INFORMATION IN THIS CHAPTER HAS BEEN REVISED. PLEASE REFER TO COVER

Appendix I: Economic Appraisal

INFORMATION IN THIS CHAPTER HAS BEEN REVISED. PLEASE REFER TO COVER NOTE

MetroLink

Economic Appraisal of the Preferred Option

ML1-JAI-LSI-ROUT_XX-RP-Y-00004 | P03

2021/02/22

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MetroLink

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Revision	Date	Description	Author	Checker	Reviewer	Approver
P01	23/11/20	Preliminary Business Case for Issue	BD	JS	GC	NC
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P03	13/09/21	Preliminary Business Case for Issue (TII amends)	ML	GC	GC	

Contents

1. Economic Appraisal of the Preferred Option

1.1 Introduction

In line with the Public Spending Code (PSC) a systematic economic appraisal of the preferred option has been undertaken. This includes providing details of the net present value (NPV) of the scheme and its Benefit Cost Ratio (BCR) via a Cost Benefit Analysis (CBA). The following analysis follows the approach set out in the PSC document "Overview of Appraisal Methods and Techniques".

Where possible, and proportional to do so at this stage, scheme impacts are monetised in accordance with the PSC and Common Appraisal Framework (CAF). Where this is not possible a qualitative assessment has been undertaken instead. All monetised costs and benefits are discounted to present values, to account for time valuation, that is, users and providers perceive costs and benefits that occur in the near term as more important than costs and benefits which occur in the long term. Monetised benefits are compared alongside (discounted) costs to provide a BCR for the scheme.

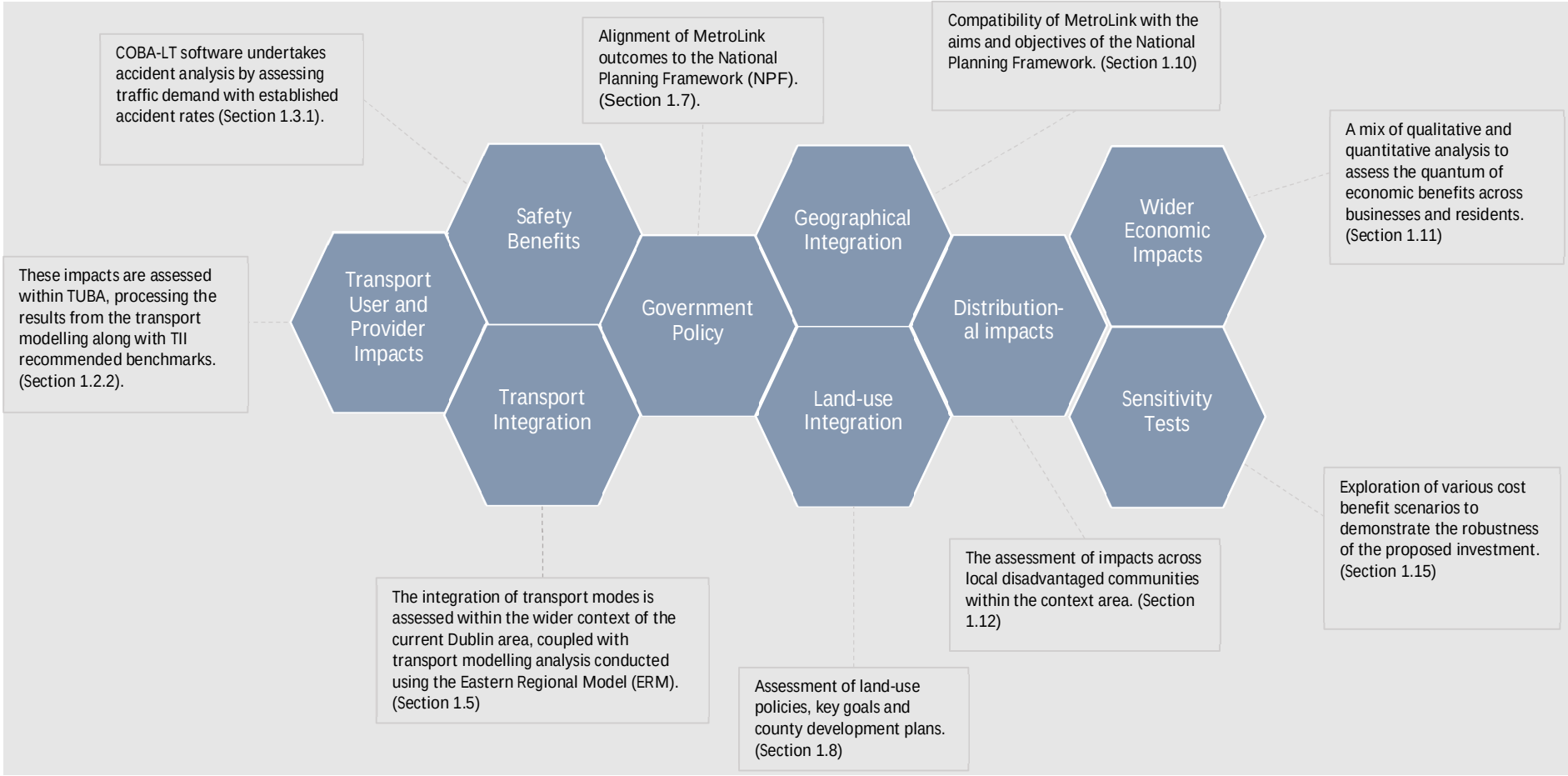
Furthermore, a rigorous assessment is undertaken to assess the qualitative and quantitative impacts and a scaling assessment to determine its rank according to a seven-point scale. This is presented in the Project Appraisal Balance Sheet covered in Section 1.14.

The scheme is appraised in line with the CAF, using the standard appraisal criteria which are as follows:

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

These have also been used to align with the Strategic Objectives of the scheme. Economic impacts appraised within this section are given in Figure 1-1.

Figure 1-1: Appraised Economic Impacts



Source: Jacobs

1.2 Direct Transport User and Provider Impacts

1.2.1 Journey Time Savings

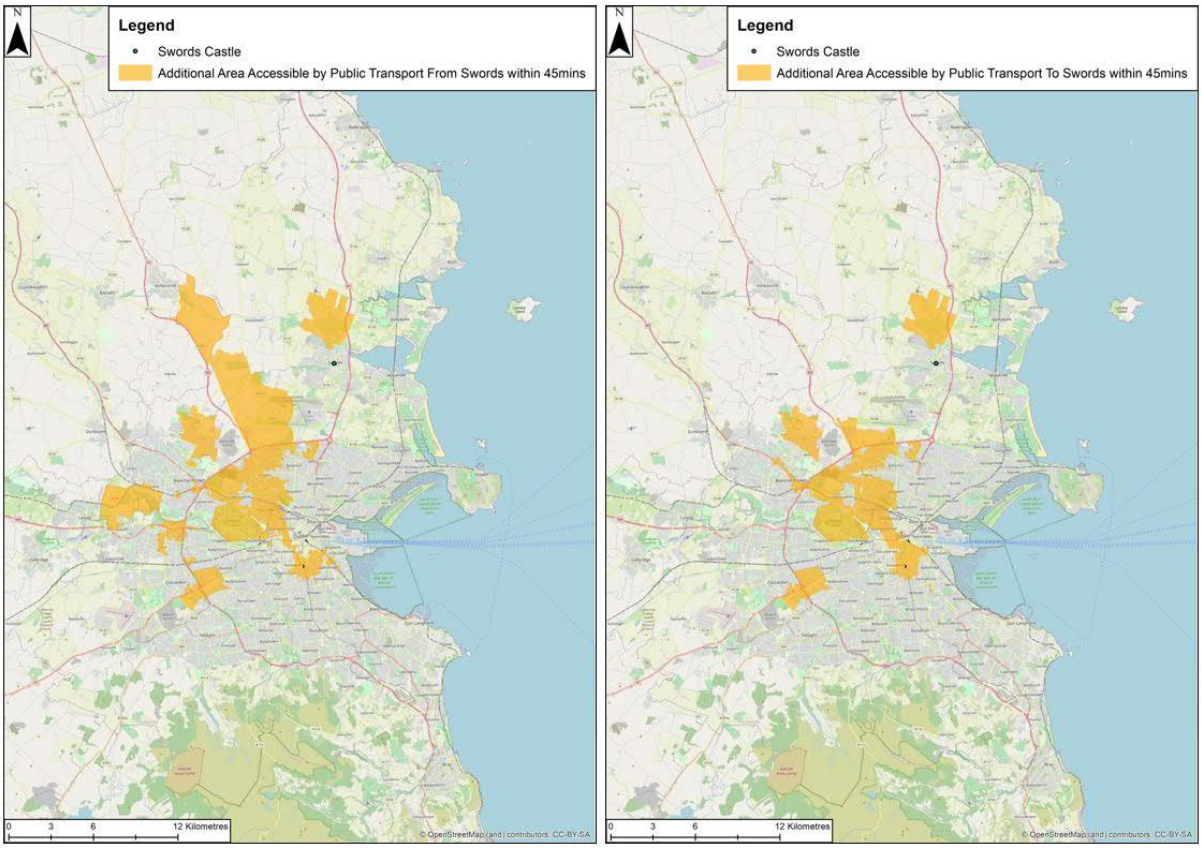
The introduction of MetroLink will provide significant journey time savings for users. The transport modelling analysis conducted indicates that there are significant journey time improvements to and from key zones as shown in the following examples:

- Swords Pavilion to St. Stephen's Green, in the morning peak, reduces from 55 minutes (without MetroLink) to 37 minutes;
- Ballymun to St. Stephen's Green, in the morning peak, reduces from an average of 46 to 32 minutes; and
- St. Stephen's Green to Dublin Airport, in the morning peak, reduces from an average of 45 to 31 minutes.

These represent a 30-33% improvement in journey times. Additional to the journey time savings are other additional key benefits of MetroLink, such as the consistency and reliability of service, which cannot be guaranteed by other modes.

Figure 1-2 illustrates the areas with enhanced accessibility to and from Castle Park in Swords. With MetroLink in place it shows the areas that are now accessible within 45 minutes in the morning peak that previously were not. Areas now accessible from swords includes not only new employment opportunities within parts of the city centre but also along some key radial routes to the north-west and west of the city.

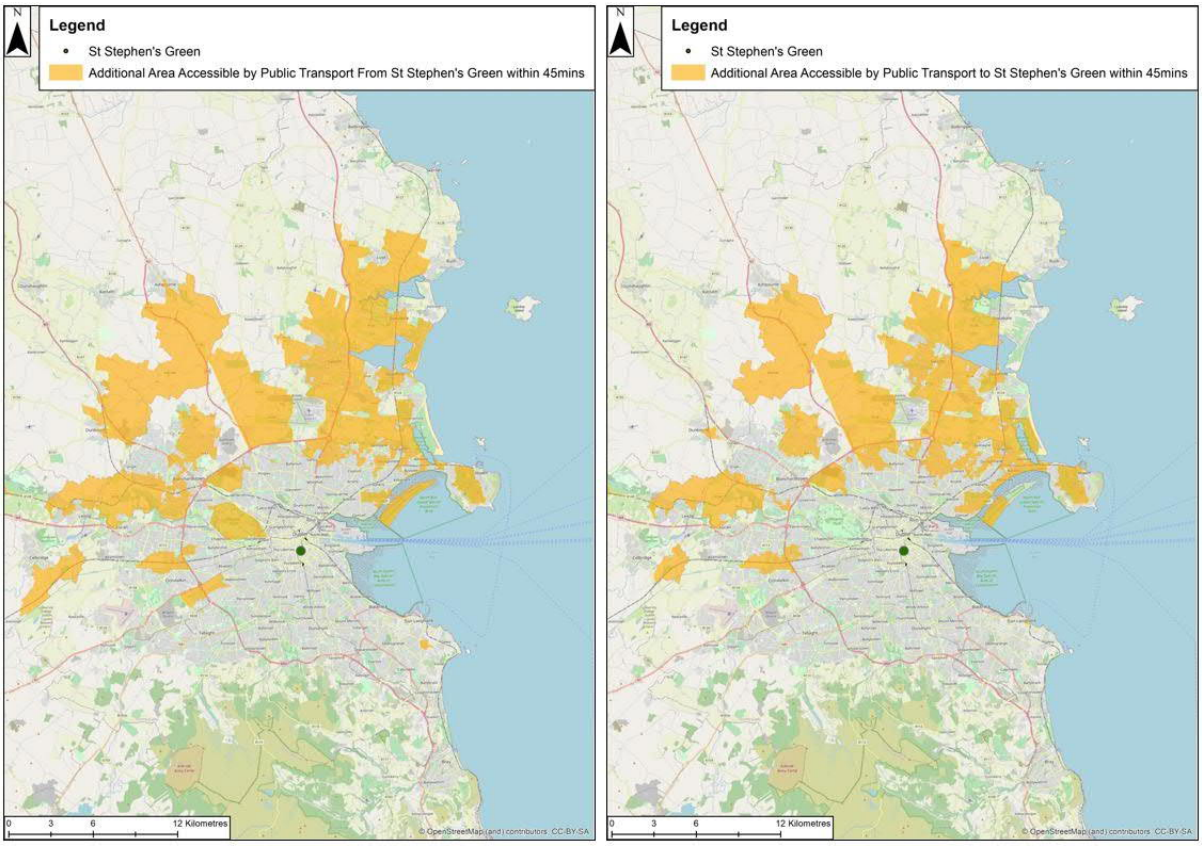
Figure 1-2: Change in accessibility at Swords by origin (left) and by destination (right) in the morning peak by public transport



Source: Jacobs' Analysis

Similar analysis for St Stephen's Green illustrates the areas which are now within 45 minutes travel time when MetroLink is in place, Figure 1-3. Approximately an additional 81,900 people will be able to access St Stephen's Green in less than 45 minutes in the morning peak, when MetroLink is in place.

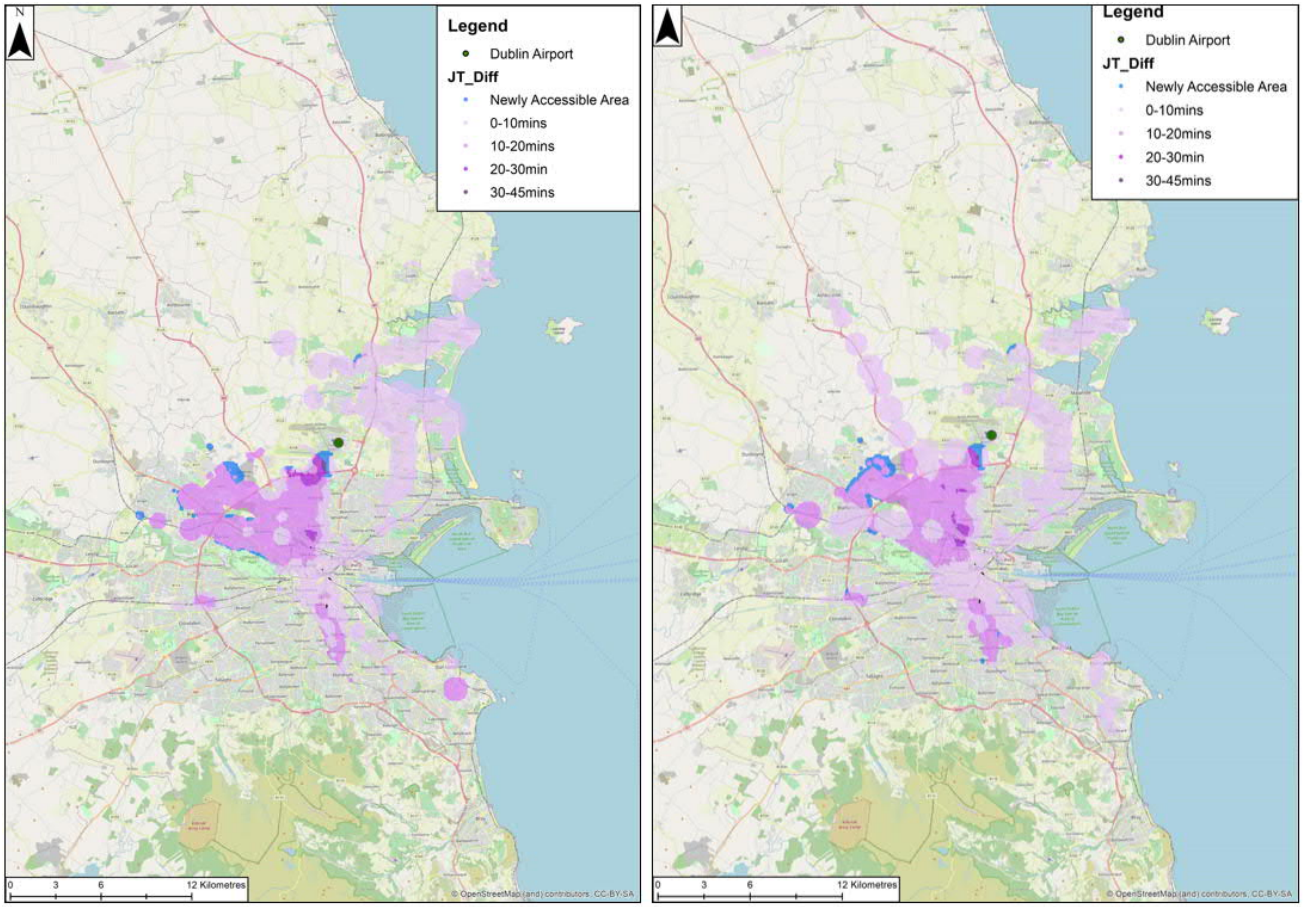
Figure 1-3: Change in accessibility at St Stephen's Green by origin (left) and by destination (right) in the morning peak by public transport



Source: Jacobs' Analysis

Figure 1-4: illustrates morning peak differences in public transport journey time catchments to and from Dublin Airport when MetroLink is in place. To the west of Dublin Airport, several new areas are now accessible within 45 minutes transit time, which are not currently accessible. Along the M2 accessibility times reduce by up to 10 minutes when using public transport to travel from Dublin Airport. Accessibility time savings up of to 20 minutes can also be seen when travelling from Dublin Airport to south of the city centre when MetroLink is in place.

Figure 1-4: Differences in public transport accessibility catchments by time band to Dublin airport in the morning peak by origin (left) and by destination (right)



Source: Jacobs' Analysis

A new segregated rail-based link between the Airport and the city centre is a key benefit of the scheme, and MetroLink delivers this to a much greater extent than a bus-based or light rail scheme. As shown in Table 1-1, there is a 7% reduction in highway users travelling to the airport in peak

hours, and a significant increase in the number of public transport trips to and from the airport in all time periods, with up to a 14% increase in the School Run period.

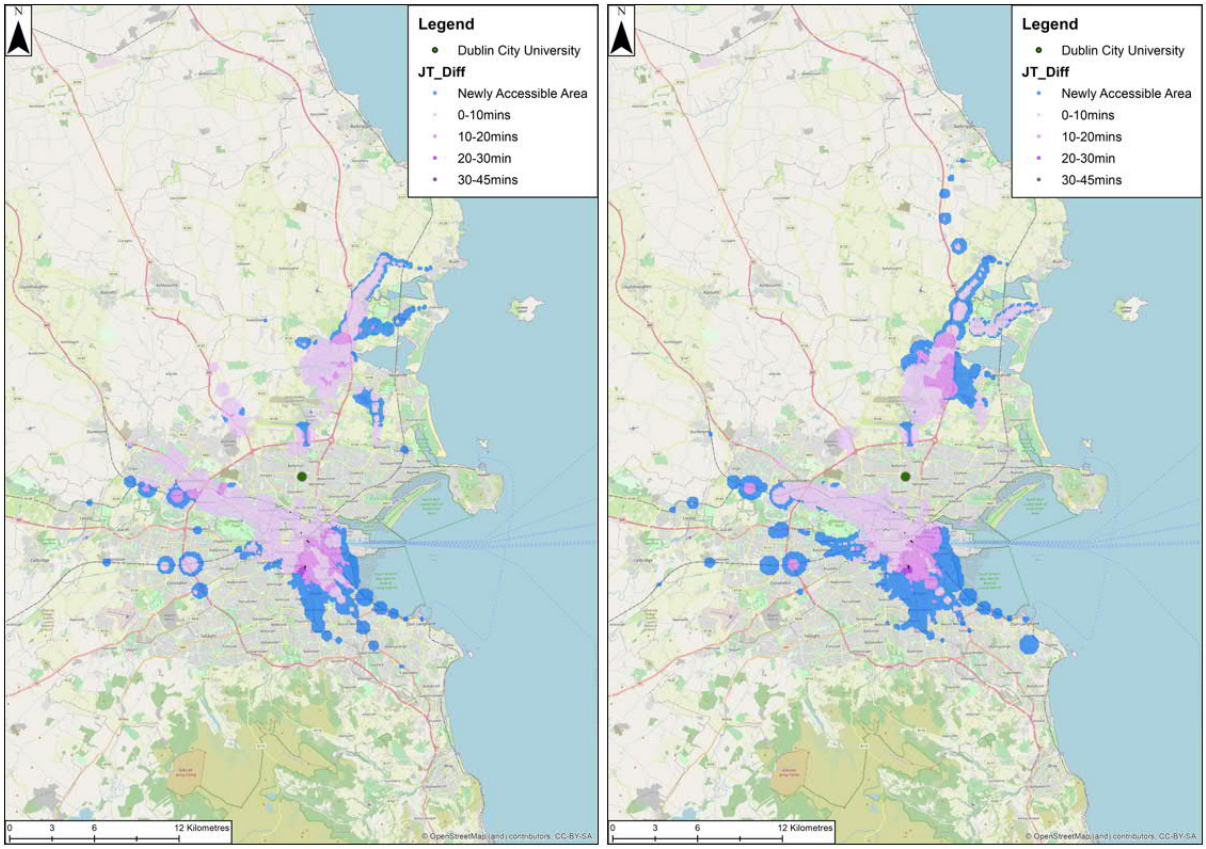
Table 1-1 Mode share splits with and without the scheme for trips to and from the airport

Time Period	Mode	Do Minimum				Do Something				Difference			
		Total From	Total To	Total From	Total To %	Total From	Total To	Total From	Total To %	Total From	Total To	Total From	Total To %
AM	PT	5,114	8,475	40.1%	37.1%	5,453	10,263	45.2%	45.5%	339	1,788	5.1%	8.4%
	Road	7,575	13,614	59.5%	59.6%	6,573	11,949	54.5%	53.0%	-1,002	-1,665	-4.9%	-6.6%
LT	PT	9,246	6,411	44.8%	31.4%	9,891	8,647	49.4%	41.4%	645	2,236	4.6%	10.0%
	Road	11,356	13,931	55.0%	68.2%	10,096	12,179	50.4%	58.3%	-1,260	-1,752	-4.6%	-9.9%
SR	PT	10,123	4,638	47.0%	27.6%	11,055	7,101	52.7%	41.1%	932	2,462	5.8%	13.4%
	Road	11,283	12,092	52.3%	72.0%	9,841	10,149	46.9%	58.7%	-1,442	-1,943	-5.4%	-13.3%
PM	PT	8,497	3,678	40.5%	25.2%	9,081	5,313	44.5%	36.7%	584	1,636	4.0%	11.5%
	Road	11,840	10,876	56.4%	74.5%	11,033	9,138	54.1%	63.1%	-807	-1,738	-2.3%	-11.4%

Source: Jacobs' Analysis

Dublin City University (DCU) is located in close proximity to the proposed Collins Avenue station. Due to the nature of student travel, public transport is the primary mode of transport. Figure 1-5 illustrates the difference in public transport journey catchments to and from DCU in the morning peak comparing scenarios with and without MetroLink in place. It shows that with MetroLink in place, the 45minute catchment extends further south, to areas currently inaccessible in that time. Similarly, newly accessible areas within 45minutes (transit times) of DCU can be seen to the north east towards Balbriggan. Access time savings of between 10 and 20 minutes can be seen to the south east.

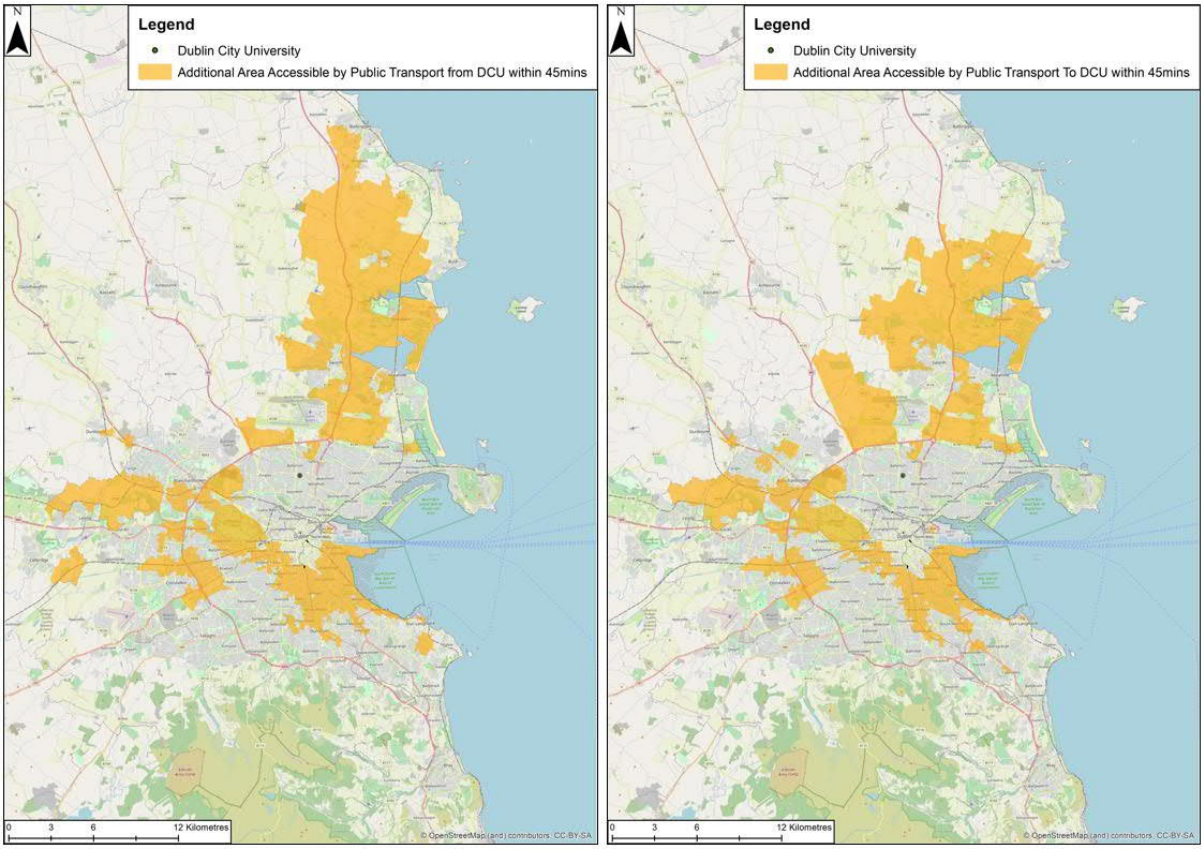
Figure 1-5: Public transport journey time catchments to DCU in the morning peak before (left) and after (right) MetroLink.



Source: Jacobs' Analysis

Figure 1-6 illustrates the areas where more people can travel to and from DCU within 45 minutes with MetroLink in place. In total, 145,000 people now live within 45 minutes of DCU by public transport.

Figure 1-6: Change in accessibility at DCU by origin (left) and by destination (right) in the morning peak by public transport



Source: Jacobs' Analysis

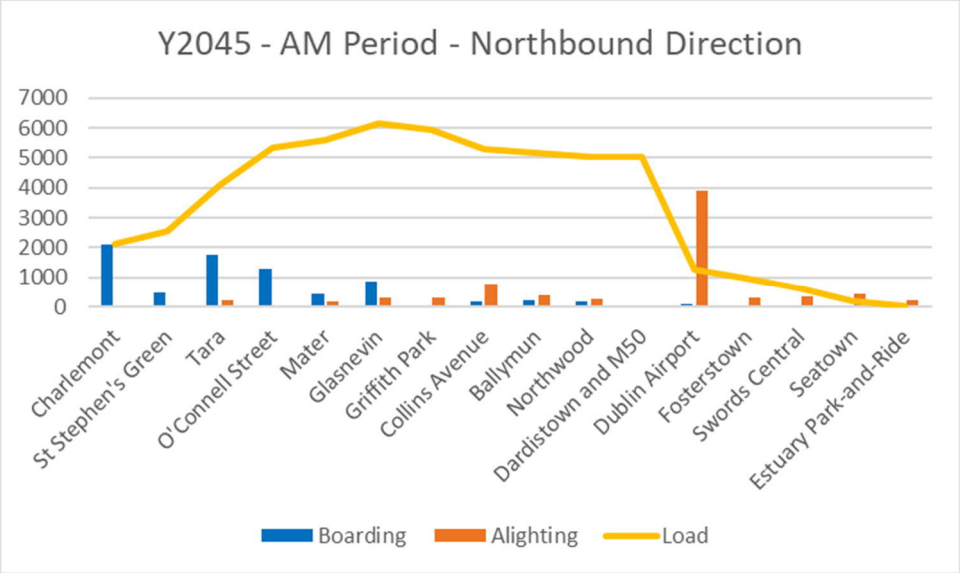
Further details, comparing change in a range of zone to zone journey times with and without MetroLink, can be found in Appendix A.

There are minor differences in travel patterns within the modelled years, but the broad impact of MetroLink is similar across the appraisal period. The discussion below focuses on 2045, the modelled year in which MetroLink has the largest patronage. It is clear that MetroLink has sufficient capacity to cope with the level of demand forecast. Travel patterns in the earlier modelled year, 2030, align with those in 2045.

By 2045, in the morning peak, over 29,000 passengers an hour are projected to use the line. This is roughly the equivalent of 800 buses or 24,000 cars an hour which would otherwise be needed to move this many people. During the day, nearly 16,000 passengers an hour are projected to use the line. With Dublin Airport being a key employment centre, as well as the city centre, demand is well balanced between north and southbound directions as seen in

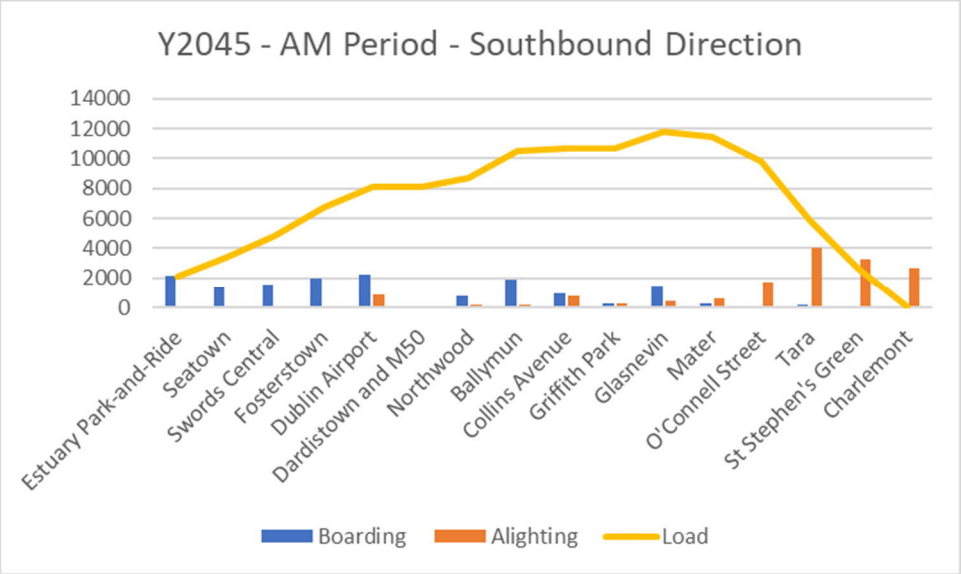
Figure 1-7: and Figure 1-8:

Figure 1-7: Boardings and alightings northbound morning peak hour 2045



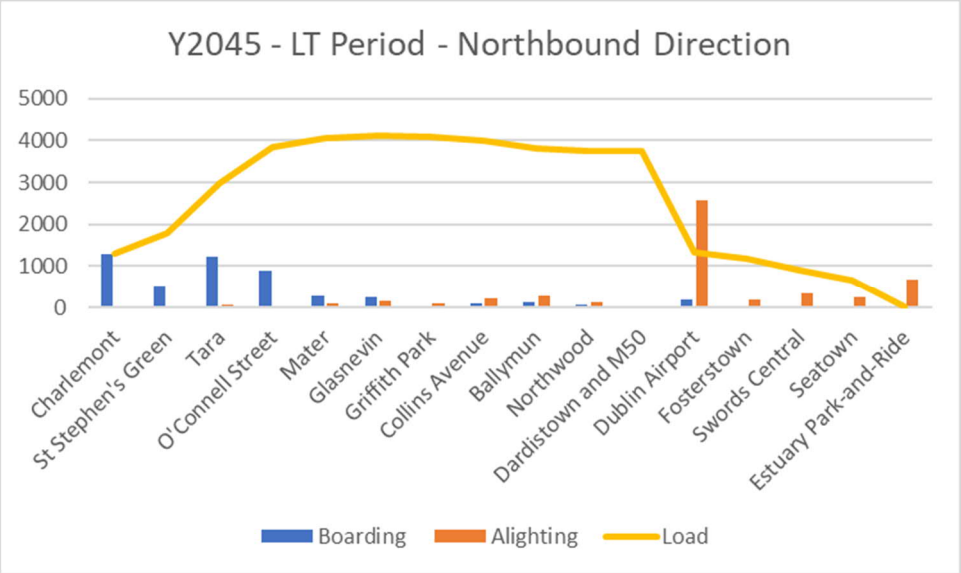
Source: Jacobs' Analysis

Figure 1-8: Boardings and alightings southbound morning peak hour 2045



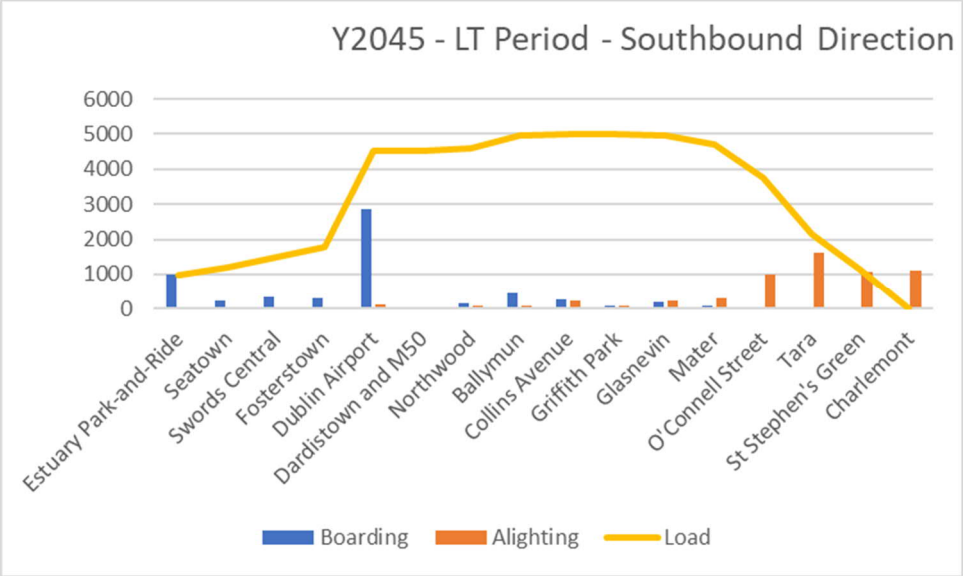
Source: Jacobs' Analysis

Figure 1-9: Boardings and alightings northbound mid-morning hour 2045



Source: Jacobs' Analysis

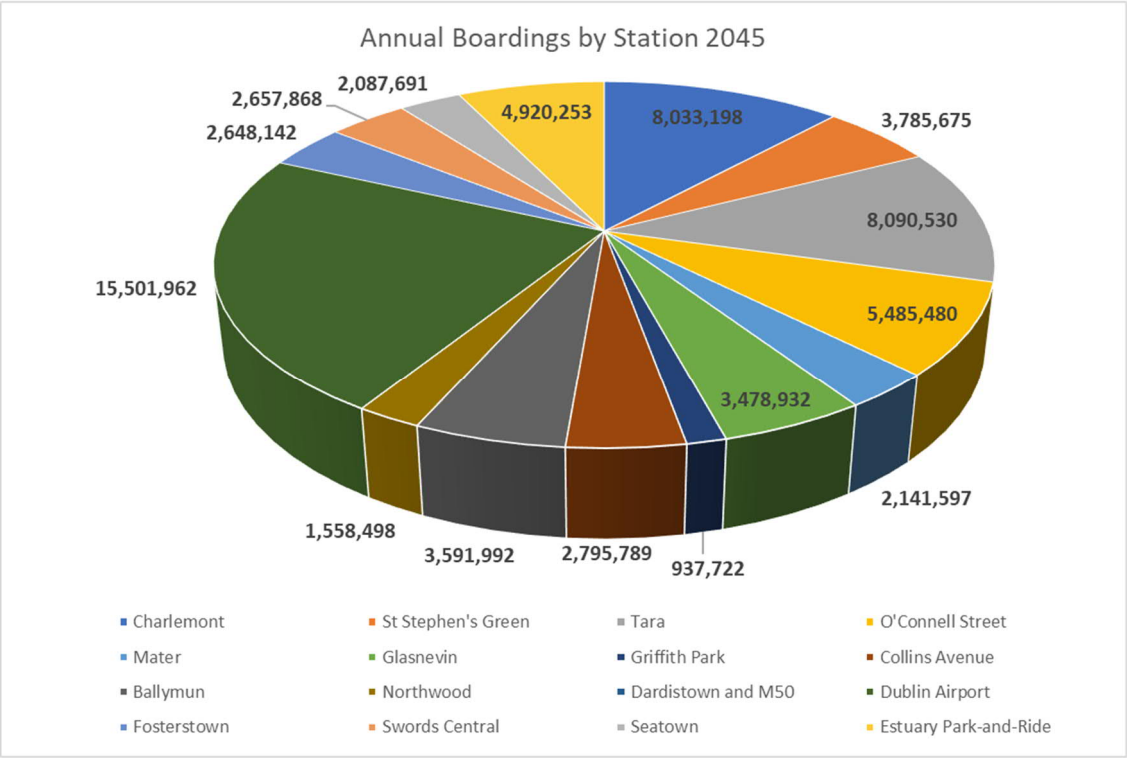
Figure 1-10: Boardings and alightings southbound mid-morning hour 2045



Source: Jacobs' Analysis

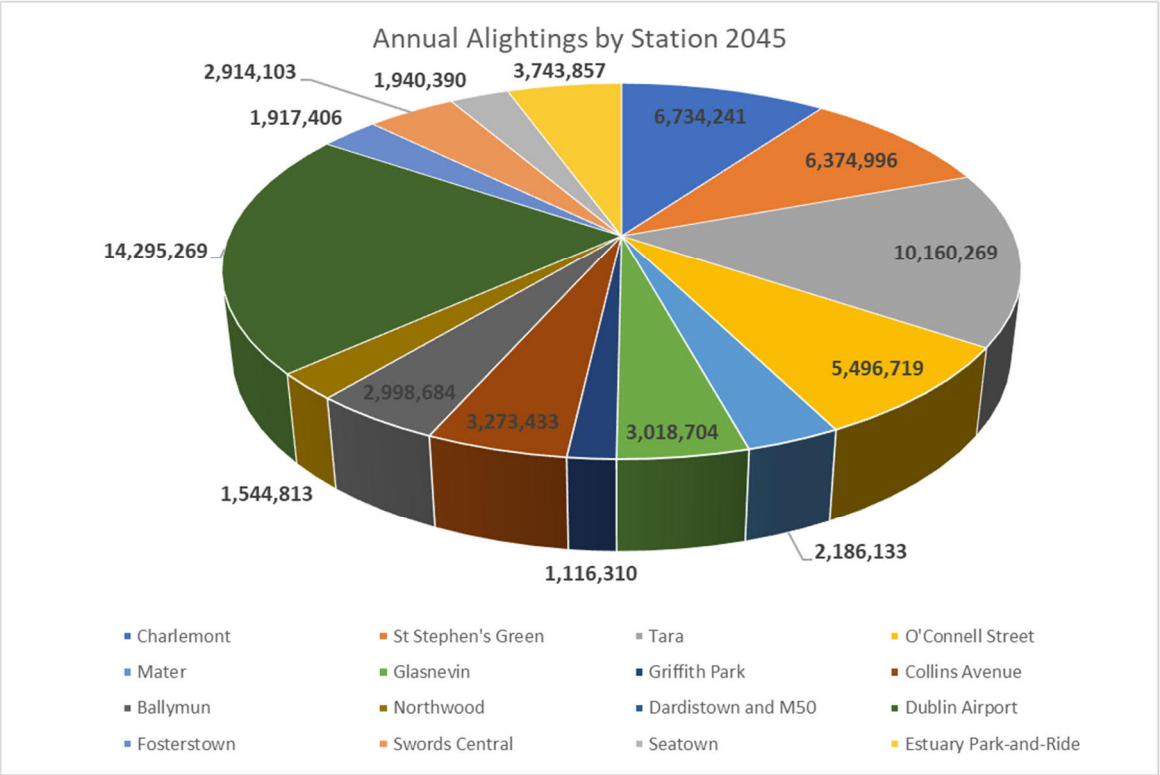
By 2045 it is projected that the system will be carrying around 68m people a year, or nearly 186,000 a day. At present DART is used by around 80,000 passengers a day and the whole of Iarnród Éireann's network by around 50m a year. The busiest stations are projected to be Dublin Airport with 28m boardings and alightings a year, Tara Street 17m, Charlemont 14m and O'Connell Street with 10m.

Figure 1-11: Annual boardings by station 2045



Source: Jacobs' Analysis

Figure 1-12: Annual alightings by station 2045



Source: Jacobs' Analysis

1.2.2 Transport User Benefits Appraisal (TUBA) Impacts

MetroLink will induce a mode-shift as the improved level of public transport provision will reduce the generalised cost of a trip compared to other modes of transport. This mode-shift will mean a reduction in trips on other modes, potentially easing congestion and providing time savings elsewhere on the transport network. This will translate into benefits for other transport mode users. The transport model captures this impact in terms of the changes in journey times for all transport users (highway and public transport) between the with and without the scheme scenarios. It is possible to monetise this impact using TUBA software.

TUBA is the industry-standard software which considers Transport User Impacts, the Private Sector Provider Impacts (revenues and costs), as well as the impact on government revenues through changes in Indirect Tax receipts. TUBA takes demand, journey time and distance travelled information from the traffic forecast model for each future year, vehicle type and journey purpose; for each time period; and calculates travel time saving benefits. It does this by comparing the travel

times in the 'Do-Minimum' scenario with those in the 'Do-Something' scenario. It then applies monetary values (known as Values of Time - VoT) to derive the monetary benefits of those time savings. These monetary values are standard for appraisals within Ireland and are provided by PAG.

TUBA also calculates Vehicle Operating Cost (VOC) changes which occur due to changes in costs associated with such items as fuel, maintenance, and vehicle wear and tear. These occur due to changes in speed and distance when the scheme is implemented and can include both positive and negative values depending upon the scheme's impact upon traffic flows and routeing.

For the public transport element of the assessment, TUBA takes travel times which are the same as those calculated within the Eastern Regional Model (v3) model assignment process[1]. The assignment cost calculations used within the ERM are based on stated preference surveys undertaken during the model development and are different to the cost calculations suggested as default within TUBA (which is based on UK, as opposed to Irish, standards). To ensure a standardised approach between assignment and appraisal the impact of MetroLink is assessed using the assignment cost calculations. Further details of this, and the impact of using the assignment cost calculations versus using 'standard' appraisal cost calculation is given in "Technical Note - Appraisal Travel Cost Assessment".

Valuations provided by TUBA rely on the model outputs for accuracy. The results in this Appendix should be read in conjunction with the technical modelling documentation to understand the level of confidence which can be placed in each of the tests undertaken.

Due to the lifespan of this Project, a 30-year appraisal is not an appropriate length of time to assess the overall impacts of the scheme and to determine the overall benefits. Therefore, a 60-year appraisal, comprised of 30-year appraisal plus 30-year residual value, has been defined for this scheme.

TUBA version 1.9.13 has been used for this assessment, and the economic parameter file has been updated in accordance with the latest PAG guidance[2]. This is to ensure the assessment is using the latest version of the software with adjusted Irish guidance to incorporate Ireland specific operating costs and other TUBA elements.

[1] Excluding additive mode constants.
[2] Including the October 2020 DoT circular – SRA 01/2020

To align the appraisal with the modelling work undertaken, two additional modelled journey purposes (beyond the core model and appraisal purposes - Business, Commute, Other[3]) have been included within the economic parameter file. These are Education and Retired, which are included within the transport model. For the purposes of this assessment, it is assumed that these two purposes have the same parameter characteristics as 'Other'.

The modelling of any time period is an average traffic flow for the respective time period, and so an annualisation factor is applied to convert this into an overall annual traffic flow. The annualisation factors that are used for this assessment have been provided by the NTA as a package with the ERM and are shown in Table 1-2. These annualisation factors are used for both the highway and public transport elements of the appraisal.

Table 1-2: Annualisation Factors

Modelled Time Period	Time	Appraisal Representative Period	Annualisation Factors
AM	0700-1000	AM	616
LT (Lunch Time)	1000-1300	LT, Evening Off-Peak, Weekend	3,044
SR (School Run)	1300-1600	SR	688
PM	1600-1900	PM	688

Source: NTA

The NTA consider the LT period to be representative of the evening, off-peak and weekend periods in terms of traffic levels and provision of public transport services, and so it is used as a proxy for the impact of MetroLink in these periods. To achieve this the lunchtime annualisation factor is increased to incorporate the evening, off-peak, weekend and bank holiday periods. The other time periods (AM, LT and PM) only represent weekday movements, and so have much lower annualisation factors. Table 1-3 shows the purpose splits within each time period. The LT period has the least number of Commuters and significantly more Other purpose users than in other time periods, and so is the modelled period most representative of off-peak and weekend time periods.

[3] 'Other' trips include all trips not captured in the four specified categories. The bulk of 'Other' trips will be journeys for leisure purposes.

Table 1-3: Model Purpose Splits in 2045 with MetroLink in place

Time Period	Purpose		
	Business	Commute	Other
AM	6.1%	39.1%	54.8%
LT	9.8%	8.2%	82.0%
SR	5.8%	11.5%	82.8%
PM	6.3%	41.7%	51.9%

Source: Jacobs' Analysis

As shown in Table 1-4 the LT period has more airport trips, including highway trips, within this time period compared to other modelled time periods – again making it more suitable for use as a proxy for off-peak and weekend trips than the other modelled time periods.

Table 1-4: Modelled hour airport demand trips within each time period in 2045 with MetroLink in place

Time Period	Public Transport	Highway	Total
AM	7,691	8,631	16,322
LT	9,269	10,491	19,760
SR	9,078	9,176	18,253
PM	7,197	8,888	16,085

Source: Jacobs' Analysis

TUBA checks and warnings

Whilst undertaking the benefit calculations, TUBA produces a detailed list of warnings, flagging any potentially unusual changes between the Do Minimum (DM) and Do Something (DS) inputs. Warnings are provided based on the ratio of DM to DS travel times and distances, and the modelled speeds, as well as flagging exceptionally long (both in distance and time) trips.

The warning messages were reviewed to highlight any potential issues with the model outputs. Warnings affecting a very small demand (less than 5 trips) were not investigated as they are unlikely to have a material impact on the results. Overall, there were very few warnings relating to movements greater than 5 trips, and therefore, requiring further investigation. For those movements that did require investigation a further detailed review was undertaken. It is not considered that the underlying causes of the remaining warnings have a material impact on the appraisal of the scheme.

1.2.3 User and Provider Impacts

The impacts of MetroLink can be considered in two parts – public and private sector impacts. Public sector impacts include any costs borne or revenue received by the public sector and private sector impacts include costs borne by, revenue received by and journey time impacts for the private sector.

In terms of appraisal revenue returns to the public sector are considered as negative costs within the BCR and private sector costs are considered as negative benefits within the BCR. This section considers on the private sector impacts of MetroLink. Public sector costs are discussed in greater detail in in "ML1-JAI-LSI-ROUT_XX-RP-y-00001_V21 Technical Appendix - Scheme Costs" and also in the Public Accounts table given in Section 1.13

The total private sector impacts as a result of the scheme are shown in Table 1-5. The benefits presented include the monetisation of journey time savings, VOC, and private sector provider impacts, taken over the 60-year appraisal period of the scheme. These are based on standard time valuations and operating cost assumptions as set out in PAG. In total, there are €15.6 billion direct benefits as a result of the scheme.

Table 1-5: Summary of scheme benefits (€M's, 2011 prices and values)

Description	Public Transport Benefit (€M's)	Highway Benefit (€M's)	Investment (€M's)	Total Benefit (€M's)
Economic Efficiency: Consumer Users (Commuting)	1,848	596	-	2,444
Economic Efficiency: Consumer Users (Other)	4,241	1,685	-	5,926
Economic Efficiency: Business Users	3,076	3,174	-	6,250
Economic Efficiency: Business Providers	205		814	1,018
Wider Public Finances (Indirect Taxation Revenues)	-35	-8	-	-43
Present Value of Benefits (PVB)	9,334	5,446	814	15,594

Source: Jacobs' Analysis

The economic evaluation of transport projects seeks to identify and account for all the impacts and transfers between sectors in the economy e.g. transfers from public sector to private sector (for

instance in the case of a fare that is both a cost to the user and a source of revenue for the public sector). All private sector impacts (positive or negative) are accounted for as a benefit in order to isolate the impacts to the public sector and analyse them as costs.

The Investment column in Table 1-5 reflects the economic treatment of the role of the Service Delivery Partner (explained in more detail in the Scheme Costs Technical Appendix and Procurement Technical Appendix). The Delivery Partner will finance a part of the scheme prior to the opening of MetroLink. This initial cashflow has been included as a negative impact to the private sector. However, when MetroLink opens the Delivery Partner will recover its investment through a unitary charge paid for by the government over 25-years. The later phase of cashflow has been included as a positive impact to the private sector. The net effect is captured as a positive cashflow in the Investment column.

The transport modelling captures the benefits for any user that changes transport mode as a result of the scheme in place. This includes the journey time saving as a result of the change in mode of transport, as well as any positive impact this has on the previous transport mode to other users, for example, a reduction in highway trips meaning less congestion on the road network. Analysis of the travel time benefits by time period is shown in Table 1-6. These are the monetised journey time benefits, not including VOC, fares or other benefits.

Table 1-6: Profile of Time Benefits in 2011 Prices Discounted to 2011 (€M's, 2011 prices and values)

Mode	Time Period	60-Year Benefit (€M's)	Percentage
Public Transport	AM	1,574	18%
	LT, Evening Off-Peak, Weekend	4,642	53%
	SR	1,255	14%
	PM	1,339	15%
Highway	AM	822	17%
	LT, Evening Off-Peak, Weekend	2,604	52%
	SR	775	16%
	PM	778	16%
All Modes	AM	2,397	17%
	LT, Evening Off-Peak, Weekend	7,246	53%
	SR	2,030	15%
	PM	2,117	15%

Source: Jacobs' Analysis

In total, 17% of the benefits are associated with morning peak trips, 53% with Lunch Time, Evening, Off-Peak and Weekend trips, 15% with school run trips, and 15% with evening peak trips. The actual lunchtime period equates to around 25% of the benefits attributed to the LT, Evening, Off-Peak and Weekend Appraisal Period. That is, 28% of benefits arise in the evenings, off-peak and weekends.

Table 1-7 shows the total benefits by the size of time saving for Public Transport Trips over the 60-year appraisal period. The majority of benefits arise from journey savings greater than 5 minutes, highlighting the transformational impact of MetroLink.

Table 1-7: Public Transport total benefits (€m) by size of time saving

Purpose	Public Transport Trip Benefits by size of Time Saving (€M's)						
	< -5 mins	-5 to - 2 mins	-2 to 0 mins	0 to 2 mins	2 to 5 mins	> 5 mins	Total
Business	-21	-32	-42	36	47	3,126	3,115
Commuting	-37	-33	-45	42	41	1,894	1,862
Other	-22	-35	-39	37	57	3,867	3,864
Education	-17	-15	-26	24	16	395	378
Retired	0	-1	-2	1	1	43	42
Total	-97	-117	-153	140	161	9,326	9,261

Source: Jacobs' Analysis

Table 1-8 shows the total benefits by time savings for Highway Trips. The majority of benefits arise from savings of less than 5 minutes, suggesting that most benefits accrue from local congestion relief. Disbenefits accrue to some users, particularly commuting and business trips. This is likely to be due to increased traffic in the peak periods as a result of people driving to the Park and Ride site to then use MetroLink to travel to the city centre. The resultant congestion, to the north of Swords affects Commuters more than Business and Other users, as it occurs in the peak periods when the number of commuting trips is highest.

Table 1-8: Highway total benefits (€Ms) by size of time saving

Purpose	Highway Trip Benefits by size of Time Saving (€M's)						
	< -5 mins	-5 to -2 mins	-2 to 0 mins	0 to 2 mins	2 to 5 mins	> 5 mins	Total
Business	-278	-83	-231	1,483	1,210	1,104	3,205

Purpose	Highway Trip Benefits by size of Time Saving (€M's)						
	< -5 mins	-5 to -2 mins	-2 to 0 mins	0 to 2 mins	2 to 5 mins	> 5 mins	Total
Commuting	-136	-33	-175	547	243	154	600
Other	-17	-17	-84	690	417	595	1,585
Education	-3	0	-3	20	5	4	23
Retired	-4	-3	-14	90	17	7	92
Total	-438	-136	-507	2,830	1,892	1,863	5,505

Source: Jacobs' Analysis

Table 1-9 shows that the most significant value of benefits by Public Transport are for trips ranging between 10 and 50kms, with the majority of these being Business and Other purpose trips. This is due to trips to and from areas beyond the city centre and includes trips that have changed from travelling by private car to using public transport.

Table 1-9: Public Transport Total benefits (€m) by distance

Purpose	Public transport trip benefits by size of trip distance (€m)							
	< 1 kms	1 to 5 kms	5 to 10 kms	10 to 15 kms	15 to 20 kms	20 to 50 kms	50 to 100 kms	>100 kms
Business	8	39	283	679	998	1,004	51	53
Commuting	3	37	277	241	610	647	19	28
Other	19	20	293	766	1,048	1,449	143	125
Education	1	-5	44	147	75	99	14	4
Retired	0	0	8	12	9	13	0	0
Total	30	92	906	1,844	2,739	3,212	227	210

Source: Jacobs' Analysis

Table 1-10 shows the breakdown of total benefits by journey distance for Highway Trips. A significant amount of the benefits from highways trips accrue to trips between 20-50km in length. This is due to the number of people transferring to public transport who previously would have used the motorway network thereby reducing congestion and reducing journey times for medium distance traffic. As highlighted above average journey time savings are low so this is more to do with the volume of traffic receiving small savings.

Table 1-10: Highway Total benefits (€m) by distance

Purpose	Highway Trip Benefits by size of Trip Distance (€m)							
	< 1 kms	1 to 5 kms	5 to 10 kms	10 to 15 kms	15 to 20 kms	20 to 50 kms	50 to 100 kms	>100 kms
Business	0	82	212	407	275	1,344	623	0
Commuting	1	40	95	84	38	202	75	1
Other	-1	111	251	219	154	444	225	-1
Education	0	3	3	4	2	9	2	0
Retired	0	4	12	14	11	41	11	0
Total	-1	239	574	727	479	2,040	936	-1

Source: Jacobs' Analysis

Table 1-11 provides a breakdown of the user benefits by user class across the following impacts: travel time, VOC and user charges. The benefits are also presented by modes.

Table 1-11: User Impacts (€M's, 2011 prices and values)

User Class	User Benefits Type	Public Transport Benefits (€M's)	Highway Benefits (€M's)	Total Benefits (€M's)
Commuting	Travel Time	1,790	526	2,316
	VOC	0	17	17
	User Charges	59	52	111
	Total	1,848	596	2,444
Business	Travel Time	2,986	3,034	6,020
	VOC	0	78	78
	User Charges	90	61	151
	Total	3,076	3,174	6,250
Other (including, retired, education and "other" trips)	Travel Time	3,968	1,396	5,364
	VOC	0	240	240
	User Charges	273	48	321
	Total	4,241	1,685	5,926
Total	Travel Time	8,743	4,957	13,700
	VOC	0	336	336
	User Charges	422	161	583
	Total	9,165	5,454	14,619

Source: Jacobs' Analysis

The User Impacts accumulate to €14.6 billion benefits, with €9.2 billion from Public Transport and €5.5 billion from Highway. The large amount of benefits in the Off-Peak, Evening, and Weekend periods mean that nearly half of the total benefits occur to the Other trip purpose.

The monetary impact of indirect tax and private sector provider impacts are shown in Table 1-12. The investment column captures the net effect to the Delivery Partner through the PPP arrangement for scheme delivery.

Table 1-12: Indirect Tax and Private Sector Provider Impacts (€M's, 2011 prices and values)

Provider Impact Type	Public Transport Fare (€M's)	Highways (€M's) Toll	Investment (€M's)	Total (€M's)
Indirect Tax	-35.3	-8.1		-43.3
Private Sector Provider Impacts	205		814	1,018

Source: Jacobs' Analysis

There is a decrease in tax payments to the government, but an increase in public transport ticket sales leading to a private sector revenue increase. There are no private sector highway provider impacts as it has been assumed that revenue impacts accrue to the public sector. The fare revenues are network wide and show the aggregate change in fares to all private sector providers – they are not just fares associated with MetroLink. The investment column is the net effect to the private sector of the PPP.

Note, that the revenue provider impacts in Table 1-12 consider only the direct farebox change between DM and DS, but User Revenue Charges (shown in Table 1-11) are calculated to consider the welfare impacts of the users. A detailed description in the differences between the impacts can be found in UK Department for Transport TAG A1.3: User and Provider Impacts.

To generate the Present Value of Transport Economic Efficiency Benefits (TEE) the user impacts in Table 1-12 are combined with the private sector provider impacts in shown in Table 1-11. This estimates the impacts to be €15.6, with €9.4 billion from Public Transport and €5.5 billion from Highway.

Table 1-13 Total Impacts (€M's, 2011 prices and values)

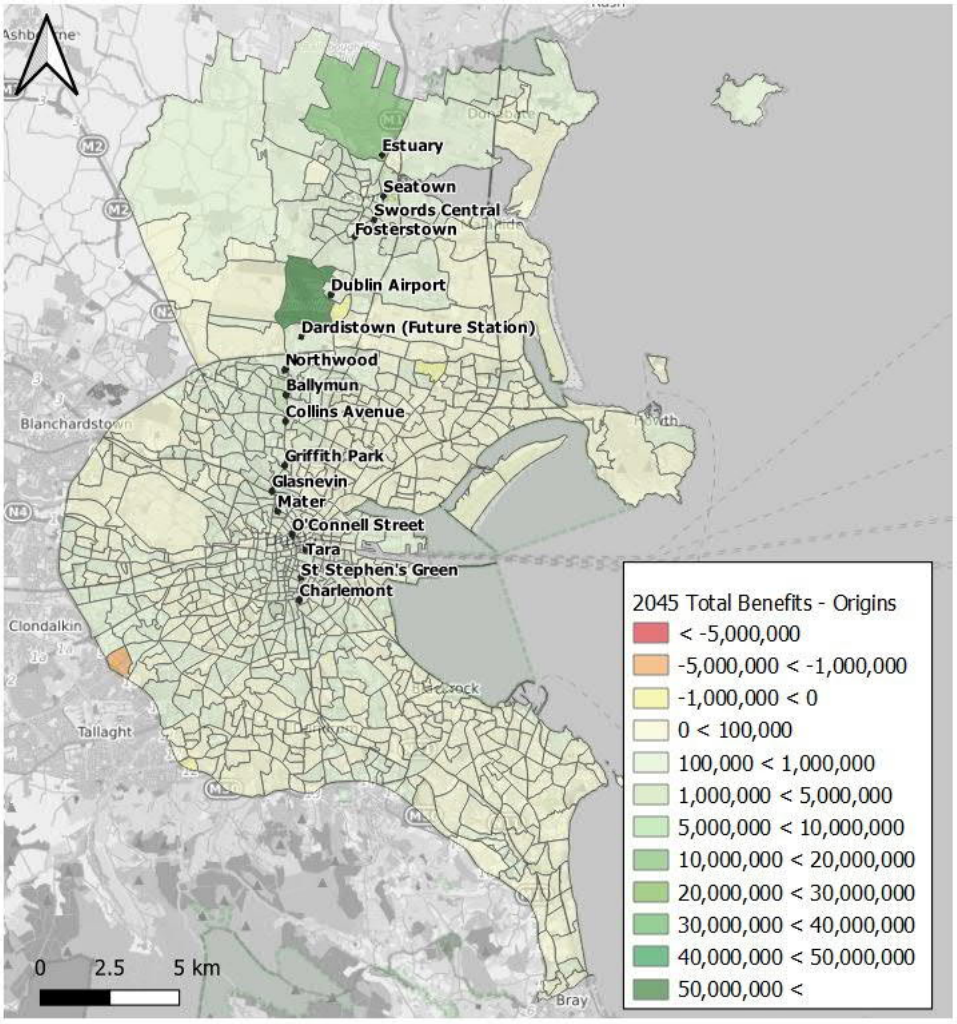
User Class	Benefits Type	Public Transport Benefits (€M's)	Highway Benefits (€M's)	Investment (€M's)	Total Benefits (€M's)
Commuting	User benefits	1,848	596		2,444
Business	User benefits	3,076	3,174		6,250
	Private Sector Provider Impacts	205		814	1,018
Other (including, retired, education and "other" trips)	User benefits	4,241	1,685		5,926
Total	User benefits	9,165	5,454		14,619
	Private Sector Provider Impacts	205		814	1,018
	Total	9,370	5,454	814	15,638

Source: Jacobs' Analysis

1.2.4 Geographic Spread of Benefits

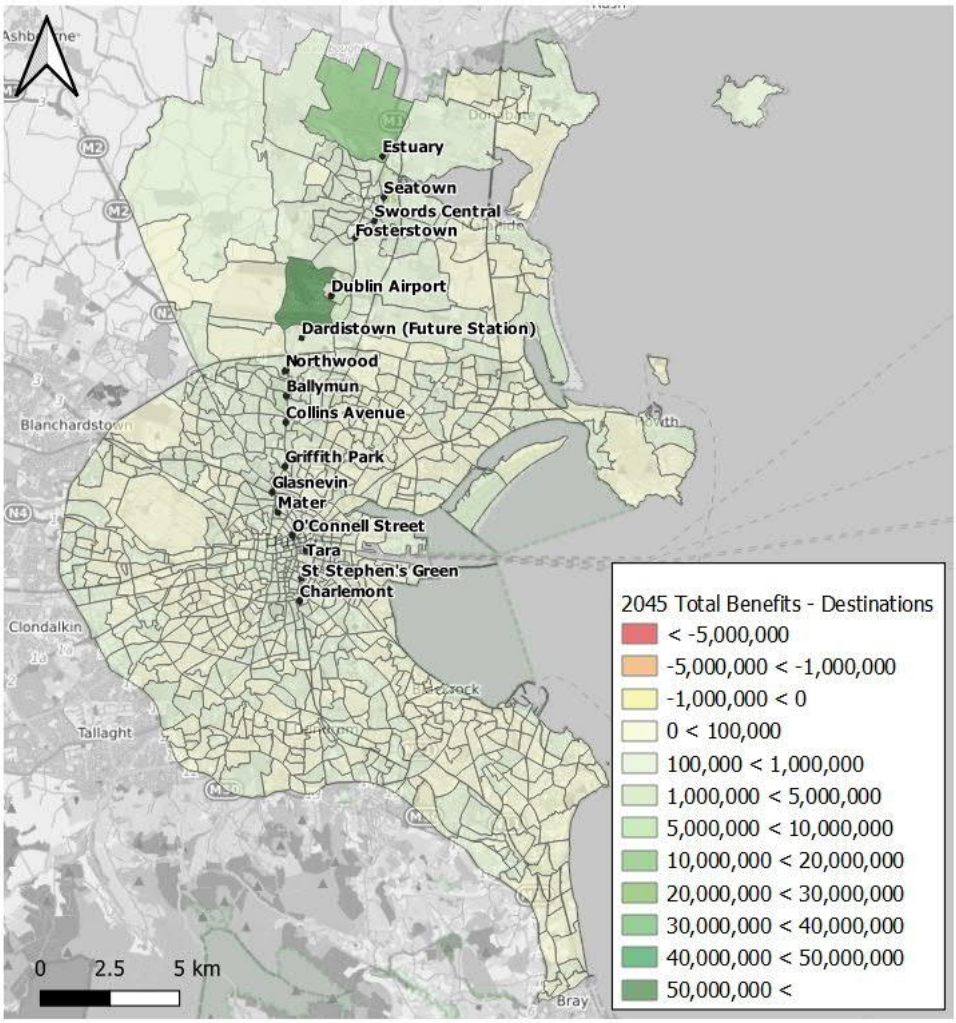
To understand the geographic spread of benefits, modelled zones were grouped into sectors, and the benefits from and to each sector were plotted. To get a complete picture of the impact of MetroLink, it is useful to look at its combined impact on both public transport and highway users. As can be seen in Figure 1-13 and Figure 1-14, the aggregate impact of MetroLink for almost all areas is positive. As well as having a large beneficial impact for some areas, Dublin as a whole will benefit from faster journey times with MetroLink in place.

Figure 1-13 Total Origin Benefits in 2045



Source: Jacobs' Analysis

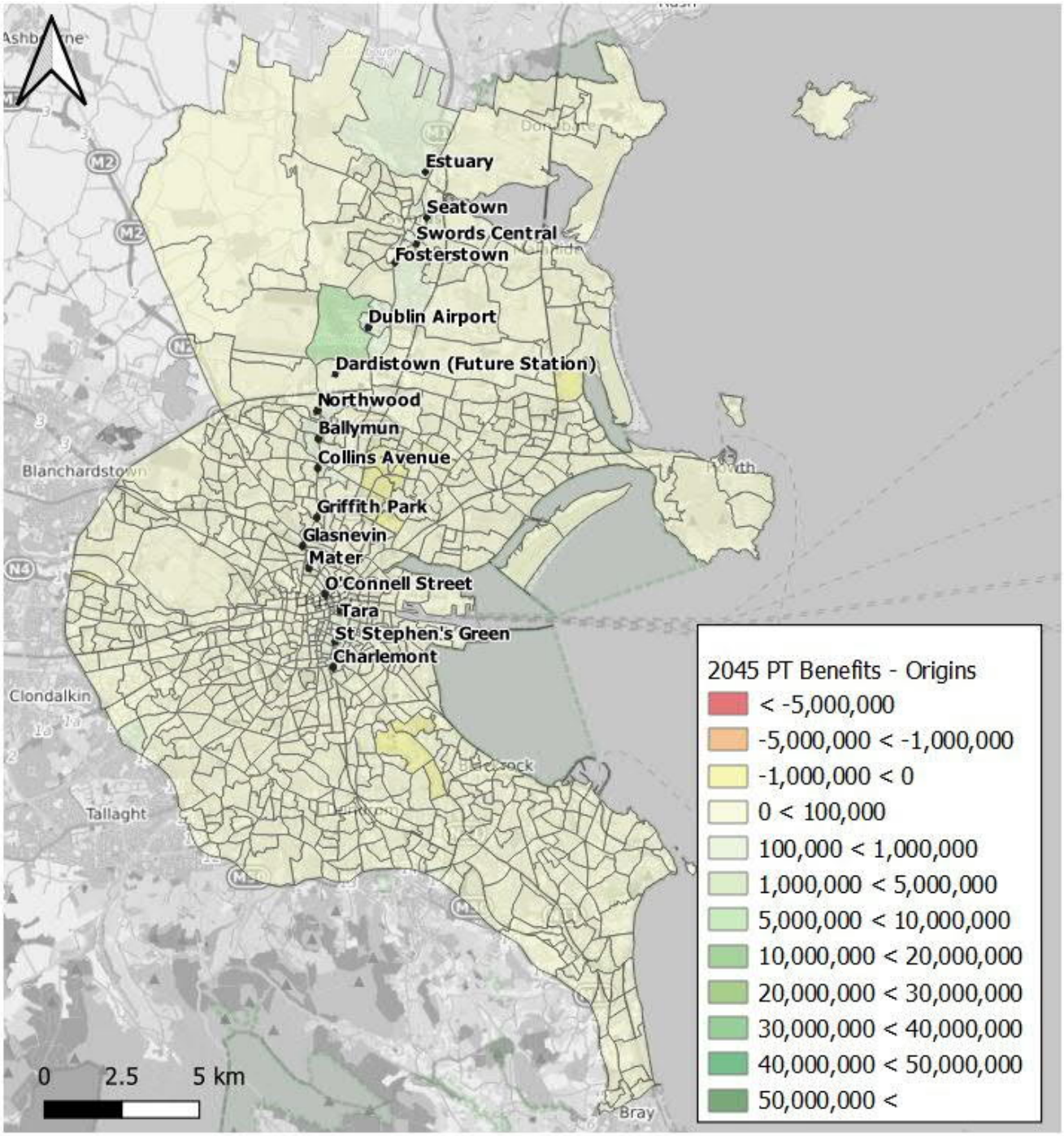
Figure 1-14: Total Destination Benefits in 2045



Source: Jacobs' Analysis

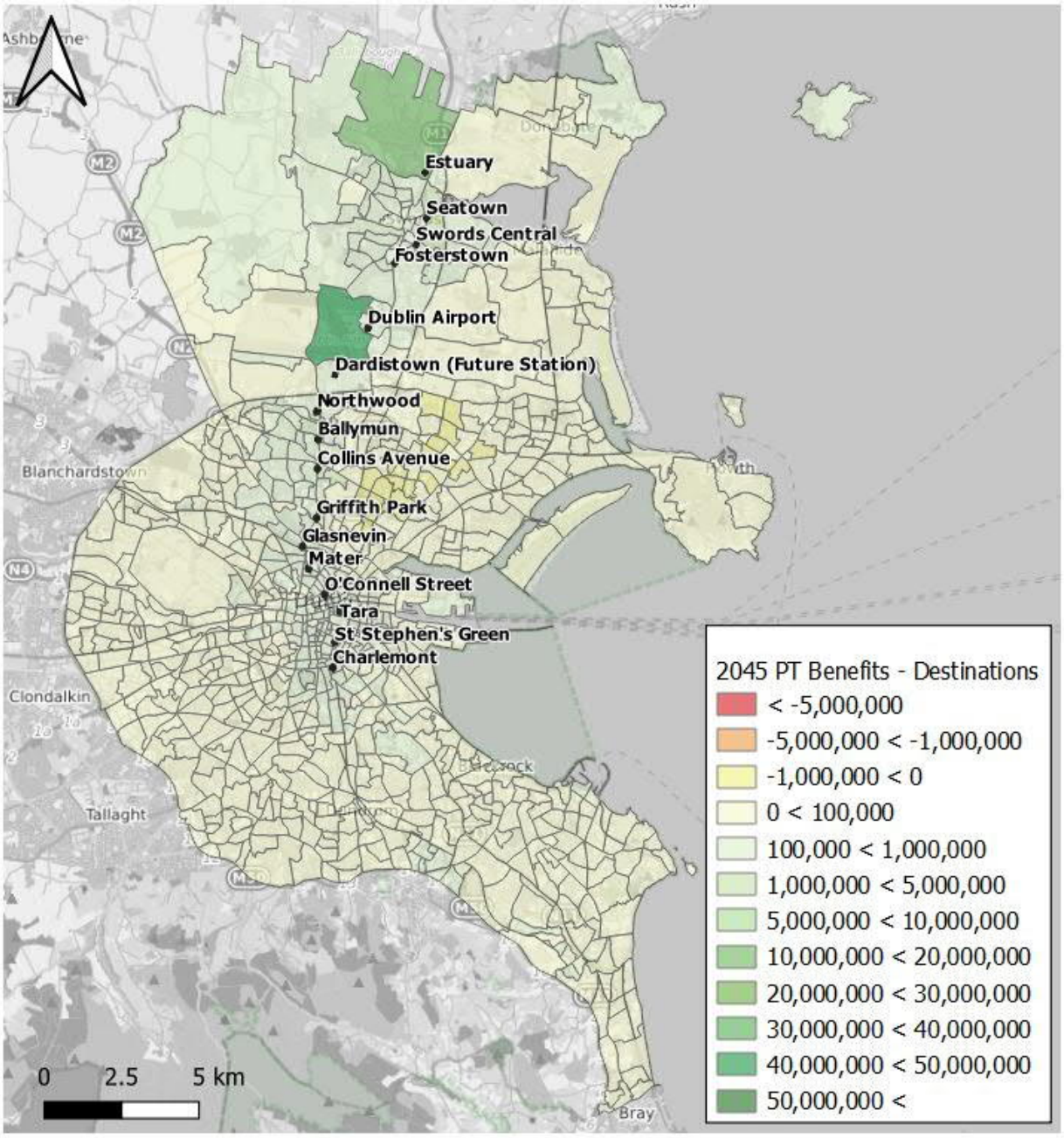
Figure 1-15 and Figure 1-16 show there are benefits for the majority of geographical areas for Public Transport trips throughout the scheme corridor in 2045. In contrast to the Highway Trip Benefits, shown in Figure 1-17 and Figure 1-18, there are also benefits for the sector that the Park and Ride Site is located within, and to the north of it.

Figure 1-15: Public Transport Origin Benefits in 2045



Source: Jacobs' Analysis

Figure 1-16: Public Transport Destination Benefits in 2045



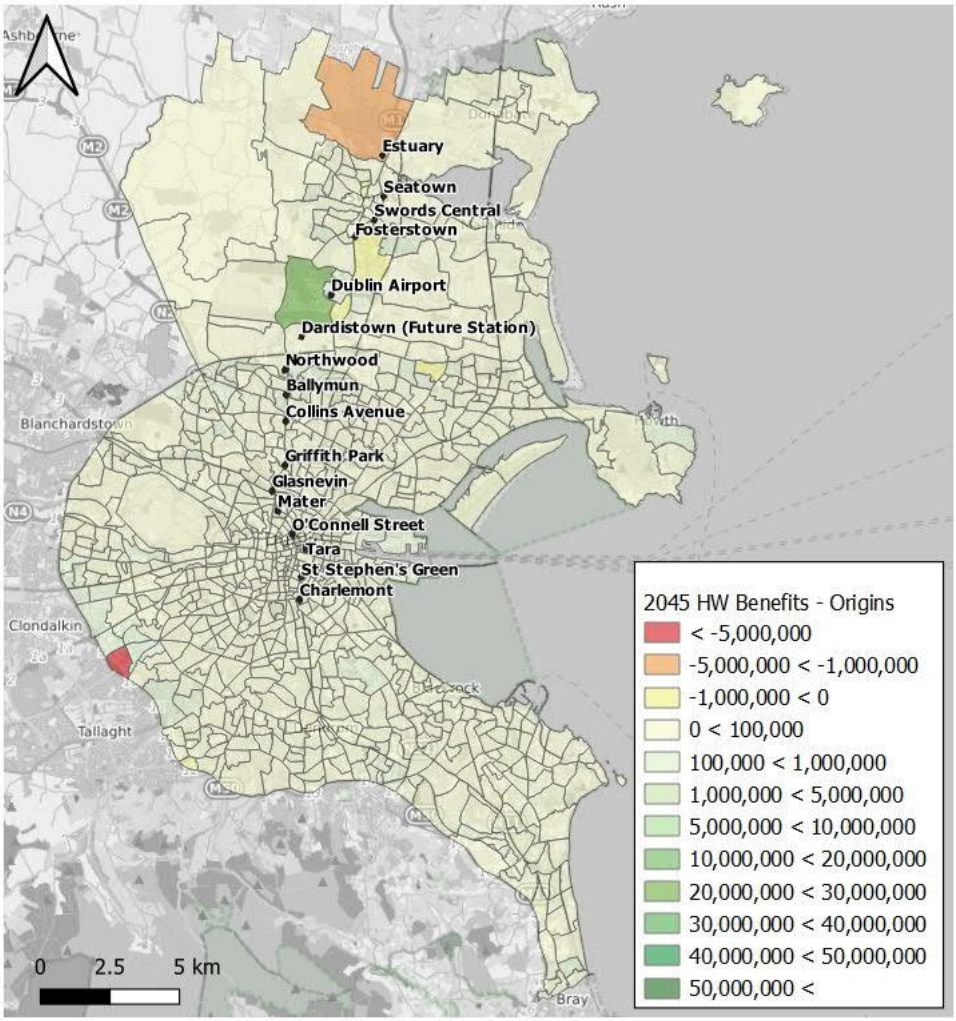
Source: Jacobs' Analysis

Figure 1-17 and Figure 1-18 illustrate the total benefits for origin and destination trips for Highway trips in 2045. Benefits accrue to most sector movements. There are disbenefits north of Estuary Park and Ride for both origin and destination trips, and as discussed previously this is due to an increase in traffic travelling to the Park and Ride Site, on already congested roads leading to further delays to

the north of Estuary. The impact to users of a combined 'through' trip (making use of the park and ride site and MetroLink to access Dublin from the north) is positive overall with significant time savings made using MetroLink on the journey leg south of the airport, in comparison to continuing the journey by highway.

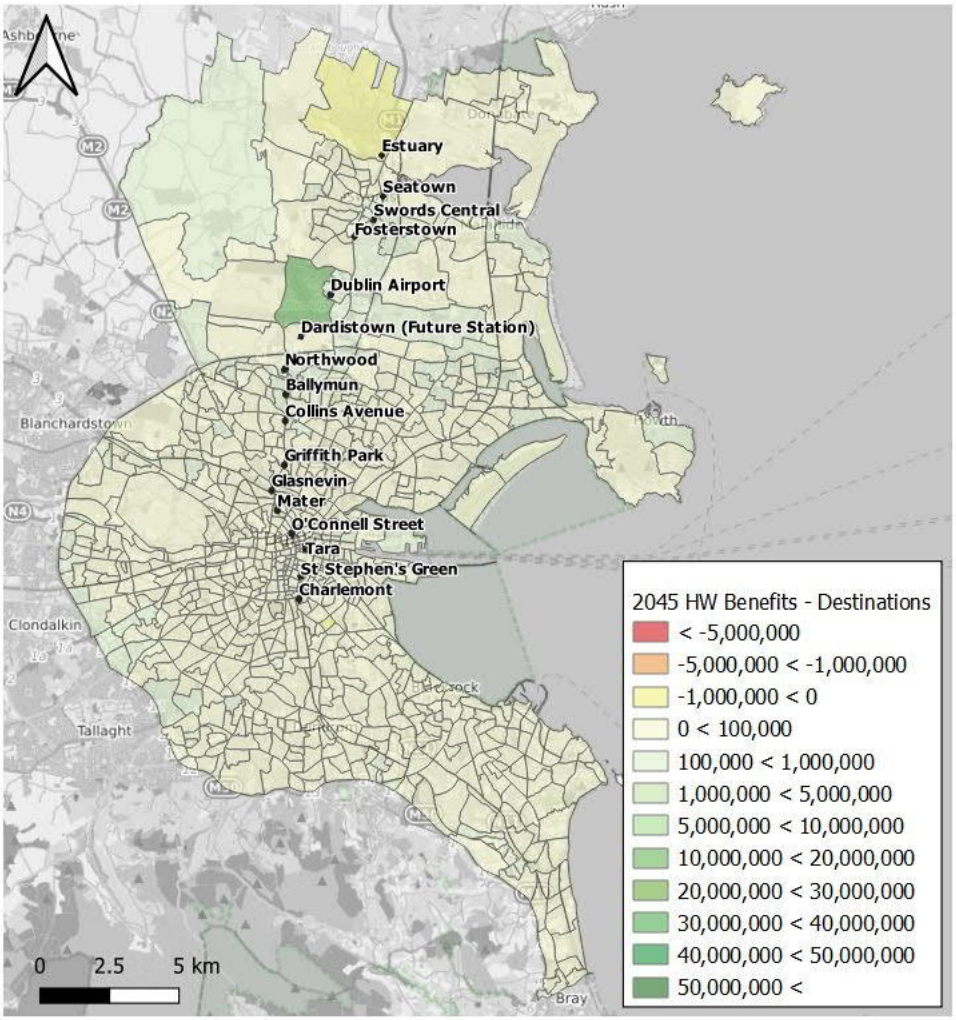
Similarly, there are disbenefits to the west of Dublin. This is likely to be due to a reduction in parking spaces used by highway trips from the north of Dublin, meaning more parking spaces available in the city centre, encouraging highway trips from the west of Dublin. This results in an increase in highway trips and slightly more congestion coming from the west of Dublin causing disbenefits for these users.

Figure 1-17: Highway Origin Benefits in 2045



Source: Jacobs' Analysis

Figure 1-18: Highway Destination Benefits in 2045



Source: Jacobs' Analysis

Such a widespread beneficial impact is indicative of the positive transformational effect that MetroLink will have om Dublin.

1.3 Safety benefits

The level of traffic on the road network will be impacted by MetroLink. As a result of a decrease in highway traffic, there will be a reduction in congestion and so users who remain will be able to (on average) travel faster. The reduction in traffic and higher traffic speeds will have an impact on the number of accidents in the area. Broadly, less traffic means fewer accidents and higher speeds

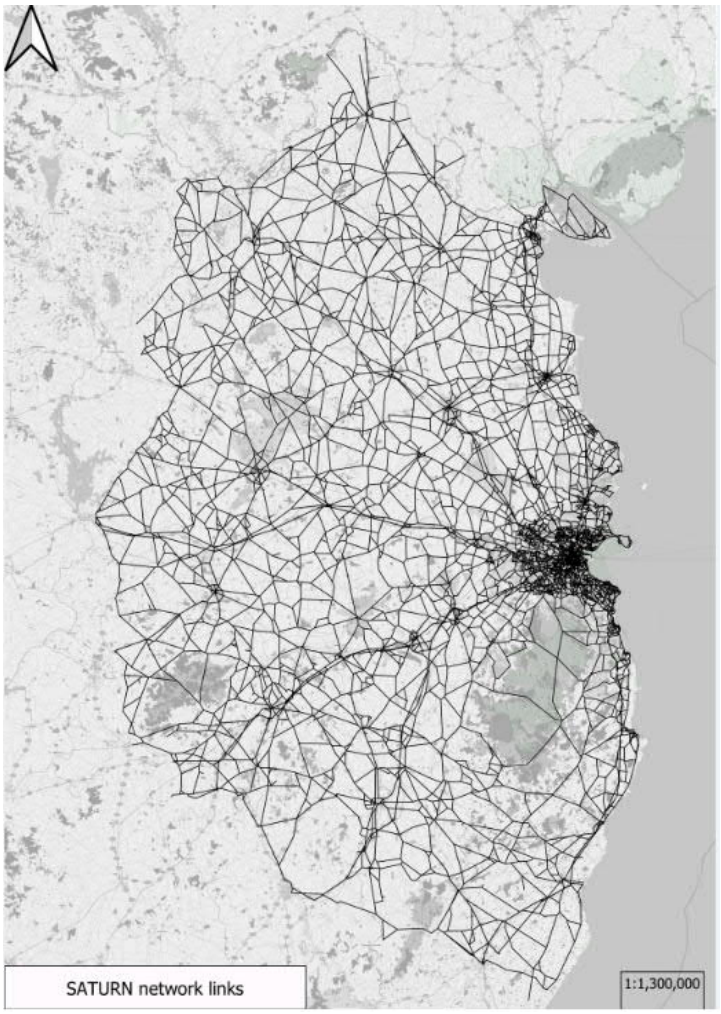
means more accidents. In the case of MetroLink these two effects almost balance, with a projected slight reduction in accidents over the 60-year appraisal period.

Different road types (dual/single carriageway, old/modern geometry) have different accident rates and these rates vary depending on vehicle speeds. By comparing the speeds travelled on the road network with and without the scheme, along with the accident rates on the road types, it is possible to estimate the impacts the scheme will have on road safety using COBA-LT software.

COBA-LT is the standard software used for undertaking accident analysis. Within COBA-LT, the predicted numbers of accidents with and without a scheme are compared and converted into monetary values by multiplying the numbers of accidents by their average monetised costs. The benefits for each year are discounted to 2011 prices and summed over the 60-year assessment period. COBA-LT calculates the number of accidents over the 60-year period from either default (national average) or observed (local) accident rates. For the purposes of this assessment, default values based on the link characteristics have been used. The traffic flows used for accident analysis were calculated from the modelled flows. They are consistent with flows used in other elements of the economic analysis including the TUBA assessment.

Figure 1-19 shows the links within the area used to determine the accident benefits. Professional judgement was used to identify the area that would realistically be significantly impacted by the scheme, and to consider the likely increase in traffic as a result of the Estuary Park and Ride Site.

Figure 1-19: ERM SATURN Model Extents



Source: Jacobs' Analysis

Table 1-14, provides a summary of the key assumptions use for the analysis.

Table 1-14: Accident Impact – assumptions and sources of information

Item	Assumptions / Notes
Software	COBA-LT-Ireland Version 2015.1 (current version)
Parameters file	COBA-LT-Ireland Parameters file Version 2019.10.03
Appraisal Period	60 Years
COBA-LT study area	Whole ERM highway network

Item	Assumptions / Notes
Accident data	Set out in PAG Unit 6.11: National Parameter Values Sheet
Traffic data	Base Year AADTs taken from ERM SATURN model. DM and DS AADTs for 2030 and 2045 taken from ERM model assignments
Geometric parameters	Speed limits, distances, carriageway standard, junction type etc. extracted from ERM SATURN models
Price basing and discounting	To ensure consistency with all other scheme impacts, the accident monetary impacts were calculated in 2011 prices and discounted to 2011.

Source: Jacobs' Analysis

In addition to this, the following assumptions have been made:

1. A limitation of COBA-LT is that it only considers links that have speeds in multiples of 10kph, and due to some modelled links having speeds not in multiples of 10kph, these links have been rounded to the nearest and most appropriate 10kph speed limit.

2. COBA-LT only includes links that have speeds greater than 50kph, and so to ensure all links are included within the analysis, any modelled links that were less than 50kph have been converted to be 50kph.

These assumptions help ensure that the links within the city centre are included within the accident analysis.

1.3.1 COBA-LT Results

The scheme's projected impact on the number of casualties over the 60-year appraisal period, split by severity, is shown in Table 1-15. This shows that there is predicted to be an overall decrease in the number of fatalities, as well as in the number of slight and serious casualties.

Table 1-15: Summary of Casualties

Casualty Severity	Total without Scheme Casualties	Total with Scheme Casualties	Total Casualties Saved
Fatal	1,151	1,137	15
Serious	4,714	4,667	47
Slight	121,463	120,129	1,333

Source: Jacobs' Analysis

The total monetary benefit of the reduction in the number of accidents over the 60-year assessment period equates to €33.2 million as shown in Table 1-16.

Table 1-16: Summary of Safety Benefits

Scheme	Collision Costs (€M's)
Total Without-Scheme	3,291.5
Total With-Scheme	3,258.3
Total Collision Benefits	33.2

Source: Jacobs' Analysis

It is important to note that while this COBA-LT assessment is positive overall, it is based on accident parameters that reflect national average conditions for different broad categories of road. It is not a substitute for the detailed operational safety assessment undertaken as part of further scheme development.

1.4 Employment Impacts

1.4.1 Introduction

In order to improve public investment decisions, it is important to understand the potential combined benefits of a project, including direct, indirect and induced employment benefits. Given that an integral part of the National Strategy[4] is the achievement of full employment, an analysis of the employment impact of investment projects can be of assistance in the formulation of budgetary decisions. A move to more productive jobs and individuals that are induced to take up employment as a result of reduced travel times increasing their effective wages also plays a key role in public investment decision making.

[4] Irelands National Skill Strategy 2025, 2016

1.4.2 Preliminary evaluation of employment impacts

The approach to forecasting employment impacts has been developed to assess the impact of the delivery of MetroLink during its construction phase. The analysis is based on a methodology developed for the National Roads Authority (NRA) on behalf of TII in 2013[5] and is largely based on Input-Output analysis. The NRA study assessed the impact infrastructure investment, including on transport, schools, hospitals, and social housing has on employment. The study identified that, per €1bn (2013 prices, excluding VAT) invested in rail, 12,858 years of employment are generated. Based on a standard assumption that 10 years of employment is the equivalent of one full time job then this equates to 1,286 FTE per €1bn spent on rail. This number includes direct, indirect and induced job creation. Direct job creation is employment generated specifically as part of the project, while indirect job creation is employment generated by the supply chain through the purchasing of goods, and induced job creation is employment generated in the economy from higher expenditure due to the additional direct and indirect employment. Table 1-17 outlines the job creation levels reported by the National Roads Authority.

Table 1-17: Annual Employment Impact per €1bn Government Spend

Infrastructure Types	Direct	Indirect	Induced	Total
Rail	8,146	3,001	1,711	12,858

Source: National Roads Authority on behalf of TII

MetroLink current construction expenditure, including risk but excluding inflation and VAT, is estimated to total to €8.87bn (2019 prices, undiscounted). According to the above-mentioned study MetroLink is estimated to enable, on average, 1,114,000 – 1,340,000 total years of employment over the years of project expenditure of which 720,000 – 910,000 years of labour will be direct, c.250,000-300,000 will be indirect and c.150,000-180,000 will be induced. Table 1-18 illustrates the employment that MetroLink will help to create in full time equivalent terms.

Table 1-18: MetroLink estimated annual FTE impacts (nearest 1,000)

	Direct	Indirect	Induced	Total
FTE	7,200 – 9,100	2,500-3,000	1,500-1,800	11,400-13,400

[5] The Employment Benefits of Investment Projects, October 2013

Source: Jacobs' Analysis

These numbers are indicative based on current stage of cost estimates. Tunnelling for underground mass-rapid-transit systems is on average more capital intensive, so a higher level of spend would be required to generate the number of jobs outlined in the NRA report. However, MetroLink has the potential of benefitting a whole generation of engineers, designers, architects and geologists, over the life of the project. Further it will create opportunities for businesses to upskill their workforce. London established a 'Tunnelling and Underground Construction Academy' which has trained 20,000 people over the course of 10 years, not only in rail but other sectors of the economy.

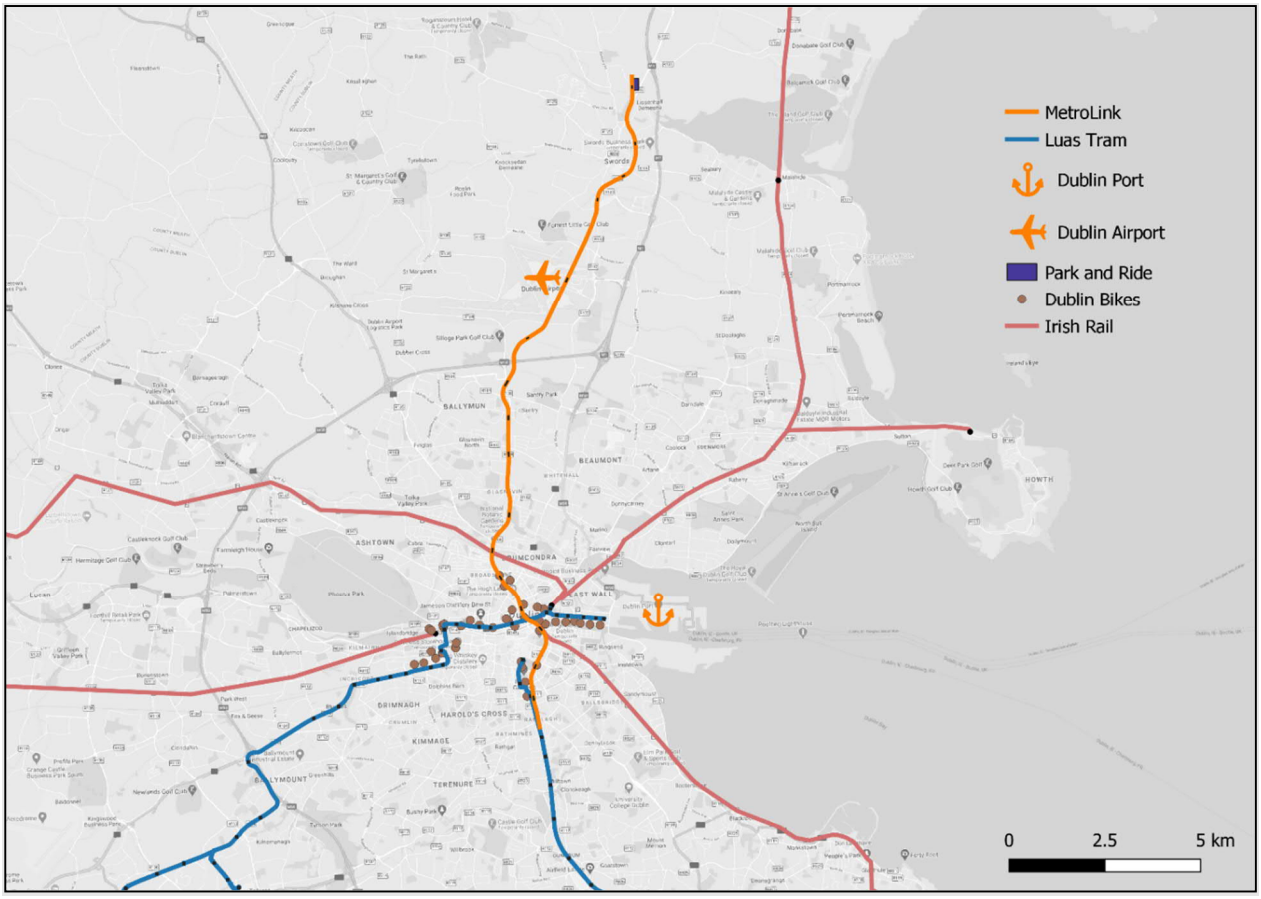
This analysis does not include the additional employment effects expected from increased productivity and clustering effects as a result of the accessibility benefits described later in this document.

1.5 Transport integration

The aim of the National Development Plan is to ensure that public investment is targeted towards projects that will fulfil the objectives of the NPF. With housing and transport so inextricably linked, the National Development Plan is directing investment towards large scale public transport infrastructure. Public transport functions best when it's properly integrated across modes. When users can change from one mode of transport to another seamlessly, with timetables and ticketing fully integrated, public transport can more effectively compete with private transport. This principle of integration and accessibility is a key element in the MetroLink project.

As well as the provision of extra capacity to support Dublin's growth, the proposed MetroLink alignment integrates with other major transport hubs. MetroLink will connect with two major Iarnród Éireann lines; the north-western line from Sligo/Maynooth to Dublin, and the south-western commuter line from Newbridge/Hazelwatch to Grand Canal Dock, these converge at Whitworth Road near Glasnevin. MetroLink will also connect with DART and Iarnród Éireann services at Tara Street and Luas at Charlemont, O'Connell Street, and St. Stephen's Green. These connections are shown in Figure 1-20.

Figure 1-20: Transport integration of MetroLink



Source: Jacobs' Analysis

MetroLink will also be designed and delivered in a manner that will complement large infrastructure assets in and around the GDA. The preferred route will have a station at Dublin Airport offering transit times between the airport to Dublin city centre of under 20 minutes.

MetroLink is part of an integrated strategy to provide sustainable mobility and promote non-mechanised modes, (walking and cycling). In line with the National Cycle Policy Framework, cycling arrangements will be appropriately considered during the design of MetroLink and where possible connect with existing sustainable transport networks. This will include items such as covered bike parking, which will be included at stations wherever feasible. In addition, underpasses and footbridges will be designed so that they are easily accessible to bikes.

The change in choices of transport modes are captured within the model, and it allows for changes in trips between highway and public transport as a result of the increased transport integration with

the scheme in place. Public transport trip movements within the model include the active mode element prior to and post the public transport element of the trip.

1.6 Construction impacts

Due to the scale of the proposed scheme, construction impacts will be considered at both the strategic and the local level at each individual station, and where appropriate along the route. This will consider the impact on pedestrians, cyclists, vehicles, public transport users, loading, parking, and access. The impacts resulting from the construction phase will occur primarily due to the construction of the stations. This will require areas of road space to be removed for some time reducing the operating capacity for all road users. Each of the proposed scheme's construction sites will also generate substantial levels of spoil removal and construction vehicles, which will impact on both the local and strategic road network.

At this stage of the project it is not feasible to monetise the construction impact of this scheme, due to there being no detailed design, knowledge of construction patterns or vehicle movements. Local modelling of all of the sites would be required, and there is not all the required detail to undertake this assessment at this stage. It is anticipated that the impact during construction will be minimal in comparison to the overall scheme benefit.

1.7 Alignment with Government policies

This section provides a summary of the impact that MetroLink has on key government policy objectives as set forth by the National Planning Framework 2040 (NPF). The results are illustrated in Table 1-19.

The key government policies which underpins the MetroLink project at a national level are the NPF and National Development Plan 2018-2027, which set out a strategic framework to guide development and investment to enhance the wellbeing and quality of life of the Irish people. The NPF establishes ten National Strategic Outcomes and 75 National Policy Objectives. Whilst the NDP sets out ten Strategic Investment Priorities that will underpin the implementation of the NPF 2040 and support its National Strategic Outcomes. National Policy Objective 74 of the NPF, is to 'Secure the alignment of the National Planning Framework and the National Development Plan through delivery of the National Strategic Outcome'.

MetroLink directly contributes to the delivery of each of the National Strategic Outcomes, especially NSO1 Compact growth; NSO2 Enhanced regional accessibility; NSO4 Sustainable mobility; NSO6 High quality international connectivity; NSO8 Transition to a low carbon and climate resilient society; and NSO10 Access to quality childcare, education and health services. These are summarised in Table 1-19.

Table 1-19: Impact on National Strategic Outcomes

NSO Outcome	Impact of MetroLink
NSO1	By providing high capacity transport movement Metrolink supports higher density development thereby encouraging compact and sustainable growth in the GDA.
NSO2	By improving accessibility throughout the GDA it improves regional accessibility.
NSO4	MetroLink will be built to the latest standards and provide a sustainable alternative to car travel along the north Dublin Corridor.
NSO6	MetroLink will provide high quality access from central Dublin to Dublin Airport, with a transit time of 20 minutes. It also relieves traffic on the M1 link to Northern Ireland
NSO8	MetroLink will provide an attractive alternative to highway travel, encouraging people to switch to a lower carbon transport option, and reducing the negative impact of their travel choices.
NSO10	By providing frequent, safe, services within Dublin, MetroLink will help to provide access to key amenities for local residents especially Mater hospital and DCU.

Source: National Planning Framework NPF and Jacobs

1.8 Land-use Integration

From the analysis undertaken it is apparent that MetroLink compliments land-use integration at a national and local level. By carefully shaping the planning of MetroLink and by considering the location, size, density, design and diversity of land use, land-use integration can help to reduce the need to travel, reduce the length of journeys and make it safer and more accessible for people to access centres of employment, commercial and leisure facilities and services by public transport, walking and cycling. Table 1-20 outlines at a high level how MetroLink is in keeping with land use policies at a national and local level.

Table 1-20: Land-Use Integration Impacts of MetroLink

Policy	Policy Year	Impact of MetroLink
Planning Land Use and Transport (PLUTO)	2040	MetroLink seeks to provide a high-quality enhancement to the existing network, which will improve accessibility, safety and reliability in the Study Areas In addition, the proposed Scheme seeks to support the economy, communities, sustainable low-carbon public transport, with the minimisation of environmental impacts.
Fingal County Development Plan	2017-2023	MetroLink complies with Fingal County Development Plan objectives as it provides a framework for the future development of Swords in line with its vision to 2035 as a city of 100,000 people.
Dublin City Development Plan	2016-2022	MetroLink will promote high density, mixed use, walkable communities linked by high quality public transport. Additionally, it will connect the major employment nodes at the airport and Swords to the city centre and provide interconnectivity across the public transport network.

Source: National Irish Policy Paper's and Jacobs

1.9 Housing

TII recognises that a holistic transport strategy for the GDA is needed, which must be prioritised and focussed based on integrated land use. Accessibility is shaped by the structure, capacity and connectivity of transport infrastructure, which is not uniform. Since accessibility differs across the GDA, this attribute has an impact on land use, such as the location of new activities, their expansion or densification. With rising rents due to increased demand compounded by a limited supply of houses, commuter belt counties such as Kildare, Meath, Fingal and Wicklow[6] may face additional pressure to cater for the GDA's housing demand in the next 25 years.

Fingal, Meath, and Kildare have seen some of the largest population growth in the GDA, with 8%, 6%, and 6%[7] growth respectively between 2011 and 2016. In comparison the population in the more centrally located part of Dublin grew by 5%[8] in the same time period. National estimates forecast that Swords, Balbriggan, South Drogheda, Clongriffin, Ballymum, Donabate, and Dublin Airport[9], of

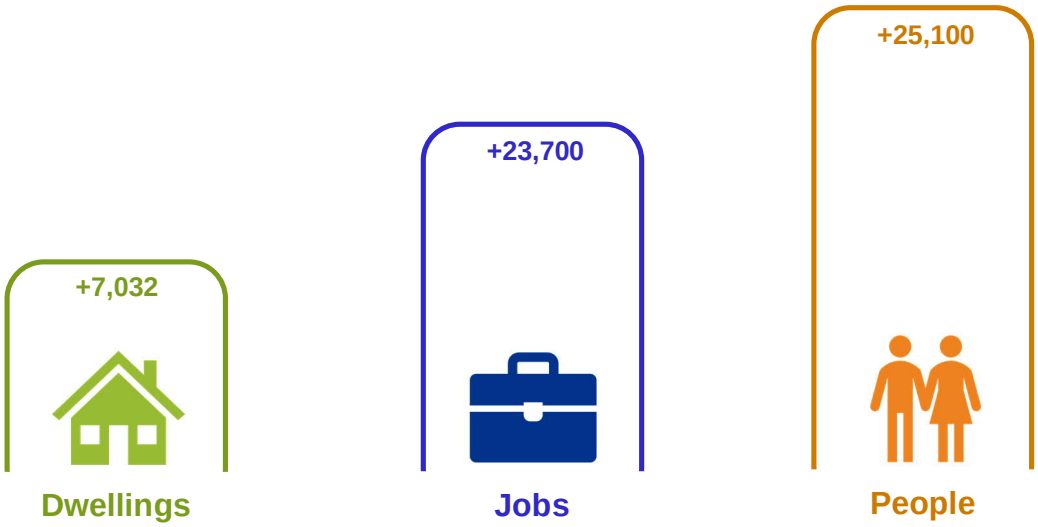
[6] Dublin Area Transport Strategy 2015-2035, March 2015
[7] Greater Dublin Area Transport Strategy 2016-2035, 2016
[8] Greater Dublin Area Transport Strategy 2016-2035, 2016
[9] Greater Dublin Area Transport Strategy 2016-2035, 2016

which some are along the proposed MetroLink route, will experience a significant growth in population and employment. Within the above areas, a significant proportion of the population will be located within Dublin's periphery. It will be difficult to effectively serve these regions with present transport services and therefore, to achieve the forecasted growth, sustainable infrastructure provision is needed.

1.9.1 Impact of housing on quality of life

The supply and demand for housing in Dublin is not balanced, which could potentially result in a deteriorating quality of life. Creating a sense of place has become a defining contributing factor to the competitiveness, attractiveness and success of a city. Housing cost problems negatively affects the decisions of businesses to invest in Dublin and can also have an impact on wellbeing. Figure 1-21 gives the number of dwellings that have been added to Dublin's housing sector in 2019, accompanied by the net additional jobs and net growth in population.

Figure 1-21: New dwellings, and population and employment growth in Dublin 2019



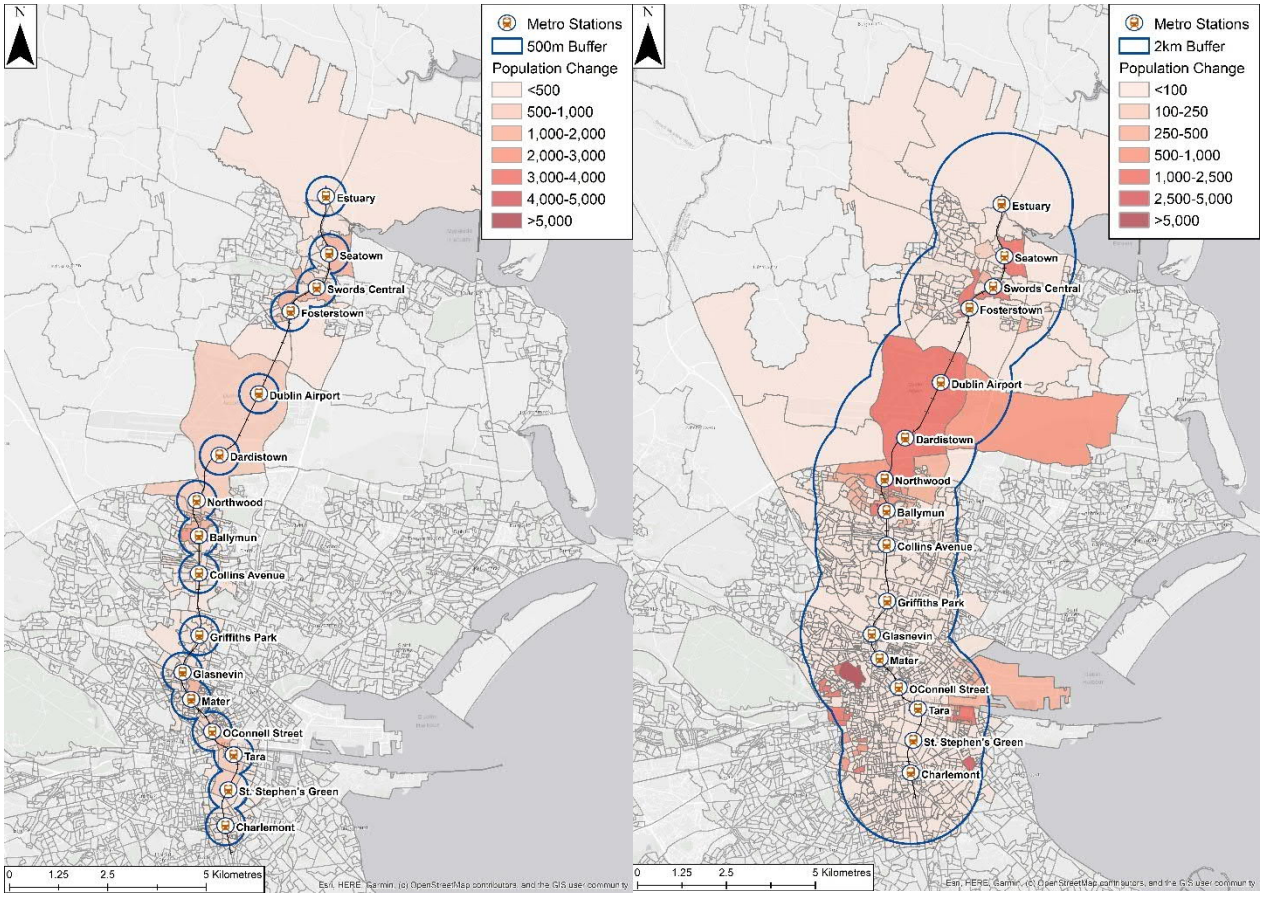
Source: CSO

Population and employment levels are rising faster than the supply of new homes. Dublin's future economic success depends on its ability to continue to accommodate population and employment growth and offer a high-quality standard of living. It is important that Dublin finds ways of unlocking housing potential within the GDA. Investment in high-quality public transport, such as in MetroLink has the potential of opening opportunities for residential and commercial property development.

1.9.2 Population growth along the MetroLink corridor

The most recent modelling undertaken, based on the NPF, confirms a strong growth in population for the north of Dublin, along the MetroLink route. The model assumes fixed-land use between the with and without MetroLink scenarios and no explicit dependent development is modelled. Figure 1-22 shows the increase in people living within 500m and 2,000m of MetroLink, between 2019 and 2045.

Figure 1-22: Increase in Greater Dublin Area population within 500m and 2km of MetroLink between 2018 and 2045



Source: Jacobs' Analysis

The number of people living within a 2 km radius of a MetroLink station is forecast to grow by 39% between 2019 and 2045. This equates to a total of 129,000 new residents along the corridor.

Table 1-21: Population within 500m, 1000m and 2000m of MetroLink (nearest 1,000)

	Distance from MetroLink		
Year	≤ 500m	≤ 1000m	≤ 2000m
2019	56,000	152,000	327,000
2030	63,000	168,000	359,000
2045	73,000	216,000	456,000
Increase by 2045 over 2019	17,000	64,000	129,000

Source: Jacobs' Analysis

1.9.3 Potential impact on house values

Property value uplifts will generally depend on the distance of the dwelling to a MetroLink station. Dwellings situated within a 500m buffer of a station may experience a higher premium than those located further away from the route. It is important to ensure that there is sufficient land zoned in the right places to meet regional and local housing targets. This will involve consolidating urban areas around the GDA and making the most efficient use of current and future infrastructure assets through integration with land use planning policy. In this regard, Ballymun, Fostertown, Dublin Airport and Swords, are forecast to experience the strongest growth in population between 2018 and 2045.

The present zoning areas in Ballymun and Swords are within the 2 km buffer zone of the MetroLink route and have also been labelled as residential development zones in the Fingal Development Plan (2017-2023). There is great potential that the land value in these areas will experience an uplift, due to the provision of high-quality public transport. Introducing high-quality public transport in an area cannot only have an impact on property values but it can also help release the value that sits within these residential and mixed-use land zones. This is confirmed by the Fingal Development Plan, which states that construction permits for the development of larger residential or mixed-use land zones

are subject to the availability of high-quality public transport. The residential and commercial development stimulated by MetroLink could create opportunity for increased passenger revenue.

The 2016 Census reported that the average number of persons per household was 2.75 compared to 2.73 in 2011[10]. If we assume that each dwelling houses an average of 2.75 people by 2057, Dublin will need an additional 80-100,000 housing units based on the Project Ireland 2040 population projections. New housing can only be facilitated by ensuring that lands identified for development are adequately serviced by high quality public transport to ensure the functionality and liveability of both new and existing residential areas, via appropriate density.

Proximity to high-frequency public transport that will provide good quality connectivity and accessibility to major employment centres is a strong positive factor that is likely to elevate the value of property in each area. A study done by Mayor et al. (2008) assessed the impact of the Luas Green and Red lines on property prices. The authors found that Luas had a significant impact on property values in Zones 2 and 3. Properties located within 500-metres of the Luas Green line in Zones 2 and 3 saw the value of their property increase by an average of 12% and 17% respectively, after accounting for all other factors. Properties that are located within 500 to 2000 metres from the Luas Green Line in Zones 2 and 3 reported premiums of 7%[11], illustrating the effect of distance decay.

Taking a cautionary approach, we consider only houses within 500m of a MetroLink station and between 500m and 2000m of MetroLink station – as opposed to the line itself. It is estimated that there are approximately 20,000 housing units within 500m of MetroLink stations and 95,000 within 500-2,000m of a station. An average property price of €380,000[12] has been used and a 10% uplift for those within 500m and a 5% uplift for those between 500m and 2000m of a MetroLink station. This gives a total property uplift of €2.57bn (in 2019 prices and values) on existing properties. Additionally, the uplift in value can have revenue implications for the public sector, in the form of increases in Stamp Duty and Local Property Tax. In the long term, this could help raise funding for additional transport schemes.

[10] Census of Population 2016, 2016
[11] A Hedonic Analysis of the Transport Network in the Dublin Area, 2018
[12] Using data from CSO dataset HPAO2 for 2019.

Table 1-22 MetroLink Land Value Impacts

	Distance to MetroLink Station	
Distance to station	0 to 500m	500 to 2000m
2019 Population (Persons)	56,071	270,617
2019 Dwellings	20,389	98,406
Assumed Value Dwelling (€ 2019 prices and values)	380,000	380,000
Land Value Uplift, per dwelling	10%	5%
Land Value Uplift (€bn, 2019 prices and values)	0.76	1.81
Total Uplift (€bn, 2019 prices and values)		2.57

Source: Jacobs Analysis

The land value impacts associated with induced housing development as a result of MetroLink are not captured within this assessment. A more detailed market viability assessment, and construction cost assessment for new dwellings will be carried out, as appropriate, during the next phase of assessment to provide a valuation of the impact of new houses directly associated with MetroLink.

1.10 Geographical integration

MetroLink is an integral part of the Irish and Dublin growth agenda, which will help bridge geographic divides between the north and south of Dublin and deliver a more united and cohesive economy. The NDP 2018 – 2027, sets out ten Strategic Investment Priorities that will underpin the implementation and support the National Strategic Outcomes of the NPF 2040 over a ten-year period. Geographic integration is at the heart of the NPF 2040 and has been strongly considered within the design of MetroLink. The delivery of three of the aims and objectives of the NPF 2040 linked to geographical integration are directly supported by MetroLink, these are; NSO1 Compact

growth; NSO2 Enhanced regional accessibility; and NSO6 High quality international connectivity as outlined in Table 1-23.

Table 1-23: Geographical integration impact of MetroLink

Policy	Impact of MetroLink
NSO1	MetroLink will improve accessibility to and between different centres and through a better integration with Dublin's surrounding areas by offering multiple interchange nodes with the existing public transport network. This will reduce the dependency on the private car by increasing public transport mode share and encouraging walking and cycling (Section 1.5).
NSO2	Through the inclusion of a Park and Ride site at its northern end and by offering an interchange option with the Iarnród Éireann, MetroLink improves connectivity between cities and large growth towns beyond the GDA (Section 1.5).
NSO6	MetroLink will improve domestic and international travel connections via improved access to and from Dublin Airport and Iarnród Éireann (Section1.5).

Source: National Planning Framework and Jacobs' Analysis

With reference to the above, it is considered that the proposed Scheme objectives align with these NPF objectives, where the proposed Scheme seeks to improve connectivity between Dublin city centre and the GDA.

1.11 Wider economic impacts

It is anticipated that MetroLink will have a profound effect on the economy of Dublin, and the surrounding area. It will allow for agglomeration and positive productivity impacts associated with better business to business and business to worker connectivity, improved worker productivity due to better access to jobs and an increase in people entering the labour market.

MetroLink is expected to reduce generalised journey times and costs for existing businesses and commuting users, with the quantified benefits discussed in detail in the sections above. Improving the access for workers' opportunities for employment and access for businesses to collaborate with each other has the potential for benefits over and above journey time savings. A reduction in journey time (with an appropriate fare) may mean that a worker is able to access a job that they are better at (increasing their productivity above the journey time saved), or it might mean that two

businesses interact to develop an improved supply chain solution (where they would not have been able to previously). These are impacts related to, but separate from, journey time savings and are the focus of this section.

At this stage business to business impacts will be assessed qualitatively, as will productivity impacts associated with people moving to more productive jobs. The impact of people entering the labour market is considered through the increase in tax take from their work and uses business time impacts as a proxy.

Impacts discussed in this section will be considered in more detail for the FBC.

1.11.1 Inward Investment

Dublin is the leading destination city for foreign investment in headquarters in relation to its size, according to FDI's Top Headquarter Locations in Europe published in May 2020[13]. It is also the fourth most successful city in Europe, after London, Paris and Berlin, for attracting the most foreign investment projects over the past five years. The city has been successful in attracting the likes of Google, Facebook, Airbnb, PayPal, Microsoft, eBay, and LinkedIn. Most of this investment has gone into software and IT services, followed by business services and financial services.

Foreign direct investment (FDI) can have a positive impact on Dublin's and Ireland's economy. If transport investment can facilitate inward investment, then some of the spin off benefits from FDI can be additional to transport user benefits. Whilst there is an abundance of external research linking the impact of FDI and a country's GDP, directly attributing any quantum of FDI as a result of MetroLink is challenging – due to the risk of misattribution and spurious correlation. Although expected to have a positive effect on FDI, the exact impact of MetroLink has not been quantified at this stage.

There are a wide range of factors that international businesses consider when making decisions about the location of their investments, depending on the sector and type of activity. Given the wide range of potential locations, extensive use is made of the surveys and rankings produced by international consultancies such as the Big 4 accountancy firms and compensation advisors e.g. Mercer as well as specialist site selection companies to draw up short lists. Ireland and Dublin

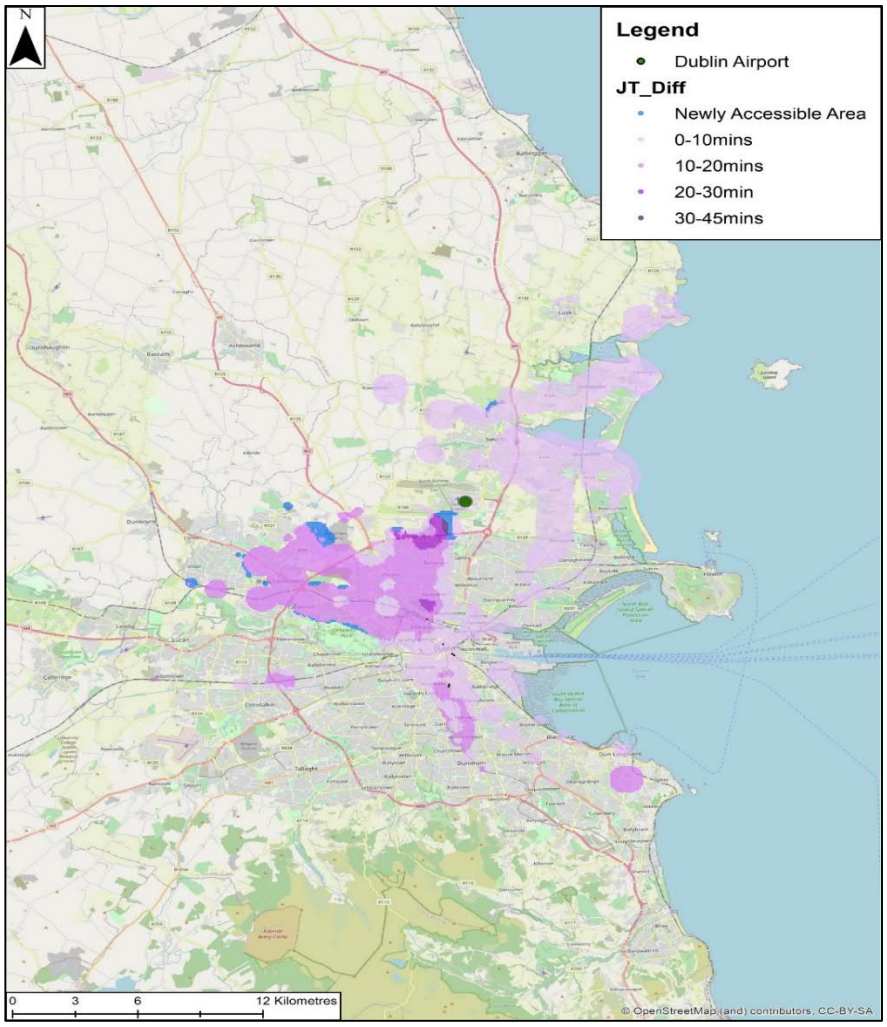
[13] https://www.fdiintelligence.com/article/77217

generally perform well on these. However, there are other international city rankings where Dublin performs badly. TomTom produces an annual traffic congestion index in which Dublin is ranked the 7th worst performing European city out of 31 and 17th out of 416 worldwide. While Dublin ranks 120th out of 150 cities worldwide for raising a family[14] in part due to poor housing affordability.

By improving local accessibility MetroLink will not only assist in reducing traffic congestion in the city but will also increase the size of the labour force living within a reasonable commute of key areas such as Docklands, that have attracted multinational companies. It will also dramatically improve access to and from Dublin Airport, given that many business trips will start or end at a central Dublin business or hotel location. Dublin is one of the few major European cities not to have a light or heavy rail link between the city and its airport. Figure 1-23 and Figure 1-24 illustrates the differences in public journey time catchments when MetroLink is in place, when travelling to and from Dublin Airport in the morning peak It shows that areas to the southwest of the Airport will become accessible within 45 minutes, which they currently are not. Savings of up to 10 minutes can be seen along the northern corridor, in areas parallel to the M1.

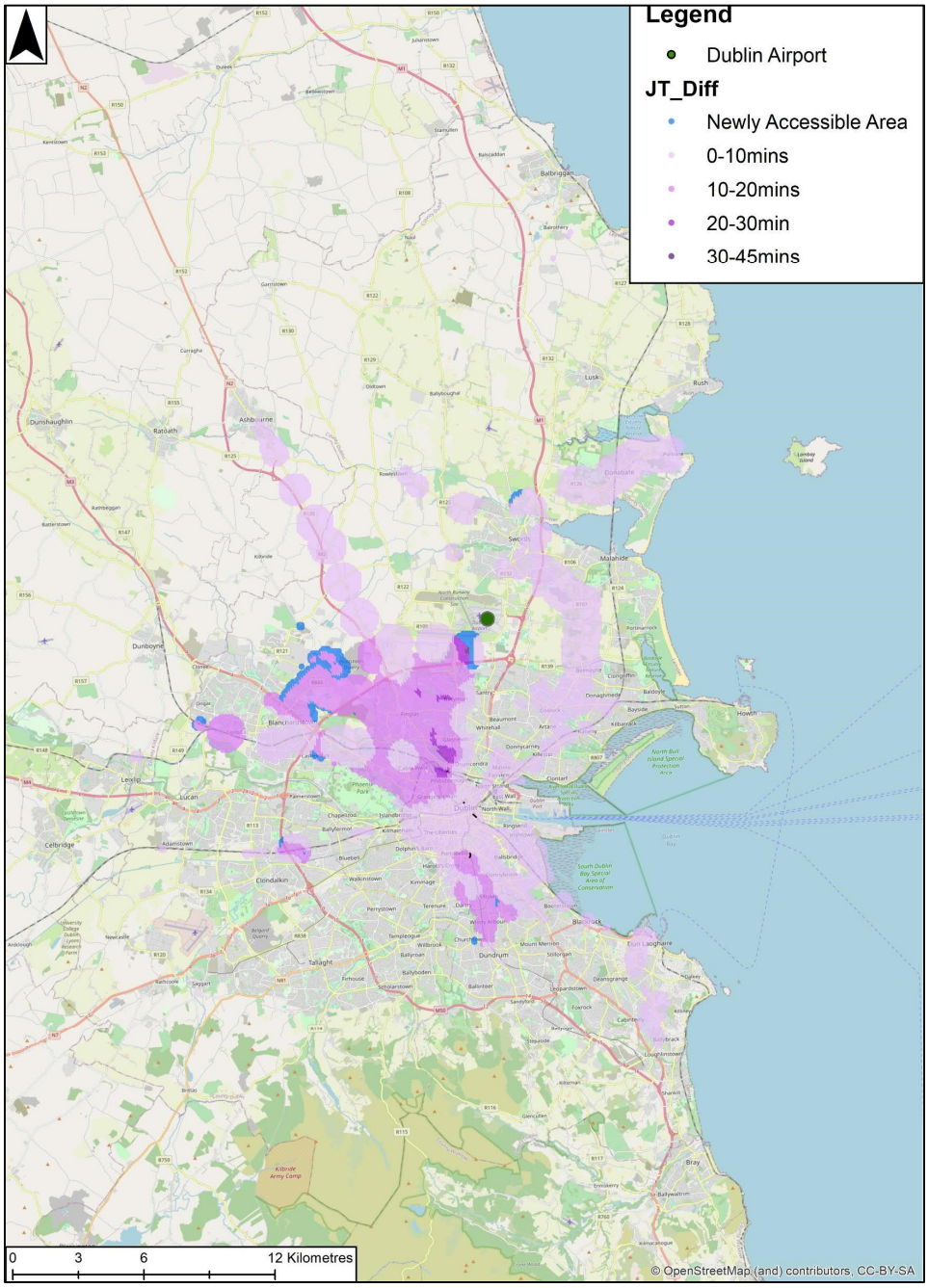
[14] https://www.irishtimes.com/life-and-style/health-family/parenting/dublin-ranks-120th-out-of-150-cities-for-raising-a-family-1.4147849

Figure 1-23: Differences in public transport journey time catchments in morning peak, trips to Dublin Airport



Source: Jacobs' Analysis

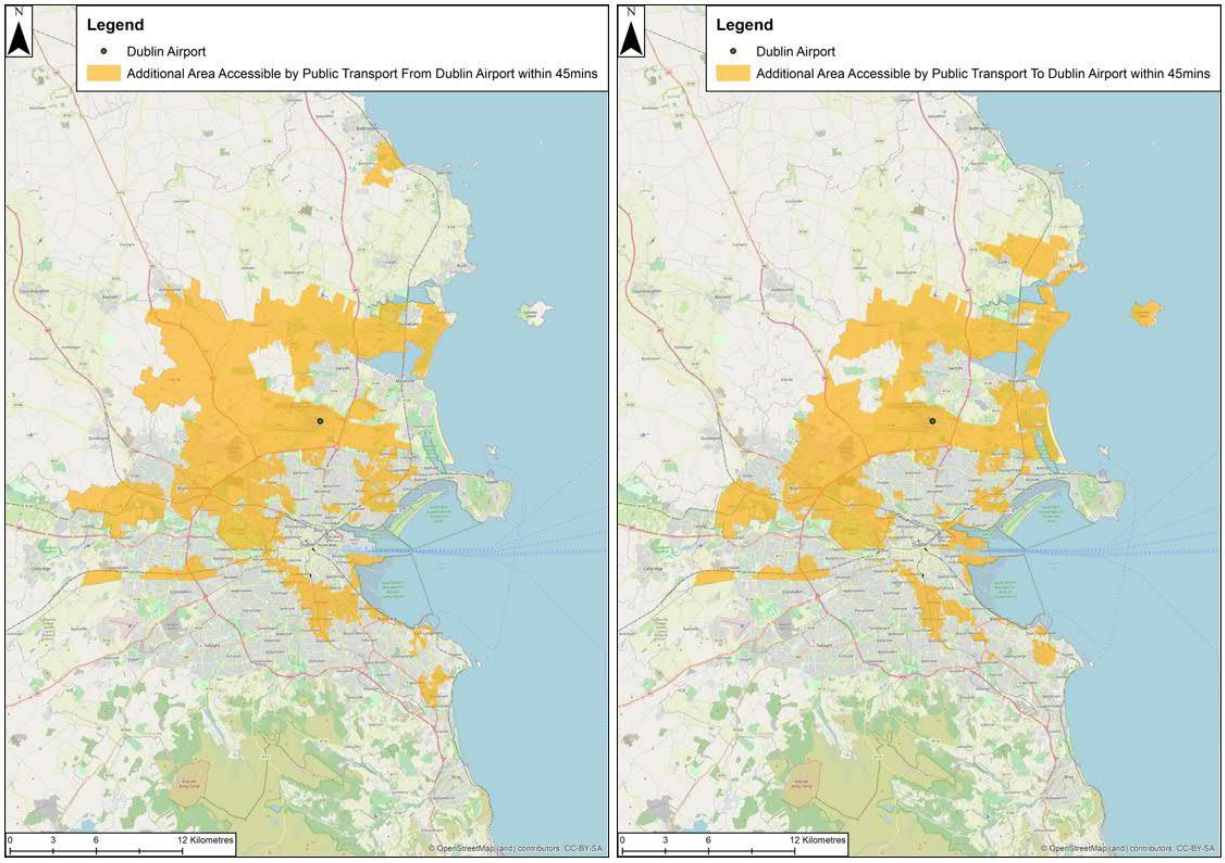
Figure 1-24: Differences in public transport journey time catchments in morning peak, trips from Dublin Airport



Source: Jacobs' Analysis

Figure 1-25 illustrates the areas where additional population have accessibility to and from Dublin Airport within a 45-minute journey time, when MetroLink is in place. With MetroLink in place, approximately 129,000 additional people are able to access Dublin Airport within 45 minutes.

Figure 1-25: Accessibility at Dublin Airport by origin (left) and destination (right) in the morning peak by public transport



Source: Jacobs' Analysis

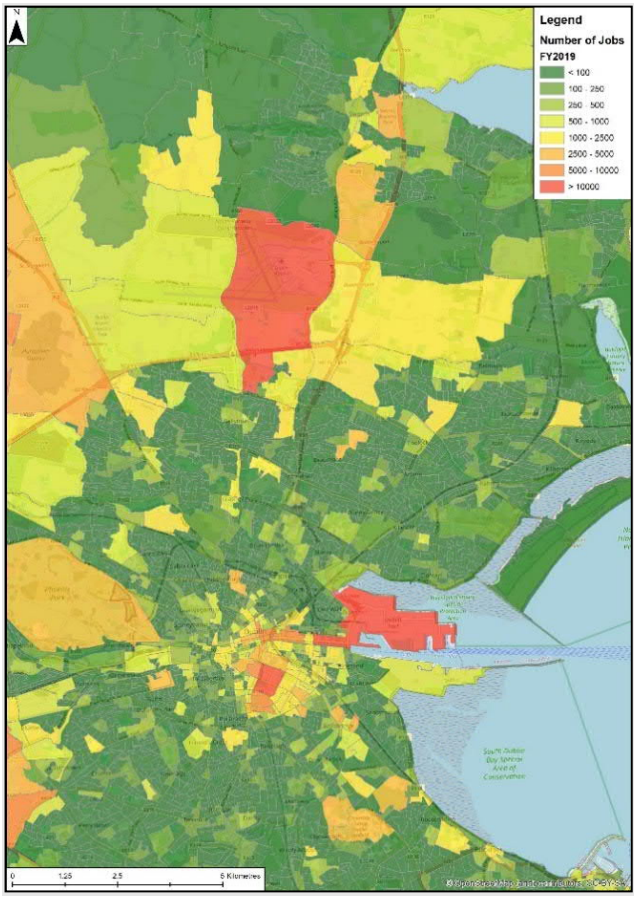
Most of the cities that Dublin is competing against to attract European HQs or other shared service functions already have extensive metro systems. This is important as companies are increasingly looking at their Carbon footprints and their staff's commute. The ability to promote Dublin as a low carbon city will increase in importance over time and MetroLink will help the city to achieve that and promote itself in a positive manner.

1.11.2 Agglomeration

As part of this analysis, agglomeration impacts have been qualitatively appraised. Agglomeration is assessed through the changes in density of the economic activity within the context area as a result of like firms located near each other. The subsequent productivity induced, additional to the direct user benefits, reflects the positive externalities through the growth of new and existing business

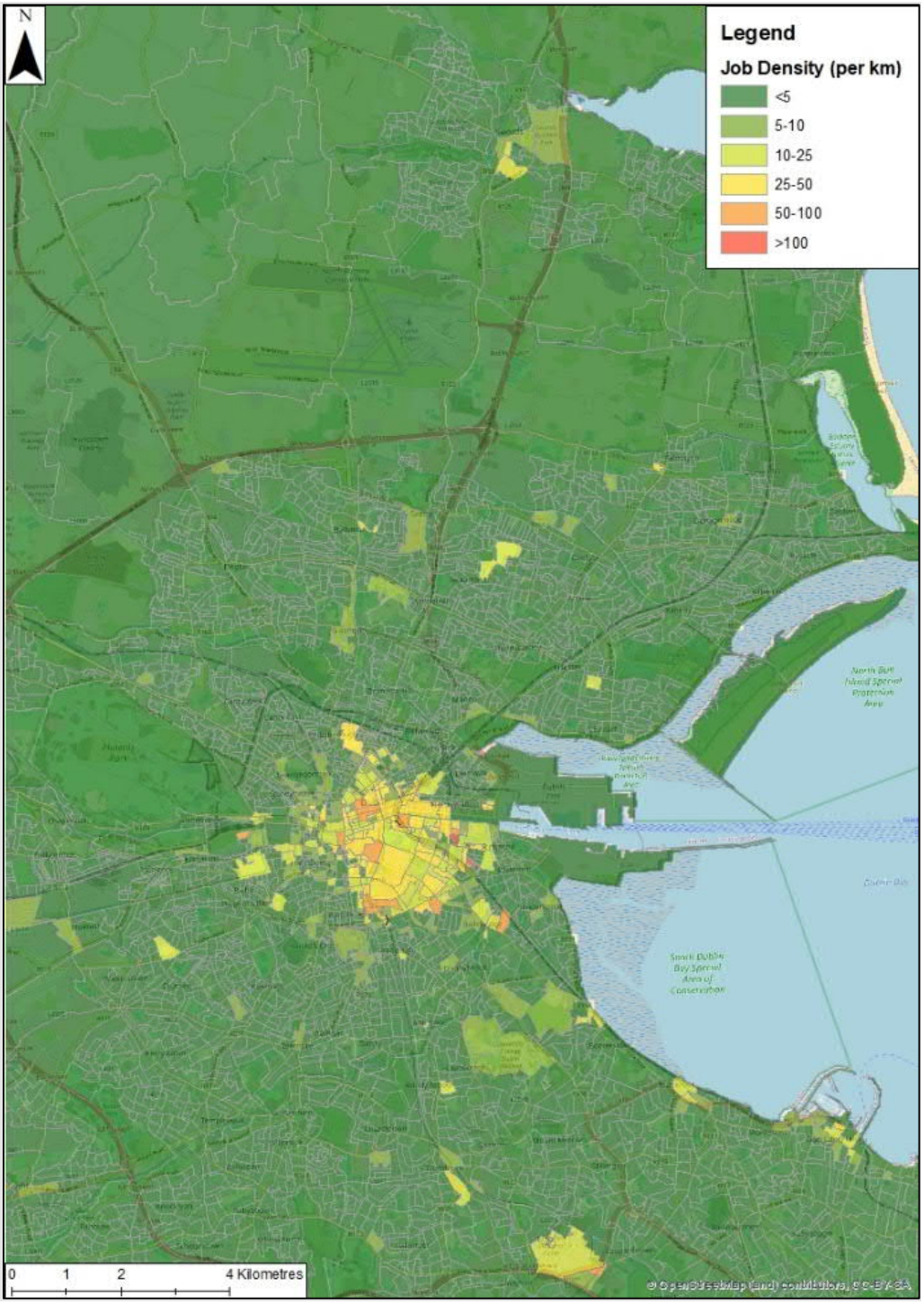
clusters and industries. This is driven by having access to larger product, input and labour markets, as well as knowledge and technology spill-overs from one firm to another.

Figure 1-26: Job location and density



Source: CSO and Jacobs' Analysis

Figure 1-27: Job Density within the GDA



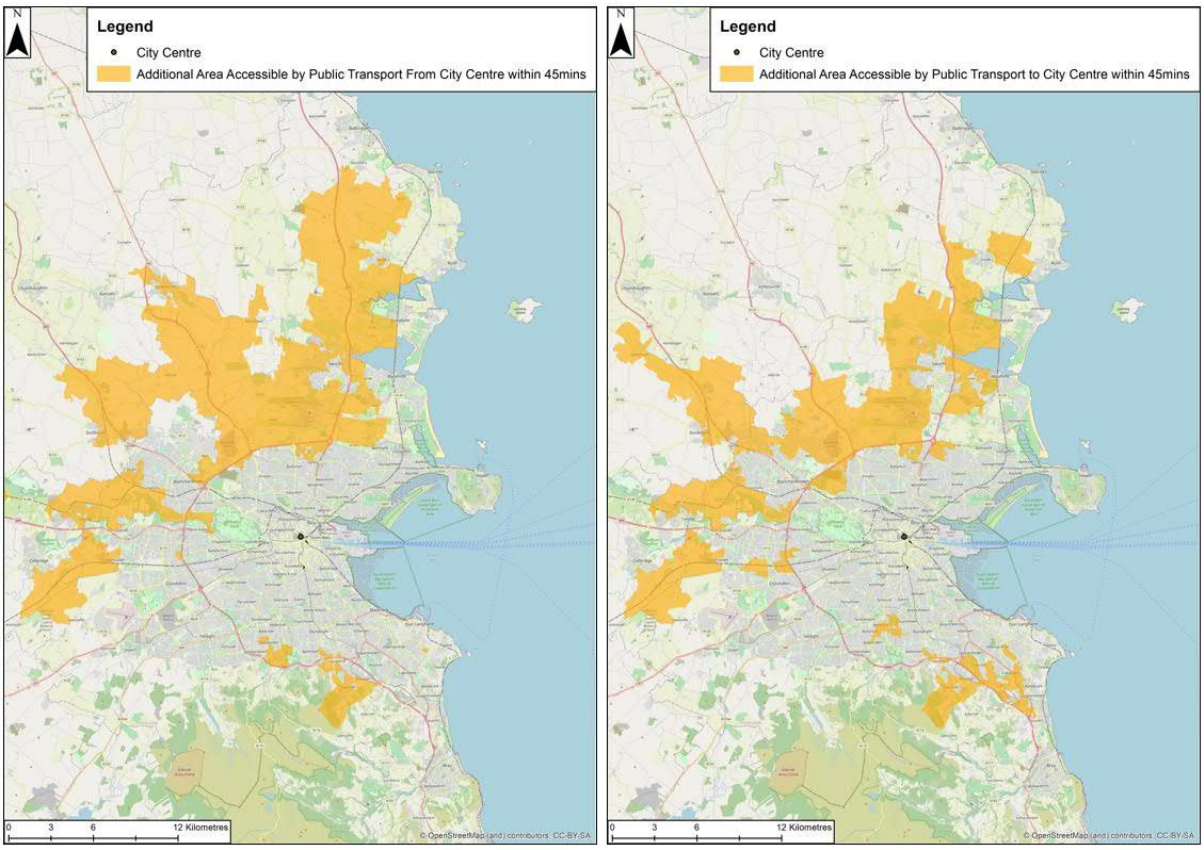
Source: CSO and Jacobs' Analysis

Figure 1-26 and Figure 1-27 show the number and density of jobs along the MetroLink route. As can be seen the greatest density of jobs occurs within central Dublin, but in absolute terms there are

areas with significant employment along the entire MetroLink route. MetroLink offers users better accessibility for these key areas for firms and workers alike, effectively increasing the proximity for both parties. By supporting better transport links between firms and workers within Dublin and its surrounding towns there is a reduction in barriers to work and cost of interaction, but also an increased willingness to travel, would be realised, ultimately resulting in higher overall productivity within the city.

Figure 1-28 highlights the areas from which the city centre is accessible within 45 minutes, following the introduction of MetroLink, for which the city centre is not accessible within 45 minutes currently. There is an approximate 24,000 additional people that are able to access the City Centre within 45 minutes with MetroLink in place, with a large increase in population within the north corridor gaining improved accessibility.

Figure 1-28: Accessibility to Dublin City Centre by origin (left) and destination (right) in the morning peak by public transport



Source: CSO and Jacobs' Analysis

Whilst high-value jobs are prominent within Dublin, the growth of Dublin's clusters and the associated foreign direct investment is being challenged by the persistent issues Dublin is facing on congestion. Analysis conducted by Tech Nation in their 2020 report, and supported by the UK Government, identified that between 2014 and 2019, Dublin was in the top European cities for total tech investment. However, its position has dropped from 4th in 2016, to 10th in 2017, to 12th in 2018/2019. Dublin has now been overtaken by smaller cities such as Cambridge and Oxford. MetroLink can strengthen existing agglomeration impacts by increasing the economic productivity through the enabling of growth and densification of the Dublin area.

According to the 2016 Census, the largest identifiable sectors in Dublin are shown in Table 1-24.

Table 1-24: Employment sectors in Dublin centre

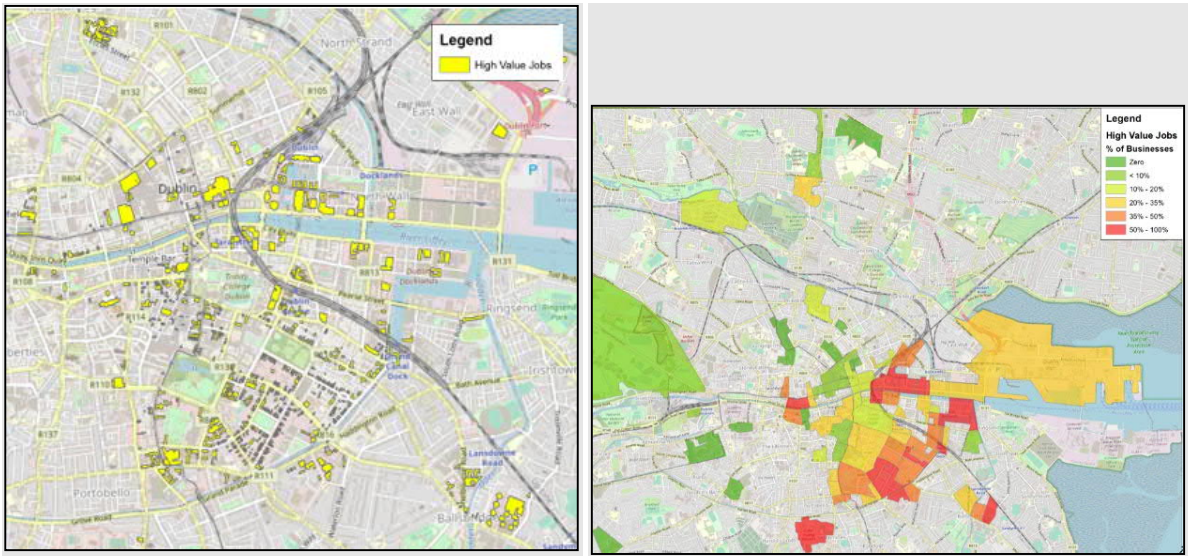
Industry	Persons at work
Computer programming, consultancy and Information service activities	31,251
Hospital activities	28,767
Public administration compulsory social security activities	27,506
Residential care and social work activities	26,324
Financial service activities, except insurance and pension funding	25,228
Retail sale in non-specialised stores with food, beverages or tobacco predominating	15,613
Restaurants and mobile food service activities	15,509
Primary education	12,745
Higher education	11,732
Insurance, reinsurance and pension funding, except compulsory social security	11,062

Source: Irish Census 2016

Dublin's employment continues to grow strongly, in 2019 Q3 employment in ICT and insurance and real estate activities recorded all-time highs. The industry sectors with the highest levels of productivity, which will drive agglomeration impacts, are computer programming, consultancy and information activities and financial services. Bringing businesses together promotes the clustering

effect, increasing the commercial attractiveness for new business to locate within close proximity of other firms in its industry. Large technology clusters are already present in Dublin, especially in and around Docklands. Figure 1-29 presents the percentage of high-value businesses within Dublin, alongside the specific locations of these jobs. This includes legal and accounting, financial services (except insurance and pension funding) and real estate jobs.

Figure 1-29: Location of high value jobs within Dublin city centre



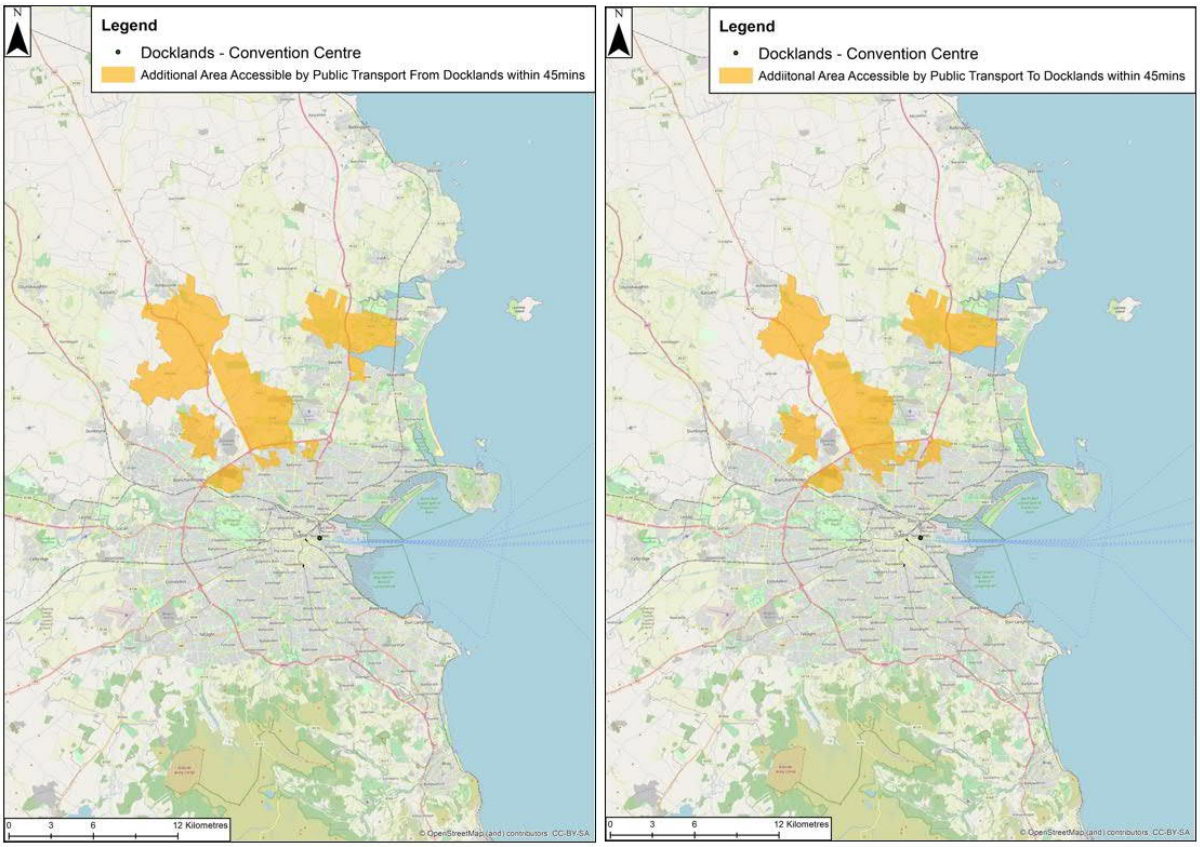
Source: CSO and Jacobs' Analysis

A recent study found that only 8% of residential tenants in Dublin's Docklands are Irish, with 52% classed as European and 32% as international[15]. In that context, there is a growing importance to address the competitiveness challenges associated with housing, infrastructure and costs, if the city is to continue to attract international talent, in high-skilled sectors, such as IT. Failure to address these issues will limit Dublin's ability to compete - for investment and talent - into the next decade. MetroLink will increase Dublin's effective density through shorter journey times by giving employers located along the route better access to a larger, more highly skilled labour market with more choice of skilled employees.

Figure 1-30 illustrates the areas which will have enhanced accessibility to and from Docklands within 45 minutes, when MetroLink is in place. In total an additional 29,100 people are able to access Docklands in less than 45 minutes.

[15] Dublin Economic Monitor: February 2020

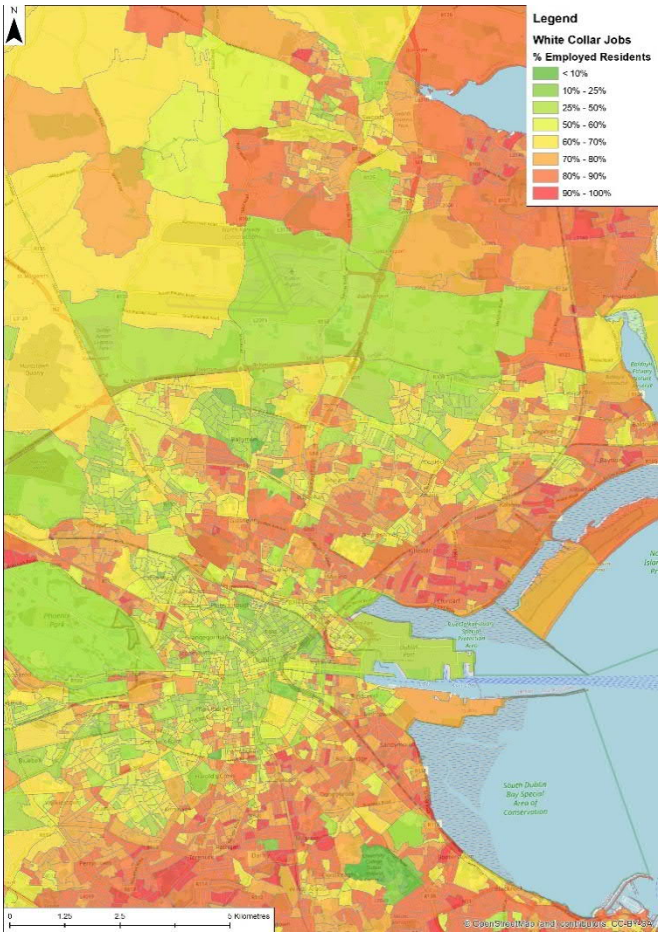
Figure 1-30: Docklands accessibility by origin (left) and by destination (right) in the morning peak by public transport



Source: Jacobs' Analysis

It is not just people working in high tech sectors that will benefit from Metrolink. Figure 1-31: shows the proportion of residents in blue- and white-collar jobs in each zone. It is clear from the figure that there will be benefits to both blue- and white-collar workers.

Figure 1-31: White collar workers as a percentage of total blue and white collar employment (home residence)



Source: CSO and Jacobs' Analysis

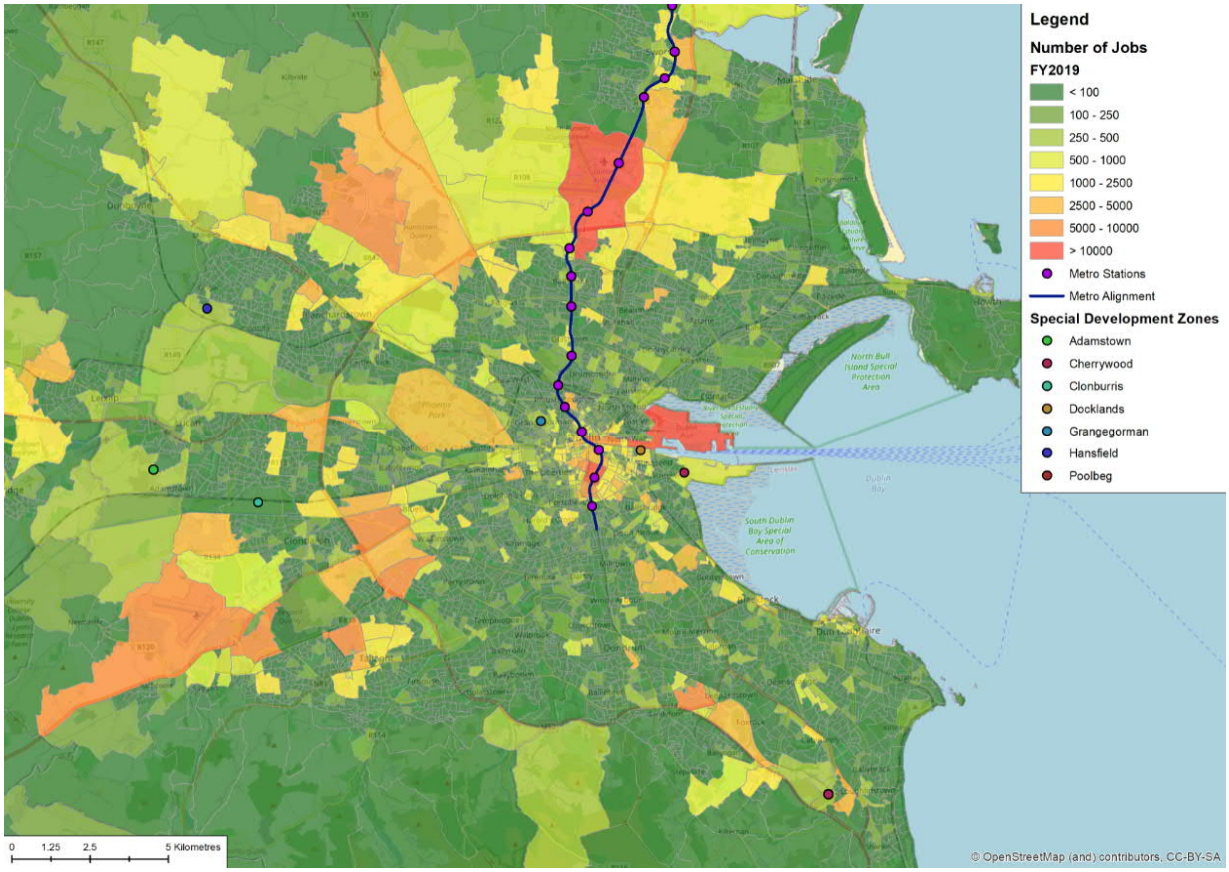
MetroLink will benefit businesses located in Dublin in both the long and short term. Businesses benefit from more efficient logistics, access to new markets for their goods and services, improved productivity and the ability to use a wide pool of labour from local communities both from the new service but also benefiting from reduced road congestion as people switch modes. Reduced transport costs also mean that businesses can connect with potential suppliers, enabling them to access higher-quality and/or lower cost inputs. The impact of MetroLink on the wider economy will be substantial.

The proposed MetroLink corridor also complements the Strategic Development Zones (SDZ) in Dublin, which have been identified by central government as being strategically important. These

parcels of land have been designated to stimulate accelerated economic growth through mixed-use development and a fast-tracked planning process, serving both residential and industrial purposes.

Figure 1-32 shows how the Docklands and Grangegorman SDZ lie within the immediate proximity of the MetroLink line. The area covered by both SDZs totals approximately 95 hectares, with an estimated population of 7,800 – 8,300 and employment around 31,000 - 33,000 on completion (expected in 2025)[16]. As the SDZs become viable sites for development and MetroLink reaches completion, it will create dynamic effects promoting the establishment of future clusters and supporting existing clusters in Dublin. Combined with accessibility to Iarnród Éireann services this will make commuting to and from these locations viable for people in the west, north and south of Dublin.

Figure 1-32: Special Development Zone locations

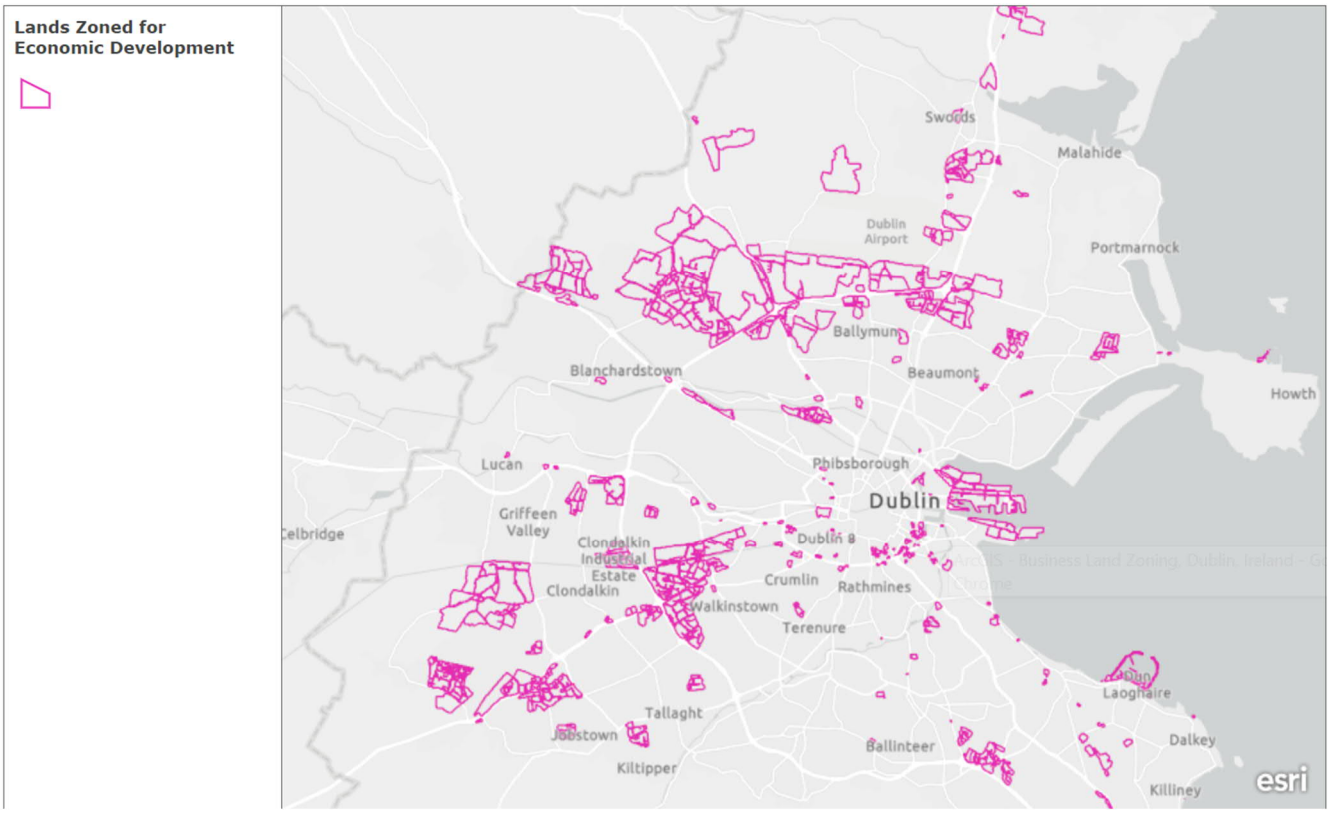


Source: Jacobs' Analysis

[16] Dublin Economic Monitor - Dublin's Strategic Development Zones (2015).

Furthermore, MetroLink will improve the connectivity of the SDZs to Ireland's international gateways such as the airport and the port. The figure above also demonstrates how these zones currently do not provide that many jobs relative to other areas around Dublin. This acts as a strong indicator that the SDZs, in conjunction with MetroLink, will result in the emergence of more jobs, supporting the potential quantum of agglomeration benefits that could be realised in Dublin.

Figure 1-33: Lands zoned for economic development 2017 (CSO)



Source: CSO

Figure 1-33 illustrates geographically delimited areas which the government has zoned for economic development in the GDA. A large cluster of which can be found in the north, specifically around Ballymun, Dublin Airport and Swords. Research identifies the provision of hard and soft infrastructure such as high-quality public transport systems, as critical success factors for zone development and impact[17]. Integrating land-use with transport planning can more easily support active clustering and specialisation efforts in these zones.

[17] Special Economic Zones - United Nations Trade and Development, 2019

The respective initiatives combined have the capacity to become major catalysts for sustainable economic activity in the region and have a compounding effect onto the existing agglomeration impacts in Dublin and beyond. Further considerations should also be made against future development. Within major cities such as Dublin, planning applications are often contingent on the transport network having sufficient capacity to support the expected increase in population/demand.

This demonstrates how MetroLink further supports the necessary accommodation of the expected growth in population and employment stemming from wider strategic objectives. In turn, agglomeration and labour supply impacts are likely to grow as a result of the attractiveness for both workers and firms to relocate or work within the zones. Agglomeration impacts accrue to business and commuting users. For the purpose of this analysis a conservative approach has been adopted, wherein the impacts accruing to business users only are considered. As the scheme progresses, the impact of agglomeration on commuting users will also be estimated.

Using business user time benefits as a proxy for agglomeration, a range of potential agglomeration benefits are estimated. These are presented in Table 1-25 and show that the agglomeration benefits are presently estimated to be in the range of €625-€1,875m.

Table 1-25: Agglomeration benefits[18]

	Value (€m, 2011 prices and values)
Business user time benefit	649
10% agglomeration test	625
30% agglomeration test	1,875

Source: Jacobs' Analysis

More detailed analysis will be undertaken for the FBC to provide a fully quantified assessment of the agglomeration impacts of the scheme.

[18] The test values are based on Feldman O., Nicol J., Simmonds D., Sinclair C., and Skinner A. (2008) *"Use of integrated transport land use models in the wider economic benefits calculations of transport schemes"*. Paper presented at 87th Transportation Research Board Annual Meeting, January 13-17, 2008, Washington, D.C., USA

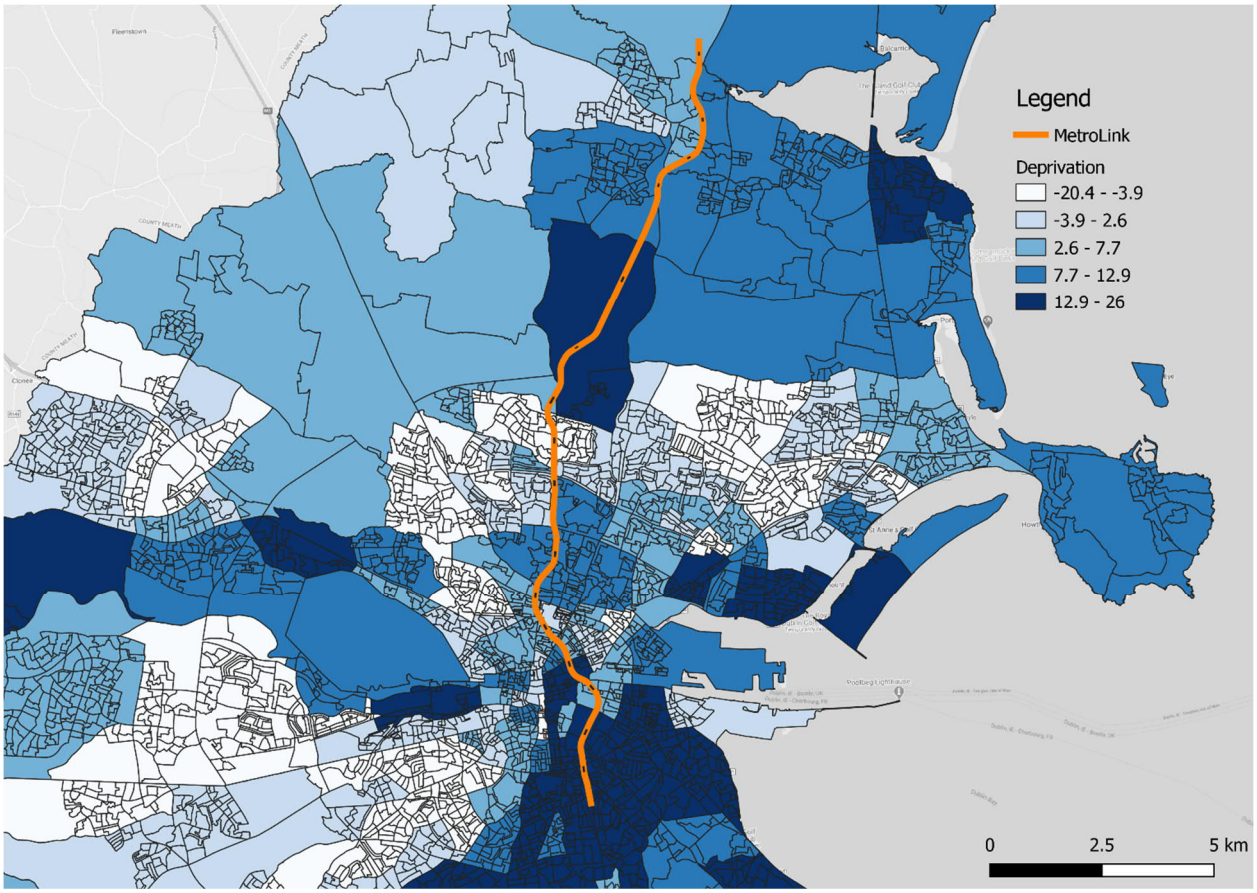
1.11.3 Employment Effects

Employment effects such as productivity or labour supply impacts, due to accessibility changes, are not being considered in detail at this stage, they will be considered for the FBC.

1.12 Distributional Impacts

Evidence suggests that different communities have varying propensities to impacts and benefits created by the scheme as a result of ethnicity, social and demographic structure and relative deprivation. This section provides an overview of how the scheme might impact disproportionately upon some communities and vulnerable people. The aim of the baseline review is to understand the impacts the scheme may have on communities located along the proposed scheme as a result of variations in social and demographic factors and relative deprivation in communities.

Figure 1-34: An Pobal HP Deprivation Index 2011 by Electoral Division (Negative means more deprived)



Source: POBAL

Figure 1-34 presents an assessment of deprivation through the An Pobal Deprivation Index, providing a measure of affluence or disadvantage in Dublin with a low figure representing high deprivation. Statistics such as proportion of skilled professionals, education levels, employment levels and single-parent households are assessed. The indicators show that, across the proposed MetroLink route, the highest levels of deprivation are in East Ballymun (-19.8) and (-20.4) in East Kilmore. To the south of Dublin, are some of the lowest levels of deprivation, with Mansion House (26.0). In light of this, the scheme is expected to improve accessibility and hence opportunities for key areas of deprivation along the northern section of MetroLink. A summary of potential impacts is provided in Table 1-26.

Table 1-26: Distributional Impacts

Deprivation Effect	MetroLink Impact
Construction Phase	As noted, the scheme runs through relatively deprived areas north of Dublin city centre. Although likely to benefit significantly from MetroLink when it is opened, these areas are the ones which will be most affected during the construction phase. People living along the line may be exposed to elevated levels of noise or other disturbances during construction. Detailed modelling will be undertaken to understand fully the likely spatial impacts during and after construction, to understand better precisely which groups will be affected. There may be opportunities for targeted training programmes to allow residents to obtain employment on the construction and operation of the scheme.
Economic Barriers	MetroLink has not yet undertaken an affordability study to assess the impact the fare regime may have on the people using it; however, the scheme does acknowledge that pricing is an important factor in making MetroLink inclusive and accessible to all. A further review will be undertaken, once a detailed fare schedule is agreed, to understand the potential impact that the fare structure will have on vulnerable groups.
Accessibility	Older people have different mobility needs to younger people, requiring a different approach to transport provision. Transport's socially enabling aspects are particularly important for older groups, as giving up driving due to age is linked to a decrease in well-being and an increase in depression and related health problems[19]. There is evidence that people use public transport more as they age – but people that are vulnerable (e.g. those with mobility impairments) are significantly less likely to use public transport[20]. MetroLink will assess the needs of the vulnerable and deprived and implement their requirement into the planning as necessary. A detailed study will be undertaken as part of the next phase.
Employment	The integration of MetroLink with existing modes of transport can improve the employment and economic opportunities for people living along the proposed route, providing access to areas of employment specifically for deprived and

[19] How can Transport and Associated Built Environment Infrastructure be Enhanced and Developed to Support the Mobility needs of Individuals as they Age: 2015

[20] Disabled People's Travel Behaviour and Attitudes to Travel: 2017

Deprivation Effect	MetroLink Impact
	vulnerable persons. A more detailed review will be undertaken for the FBC to understand which segments of the labour market are most likely to benefit from the introduction of MetroLink, and to help ensure that those who currently struggle to access work benefit from its implementation.

Source: Jacobs' Analysis

1.13 Cost Benefit Analysis

The CBA for MetroLink has been carried out using the appraisal parameters set out in the PSC. The following key parameters were assumed for the base case:

- The ERM model opening year is 2030, therefore for economic modelling 2030 has been used as the opening year, current construction program is reflecting the Metro to open during Q1 2031;
- 14 years of spending prior to opening in 2030;
- An appraisal period of 30 years, after opening year (i.e. after 2030);
- A residual value period of a further 30 years;
- A discount rate of 4% for the first 30 years, 3.5% for years 31 to 60, 3% for years 61 - 100;
- A shadow price of public funds to account for the effects of taxation in public spending, which adds 30% on to estimate costs (a shadow price factor of 1.3);
- A shadow price of labour of which does not increase estimated costs (a shadow price factor of 1);
- Prescribed values of time for commuting, business and other trips, provided by the Department of Transport;
- Fuel consumption parameters from UK TAG (necessary for the TUBA software and comparable to CAF parameters);
- Non-fuel costs from CAF;
- Collision and casualty related costs from CAF.

All scheme cost elements are considered in 2011 prices and values, and are net of all indirect taxation and VAT.

This section considers the appraisal of the MetroLink scheme, using the core assumptions. A range of alternate scenarios (which consider the impact of different levels of growth, the impact of the

inclusion of complimentary infrastructure and a high cost test, among others) are presented in Section 1.15

Valuations provided by TUBA rely on the model outputs for accuracy. The results in this Appendix should be read in conjunction with the technical modelling documentation to understand the level of confidence which can be placed in each of the tests undertaken.

Table 1-28 provides a summary of the overall benefits that have been monetised to generate the initial (PVB). The project is expected to deliver a core PVB of €15.6bn (2011 prices and values).

Delivery of the scheme in present value of costs (PVC) is an estimated €8.6bn (2011 prices and values). Further details of the costs is given in "ML1-JAI-LSI-ROUT_XX-RP-y-00001_V21 Technical Appendix - Scheme Costs" and "ML1-JAI-LSI-ROUT_XX-RP-y-00001_V21_Financial Case", with a summary given in Table 1-27

Table 1-27 Costs for CBA (2011 Prices and Values)

Element	Bn (€)
Construction Costs	1.9
Client Costs	0.6
Capex Risk Adjustment	1.7
O&M and Renewals	0.7
Unitary Charges	1.5
Total funding requirement	6.4
Additional Shadow Price Adjustment	1.9
Passenger / user revenue	0.3
Net funding requirement	8.6

Source: Jacobs Analysis

This generates an NPV of €7.0bn (2011 prices and values), and a scheme benefit to cost ratio (BCR) of 1.8:1.

Table 1-28: Core Scenario AMCB Table (€000's), 2011 values and prices.

Analysis of Monetised Costs and Benefits

Accidents	€	33,207	*(17)*
Economic Efficiency: Consumer Users (Commuting)	€	2,444,018	*(1a)*
Economic Efficiency: Consumer Users (Other)	€	5,925,542	*(1b)*
Economic Efficiency: Business Users and Providers	€	7,268,100	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-€	43,337	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	€	15,627,530	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	€	8,616,686	*(10)*
Present Value of Costs (see notes) (PVC)	€	8,616,686	*(PVC) = (10)*
OVERALL IMPACTS			
Net Present Value (NPV)	€	7,010,844	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)		1.8	BCR=PVB/PVC

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.

Source: Jacobs' Analysis

The scheme will also give rise to non-user impacts such as increase in output in imperfectly competitive markets, land value uplift and agglomeration. These benefits have been combined under "non-user impacts". To account for the range in which the agglomeration benefits could lie between, the adjusted AMCB, Table 1-29, captures a range in the PVB. The adjusted PVB is between €17.7-€19.0bn (2011 prices and values). The adjusted BCR subsequently is between 2.2-2.3.

Table 1-29: Core Scenario Adjusted AMCB Table (€000's), 2011 values and prices.

Analysis of Monetised Costs and Benefits

Non-user impacts	€ 3,124,147	€ 4,374,074	*(16)*
Accidents	€ 33,207	€ 33,207	*(17)*
Economic Efficiency: Consumer Users (Commuting)	€ 2,444,018	€ 2,444,018	*(1a)*
Economic Efficiency: Consumer Users (Other)	€ 5,925,542	€ 5,925,542	*(1b)*
Economic Efficiency: Business Users and Providers	€ 7,268,100	€ 7,268,100	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-€ 43,337	-€ 43,337	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	€ 18,751,677	€ 20,001,604	*(PVB) = (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	€ 8,616,686	€ 8,616,686	*(10)*
Present Value of Costs (see notes) (PVC)	€ 8,616,686	€ 8,616,686	*(PVC) = (10)*
OVERALL IMPACTS			
Net Present Value (NPV)	€ 10,134,991	€ 11,384,918	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	2.2	2.3	BCR=PVB/PVC

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.

Source: Jacobs' Analysis

The Economic Efficiency of the Transport System (TEE) Table 1-30 captures the travel time, VOC, user charges by user class. The table also captures the private sector provider impacts generated

through the PPP delivery mechanism. The Present Value of Transport Economic Efficiency Benefits is €15.6bn.

Table 1-30: Core Scenario TEE Table (€000's), 2011 values and prices.

Non-business: Commuting	**ALL MODES**			**Highways**			**Public Transport**		
User benefits	**TOTAL**						**Passengers**		
Travel time	€	2,315,808		€	526,223		€	1,789,585	
Vehicle operating costs	€	17,371		€	17,371		€	-	
User charges	€	110,839		€	52,111		€	58,728	
During Construction & Maintenance	€	-		€	-		€	-	
NET NON-BUSINESS BENEFITS: COMMUTING	€	2,444,018	*(1a)*	€	595,705		€	1,848,313	
Non-business: Other	**ALL MODES**			**Highways**			**Public Transport**		
User benefits	**TOTAL**						**Passengers**		
Travel time	€	5,364,249		€	1,396,198		€	3,968,051	
Vehicle operating costs	€	240,187		€	240,187		€	-	
User charges	€	321,106		€	48,442		€	272,664	
During Construction & Maintenance	€	-		€	-		€	-	
NET NON-BUSINESS BENEFITS: OTHER	€	5,925,542	*(1b)*	€	1,684,827		€	4,240,715	
Business				**Highways**			**Public Transport**		**Investment**
User benefits				**Road Personal**		**Road Freight**	**Passengers**		
Travel time	€	6,020,092		€	2,488,903	€ 545,405	€	2,985,784	
Vehicle operating costs	€	78,409		€	39,230	€ 39,179	€	-	
User charges	€	151,132		€	20,652	€ 40,253	€	90,227	
During Construction & Maintenance	€	-		€	-	€ -	€	-	
Subtotal	€	6,249,633	*(2)*	€	2,548,785	€ 624,837	€	3,076,011	
Private sector provider impacts									
Revenue	€	1,742,684					€	204,534	€ 1,538,150
Operating costs	€	-							
Investment costs	-€	724,218							-€ 724,218
Grant/subsidy	€	-							
Subtotal	€	1,018,467	*(3)*	€	-		€	204,534	€ 813,933
Other business impacts									
Developer contributions			*(4)*						
NET BUSINESS IMPACT	€	7,268,100	*(5) = (2) + (3) + (4)*	€	2,548,785	€ 624,837	€	3,280,545	€ 813,933
TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	€	15,637,660	*(6) = (1a) + (1b) + (5)*						

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

Source: Jacobs' Analysis

Table 1-31 shows the Public Accounts (PA) table. This captures the costs that will accrue to the public sector as a result of the scheme being delivered. In 2011 present values and prices, the scheme is estimated to the cost the public purse €8.6bn (2011 prices and values).

Table 1-31: Core Scenario PA Table (€000's), 2011 values and prices.

	ALL MODES		Highways	Public Transport
Local Government Funding	**TOTAL**		**INFRASTRUCTURE**	
Revenue				
Operating Costs				
Investment Costs				
Developer and Other Contributions				
Grant/Subsidy Payments				
NET IMPACT	€ -	*(7)*		
Central Government Funding: Transport				
Revenue	€ 342,772		€ 365,498	-€ 22,726
Operating costs	€ 897,127			€ 897,127
Investment Costs	€ 7,376,787			€ 7,376,787
Developer and Other Contributions	€ -			
Grant/Subsidy Payments	€ -			
NET IMPACT	€ 8,616,686	*(8)*		
Central Government Funding: Non-Transport				
Indirect Tax Revenues	€ 43,337	*(9)*	€ 8,053	€ 35,284
TOTALS				
Broad Transport Budget	€ 8,616,686	*(10) = (7) + (8)*		
Wider Public Finances	€ 43,337	*(11) = (9)*		

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2011 prices and values.

Source: Jacobs' Analysis

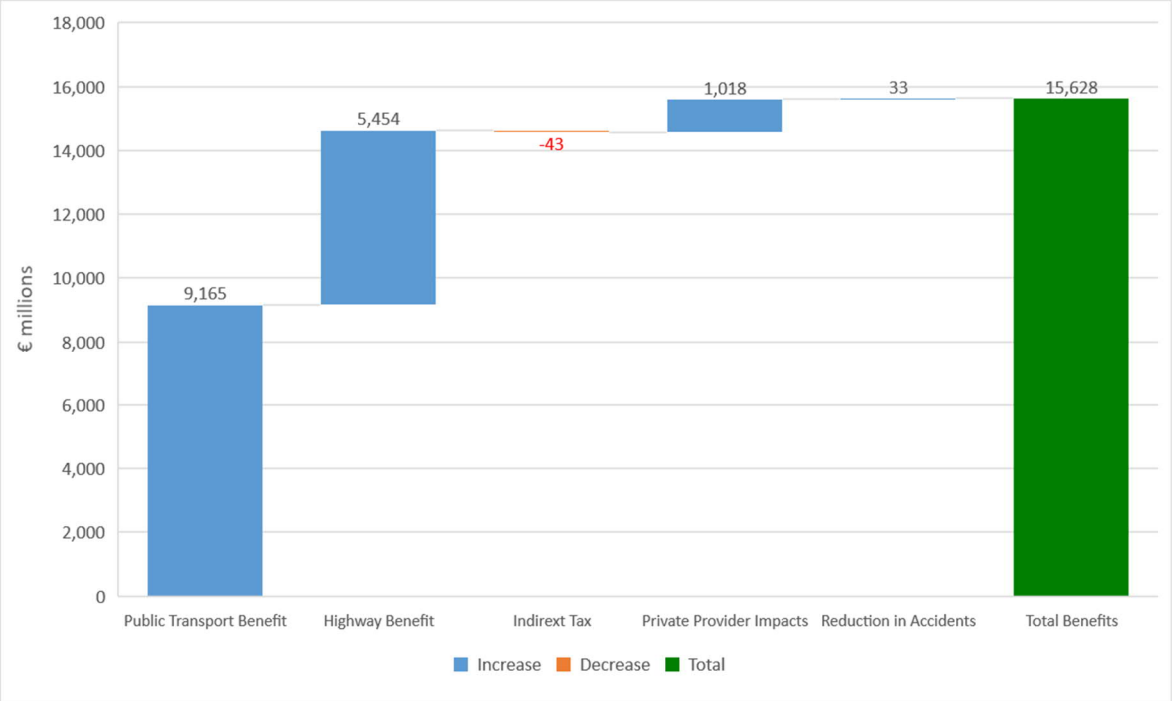
1.14 Project Appraisal Balance Sheet (PABS)

1.14.1 Overview

The value for money (VfM) assessment of a scheme considers not just the monetised costs and benefits, which are used to inform its NPV, its BCR and its Economic Internal Rate of Return (EIRR), but also the effect of other, qualified impacts. TII requires schemes to undertake a Project Appraisal Balance Sheet (PABS). The purpose of PABS is to provide a summary appraisal of project impacts based on qualitative and quantitative outcomes obtained from the Multi-Criteria Analysis (MCA)

assessment. PABS is a mechanism used by the TII to easily compare schemes across the country in order to prioritize schemes for investments.

Figure 1-35: Total MetroLink Benefits (2011 prices and values, 60-year appraisal)



Source: Jacobs' Analysis

Figure 1-35 shows the contribution in € millions of the different components of the impact for MetroLink. It is estimated that MetroLink could generate €15.6bn of benefits over the appraisal period. Most benefits originate from public transport and highway with a large share also stemming from agglomeration. These numbers may change as further appraisal work may be undertaken as part of the full business case. Quantitative impacts is one medium in which MetroLink may benefit Ireland, however Table 1-33 also provides a summary of further impacts that have been assessed qualitatively.

1.14.2 Outcome

The PABS identifies three important elements in a scheme.

1. The qualitative statement summarises the impact of the project in qualitative terms,

2. The quantitative statement, identifies the impacts of the scheme that are monetised; and

3. A scaling statement that ranks the project according to a seven-point scale.

Table 1-33 lists the different objectives the scheme can deliver and if they have been assessed qualitatively or quantitatively. MetroLink's objectives have been aligned to five of the seven CAF objectives: Economy, Safety, Integration, Environment, and Accessibility and Social Inclusion. Below is a summary of how MetroLink will deliver the objectives set out by the CAF. MetroLink will:

1. provide great opportunities to maximise the potential of Dublin, providing both increased economic and environmental benefits, as well as improving safety, accessibility, integration and social inclusion, contributing to the creation of a sustainable, forward-looking city.

2. support the economy in a number of ways, such as by supporting the growing travel demand along the corridor driven by a strong growth in the local population (Section 0). The capital expenditure will help create direct, indirect and induced jobs during the construction phase creating legacy benefits for Dublin and Ireland as a whole (Section 1.4).

3. reduce journey times for individuals along the north Dublin Fingal corridor and help shift people away from single car journeys and onto public transport effectively reducing urban congestion in Dublin (Section 1.2).

4. likely reduce the number of trips on other modes of transport, potentially easing congestion and providing time savings on the Dublin transport network generating transport benefits for Dublin as a whole.

5. help deliver the nation's strategy to improve transport safety and security in Dublin. People will switch from commuting by car to commuting by metro, reducing congestion and traffic on the road network. A reduction in the number of cars on Dublin's road is likely to reduce the number of accidents, due to a re-balance of vehicle speeds and a change in flows (Section 1.3).

6. offer convenient connections via interchange nodes with Iarnród Éireann lines, DART, Luas and BusConnects (Section 1.5) and with pre-existing bike lanes and park and ride options. A seamless integration between all modes of transport, supported by a fully integrated

ticketing system (Section 1.5) is vital to ensure that people will get out of the comfort of their cars and onto public transport.

7. help reduce CO2 emissions, improve air quality, lower noise pollution and encourage regeneration where needed making Dublin a better place to live, work, shop or visit. Radical interventions, such as MetroLink, are needed to shift Ireland onto a low carbon pathway as it manages an increasing population and more demand for housing and employment.

8. help promote social inclusion by tackling accessibility problems experienced by those more disadvantaged in society. The entire length of the system, inclusive of all stations, will be accessible for wheelchair and pushchair users.

9. be equipped with audio and visual devices that will assist people with visual or hearing difficulties. The barriers on every platform will also give people an extra layer of safety that will help prevent accidental falls and other injuries. At its core MetroLink is a people focused scheme with “accessibility for all” at the centre of its planning and design work.

Table 1-32 provides the analysis scale for the PABS, and Table 1-33 provides the PABS itself.

Table 1-32 Multi Criteria Analysis Scale

Multi Criteria Analysis Scale		
Highly Positive	7	Highly Positive
Moderately Positive	6	Moderately Positive
Minor or Slightly Positive	5	Slightly Positive
Neutral	4	Neutral
Minor or Slightly Negative	3	Slightly Negative
Moderately Negative	2	Moderately Negative
Highly Negative	1	Highly Negative

Source: Common Appraisal Framework

Table 1-33: Project Appraisal Balance Sheet (PABS)

Criteria	Qualitative statement	Quantitative statement	Sub-criteria score (1-7 where 7 is the highest)	Appraisal criteria score
Economy				
Transport Efficiency and Effectiveness		Scheme will deliver a significant reduction in travel times. PVB: €15.6 billion.	7	Significantly Positive
Transport Reliability and Quality	Operate with greater reliability and frequency than other modes of mass transit such as Luas		6	
Wider Economic Impacts	Inward Investment: MetroLink is a high-quality transport investment, and is likely to help facilitate inward investment. Employment Benefits: Employment impacts due to changes in effective return to labour are likely to be an additional benefit of the scheme.	Agglomeration: Scheme will deliver a significant reduction in travel times leading to large agglomeration benefits PVB: €3.1-4.4bn Employment Impacts: MetroLink will support 11,400-13,400 FTE, through direct, indirect and induced employment effects.	7	

Criteria	Qualitative statement	Quantitative statement	Sub-criteria score (1-7 where 7 is the highest)	Appraisal criteria score
Safety				
Safety		Scheme predicted to decrease the overall number of fatalities, as well as serious and slight casualties. Monetary Benefit: €33.2 million	4	Neutral
Physical Activity				
Physical Activity	People who use public transport are more physically active than people who use their car[21]. MetroLink will reduce the reliance on private cars and shift people towards public transport. The scheme will also offer walking and cycling solutions, such as covered bike parking. Overall MetroLink is anticipated to offer a marginal positive impact on physical activity.		4	Neutral
Environment				

[21] Victorian Integrated Survey of Travel and Activity (VISTA), 2014

Criteria	Qualitative statement	Quantitative statement	Sub-criteria score (1-7 where 7 is the highest)	Appraisal criteria score
Air Quality	MetroLink will help reduce road congestion, energy and oil consumption and thus contribute to improvement in air quality.		5	Neutral
Noise and Vibration	It is anticipated that the overall impact will be marginally positive, with improvements caused by a reduction in highway traffic offset to some extent by an increase in noise and vibration caused by the MetroLink rolling stock.		4	
Landscape and Visual Quality	Modern stations are expected to interact with the urban environment and increase rather than decrease the value of the public space. Additionally, the design will be appropriate to Dublin and provide context and character.		4	
Environment				
Cultural, Archaeological, and Architectural Heritage	Tunnelling and construction works will enable archaeological explorations to take place.		4	Neutral

Criteria	Qualitative statement	Quantitative statement	Sub-criteria score (1-7 where 7 is the highest)	Appraisal criteria score
Land use, soils, and geology	Likely to be a large impact on land-use. Positive land use change associated with desired development facilitated by MetroLink will be partially offset by the need to purchase land for the construction of MetroLink.		4	
Water resources			Not Applicable	
Accessibility and Social Inclusion				
Vulnerable Groups	It is anticipated that MetroLink will have a positive impact for vulnerable groups by improving accessibility.		5	Moderately Positive
Deprived Geographic Areas	It is anticipated that MetroLink will have a strong positive impact for within deprived geographic areas – facilitating regeneration and access to employment and amenities.		6	
Integration				

Criteria	Qualitative statement	Quantitative statement	Sub-criteria score (1-7 where 7 is the highest)	Appraisal criteria score
Transport Integration	Full integration with all major and minor forms of public transport in Dublin, including an integrated ticketing system		6	Moderately Positive
Land Use Integration	Fully supportive of policy of integrating land-use with transport planning on a national and local level. Increases accessibility, to SDZ's, low and high density and mixed land-use. Supports the commercial viability of land along the MetroLink corridor and through the GDA due to the scheme's strong emphasis on transport integration.		6	
Geographical Integration	MetroLink is designed to be fully compatible with the objectives of the NPF 2040 and other regional and local relevant policies		6	
Other Governmental Policy Integration	MetroLink has fully considered local, national and international governmental policies and has aligned its objectives and delivery of the scheme accordingly.		6	

Source: Common Appraisal Framework and Jacobs

1.15 Sensitivity Tests

In line with guidance, it is necessary to undertake sensitivity tests, to understand a range of impacts as a result of variance from the central scenario as outlined below.

1.15.1 Not Used

Not Used

1.15.2 Low Growth Scenario

The low growth scenario assumes that underlying transport usage grows at a lower rate than in the core scenario. It assumes that growth is roughly 20% below the level in the core scenario in 2030 and 25% below in 2045.

Under this scenario, the PVB is lower, whilst the PVC remains the same. The changes to the PVB are captured in the AMCB/TEE tables presented in Table 1-34 Low Growth Scenario. Under this scenario accident benefits increase marginally, however the transport user benefits generated through TUBA decrease. The revised PVB is €13.6bn (2011 prices and values), resulting in a lower NPV of €5bn (2011 prices and values). The BCR is 1.6.

Table 1-34 Low Growth Scenario AMCB Table (€000's), 2011 values and prices.

Analysis of Monetised Costs and Benefits

Accidents	€	40,186	*(17)*
Economic Efficiency: Consumer Users (Commuting)	€	2,315,655	*(1a)*
Economic Efficiency: Consumer Users (Other)	€	5,017,867	*(1b)*
Economic Efficiency: Business Users and Providers	€	6,287,808	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-€	42,507	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	€	13,619,009	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	€	8,587,362	*(10)*
Present Value of Costs (see notes) (PVC)	€	8,587,362	*(PVC) = (10)*
OVERALL IMPACTS			
Net Present Value (NPV)	€	5,031,647	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)		1.6	BCR=PVB/PVC

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.

Source: Jacobs' Analysis

The TEE Table 1-35 presents the benefit break down in more detail by user class as well as by mode.

Table 1-35 Low Growth Scenario TEE Table (€000's), 2011 values and prices.

Non-business: Commuting	ALL MODES TOTAL		Highways	Public Transport Passengers
User benefits				
Travel time	€ 2,189,732		€ 479,182	€ 1,710,550
Vehicle operating costs	€ 11,582		€ 11,582	€ -
User charges	€ 114,341		€ 55,865	€ 58,476
During Construction & Maintenance	€ -		€ -	€ -
NET NON-BUSINESS BENEFITS: COMMUTING	€ 2,315,655	(1a)	€ 546,629	€ 1,769,026

Non-business: Other	ALL MODES TOTAL		Highways	Public Transport Passengers
User benefits				
Travel time	€ 4,502,143		€ 1,110,368	€ 3,391,775
Vehicle operating costs	€ 223,236		€ 223,236	€ -
User charges	€ 292,488		€ 51,476	€ 241,012
During Construction & Maintenance	€ -		€ -	€ -
NET NON-BUSINESS BENEFITS: OTHER	€ 5,017,867	(1b)	€ 1,385,080	€ 3,632,787

Business			Highways		Public Transport	Investment
User benefits			Road Personal	Road Freight	Passengers	
Travel time	€ 5,022,518		€ 2,068,563	€ 385,702	€ 2,568,253	
Vehicle operating costs	€ 67,009		€ 33,582	€ 33,427	€ -	
User charges	€ 141,332		€ 20,571	€ 39,656	€ 81,105	
During Construction & Maintenance	€ -		€ -	€ -	€ -	
Subtotal	€ 5,230,859	(2)	€ 2,122,716	€ 458,785	€ 2,649,358	
Private sector provider impacts						
Revenue	€ 1,781,167				€ 243,016	€ 1,538,150
Operating costs	€ -					
Investment costs	-€ 724,218					-€ 724,218
Grant/subsidy	€ -					
Subtotal	€ 1,056,949	(3)	€ -		€ 243,016	€ 813,933
Other business impacts						
Developer contributions		(4)				
NET BUSINESS IMPACT	€ 6,287,808	(5) = (2) + (3) + (4)	€ 2,122,716	€ 458,785	€ 2,892,374	€ 813,933

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	€ 13,621,330	(6) = (1a) + (1b) + (5)

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

Source: Jacobs' Analysis

1.15.3 High Cost Scenario

Under this sensitivity it is assumed that the construction and operational, maintenance and renewal costs all increase by 30%. The Impact of this can be seen across the TEE/PA/AMCB tables. The increase in scheme cost assumes that the Delivery Partner will also increase the initial contribution under the PPP agreement. The Unitary charge is also assumed to increase by 30%.

The impacts at a high level are summarised in the AMCB Table 1-36. Under the high cost scenario, the PVC increases to €11.1bn (2011 prices and values), with the NPV decreasing to €4.8bn (2011 prices and values). The schemes BCR with the cost increase would be an estimated 1.4.

Table 1-36 High Cost Scenario AMCB Table (€000's), 2011 values and prices.

Analysis of Monetised Costs and Benefits

Accidents	€	33,207	*(17)*
Economic Efficiency: Consumer Users (Commuting)	€	2,444,018	*(1a)*
Economic Efficiency: Consumer Users (Other)	€	5,925,542	*(1b)*
Economic Efficiency: Business Users and Providers	€	7,512,280	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-€	43,337	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	€	15,871,710	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	€	11,098,860	*(10)*
Present Value of Costs (see notes) (PVC)	€	11,098,860	*(PVC) = (10)*
OVERALL IMPACTS			
Net Present Value (NPV)	€	4,772,850	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)		1.4	BCR=PVB/PVC

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.

Source: Jacobs' Analysis

The PA Table (Table 1-37 High Cost Scenario) presents the impact of the increase in costs to the public purse.

Table 1-37 High Cost Scenario PA Table (€000's), 2011 values and prices.

	ALL MODES TOTAL		Highways		Public Transport
Funding			INFRASTRUCTURE		
Revenue					
Operating Costs					
Investment Costs					
Contributions					
Grant/Subsidy Payments					
NET IMPACT	0	*(7)*			
Transport					
Revenue	€ 342,772		€ 365,498		-€ 22,726
Operating costs	€ 1,166,265				€ 1,166,265
Investment Costs	€ 9,589,823				€ 9,589,823
Developer and Other Contributions	€ -				
Grant/Subsidy Payments	€ -				
NET IMPACT	€ 11,098,860	*(8)*			
Central Government Funding: Non-Transport					
Indirect Tax Revenues	€ 43,337	*(9)*	€ 8,053		€ 35,284
TOTALS					
Broad Transport Budget	€ 11,098,860	*(10) = (7) + (8)*			
Wider Public Finances	€ 43,337	*(11) = (9)*			

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2011 prices and values.

Source: Jacobs' Analysis

The TEE Table (Table 1-38) presents the benefit breakdown in more detail by user class as well as by mode.

Table 1-38: High Cost Scenario TEE Table (€000's), 2011 values and prices.

			Highways		Public Transport	
Non-business: Commuting	**ALL MODES**					
User benefits	**TOTAL**				**Passengers**	
Travel time	€ 2,315,808		€ 526,223		€ 1,789,585	
Vehicle operating costs	€ 17,371		€ 17,371		€ -	
User charges	€ 110,839		€ 52,111		€ 58,728	
Maintenance	€ -		€ -		€ -	
NET NON-BUSINESS BENEFITS: COMMUTING	€ 2,444,018	*(1a)*	€ 595,705		€ 1,848,313	
Non-business: Other	**ALL MODES**		**Highways**		**Public Transport**	
User benefits	**TOTAL**				**Passengers**	
Travel time	€ 5,364,249		€ 1,396,198		€ 3,968,051	
Vehicle operating costs	€ 240,187		€ 240,187		€ -	
User charges	€ 321,106		€ 48,442		€ 272,664	
Maintenance	€ -		€ -		€ -	
OTHER	€ 5,925,542	*(1b)*	€ 1,684,827		€ 4,240,715	
Business			**Highways**		**Public**	**Investment**
User benefits			**Road Personal**	**Road Freight**	**Passengers**	
Travel time	€ 6,020,092		€ 2,488,903	€ 545,405	€ 2,985,784	
Vehicle operating costs	€ 78,409		€ 39,230	€ 39,179	€ -	
User charges	€ 151,132		€ 20,652	€ 40,253	€ 90,227	
Maintenance	€ -		€ -	€ -	€ -	
Subtotal	€ 6,249,633	*(2)*	€ 2,548,785	€ 624,837	€ 3,076,011	
Private sector provider impacts						
Revenue	€ 2,204,129				€ 204,534	€ 1,999,595
Operating costs	€ -					
Investment costs	-€ 941,483					-€ 941,483
Grant/subsidy	€ -					
Subtotal	€ 1,262,647	*(3)*	€ -		€ 204,534	€ 1,058,113
Other business impacts						
Developer contributions		*(4)*				
NET BUSINESS IMPACT	€ 7,512,280	*(5) = (2) + (3) + (4)*	€ 2,548,785	€ 624,837	€ 3,280,545	€ 1,058,113
TOTAL						
Present Value of Transport Economic Efficiency Benefits (TEE)	€ 15,881,840	*(6) = (1a) + (1b) + (5)*				

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

Source: Jacobs' Analysis

1.15.4 Alternative Growth Scenario

Under this scenario only the present value of benefits delivered through the scheme proposals change as a result of one possible outcome of the economic impact of COVID-19. The present value of costs is assumed to be the same.

In broad terms the alternative growth scenario assumes that the reduction in travel due to COVID reduces, and that by 2030 the same level of transport use occurs as in the final year pre-COVID. Transport use grows from that point, and in 2045 has reached levels that were assumed by 2035 if the pandemic had not occurred.

The rate at which transport use will return is uncertain at this time, and this test is informed by parameters provided by the NTA for us in COVID-19 scenario testing.

The present value of benefits under this scenario reduce to €13.5bn (2011 prices and values), this subsequently leads to a reduction in the NPV, with the new estimate at €5bn (2011 prices and values). The benefit to cost ratio reduces to 1.6 as a result of the economic impact of COVID -19.

Table 1-39 Alternative Growth Scenario AMCB Table (€000's), 2011 values and prices.

Accidents	€ 33,207	*(17)*
Economic Efficiency: Consumer Users (Commuting)	€ 1,842,535	*(1a)*
Economic Efficiency: Consumer Users (Other)	€ 5,402,196	*(1b)*
Economic Efficiency: Business Users and Providers	€ 6,322,731	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-€ 50,930	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	€ 13,549,739	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	€ 8,594,886	*(10)*
Present Value of Costs (see notes) (PVC)	€ 8,594,886	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	€ 4,954,853	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.6	BCR=PVB/PVC

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.

Source: Jacobs' Analysis

The TEE Table (Table 1-40) presents the benefit breakdown in more detail by user class as well as by mode.

Table 1-40:Alternative Growth Scenario TEE Table (€000's), 2011 values and prices.

Non-business: Commuting	**ALL MODES**			**Highways**			**Public Transport**		
User benefits	**TOTAL**						**Passengers**		
Travel time	€ 1,739,521			€ 424,290			€ 1,315,231		
Vehicle operating costs	-€ 4,238			-€ 4,238			€ -		
User charges	€ 107,252			€ 54,218			€ 53,034		
During Construction & Maintenance	€ -			€ -			€ -		
NET NON-BUSINESS BENEFITS: COMMUTING	€ 1,842,535	*(1a)*		€ 474,270			€ 1,368,265		
Non-business: Other	**ALL MODES**			**Highways**			**Public Transport**		
User benefits	**TOTAL**						**Passengers**		
Travel time	€ 4,854,505			€ 1,264,816			€ 3,589,689		
Vehicle operating costs	€ 236,622			€ 236,622			€ -		
User charges	€ 311,069			€ 54,094			€ 256,975		
During Construction & Maintenance	€ -			€ -			€ -		
NET NON-BUSINESS BENEFITS: OTHER	€ 5,402,196	*(1b)*		€ 1,555,532			€ 3,846,664		
Business				**Highways**			**Public Transport**	**Investment**	
User benefits				**Road Personal**	**Road Freight**		**Passengers**		
Travel time	€ 5,009,413			€ 2,120,090	€ 426,155		€ 2,463,168		
Vehicle operating costs	€ 69,254			€ 34,045	€ 35,209		€ -		
User charges	€ 151,053			€ 23,481	€ 46,290		€ 81,282		
During Construction & Maintenance	€ -			€ -	€ -		€ -		
Subtotal	€ 5,229,720	*(2)*		€ 2,177,616	€ 507,654		€ 2,544,450		
Private sector provider impacts									
Revenue	€ 1,817,229						€ 279,078	€ 1,538,150	
Operating costs	€ -								
Investment costs	-€ 724,218							-€ 724,218	
Grant/subsidy	€ -								
Subtotal	€ 1,093,011	*(3)*		€ -			€ 279,078	€ 813,933	
Other business impacts									
Developer contributions		*(4)*							
NET BUSINESS IMPACT	€ 6,322,731	*(5) = (2) + (3) + (4)*		€ 2,177,616	€ 507,654		€ 2,823,528	€ 813,933	
TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	€ 13,567,462	*(6) = (1a) + (1b) + (5)*							

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

Source: Jacobs' Analysis

1.15.5 Delivery of Complimentary Infrastructure Scenario

This test includes all infrastructure included within the National Development Plan, within the Do Minimum. Full details can be found in in "ML1-JAI-TRA-ROUT_XX-PL-Y-00001 Traffic Modelling Plan", but in summary the following schemes are included, above what is considered within the core case:

1. Complete DART expansion (non-tunnel elements)
2. Full Bus Connects Routes and Services
3. Enhanced Rail and Bus Park and Ride provision
4. Greater Dublin Area Park and Ride

As well as these named schemes are range of more minor highway improvements are included within the model.

The impact of this is a reduction in the quantum of present value of benefits that can be attributed to the delivery of this scheme. The present value of benefits are an estimated €12.9bn (2011 prices and values), giving rise to a lower NPV of €4.6bn (2011 prices and values). The benefit to cost ratio is 1.5.

Table 1-41 Complementary Infrastructure Scenario AMCB Table (€000's), 2011 values and prices.

Accidents	€	33,207	(17)
Economic Efficiency: Consumer Users (Commuting)	€	1,682,116	(1a)
Economic Efficiency: Consumer Users (Other)	€	5,403,863	(1b)
Economic Efficiency: Business Users and Providers	€	5,796,173	(5)
Wider Public Finances (Indirect Taxation Revenues)	€	22,745	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	€	12,938,104	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	€	8,358,483	(10)
Present Value of Costs (see notes) (PVC)	€	8,358,483	*(PVC) = (10)*
OVERALL IMPACTS			
Net Present Value (NPV)	€	4,579,621	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)		1.5	BCR=PVB/PVC

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.

Source: Jacobs' Analysis

The TEE Table (Table 1-42) presents the benefit breakdown in more detail by user class as well as by mode.

Table 1-42: Complementary Infrastructure Scenario TEE Table (€000's), 2011 values and prices.

Non-business: Commuting	ALL MODES		Highways	Public Transport
User benefits	TOTAL			Passengers
Travel time	€ 1,713,127		-€ 76,458	€ 1,789,585
Vehicle operating costs	-€ 85,648		-€ 85,648	€ -
User charges	€ 54,637		-€ 4,091	€ 58,728
During Construction & Maintenance	€ -		€ -	€ -
NET NON-BUSINESS BENEFITS: COMMUTING	€ 1,682,116	*(1a)*	-€ 166,197	€ 1,848,313

Non-business: Other	ALL MODES		Highways	Public Transport
User benefits	TOTAL			Passengers
Travel time	€ 5,104,011		€ 1,135,960	€ 3,968,051
Vehicle operating costs	€ 48,875		€ 48,875	€ -
User charges	€ 250,977		-€ 21,687	€ 272,664
During Construction & Maintenance	€ -		€ -	€ -
NET NON-BUSINESS BENEFITS: OTHER	€ 5,403,863	*(1b)*	€ 1,163,148	€ 4,240,715

Business			Highways		Public Transport	Investment
User benefits			Road Personal	Road Freight	Passengers	
Travel time	€ 4,687,255		€ 1,403,652	€ 297,819	€ 2,985,784	
Vehicle operating costs	€ 32,717		€ 17,063	€ 15,654	€ -	
User charges	€ 57,734		-€ 22,029	-€ 10,464	€ 90,227	
During Construction & Maintenance	€ -		€ -	€ -	€ -	
Subtotal	€ 4,777,706	*(2)*	€ 1,398,686	€ 303,009	€ 3,076,011	
Private sector provider impacts						
Revenue	€ 1,742,684				€ 204,534	€ 1,538,150
Operating costs	€ -					
Investment costs	-€ 724,218					-€ 724,218
Grant/subsidy	€ -					
Subtotal	€ 1,018,467	*(3)*	€ -		€ 204,534	€ 813,933
Other business impacts						
Developer contributions		*(4)*				
NET BUSINESS IMPACT	€ 5,796,173	*(5) = (2) + (3) + (4)*	€ 1,398,686	€ 303,009	€ 3,280,545	€ 813,933

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	€ 12,882,152	*(6) = (1a) + (1b) + (5)*

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

Source: Jacobs' Analysis

1.15.6 Low Cost Scenario

Under this sensitivity it is assumed that the construction, operational, maintenance and renewal costs all decrease by 30%. The Impact of this can be seen across the TEE/PA/AMCB tables. The decrease in scheme cost assumes that the Delivery Partner will also reduce the initial contribution under the PPP agreement. The Unitary charge subsequently also decreases by 30%.

The impacts at a high level are summarised in the AMCB. Under the low-cost scenario, the PVC decreases to €6.1bn (2011 prices and values), with the NPV decreasing to €9.2bn (2011 prices and values). The schemes BCR with the cost decrease would be an estimated 2.5.

Table 1-43 Low Cost Scenario AMCB Table (€000's), 2011 values and prices.

Source: Jacobs' Analysis

The PA Table (Table 1-43) presents the impact of the decrease in costs to the public purse

Analysis of Monetised Costs and Benefits

Accidents	€	33,207	*(17)*
Economic Efficiency: Consumer Users (Commuting)	€	2,444,018	*(1a)*
Economic Efficiency: Consumer Users (Other)	€	5,925,542	*(1b)*
Economic Efficiency: Business Users and Providers	€	7,023,920	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-€	43,337	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	€	15,383,350	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	€	6,134,512	*(10)*
Present Value of Costs (see notes) (PVC)	€	6,134,512	*(PVC) = (10)*
OVERALL IMPACTS			
Net Present Value (NPV)	€	9,248,838	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)		2.5	BCR=PVB/PVC

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.

1.15.7 National Development Plan with Alternative Demand

In order to address the request for a further sensitivity test for the Metrolink scheme, we have assessed the results from model runs undertaken for the scheme to date. Our understanding is that a combination of the Enhanced Transport Network – National Development Plan and the Alternative Demand scenario would be appropriate for the additional test required.

This captures the impact of COVID-19 on future trip patterns as well containing transport proposals to be delivered in the State by 2027. Under this scenario, the revised Present Value of Benefits is an estimated €12.7bn (2011 prices and values), which corresponds to a BCR of 1.5. This can be seen in the AMCB table below.

Table 1-44 National Development Plan with Alternative Demand Scenario AMCB Table (€000's), 2011 values and prices.

Analysis of Monetised Costs and Benefits

Noise		(12)
Local Air Quality		(13)
Greenhouse Gases		(14)
Journey Quality		(15)
Physical Activity		(16)
Accidents	€ 33,207	(17)
Economic Efficiency: Consumer Users (Commuting)	€ 1,311,714	(1a)
Economic Efficiency: Consumer Users (Other)	€ 5,870,893	(1b)
Economic Efficiency: Business Users and Providers	€ 5,408,186	(5)
Wider Public Finances (Indirect Taxation Revenues)	€ 30,016	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	€ 12,654,016	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	€ 8,397,090	(10)
Present Value of Costs (see notes) (PVC)	€ 8,397,090	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	€ 4,256,926	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.5	BCR=PVB/PVC

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.

Source: Jacobs' Analysis

Similarly, the revised Present Value of Transport Economic Efficiency (TEE) is an estimated €12.6bn (2011 prices and values),

Table 1-45 National Development Plan with Alternative Demand Scenario TEE Table (€000's), 2011 values and prices.

Non-business: Commuting	**ALL MODES**		**Highways**		**Public Transport**	
User benefits	**TOTAL**				**Passengers**	
Travel time	€ 1,335,702		-€ 76,458		€ 1,412,160	
Vehicle operating costs	-€ 85,648		-€ 85,648		€ -	
User charges	€ 61,660		-€ 4,091		€ 65,751	
During Construction & Maintenance	€ -		€ -		€ -	
NET NON-BUSINESS BENEFITS: COMMUTING	€ 1,311,714	*(1a)*	-€ 166,197		€ 1,477,911	
Non-business: Other	**ALL MODES**		**Highways**		**Public Transport**	
User benefits	**TOTAL**				**Passengers**	
Travel time	€ 5,244,589		€ 1,135,960		€ 4,108,629	
Vehicle operating costs	€ 48,875		€ 48,875		€ -	
User charges	€ 577,429		-€ 21,687		€ 599,116	
During Construction & Maintenance	€ -		€ -		€ -	
NET NON-BUSINESS BENEFITS: OTHER	€ 5,870,893	*(1b)*	€ 1,163,148		€ 4,707,745	
Business			**Highways**		**Public Transport**	**Investment**
User benefits			**Road Personal**	**Road Freight**	**Passengers**	
Travel time	€ 4,604,343		€ 1,403,652	€ 297,819	€ 2,902,872	
Vehicle operating costs	€ 32,717		€ 17,063	€ 15,654	€ -	
User charges	€ 100,125		-€ 22,029	-€ 10,464	€ 132,618	
During Construction & Maintenance	€ -		€ -	€ -	€ -	
Subtotal	€ 4,737,185	*(2)*	€ 1,398,686	€ 303,009	€ 3,035,490	
Private sector provider impacts						
Revenue	€ 1,395,219				-€ 142,932	€ 1,538,150
Operating costs	€ -					
Investment costs	-€ 724,218					-€ 724,218
Grant/subsidy	€ -					
Subtotal	€ 671,001	*(3)*	€ -		-€ 142,932	€ 813,933
Other business impacts						
Developer contributions		*(4)*				
NET BUSINESS IMPACT	€ 5,408,186	*(5) = (2) + (3) + (4)*	€ 1,398,686	€ 303,009	€ 2,892,558	€ 813,933
TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	€ 12,590,793	*(6) = (1a) + (1b) + (5)*				

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

Source: Jacobs' Analysis

1.16 Further Appraisal

Further appraisal work will be undertaken for the FBC and in parallel with the EIA, so that this can inform the development of the scheme taken forward. A key part of any future business case and EIA will be to undertake stakeholder engagement to understand people's concerns and perceptions so that these can be taken into account in assessing the potential impacts this scheme has on those living in areas of deprivation and vulnerable people.

This preliminary business case sets out a justification for the investment that is required. The resources put into developing a preliminary business case should be proportionate to the scale of the proposal. Therefore, we have provided a high-level view of some of the benefits that MetroLink may deliver in the GDA. Further areas of work to be undertaken at FBC include quantifying agglomeration, employment and development impacts.

1.17 Conclusion

The introduction of MetroLink to Dublin is predicted to have a wide-ranging positive impact, across the entire city. Journey times for all purposes will decrease, and people will move from highway to public transport trips, with the associated positive environmental impacts. The largest driver of benefits associated with MetroLink are journey time savings – due both to the faster travel time on MetroLink itself (in comparison to existing public transport infrastructure), and due to the associated decongestion effects which occur as people switch from highway to public transport modes.

It is anticipated that MetroLink will have a wider positive effect than this. It is estimated to support ~11,000 jobs (directly and indirectly) during the construction phase, and to add between €1.2 and €2.5 bn to the economy, post opening due to the transformational effect it will have on business to business interactions and the labour market.

The core scenario predicts benefits worth €15.6Bn, and a BCR of 1.8 – so for every €1 spent, the economy receives €1.80 back. When wider impacts are considered – including the effect of job creation, land value changes and enhancements in business to business interactions - the estimated return is between €2.2 and €2.3 for every €1, spent.

A range of scenarios has been assessed, to understand the impact that MetroLink will have across a range of possible futures. For all of the these the level of benefit associated with MetroLink is above the cost of the scheme, with the lowest return indicating that MetroLink will deliver at least €1.40 for every €1 spent. This helps to provide assurance that MetroLink will deliver value, even of the assumptions used to build the core scenario are not met.

Appendix A. Key Origin Destination Travel Time Impacts

Table 1-46 shows the journey time changes between key origin-destination pairs around Dublin. Negative values are shown in green and represent a travel time reduction. Journey time increases are related to re-routing within the model and are linked to the issues discussed in "Technical Note - Appraisal Travel Cost Assessment".

Table 1-46 2045 Journey Time Change (Minutes)

Journey Time 2045 DS - 2045 DM Business Case AM Period	O'Connel Street	St. Stephen's Green	College Street (Trinity)	Glasnevin	DCU	Rathgar Road	Coolock	Ballymun	Finglas	Sandyford	Tallaght	Red Cow	Blanchardstown	Ashbourne	Donabate	Balbriggan	Drogheda	Swords Pavilion	Swords East	Airport
O'Connel Street	0.0	0.0	0.0	0.0	-7.5	0.2	0.2	-12.1	0.3	0.2	0.0	0.0	-0.8	-1.1	0.0	0.0	0.0	-26.0	0.8	-23.0
St. Stephen's Green	0.0	0.0	0.1	-2.9	-11.3	0.1	0.2	-14.5	-2.0	0.0	0.0	0.0	-2.2	-3.4	0.0	0.0	0.0	-32.7	-0.9	-14.3
College Street (Trinity)	0.0	0.0	0.0	0.2	-8.3	0.2	0.2	-12.7	0.4	0.1	0.0	0.0	-0.2	-0.9	0.0	0.0	0.0	-27.3	5.3	-8.7
Glasnevin	-3.8	-9.3	-2.1	0.0	-0.1	-6.4	-8.5	2.1	0.2	-16.8	0.4	0.4	-11.7	-0.9	-5.5	-8.7	0.1	-28.7	-14.1	-24.5
DCU	-4.8	-9.9	-4.7	0.1	0.0	-9.9	0.0	0.0	0.3	-16.5	-3.2	-3.2	-12.5	-1.3	-23.0	-15.4	-0.8	-13.5	-12.8	-9.7
Rathgar Road	0.1	0.1	0.2	-4.6	-15.6	0.0	0.3	-18.9	-0.4	0.0	0.2	0.5	-6.6	-5.8	-0.8	-2.9	0.0	-34.3	-1.8	-22.4
Coolock	0.3	0.3	0.2	-7.0	0.2	0.3	0.0	-0.1	0.2	-0.8	0.5	0.3	0.3	-1.0	0.3	0.3	-3.9	0.0	0.3	0.3
Ballymun	-9.3	-14.7	-8.6	2.4	0.0	-15.6	-0.5	0.0	0.3	-20.5	-0.2	-0.2	-21.5	-1.2	-12.4	-18.0	-0.8	-11.1	-10.4	-8.1
Finglas	0.2	-6.2	0.1	-1.0	0.0	-0.7	-0.6	0.0	0.0	-11.7	2.3	2.3	0.0	-1.1	-0.9	-15.5	7.9	-10.3	-11.2	-7.3
Sandyford	0.0	0.0	0.0	-8.2	-15.8	-0.1	-1.2	-18.7	-1.7	0.0	0.0	0.0	-4.1	-6.4	-0.4	-0.3	-0.1	-35.0	-2.3	-23.7
Tallaght	0.0	0.0	0.0	1.7	-6.3	-0.1	0.2	-10.4	1.9	0.1	0.0	0.0	0.2	1.2	0.0	0.0	0.0	-23.6	5.4	-18.5
Red Cow	0.0	0.0	0.0	1.6	-6.2	-0.1	0.2	-10.4	1.4	0.2	0.0	0.0	0.2	1.2	0.0	0.0	0.0	-22.5	7.1	1.8
Blanchardstown	1.6	0.0	0.7	-12.1	-3.5	-1.0	0.1	-8.4	0.0	-1.6	0.2	0.2	0.0	-2.1	0.0	0.0	0.0	-22.3	-2.0	-21.3
Ashbourne	-0.5	-0.5	-0.5	-0.5	-0.2	-0.5	0.0	1.7	-0.7	-2.0	0.3	0.3	-9.3	0.0	-6.9	-14.3	1.2	-18.4	-16.7	3.7
Donabate	5.5	0.0	0.0	7.3	-13.9	1.0	5.6	-14.1	-8.2	-1.8	5.5	5.5	5.5	-17.2	0.0	0.0	0.0	1.0	0.2	-9.1
Balbriggan	0.0	7.8	7.8	-7.7	6.8	8.8	0.2	-16.2	3.6	6.0	0.0	0.0	0.0	-0.1	0.0	0.0	-0.2	3.4	-0.3	2.0
Drogheda	0.0	0.0	0.0	-5.2	0.8	1.0	0.8	4.8	-12.9	-1.7	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	4.1	-0.3	1.1
Swords Pavilion	-15.4	-17.9	-7.7	-40.6	-17.4	-14.1	2.1	-17.3	-18.3	-20.0	-7.6	-7.5	-24.3	-33.3	0.7	0.3	-8.4	0.0	0.0	-9.3
Swords East	2.4	3.5	4.4	-14.6	-15.9	2.7	-0.4	-15.9	-16.9	-4.0	4.2	3.6	-7.4	-25.0	0.8	0.3	0.2	-0.3	0.0	-5.9
Airport	-13.7	-11.8	-7.8	-24.8	-6.9	-21.0	-0.3	-5.7	-6.7	-25.6	-3.6	13.0	-20.4	-14.0	-2.3	0.3	-0.2	3.1	3.5	0.0

Source: Jacobs' Analysis