expected to experience lower benefits compared to AM trip origins. Disbenefits are experienced by highways users in the Rest of GDA Area.

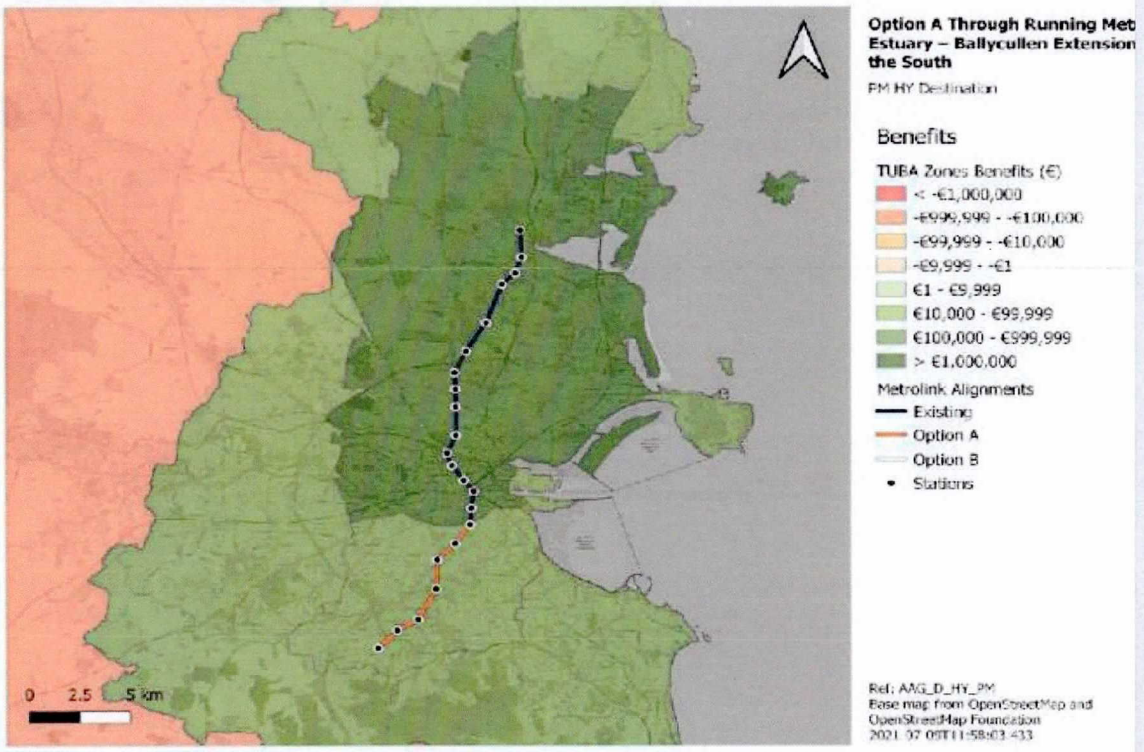

Figure 6-7: Total monetised user impact (€), PM, 2045, destination, 2011 prices and values.

Table 6-6 shows the distribution of monetised highways user time impacts by trip purpose. All five trip purposes experience a monetised user time benefit as a result of the Option A Alignment, with the greatest benefit being the €212,300,000 (2011 prices and values) received by business trips across the 60-year appraisal period.

A disbenefit as a result of user charge changes (national toll) can be seen for business trips, indicating this group sees the greatest increase in toll payments.

This is no satisfactory explanation provided for this

Table 6-6 also shows the change in welfare resulting from changes in vehicle operating costs for highways users as a result of the scheme. Positive welfare benefits can be seen for fuel and non-fuel vehicle operating costs across all five trip purposes, with the greatest benefit for business travel and commuting.

Positive welfare benefits indicate highways users have to pay lower operating costs as a result of the MetroLink improvements. A large proportion of this benefit is likely to be due to a reduction in congestion.

Table 6-6: Total monetised user impacts and vehicle operating costs by trip purpose over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Trip Purpose	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
Business	212,300,000	-500,000	1,600,000	3,600,000
Commuting	78,200,000	100,000	1,600,000	5,300,000
Leisure	17,000,000	300,000	200,000	700,000
Education	9,100,000	300,000	100,000	200,000
Retired	8,600,000	300,000	100,000	200,000

Table 6-7 shows the distribution of monetised highways user time impacts, user charges and vehicle operating costs (fuel and non-fuel), disaggregated by time period. The greatest user time benefit is experienced in the AM time period, where benefits of €144,400,000 (2011 prices and values) accrue over the 60-year appraisal period.

Time benefits are also experienced in the other time periods. These benefits are likely to accrue due to the reduction in highways congestion from the implementation of the MetroLink improvements allowing quicker road journeys.

Table 6-7 shows the benefit impact of changes in user charge payments (tolls) as a result of the proposed scheme, disaggregated by time period. Both the AM and LT time periods see a benefit from changes in user charge payments over the 60-year appraisal period. However, the benefit in the AM time period is smaller than €100,000. The benefits are likely to be the result of reduced travel on toll roads due to a decrease in congestion on non-toll roads. Disbenefits can be seen in the SR and PM time periods. This suggests highways users in these time periods are paying more toll charges than they were previously.

Table 6-7 also shows the change in welfare from changes in vehicle operating costs for highway users as a result of the scheme. A benefit can be seen as a result of changes in both fuel and non-fuel vehicle operating costs for all time periods. This suggests highways users are spending less on vehicle operating costs either due to shorter highway or less congested highway journeys.

Table 6-7: Total monetised user impacts by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
AM	144,400,000	-	1,300,000	2,800,000
LT	21,700,000	1,100,000	800,000	3,700,000
SR	61,200,000	-200,000	700,000	1,400,000
PM	97,800,000	-500,000	800,000	2,100,000

The explanation for this is vague and unconvincing

Table 6-8 shows the expected change in operator and indirect tax revenue as a result of the proposed scheme, disaggregated by time slice.

All time periods experience a reduction in indirect tax revenue over the 60-year appraisal period. This indicates a reduction in taxable expenditure on road travel by highways users travelling in these time periods. Table 6-8: Total provider impacts and changes in indirect tax revenues by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	Operator Revenue National Toll (€)	Indirect Taxes (€)
AM	-600,000	-7,900,000
LT	-6,700,000	-11,900,000
SR	-800,000	-3,100,000
PM	-400,000	-7,100,000

Table 6-9 shows the distribution of monetised highways user time impacts, user charges and vehicle operating costs (fuel and non-fuel), disaggregated by vehicle type. The greatest user time benefits are experienced by car users, who received over 80% of all highway benefits generated by the proposed scheme. Positive benefits are experienced by all vehicle types. Car users also experience a benefit from the change in user charge payments, of approximately €400,000 (2011 prices and values).

Table 6-9 also shows the change in welfare from changes in vehicle operating costs for highway users as a result of the scheme. Benefits are seen for all vehicle types for both fuel and non-fuel operating costs, implying reductions in operating costs for all vehicle types. The greatest benefits are experienced by car users.

Table 6-9: User benefits and changes in revenues by submode/vehicle type over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Vehicle Type	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
Car	266,200,000	400,000	2,400,000	9,700,000
LGV	55,700,000	100,000	1,200,000	100,000
OGV1	3,300,000	-	-	200,000
OGV2	-	-	-	-
All	325,200,000	500,000	3,600,000	10,000,000

Table 6-10 shows the expected change in operator and indirect tax revenue as a result of the proposed scheme, disaggregated by vehicle type. A reduction in toll revenue of over €8,000,000 (2011 prices and values) is expected from car users. This is likely to be caused by car users switching

to non-toll roads due to reductions in congestion as a result of the scheme. A decrease in indirect tax revenue is expected from all vehicle types as a result of the Option A Alignment over the 60-year appraisal period. This indicates a reduction in taxable expenditure on road travel by highways users travelling by these vehicle types.

Table 6-10: Total provider impacts and changes in indirect tax revenues by submode/vehicle type over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Vehicle Type	Operator Revenue National Toll (€)	Indirect Taxes (€)
Car	-8,400,000	-500,000
LGV	-100,000	-500,000
OGV1	-	-
OGV2	-	-
All	-8,500,000	-1,000,000

6.2.4 Summary

Figure 6-8 presents the combined Highways and Public Transport Economic Efficiency of the Transport System (TEE) Tables over a 60-year Appraisal Period (2011 prices and values).

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Highway**	**Public Transport**
Travel Time	€ 389,991	€ 78,218	€ 311,774
Vehicle operating costs	€ 6,904	€ 6,904	€ 0
User charges	-€ 827	€ 141	-€ 968
During Construction & Maintenance	€ 0	€ 0	€ 0
NET CONSUMER - COMMUTING BENEFITS	**€ 396,068**	**€ 85,262**	**€ 310,806**

Consumer - Other user benefits	**All Modes**	**Highway**	**Public Transport**
Travel Time	€ 770,831	€ 34,656	€ 736,176
Vehicle operating costs	€ 1,513	€ 1,513	€ 0
User charges	-€ 679	€ 819	-€ 1,498
During Construction & Maintenance	€ 0	€ 0	€ 0
NET CONSUMER - OTHER BENEFITS	**€ 771,665**	**€ 36,988**	**€ 734,677**

	All Modes	**Highway**		**Public Transport**	
Business		Road Personal	Road Freight	Bus Personal	Bus Freight
Travel Time	€ 638,491	€ 209,003	€ 3,309	€ 426,179	€ 0
Vehicle operating costs	€ 5,218	€ 4,996	€ 223	€ 0	€ 0
User charges	-€ 1,148	-€ 455	-€ 45	-€ 649	€ 0
During Construction & Maintenance	€ 0	€ 0	€ 0	€ 0	€ 0
Subtotal	**€ 642,561**	**€ 213,544**	**€ 3,487**	**€ 425,530**	**€ 0**

Private Sector Provider Impacts	**All Modes**	**Highway**	**Public Transport**
Revenue	€ 214,543	-€ 8,460	€ 223,003
Operating costs	€ 0	€ 0	€ 0
Investment costs	€ 0	€ 0	€ 0
Grant/subsidy	€ 0	€ 0	€ 0
Subtotal	**€ 214,543**	**-€ 8,460**	**€ 223,003**

Other business Impacts			
Developer contributions	€ 0	€ 0	€ 0
NET BUSINESS IMPACT	**€ 857,104**		
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	**€ 2,024,837**		

Notes: Benefits appear as positive numbers, while costs appear as negative numbers
All entries are discounted present values, in 2011 prices and values

Figure 6-8: Combined Highways and Public Transport TEE Tables (2011 Prices and Values, €000's)

Figure 6-9 shows the combined Highways and Public Transport Public Accounts (PA) Table over a 60-year Appraisal Period (2011 prices and values).

Public Accounts			
Local Government Funding	**ALL MODES**	**Highway**	**Public**
Revenue	€ 0	€ 0	€ 0
Operating Costs	€ 0	€ 0	€ 0
Investment Costs	€ 0	€ 0	€ 0
Developer Contributions	€ 0	€ 0	€ 0
Grant/Subsidy Payments	€ 0	€ 0	€ 0
NET IMPACT	**€ 0**	**€ 0**	**€ 0**
Central Government Funding: Transport	**ALL MODES**	**Highway**	**Public**
Revenue	€ 0	€ 0	€ 0
Operating costs	€ 119,398	€ 0	€ 119,398
Investment costs	€ 2,423,313	€ 0	€ 2,423,313
Developer Contributions	€ 0	€ 0	€ 0
Grant/Subsidy Payments	€ 0	€ 0	€ 0
NET IMPACT	**€ 2,542,711**	**€ 0**	**€ 2,542,711**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	**€ 30,042**	**€ 955**	**€ 29,087**
TOTALS			
Broad Transport Budget	**€ 2,542,711**	**€ 0**	**€ 2,542,711**
Wider Public Finances	**€ 30,042**	**€ 955**	**€ 29,087**

Note: Costs appear as positive numbers, while revenues and developer contributions appear as negative numbers.

Note: All entries are present values discounted to 2011, in 2011 prices

Figure 6-9: Combined Highways and Public Transport PA Table (2011 prices and values, €000's)

Figure 6-9 was referred to as Figure 6-10

Error! Reference source not found. Combined Highways AMCB Table (2011 prices and values, €000's)

It should be noted that no accident valuation has been undertaken as part of this appraisal. However, the impact is expected to be small in comparison to overall scheme benefits and of similar value across schemes.

The BCR for the scheme is 0.8. This represents a return of €0.80 for every €1 spent for direct transport users. Without consideration of other wider benefits which may be associated with the scheme, the Option A alignment provides poor value for money.

6.3 Option B Linked St Stephen's Green – Metro St Stephen's Green-Ballycullen

6.3.1 Introduction

Section 6.3 of this report discusses the user and provider impacts expected to occur as a result of Option B, the Ballycullen to St Stephen's Green MetroLink development. An overview of Option B is provided in the Transport Modelling chapter of this report.

Option B is a standalone line which runs from Ballycullen to a separate terminus at St Stephen's Green station to the south of the city centre. It is designed to improve connectivity to and from the city centre for residents located to the south of Dublin. It is expected to provide a total of €1.82bn (2011 prices and values) benefits to Public Transport users over the appraisal period. This includes benefits through improved accessibility to and from the city centre via public transport.

Chapter 6 goes on to provide details of the economic impacts attributable to Option B.

With regard to the total combined Public Transport and Highways impact for trip origins positive benefits are projected in the two sectors covering the entire alignment (Reference Metro and Metro Extension) as well as in the Rest of Dublin. Residents along the alignment will now have access to MetroLink, improving city centre access. The Rest of GDA Area is expected to experience slight disbenefits as a result of the scheme.

For the total combined Public Transport and Highways impact for trip destinations it shows a similar distribution of impacts with greater disbenefits as a result of the proposed scheme in the Rest of GDA Area

In relation to public transport generally, there are widespread benefits across Dublin. The highest benefits are received in the two central sectors with over €1m. The Rest of GDA Area will experience the lowest benefits as a result of the proposed scheme in the AM period.

Table 6-11 shows ***(for Option B)*** the distribution of monetised public transport user time impacts by trip purpose. All trip purposes receive a net monetised user time benefit as a result of the Option B Alignment. Leisure trips receive the greatest benefit, with aggregate user benefits of €697,900,000 (2011 prices and values) across the 60-year appraisal period. Benefits are distributed fairly consistently for business and commuting trip purposes.

The 'User Charges' column in Table 6-11 indicates the welfare change for Public Transport users from the change in fare payments. A positive user charge value is expected for Leisure trips as a result of the Option B Alignment. Negative user charges are expected for commuting trips.

Table 6-11: Total monetised user impacts by trip purpose over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Trip Purpose	User Time impacts (€)	User Charges (€)
Business	359,200,000	-
Commuting	373,000,000	-1,100,000
Leisure	667,900,000	1,300,000
Education	-	-
Retired	-	-

Table 6-12 shows the total monetised public transport user impacts accrued across the 60-year appraisal period disaggregated by time period. All four time periods are expected to receive net

benefits over the 2030-2089 appraisal period. The LT time period is expected to receive approximately €525,000,000 (2011 prices and values) of benefits – the most of any time period. This is significantly higher than the AM and PM time periods.

The 'User Charges' column in Table 6-12 represents the welfare change for Public Transport users from the change in fare payments. A positive user charge value is expected for the LT and SR time periods as a result of the Option B Alignment, suggesting Public Transport users spend less on Public Transport fares than previous.

The greatest benefit is expected for LT trips, with benefits of over €1,800,000 (2011 prices and values). Both AM and PM time period are expected to experience a negative user charge value as a result of the scheme.

Table 6-12: Total monetised user impacts by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	User Time impacts (€)	User Charges (€)
AM	382,100,000	-1,500,000
LT	525,400,000	1,800,000
SR	145,200,000	300,000
PM	347,300,000	-400,000

Table 6-13 shows the change in operator revenue and indirect tax revenue as a result of the proposed scheme, disaggregated by time period. All four time periods are expected to see an increase in operator revenue as a result of the proposed scheme. This is because of an increase in MetroLink patronage for all time periods, with more people willing to use the scheme as a result of the proposed improvements. The greatest increase in operator revenue is experienced in the LT time period, with an increase of approximately €55,900,000 (2011 prices and values) in revenue.

A reduction in indirect tax revenue can be seen for all time periods, with the greatest reduction in the LT time period (over €6,000,000) (2011 prices and values). Indirect tax revenues are expected to fall as a result of the proposed scheme due to the increase in public transport patronage. Increased public transport usage is causes a re-allocation of personal expenditure towards public transport. As consumers spend a greater proportion of their income on public transport (which is not taxable) and less on alternative, taxable, consumption, indirect tax revenue falls.

Table 6-13: Total monetised provider impacts and changes in indirect tax revenues by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	Operator Revenue (PT fares) (€)	Indirect Taxes (€)
AM	39,200,000	-5,400,000
LT	55,900,000	-6,800,000
SR	14,600,000	-2,000,000
PM	34,600,000	-4,700,000

6.3.3 Highways

(In relation to) .....the Highway impact of the proposed scheme for PM trip destinations. Whilst benefits are experienced by highway users in both the Metro Extension Area and the Rest of Dublin, the Reference Metro Area and the Rest of the GDA Area are expected to experience disbenefits.....

Table 6-14 shows the distribution of monetised highways user time impacts by trip purpose. All five trip purposes experience a monetised user time benefit as a result of the Option B Alignment, with the greatest benefit being the €129,900,000 (2011 prices and values) received by business trips across the 60-year appraisal period. Disbenefits as a result of user charge changes (national toll) can be seen for all trip purposes apart from a minor increase lower than €100,000 for business trips.

Table 6-14 also shows the change in welfare resulting from changes in vehicle operating costs for highways users as a result of the scheme. Positive welfare benefits can be seen for fuel and non-fuel vehicle operating costs across all five trip purposes, with the greatest benefit for business travel and commuting. Positive welfare benefits indicate highways users have to pay lower operating costs as a result of the MetroLink improvements. A large proportion of this benefit is likely to be due to a reduction in congestion.

Table 6-14: Total monetised user impacts and vehicle operating costs by trip purpose over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Trip Purpose	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
Business	129,900,000	-	900,000	2,200,000
Commuting	105,600,000	-900,000	2,000,000	4,900,000
Leisure	31,200,000	-200,000	300,000	700,000
Education	11,000,000	-200,000	100,000	100,000
Retired	11,000,000	-200,000	100,000	100,000

Table 6-15 shows the distribution of monetised highways user time impacts, user charges and vehicle operating costs (fuel and non-fuel), disaggregated by time period. The greatest user time benefit is experienced in the LT time period, where benefits of €229,200,000 (2011 prices and values) accrue over the 60-year appraisal period.

Time benefits are also experienced in the other time periods. These benefits are likely to accrue due to the reduction in highways congestion from the implementation of the MetroLink improvements allowing quicker road journeys.

Table 6-15 also shows the benefit impact of changes in user charge payments (tolls) as a result of the proposed scheme, disaggregated by time period. Both the AM and LT time periods see a disbenefit from changes in user charge payments over the 60-year appraisal period. This suggests highways users in these time periods are paying more toll charges than they were previously. Minor benefits are experienced in both the SR and PM time periods. The benefits are likely to be the result of reduced travel on toll roads due to a decrease in congestion on non-toll roads.

Table 6-15 also shows the change in welfare from changes in vehicle operating costs for highway users as a result of the scheme. A benefit can be seen as a result of changes in both fuel and non-fuel vehicle operating costs in the AM, LT and SR time periods. This suggests highways users are spending less on vehicle operating costs. However, disbenefits can be seen in the PM period.

Table 6-15: Total monetised user impacts by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
AM	27,800,000	-400,000	400,000	300,000
LT	229,200,000	-1,300,000	2,500,000	6,900,000
SR	70,800,000	100,000	800,000	1,500,000
PM	39,100,000	200,000	-100,000	-600,000

Table 6-16 shows the expected change in operator and indirect tax revenue as a result of the proposed scheme, disaggregated by time slice. The LT, SR and PM time periods experience a reduction in indirect tax revenue over the 60-year appraisal period. This indicates a reduction in taxable expenditure on road travel by highways users travelling in these time periods. The PM time period experiences a slight increase in indirect tax revenue.

Table 6-16: Total provider impacts and changes in indirect tax revenues by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	Operator Revenue National Toll (€)	Indirect Taxes (€)
AM	300,000	-200,000
LT	-5,200,000	-700,000
SR	-900,000	-300,000
PM	-800,000	200,000

Table 6-17 shows the distribution of monetised highways user time impacts, user charges and vehicle operating costs (fuel and non-fuel), disaggregated by vehicle type. The greatest user time benefits are experienced by car users, who received over 50% of all highways benefits generated by the proposed scheme. Positive benefits are experienced by all vehicle types. Car users experience disbenefit from the change in user charge payments, of approximately -€2,900,000 (2011 prices and values).

Table 6-17 also shows the change in welfare from changes in vehicle operating costs for highway users as a result of the scheme. Benefits are seen for all vehicle types for both fuel and non-fuel operating costs, implying reductions in operating costs for all vehicle types. The greatest benefits are experienced by car users.

Table 6-17: User benefits and changes in revenues by submode/vehicle type over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Vehicle Type	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
Car	145,100,000	-1,400,000	1,600,000	5,900,000
LGV	113,100,000	-700,000	1,900,000	500,000
OGV1	30,500,000	600,000	100,000	1,700,000
OGV2	-	-	-	-
All	288,700,000	-1,400,000	3,500,000	8,000,000

Table 6-18 shows the expected change in operator and indirect tax revenue as a result of the proposed scheme, disaggregated by vehicle type. A reduction in toll revenue of over €6,000,000 (2011 prices and values) is expected from car users. This is likely to be caused by car users switching to non-toll roads due to reductions in congestion as a result of the scheme. A decrease in indirect tax revenue is expected from all vehicle types as a result of the Option B Alignment over the 60-year appraisal period. This indicates a reduction in taxable expenditure on road travel by highways users travelling by these vehicle types.

Table 6-18: Total provider impacts and changes in indirect tax revenues by submode/vehicle type over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Vehicle Type	Operator Revenue National Toll (€)	Indirect Taxes (€)
Car	-6,700,000	-100,000
LGV	700,000	-900,000
OGV1	-600,000	-
OGV2	-	-
All	-6,600,000	-1,000,000

6.3.4 Summary

For completeness, the tables are presented in their standard layout in the following pages (with the column for highways benefits included).

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Highway**	**Public Transport**
Travel Time	€ 478,523	€ 105,555	€ 372,968
Vehicle operating costs	€ 6,938	€ 6,938	€ 0
User charges	-€ 1,981	-€ 911	-€ 1,070
During Construction & Maintenance	€ 0	€ 0	€ 0
NET CONSUMER - COMMUTING BENEFITS	**€ 483,479**	**€ 111,581**	**€ 371,898**

Consumer - Other user benefits	**All Modes**	**Highway**	**Public Transport**
Travel Time	€ 721,095	€ 53,232	€ 667,863
Vehicle operating costs	€ 1,503	€ 1,503	€ 0
User charges	€ 705	-€ 553	€ 1,258
During Construction & Maintenance	€ 0	€ 0	€ 0
NET CONSUMER - OTHER BENEFITS	**€ 723,303**	**€ 54,182**	**€ 669,121**

	All Modes	**Highway**		**Public Transport**	
Business		Road Personal	Road Freight	Bus Personal	Bus Freight
Travel Time	€ 489,086	€ 99,402	€ 30,468	€ 359,216	€ 0
Vehicle operating costs	€ 3,100	€ 1,373	€ 1,727	€ 0	€ 0
User charges	€ 24	-€ 601	€ 643	-€ 19	€ 0
During Construction & Maintenance	€ 0	€ 0	€ 0	€ 0	€ 0
Subtotal	**€ 492,209**	**€ 100,174**	**€ 32,839**	**€ 359,197**	**€ 0**

Private Sector Provider Impacts	**All Modes**	**Highway**	**Public Transport**
Revenue	€ 137,641	-€ 6,605	€ 144,246
Operating costs	€ 0	€ 0	€ 0
Investment costs	€ 0	€ 0	€ 0
Grant/subsidy	€ 0	€ 0	€ 0
Subtotal	**€ 137,641**	**-€ 6,605**	**€ 144,246**

Other business Impacts			
Developer contributions	€ 0	€ 0	€ 0
NET BUSINESS IMPACT	**€ 629,850**		
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	**€ 1,836,632**		

Note: Benefits appear as positive numbers, while costs appear as negative numbers.
Note: All entries are present values discounted to 2011, in 2011 prices

Figure 6-17 presents the Public Transport Economic Efficiency of the Transport System (TEE) Tables over a 60-year Appraisal Period (2011 prices and values)

Figure 6-18 shows the Public Transport Public Accounts (PA) Tables over a 60-year Appraisal Period (2011 prices and values).

Public Accounts

Local Government Funding	**ALL MODES**	**Highway**	**Public**
Revenue	€ 0	€ 0	€ 0
Operating Costs	€ 0	€ 0	€ 0
Investment Costs	€ 0	€ 0	€ 0
Developer Contributions	€ 0	€ 0	€ 0
Grant/Subsidy Payments	€ 0	€ 0	€ 0
NET IMPACT	**€ 0**	**€ 0**	**€ 0**

Central Government Funding: Transport	**ALL MODES**	**Highway**	**Public**
Revenue	€ 0	€ 0	€ 0
Operating costs	€ 119,398	€ 0	€ 119,398
Investment costs	€ 3,350,636	€ 0	€ 3,350,636
Developer Contributions	€ 0	€ 0	€ 0
Grant/Subsidy Payments	€ 0	€ 0	€ 0
NET IMPACT	**€ 3,470,034**	**€ 0**	**€ 3,470,034**

Central Government Funding: Non-Transport			
Indirect Tax Revenues	**€ 19,853**	**€ 974**	**€ 18,878**

TOTALS			
Broad Transport Budget	**€ 3,470,034**	**€ 0**	**€ 3,470,034**
Wider Public Finances	**€ 19,853**	**€ 974**	**€ 18,878**

Note: Costs appear as positive numbers, while revenues and developer contributions appear as negative numbers.

Note: All entries are present values discounted to 2011, in 2011 prices

Figure 6-18: Public Transport PA Tables (2011 Prices and Values €1000's).

Figure 6-19 shows the Public Transport Analysis of Monetised Costs and Benefits (AMCB) Table over a 60-year Appraisal Period (2011 prices and values).

It should be noted that no accident valuation has been undertaken as part of this appraisal. However, the impact is expected to be small in comparison to overall scheme benefits and of similar value across schemes.

Analysis of Monetised Costs and Benefits	
Greenhouse Gases	**€ 143**
Economic Efficiency: Consumer Users (Commuting)	**€ 483,479**
Economic Efficiency: Consumer Users (Other)	**€ 723,303**
Economic Efficiency: Business Users and Providers	**€ 629,850**
Wider Public Finances (Indirect Taxation Revenues)	**-€ 19,853**
Present Value of Benefits (PVB)	**€ 1,816,922**
Broad Transport Budget	**€ 3,470,034**
Present Value of Costs (PVC)	**€ 3,470,034**
OVERALL IMPACTS	
Net Present Value (NPV)	**-€ 1,653,112**
Benefit to Cost Ratio (BCR)	**0.5**

Note: This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Figure 6-19: Public Transport AMCB Table (2011 Prices and Values €1000's).

The BCR for the scheme is 0.5. This represents a return of €0.50 for every €1 spent for direct transport users. Without consideration of other wider benefits which may be associated with the scheme, the Option B alignment provides poor value for money.

7. Conclusions and Recommendations

Following a demand-led approach, this study has reviewed the demand, economic, technical and environmental feasibility of two alternative Metro alignments which are considered broadly representative of the range of potential Metro options for serving the transport corridor from Central Dublin to Knocklyon via Rathmines.

The demand subsequently assessed through use of the NTA's Regional Modelling System and, the results of which were taken forward to complete an assessment of the overall Transport User Benefits and calculate a benefit cost ratio (BCR) for each option. This was undertaken in line with the relevant guidance, and, as with the MetroLink scheme proposals was undertaken using a 60-year appraisal period.

The analysis of the benefits and costs of the proposals show that both have a benefit cost ratio (BCR) of below 1.0. This provides an initial indication that a Metro option is unlikely to be a cost-effective approach to enhancing public transport in this area of Dublin.

Although both options can be seen to offer a poor value of money in appraisal terms, there are significant differences between them, with the through running option offering a cheaper construction subtotal cost due to not having to construct a turnback facility and longer tunnelling as in the SSG linked option.

Review of the demand modelling results highlights that while demand in the AM is high for inbound movements, outbound movements are below 2,000 for off-peak periods. Similarly, for the PM period, demand is also high for outbound movements from the city centre towards Knocklyon.

The NTA/Jacobs Metro to Knocklyon Feasibility Study, 2021

Chapter 6
Observations and Commentary

The economic appraisal has estimated a Metro to Knocklyon under Option A (through running via Charlemont) would generate an estimated present value of €2 billion (2011 prices and values) in economic benefits over a 60 year planning horizon. **It must be pointed out however that the reported valuation of benefits is partial and excludes a range of benefits and costs incorporated in the appraisal of the Metrolink scheme.**

We return to that point below. Almost 90% of those benefits estimated and reported for the Metro to Knocklyon scheme are attributable to journey time savings accrued by people making trips on the new metro route or benefiting as vehicle users by reduced congestion the metro would lead to with modal shift to public transport. That change in behaviour reflects the time savings estimated or assumed to manifest themselves with the new metro route and input to the ERM that in turn yields projections of changes in travel behaviour.

The economic performance of the scheme, its value for money to society, is a function of the value of the benefits compared to the costs to society in this case estimated by Jacobs at €2.57 billion (2011 prices and values). The most prominent indicator to measure the scheme's performance in the Jacobs feasibility study is the benefit: cost ratio (BCR). For Option A the reported BCR is 0.8. The equivalent BCR for Option B (operating as a self-contained branch from St Stephens Green (SSG)) is 0.5 reflecting its reduced projected patronage due to the requirement to change trains at SSG and higher capital costs attributable to additional station construction costs and quite likely more trains being required to operate the service.

The value of 0.8 reflects the modest patronage projections provides by Jacobs in the feasibility study report. Thus, in the light of our observations above about uncertainty over the forecasting model parameters and other question marks about the inputs to the forecasting process this BCR value could well change. Additionally, the allowance for Optimism Bias in the Jacobs cost estimates is an arbitrary 65% allocated to the total costs.

It has been pointed out that this is larger allowance for risk than has been applied to the Metrolink scheme. For MetroLink, the total preliminary cost forecast ranges from a low with a 7% risk allowance, offering a 30% confidence in budget adherence with a low inflation forecast, to a high with a 55% risk allowance, offering an 80% confidence level and high inflation forecast.

In relation to the 'Management Target (Stretch and Base)' TII's provides for an internal project budget expectation of a 30% allowance for risk that reflects the P50 risk assessment, (50% risk value allowance), together with the medium inflation assessment. Moreover, while TII sets 30% risk allowance for its management base target, it seeks to reduce that to 7% to achieve the stretch target of P30 with low inflation.

Nevertheless while 7% and 30% are the risk allowances reflect TII's goals for delivering MetroLink, as a 'prudent client', TII has applied a 50% risk allowance in its estimation of the overall delivery costs for the purposes of evaluating the economic benefits of the project.

This contrasts with single 65% risk allowance in the form of an allocation for Optimism Bias that the Jacobs Report attribute to the Metro to Knocklyon scheme.

The implications for the Metro to Knocklyon scheme of an Optimism Bias equivalent value to the Metrolink 30% (TII internal budget allocation) and even a 50% risk value allowance would be to increase the BCR value considerably dependent upon the risk allowance employed.

It is estimated that the Metro to Knocklyon scheme's BCR would be increased by between 0.2 and 0.4 based on the QRA based risk allowance attributable in the case of the economic appraisal for Metrolink. In other words the BCR would be 1.0-1.2 in the case of Option A. If however, TII's own management allowance for risk was applied this would have the effect of increasing the BCR for the Knocklyon scheme assessed by Jacobs by 0.4-0.7 to yield a value of 1.2-1.5.

It was noted above that the appraisal of the Metro to Knocklyon scheme is partial. It excludes estimates for:

- Transport reliability and quality.
- Wider economic benefits including agglomeration and employment benefits.
- Safety benefits
- Air quality benefits
- Noise and vibration benefits attributable to reduced use of road vehicles
- Accessibility benefits
- Land use integration

These were included in the Metrolink economic appraisal. In the case of the Metrolink scheme the value of agglomeration benefits alone add the equivalent of 20% -28% of value of transport efficiency and effectiveness benefits (mainly time savings) to the total benefits of Metrolink. Inclusion of estimates for such benefits in the case of the metro to Knocklyon scheme would increase significantly the total benefits attributed to the scheme.

The **range** of economic impacts included in the Metro to Knocklyon Feasibility Study is significantly less than that assessed for the economic appraisal set out in the Metrolink PBC. The principal implication of this divergence from the practice for the Metrolink PBC is to reduce quite significantly the BCR for the Metro to Knocklyon scheme compared to a situation where the Metrolink Estuary to Charlemont Preliminary Business Case (PBC) practice had been applied. It is estimated that this underestimates the Metro to Knocklyon scheme BCR by up to 0.4 - 0.5 **relative to** a situation where the Metrolink Estuary to Charlemont Preliminary Business Case (PBC) practice had been employed.

Finally, economic appraisals that are applied to Options C and D serving Tallaght would also significantly increase the user benefits of a metro scheme serving southwest Dublin. These would reflect the increase in ridership generated by such scheme options as well as the benefits in terms of reduced congestion and other non-user benefits including:

- Transport reliability and quality.
- Wider economic benefits including agglomeration and employment benefits.
- Safety benefits
- Air quality benefits
- Noise and vibration benefits attributable to reduced use of road vehicles
- Accessibility benefits
- Land use integration

Moreover, we are confident both Options C and D for a metro to serve Tallaght, that have been set out in Chapter 4 of this report, would significantly boost ridership for a metro route serving south west Dublin. This would also significantly boost the value for money for such a scheme reflected in the BCR an economic appraisal of Option C and D would yield.

Our initial analysis suggests that a metro scheme adopting an alternative alignment and with a terminus in the vicinity of 'The Square' in Tallaght would, in conjunction with application of costing and economic appraisal practice wholly consistent with that adopted for the Metrolink PBC, could boost the BCR for such an option by up to a further 0.3-0.4.

This excludes the impact of capital cost differences between the NTA/Jacobs Metro to Knocklyon Feasibility Study' s Option A and Options C and D. In the case of the latter two options their preliminary cost estimates lie in the range Option A – 10% to +12% dependent upon which of C and D is being considered and the number of stations as referred to in Option C specified.

In summary we believe the BCR figure of 0.8 for the through running alignment from Knocklyon to Estuary represents a significant underestimate of performance of a Metro to serve South West Dublin compared to a situation where the costing approach and assumptions and valuation of the more comprehensive range of benefits applied in the Metrolink PBC, had been employed in this case. The BCR would be further improved significantly where an alternative alignment to serve key parts of Tallaght had been selected by Jacobs in their demand forecasting and economic appraisal. In the case of the latter Option the BCR could be in the range 1.6-2.2 even in the absence of the growth rates anticipated for Tallaght in its local development plan.

Conclusion

The "Knocklyon" feasibility study includes an economic appraisal that is partial.

The range of economic impacts included in the Metro to Knocklyon Feasibility Study is significantly less than that assessed for the economic appraisal set out in the Metrolink PBC.
It excludes estimates for:

- **Transport reliability and quality.**
- **Wider economic benefits including agglomeration and employment benefits.**
- **Safety benefits**
- **Air quality benefits**
- **Noise and vibration benefits attributable to reduced use of road vehicles**
- **Accessibility benefits**
- **Land use integration**

The rationale for this is unclear or absent.

The principal implication of this divergence from the practice for the Metrolink PBC is to reduce quite significantly the BCR for the Metro to Knocklyon scheme compared to a situation where the Metrolink Estuary to Charlemont Preliminary Business Case (PBC) practice had been applied.

Moreover it is estimated that the Metro to Knocklyon scheme's BCR would be increased by between 0.2 and 0.4 based if Reference Case Forecasting(RCF) to adjust for risk and optimism bias in the Jacobs study had been replaced by application of a Quantified Risk Assessment (QRA) as in the case of the economic appraisal for Metrolink

In summary we believe the BCR figure of 0.8 for the through running alignment from Knocklyon to Estuary represents a significant underestimate of performance of a Metro to serve South West Dublin compared to a situation where the costing approach and assumptions and valuation of the more comprehensive range of benefits applied in the Metrolink PBC, had been employed in this case. The BCR would be further improved significantly where an alternative alignment to serve key parts of Tallaght had been selected by Jacobs in their demand forecasting and economic appraisal.

In the case of the latter Option the BCR could be in the range 1.6-2.2 even in the absence of the growth rates anticipated for Tallaght in its local development plan.

11 Key Issues and Findings arising from the Audit of the Report of NTA/Jacobs Metro to Knocklyon Feasibility Study, released in 2021

The Report of NTA/Jacobs Metro to Knocklyon Feasibility Study, as released in 2021 was not Quality Assured and is punctuated with errors and omissions as set out above. The first of two requests for additional information from the NTA to allay concerns arising from these omissions was answered only in part. This confirmed the absence of quality assured record keeping of the work underpinning the report and leaving questions about the robustness of the work programme and its findings unanswered. A key analytical technique selected for application in the feasibility study was not adhered to during implementation of the work programme.

The approach to costing applied in the Report of the NTA/Jacobs Metro to Knocklyon Feasibility Study is not wholly consistent with that applied to the Metrolink Estuary to Charlemont scheme as set out in the Metrolink Estuary to Charlemont Preliminary Business Case (PBC) and supporting costing documents/appendices.

This is particularly due to the reliance on Reference Case Forecasting(RCF) to adjust for risk and optimism bias instead of application of a Quantified Risk Assessment (QRA). While the arguments for so doing are plausible the effect has been to inflate the risk costs attributable to the NTA/Jacobs Metro to Knocklyon scheme substantially compared to the costs of risk in project delivery that would have emerged had the QRA estimated risk allowance used in the case of the Metrolink scheme been applied in the Knocklyon case. It is noted that a Quantified Risk Assessment (QRA) provided the key estimator for risk in the cost of delivering the scheme. While an RCF estimate for set out in an appendix to the Metrolink PBC this was employed simply as a validation tool to test the QRA derived estimates and ultimately was not employed to the costs applied to the economic appraisal for that scheme.

The principal effect of this is that the costs attributable to the Metro scheme in the Jacobs Metro to Knocklyon Feasibility Study are typically significantly higher than would be the case had the methodology and associated costing assumptions employed in the Metrolink Estuary to Charlemont Preliminary Business Case (PBC) been employed in this instance and in particular in relation to the economic appraisal of the scheme.

The principal implication of this divergence from the practice for the Metrolink PBC is to reduce quite significantly the Benefit Cost Ratio (BCR) reported in the NTA/Jacobs Metro to Knocklyon Feasibility Study report for the Metro to Knocklyon scheme compared to a situation where the Metrolink Estuary to Charlemont Preliminary Business Case (PBC) practice had been applied. It is estimated that this reduced the Metro to Knocklyon scheme BCR by between 0.2 and 0.4 based on the QRA based risk allowance attributable in the case of the economic appraisal for Metrolink. In other words the BCR would be 1.0-1.2 in the case of Option A. If however, TII's own management allowance for risk was applied this would have the effect of increasing the BCR for the Knocklyon scheme assessed by Jacobs by 0.4-0.7 to yield a value of 1.2-1.5. This could provide a useful sensitivity test as it would imply more effective management of the delivery of the scheme.

The **range** of economic impacts included in the Metro to Knocklyon Feasibility Study is significantly less than that assessed for the economic appraisal set out in the Metrolink PBC. The principal implication of this divergence from the practice for the Metrolink PBC is to reduce quite significantly the BCR for the Metro to Knocklyon scheme compared to a situation where the Metrolink Estuary to Charlemont Preliminary Business Case (PBC) practice had been applied. It is estimated that this underestimates the Metro to Knocklyon scheme BCR by up to 0.4 - 0.5 **relative to** a situation where the Metroiink Estuary to Chariemont Preliminary Business Case (PBC) practice had been employed.

Our initial analysis suggests that a metro scheme adopting an alternative alignment and with a terminus in the vicinity of 'The Square' in Tallaght would, in conjunction with application of costing and economic appraisal practice wholly consistent with that adopted for the Metrolink PBC, could boost the BCR for such an option by up to a further 0.3-0.4.

in summary we believe the BCR figure of 0.8 for the through running alignment from Knocklyon to Estuary represents a significant underestimate of performance of a Metro to serve South West Dublin compared to a situation where the costing approach and assumptions and valuation of the more comprehensive range of benefits applied in the Metrolink PBC, had been employed in this case. The BCR would be further improved significantly where an alternative alignment to serve key parts of Tallaght had been selected by Jacobs in their demand forecasting and economic appraisal. In the case of the latter Option the BCR could be in the range 1.6-2.2 even in the absence of the growth rates anticipated for Tallaght in its local development plan.

Conclusion

We conclude that the "Knocklyon Feasibility Study report was not quality assured.

The Report of NTA/Jacobs Metro to Knocklyon Feasibility Study, as released in 2021 was not Quality Assured and is punctuated with errors and omissions.

The approach to costing applied in the Report of the NTA/Jacobs Metro to Knocklyon Feasibility Study is not wholly consistent with that set out in the Metrolink Estuary to Charlemont Preliminary Business Case (PBC).

This is particularly due to the reliance on Reference Case Forecasting(RCF) to adjust for risk and optimism bias instead of application of a Quantified Risk Assessment (QRA). The effect has been to inflate the risk costs attributable to the NTA/Jacobs Metro to Knocklyon scheme substantially. compared to the costs of risk in project delivery had the QRA estimated risk allowance used in the case of the Metrolink scheme been applied in the Knocklyon case.

The principal effect of this is that the costs attributable to the Metro scheme in the Jacobs Metro to Knocklyon Feasibility Study are typically significantly higher than would be the case had the methodology and associated costing assumptions employed in the Metrolink Estuary to Charlemont

Preliminary Business Case (PBC) been employed in this instance and in particular in relation to the economic appraisal of the scheme.

The principal implication of this divergence from the practice for the Metrolink PBC is to reduce quite significantly the Benefit Cost Ratio (BCR) reported in the NTA/Jacobs Metro to Knocklyon Feasibility Study report for the scheme compared to a situation where the Metrolink PBC practice had been applied.

The range of economic impacts included in the Metro to Knocklyon Feasibility Study is significantly less than that assessed for the economic appraisal set out in the Metrolink PBC. The principal implication of this divergence from the practice for the Metrolink PBC is to reduce quite significantly the BCR for the Metro to Knocklyon scheme compared to a situation where the Metrolink PBC practice had been applied.

A metro scheme adopting an alternative alignment and with a terminus in the vicinity of 'The Square' in Tallaght would, in conjunction with application of costing and economic appraisal practice wholly consistent with that adopted for the Metrolink PBC, could boost the BCR for such an option significantly.

in summary we believe the BCR figure of 0.8 for the through running alignment from Knocklyon to Estuary represents a significant underestimate of performance of a Metro to serve South West Dublin. The BCR would be further improved significantly where an alternative alignment to serve key parts of Tallaght had been selected by Jacobs in their demand forecasting and economic appraisal. In the case of the latter Option the BCR could be in the range 1.6-2.2.

12 The Metro to Knocklyon Feasibility Study: Recommendations arising from the Audit of the Report of NTA/Jacobs Metro to Knocklyon Feasibility Study, released in 2021

The NTA should commission an updated Metro to Knocklyon Feasibility Study, taking into account the findings of this Audit. This could be undertaken by Jacobs but with guaranteed allowance for independent oversight, including from the MSWG, and strict adherence to the quality assurance requirements expected for such an important exercise with large financial implications for the State.

The feasibility study must include provision for;

1) assessment of;
   - a number of Charlemont to Tallaght alignments with through running to/from Estuary;
   - a number of St Stephens Green to Tallaght alignments with through running to/from Estuary;
2) application of cost assumptions, including treatment of risk and optimism bias as actually applied to the costings and economic appraisal stages in the Metrolink PBC;
3) application of the ERM demand model to these new alignments with increased sensitivity testing for selected model parameters and validation checks for background demographic, economic and development data and associated assumptions potentially impacting demand for travel;
4) undertaking updated economic appraisals of Metro to Knocklyon schemes for the comprehensive set of benefit/cost impacts included in the Metrolink economic appraisals; and
5) draw conclusions from economic appraisal and follow up likely with preparation of a comprehensive Preliminary Business Case (PBC).

Conclusion

We recommend that NTA must now commission an updated Metro to Knocklyon Feasibility Study, taking into account the findings of this Audit. This could be undertaken by Jacobs but with guaranteed allowance for independent oversight, including from the MSWG, and strict adherence to the quality assurance requirements expected for such an important exercise with large financial implications for the State.

Any decisions to be made by An Bord Pleanála in its consideration of: NA29N.314724 MetroLink: Estuary through Swords, Dublin Airport, Ballymun, Glasnevin and City Centre to Charlemont, Co. Dublin, that relate to the section of the scheme in the city centre and particularly St Stephen's Green and south from there, should be placed on hold pending the outcome of such an exercise.