An Bord Pleanála

DART UNDERGROUND

REPORT ON TRAFFIC AND TRANSPORTATION

This report has been produced by Steve Wallace BSc, CEng, MICE, MCIHT, CMILT, MIEI who has been appointed by An Bord Pleanála to assist the Inspector in the consideration of traffic matters relating to the Railway Order application for the DART Underground strategic infrastructure development.

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1 INTRODUCTION

1.1 Transport Planning Context

DART Underground is considered to be the 'missing link' in the existing Greater Dublin Area rail network and its provision would be significant in further establishing an integrated transport system for the city and region. DART Underground would form the central spine of the commuter rail network to deliver additional rail capacity by transforming existing DART services with new underground stations linking with other public transport services:

- Docklands Station would link with the LUAS Red Line and bus services along North Wall Quay and would be close to Docklands Mainline Station;
- Pearse Station would become the central rail transport hub, since under a new service pattern two DART lines would intersect here;
- St Stephen's Green Station would offer access to the LUAS Green Line, the proposed Metro North, the proposed LUAS Line BXD and numerous bus services;
- Christchurch Station would provide access to bus routes along the Quays as well as on Lord Edward Street;
- Heuston Station would provide links to intercity services from the south and west, suburban commuter trains, the LUAS Red Line and numerous bus services;
- Inchicore Station would be close to the future LUAS Line F station.

A Railway Order Application for the development was lodged for consideration by An Bord Pleanála in June 2010. The application included supporting material including an Environmental Impact Statement containing various technical appraisals.

1.2 Brief

An Bord Pleanála appointed an in-house Inspector to examine and report on the railway order application, including undertaking an oral hearing. I have been commissioned to assist the Inspector in a specialist capacity in considering traffic-related matters. In broad outline, the nature of the advice is as follows:

1. Following a review of the documentation submitted with the application in relation to traffic, advise on the adequacy of the application details and Environmental Impact Statement in relation to predicted traffic impacts, both for the construction and operational phases of the scheme.

2. Advise on the adequacy of the applicant's methodology in assessing traffic impacts and on mitigation measures proposed, including confirmation of the robustness of the traffic models chosen.

I have taken into consideration the potential for effects on all transport modes including pedestrians, cyclists, bus, LUAS and rail users, as well as on road traffic. Where appropriate, my assessment draws comparison with the proposed Metro North scheme,

for which I also gave advice to the An Bord Pleanála Inspector during it's railway order process.

1.3 Approach

Since being commissioned in September 2010 I have reviewed the order material, the Environmental Impact Statement (EIS) and subsequent applicant submissions relating to traffic matters. I have also considered specific traffic issues raised in observer's submissions. I have been present throughout the majority of the oral hearing and had the chance to ask questions of the applicant and observers when appropriate.

1.4 Layout of this Report

This report draws together summaries of the extensive material both submitted and presented in evidence by the applicant and observers in relation to traffic and transportation matters. The report is set out as follows:

- Chapter 2 establishes the context of DART Underground in transport policy;
- Chapter 3 explains the transport assessment methodologies used by the applicant in appraising potential impacts and effects and confirms they are "fit-for-purpose";
- Chapter 4 deals with the changes in the transport network once the Underground, as proposed, becomes operational;
- Chapter 5 addresses the construction stage impacts, the associated mitigation proposed and observers concerns in relation to the remaining impacts;
- Chapter 6 provides an overall summary and conclusion.

2 TRANSPORT POLICY BACKGROUND

2.1 Introduction

This chapter draws together key references to DART Underground (previously referred to as the "interconnector") that have been made in various national and regional transport policy documents over the last decade. A comprehensive listing of all policy references is contained in EIS Chapter 4. It should also be noted that since EIS publication the National Transport Authority have published their Draft Transport Strategy called 2030 Vision, this demonstrates continued commitment to DART Underground as a key measure representing "a cornerstone of the future transport system for the Greater Dublin Area".

2.2 Transport 21, Department of Transport

This capital investment framework was published in 2005 and detailed a number of project and programme objectives relating to the overall investment proposed in the National Development Plan 2000-2006. At its launch a €34billion investment package was announced, of which €16 billion would be invested in public transport projects. One of the main objectives in relation to the Greater Dublin Area is stated as being:

"To construct the Suburban Rail Interconnector providing a tunneled link between Heuston Station and the Docklands, via St Stephen's Green and linking with the Northern line." (transport21.ie website)

DART Underground is compliant with the general aims of Transport 21 which are to increase accessibility, ensure sustainability, expand transport capacity, increase public transport use and enhance quality of life.

2.3 National Development Plan 2007-2013, Department of Finance

This plan proposes investment of some €184billion over a 6 year period. A key objective of the Economic Infrastructure Priority element is to radically upgrade the public transport system, especially in the Dublin area. Accordingly, a number of projects are listed to be advanced in line with the Transport 21 timetable including:

"Commencement of the Heuston Docklands Interconnector…" (NDP, page 134)

2.4 National Spatial Strategy 2002 -2020

This strategy is a 20 year planning framework designed, inter alia, to improve the effectiveness of public investment infrastructure around the country. The strategy lists a number of requirements which the future health of Dublin is dependent on. One such requirement is:

"creating an efficient and high quality system of public transport connections within Dublin area to improve access to employment, education, services and amenities". (NSS, page 43)

DART Underground would contribute significantly to this goal.

2.5 Smarter Travel - A Sustainable Transport Future (2009 - 2020)

This government policy framework sets out a vision, key goals and a number of actions that form the basis of achieving targets for sustainable travel. Whilst the framework is not project specific, the DART Underground could be seen as making a significant contribution to the national target of reducing work-related car commuting from 65% to 45% by 2020.

2.6 Statement of Strategy 2008 – 2010

This Department of Transport strategy contains a key performance indicator that is relevant to DART Underground:

"Timely implementation within budget of the rail and bus improvement programme provided for in Transport 21" (SoS, page 35)

In broader terms the underground would support commitments stated in the document: *(SoS, page 15)*

- "*a considerable shift to public transport, cycling and walking;*
- *A significant reduction in congestion;*
- *A reduction in transport emissions;*
- *The enhancement of Ireland's competitiveness; and*
- *a transformation in public awareness of necessary changes."*

2.7 Regional Planning Guidelines for GDA (2010 - 2022)

These guidelines set out a 12 year strategic policy for the region, providing a regional context to the National Spatial Strategy. The guidelines note that congestion and poor transport networks are considered internationally as one of Dublin and the wider region's main competitive weaknesses. The guidelines therefore regard the delivery of Transport 21 projects as essential for the sustainable economic growth of the region.

2.8 DTO – Platform for Change (2001)

This integrated transport strategy produced by the former Dublin Transportation Office (now NTA) outlined an extensive number of transport projects, a number of which have been implemented. DART Underground is specifically mentioned as:

"transforming the suburban rail system from one of severe constraints in terms of capacity and accessibility to a system that has a well balanced high capacity, that is operationally very efficient and that penetrates all the major areas of demand in the city centre." (PfC, page 55)

Furthermore significant other elements of the strategy cannot be achieved without DART Underground.

3 APPLICANT'S TRANSPORT ASSESSMENT METHODOLOGY

3.1 Introduction

The applicant has developed a transport assessment methodology in conjunction with Dublin City Council (DCC) that uses appraisal techniques commensurate with the overall scale of issue being analysed. This results in the use of a transport model for understanding strategic transport effects brought about by scheme operation, whilst site specific assessments of routes for construction traffic in the vicinity of underground station sites have been undertaken effectively without needing to use network-wide modelling.

3.2 Patronage & Transport Network Effects Modelling

The applicant appointed the National Transport Authority Commercial Section (NTACS) in June 2008 to carry out multi-modal transport modelling for DART Underground using the NTA model of the Greater Dublin Area (GDA). Given that the NTA model is the preeminent tool for testing transport and development schemes, the NTA has established this separate commercial section so that any party can test a range of scenarios without reference to the policies and objectives of the NTA.

The NTA model is a strategic multi-model that covers the GDA divided into 648 zones based on the District Electoral Divisions used in the census. It represents the total demand for travel over the three hour morning peak, with the exception of intrazonal trips. Demographic information for each zone is represented by variables including population, employment and education. All national / regional roads and most through routes in the metropolitan area are included, as are all LUAS, bus and rail services and networks. The model simulates capacity restraint on the public transport network to be consistent with the capacity restraint applied to the road network. This is achieved by applying a penalty once seating capacity is exceeded to represent the disincentive to stand in a crowded carriage. Further technical information on the NTA model and its use in testing DART Underground scenarios can be found in EIS Appendix A6.1 V4.

Since their appointment the NTACS has tested many scenarios that have required forecasts for future years 2016, 2020 and 2030. The forecasts used have been updated twice to reflect revised planning / landuse projections that take into account the economic downturn. The updated forecasts used for the environmental assessment are based on a DoT's moderate growth forecast in 2010, which represents the GDA population growth of 25% by 2030 to 2.1million, with the majority of growth occurring outwith the city. Employment levels for 2030 have been projected on the same basis, with the growth being mostly focused on Dublin business areas outwith the city's canal cordon. The levels of growth in population and employment assumed in the EIS are less than those previously used in the scheme development stages that relied specifically on regional planning guidance land use assumptions.

For environmental assessment purposes, NTA model results for a Do-minimum scenario and a Do-something scenario have been compared to highlight transport network changes in rail patronage, highway network distance travelled, time travelled, average road vehicle speeds and travel mode choices. In such reporting the Do-minimum (known as DoMin2) assumes all Transport 21 projects are implemented, including Metro North, with the do-something including the addition of the DART Underground (DoS3). A further Do-something scenario, DoS4, reports results for a case excluding Metro North.

3.3 Pedestrian Level of Service Analysis

In addition to designing lines and station layouts to suit projected service demand, the applicant has appraised the effect of the additional footfall on pedestrian routes adjacent to stations. This has been based on accessibility mapping using ACCESSION™ software to identify 1 kilometre walking catchments around each station. Further to that the NTA model contains forecast employment information that has been used to estimate the volume of future pedestrian trips to and from new stations. This information was used to assess the adequacy of the existing pedestrian network, and consider extra facilities where appropriate. On footpaths the level of service was derived using projected pedestrian flows per metre width and related to US Highway Capacity Manual thresholds, levels A (free circulation) to F (shuffling pedestrian movement). Mitigation was considered appropriate if the level of service was predicted to drop below Level D (defined as restricted and reduced walking speed for most pedestrians).

3.4 Construction Traffic Assessment

For the Metro North scheme, construction of the proposed stations requires significant reductions in traffic lanes in the city centre, notably on key routes such as Parnell Square East and Westmoreland Street. Therefore, as part of the environmental assessment process, the RPA developed traffic models to simulate potential effects of reduced network capacity. In contrast DART Underground has construction sites that are off-road such that there would be no significant displacements of existing traffic. No city wide traffic modelling is therefore necessary. Instead the applicant's assessment of traffic impact during construction focuses on individual sites and access of construction traffic to and from these.

In developing transport mitigation measures that met with the requirements of DCC, it is clear that the applicant's traffic and transportation team worked closely with those developing the construction planning strategy presented in the EIS so that potential impacts have been minimized. This is to be commended, with the resulting scheme construction processes presented being more specified than would normally be the case at environmental assessment stage. This means that the benchmark is established, so that a future contractor would need to ensure construction-related environmental effects are no worse that those reported in the EIS.

Specifically, in terms of tunnel and station spoil removal the EIS considers the impacts of removal by both rail and road. This allows flexibility in terms of options available for the future, for example in relation to re-use and disposal sites that would be identified based on their requisite permissions to accept spoil material. The construction traffic assessment presents a 'worst case scenario' for the transport network by assuming 100% of spoil removal is by road haulage. This conservative approach means that road network can be checked out in relation to operational limits. Such checks have been undertaken at a local level to the point where designated construction routes join with a national primary road. Beyond this the road network is assumed to be 'fit-for-purpose' in absorbing the quantum of additional traffic generated. For disposal of spoil by rail, the EIS assesses activity at specific railheads (ie that are identified at the eastern and western portal sites), beyond which the rail network is assumed to be capable of carrying the additional train movements.

The construction traffic impact assessment undertaken involved the following tasks:

- Traffic surveys and data collection
- Construction traffic estimation based on projected maximum levels of activity and their duration;
- Road capacity assessment using local junction modelling to establish any capacity issues and develop mitigation measures where appropriate;
- Access analysis to confirm suitability of routes including swept path analyses;
- Impact assessment on bus services resulting from changes to bus stop locations and loss of bus lanes;
- Impacts to pedestrians and cyclists as a consequence of footway width reduction by estimating the change to level of service (see below);
- Other areas addressed included impacts on on-street car parking, loading and unloading facilities and consequent proposals for temporary relocation.

The applicant undertook junction capacity assessments where the increase in construction traffic is anticipated to be more than 5% of the background traffic levels. This threshold accords with current guidance as applied by DCC's Roads and Traffic Department. In such cases a local area road network junction model was prepared and used to test any proposed traffic management measures. Particular measures were brought forward where the effect of construction traffic at any link or junction approach was predicted to exceed its practical capacity. In these assessments the standard definition of practical capacity was adopted, this being a volume / capacity ratio of 0.85.

3.5 Construction Stage Scheme Traffic Management Plan (STMP)

The approach to traffic assessment of construction impacts and associated mitigation allows for more detailed traffic management planning to be undertaken by an appointed contractor in the future. Further measures identified then would be over and above those described in the EIS, which have been recognized by DCC as representing minimum requirements. A Scheme Traffic Management Plan (STMP) would be developed by the PPPCo contractor in consultation and agreement with the Council, as roads authority. It is recognized, in a similar way to the Metro North STMP, that the plan would be a "live" document, subject to change, not least to reflect specific circumstances at the time of construction.

The "Agreed Position" document submitted by DCC to the oral hearing confirmed a common understanding of the above points. It also set out that on receipt of the STMP, the Roads Authority would confirm its acceptance, or alternatively confirm what additional measures would be required to make acceptable, within 21 days. In this regard it was clarified at the hearing that the formal STMP submission would be made following extensive liaison between parties to firm up the details of the plan and the consent process should therefore be straightforward.

3.6 Adequacy of Assessment Methodology

In terms of forecasting assumptions used in the DART Underground transport modelling, projections continue to change since the assessments undertaken and reported in the EIS. The NTA recently carried out a consultation exercise on their draft

Transport Strategy for the Greater Dublin Area (GDA). It is noted that the modelling to support the strategy was undertaken on the basis of newer GDA population projections to 2030 that are around 10% higher than those used for the DART assessments. This would suggest actual demand for DART Underground could be slightly higher and the benefits to the rest of the transport system being, if anything, an underestimate. In considering the DART Underground operational assessments presented it is therefore necessary to consider some latitude in the results, recognizing that all forecasting is subject to uncertainty and that the best available assumptions had been used at the time of assessment.

In a similar way the assumptions about delivery of all Transport 21 projects need to be borne in mind in considering reported impacts and effects of the DART Underground. Specifically, with business cases for all major public transport infrastructure projects currently being reviewed by Government then the operational transport effects for scenarios with and without Metro North and LUAS BXD should be considered. Chapter 4 focuses on effects associated with adding Dart Underground to the Transport 21 network, whilst also highlighting any particular environmental issues for the scenario where DART Underground was implemented and other major projects were not taken forward.

The modelling and appraisal techniques applied by the applicant is assessing the environmental consequences of DART Underground are considered to be fit-for-purpose. Indeed the extent of interaction between design and appraisal teams is to be applauded – this has resulted into a well specified plan for construction that allows detailed scrutiny by those potentially affected. It is also noted that the applicant's traffic witness presented detailed estimates of construction traffic, etc with a high degree of clarity to the benefit of all parties at the oral hearing.

4 TRANSPORT ASSESSMENT - OPERATIONAL STAGE

The DART Underground operational stage impacts and effects have been assessed in the EIS at both strategic (transport network) and local (station and environs) levels. These are described in this chapter, as are traffic / transport specific design issues raised in submissions to the railway order and at oral hearing.

4.1 Service Demand Forecasts

All services are proposed using 8-car DART electric trains with a seating capacity of 360 and a crush capacity (ie standing and seating) of between 1,400 and 1,600 passengers. Given there would be 8 trains per hour, this equates to a capacity per direction of approximately 12,000 passengers (by comparison, Metro North is planned to have an initial operating capacity of 10,000). The NTA model has been used to derive passenger flows for the peak commuting period of 8:00am to 9:00am. For the assessment year 2030 the maximum predicted hourly patronage is 9,100 westbound and 8,200 eastbound both of which occur immediately in advance of St Stephen's Green station. This modelling confirms the system is being designed at an appropriate capacity. Outwith the peak commuting periods there is predicted to be a considerable drop off in demand, for example in the hour between 9:00am and 10:00am the demand is predicted to be around 43% of the peak hour level.

NTA model has been used to derive approximate levels of boardings and alightings at the various proposed stations, as shown in Table 4.1. The table also indicates the change in usage that would occur should Metro North not be constructed.

Station	Boardings	Alightings	Total	Change if no Metro North
Docklands	2,800	7,200	10,000	+ 4%
Pearse	2,900	7,400	10,300	+4%
St Stephen's Green	4,800	12,400	17,200	-23%
Christchurch	1,500	2,700	4,200	+7%
Heuston	4,000	1,900	5,900	-5%
Inchicore	800	2,000	2,800	+7%

Table 4.1 Forecast Station Patronage 2030 (8:00am to 9:00am)

The busiest station is St Stephen's Green, in both the with and without Metro North scenarios. The above predictions relate to the new station at Pearse. The existing Pearse station would have 3,300 boardings and 5,300 alightings associated with Maynooth - Greystones DART services.

4.2 Strategic Impacts & Benefits

The applicant has reported the strategic effects of the DART Underground based on GDA-wide outputs from the NTA model. The main findings for the assessment year 2030 are:

- Rail network patronage rises by 20% during the 3 hour morning peak to over 250,000 passengers.
- Highway network distance travelled decreases by 1.8% (and by a significantly higher amount if there is no Metro North of 7.7%).
- Congestion relief for all modes of travel is confirmed by results indicating overall average journey time savings of 2.4% (and 8.1% for the no Metro North scenario). On the highway network corresponding vehicle speeds improve by similar proportions.
- In terms of mode choice the Table 4.2 below indicates a small but significant shift towards public transport.

Scenario with Metro North			
	Do Minimum	**With DART Underground**	**Change**
Highway	58%	57%	-1%
Public transport	42%	43%	+1%
Scenario with no Metro North			
	Do Minimum	**With DART Underground**	**Change**
Highway	60%	58%	-2%
Public transport	40%	42%	+2%

Table 4.2 Change in Mode Choice

These results verify that DART Underground would significantly transform how people travel within the Greater Dublin Area to the benefit of users of both public and private transport networks. The applicant has stated in a number of documents that DART Underground will "triple the GDA rail capacity". I did seek clarification on the basis of statement – it was acknowledged that this came about by comparing projected demand in 2030 from the NTA model with actual usage in 2006. The "tripling" therefore also includes general growth in land use / travel and assumed infrastructural changes, including other projects in the DART programme. In isolation the applicant confirmed that the Underground brings about a 20% increase in DART and suburban rail demand. I also sought clarification on the effect the Underground would have on other public transport services. The applicant produced NTA model outputs that showed 8% reduction in bus service patronage and 9% reduction in usage of LUAS services. Such effects would be particularly evident in areas where there would be service overlap, for

example between Heuston and Connolly stations. As observers, neither Dublin Bus nor the RPA raised any concerns in this regard and both supported the DART Underground Railway Order Application in principle.

4.3 General Operational Issue – Platform / Train Interface

Concern was raised by a number of observers that the platform to train gap at DART Underground stations would be such that the deployment of manual ramps for wheelchair users would be required in all cases. In the railway order design the applicant has committed to achieving a maximum stepping distance of 75mm horizontally and 50mm vertically at DART Underground stations. The applicant confirmed that whilst deployment of manual ramps may be necessary for some wheelchair users (assumed to be around 20%), this frequency would be significantly less than at existing DART stations where stepping distances are considerably greater. The applicant also confirmed that, given the use of DART "heavy rail" trains (rather that the light rail vehicles that are associated with LUAS), the stepping distance specified is the practical minimum and would be compliant with current EU "Technical Specification on Interoperability – Persons with Reduced Mobility".

Based on the evidence presented, and given the Underground would be an extension to the existing DART heavy rail system, I do not consider there is a practical platform design layout that would achieve totally unassisted access. Further the applicant has stated that their plan is that future new DART trains would be fitted with integrated ramps with the aim of achieving fully unassisted access at all stations in the future.

4.4 Local Issues - Operational Control Centre Area

The proposed vertical alignment for the new railway in the East Wall area has resulted in the need to realign West Road (West) to pass beneath the both the new and existing rail lines at a new bridge location. It is also proposed to locate the operational control centre in lands adjacent to the re-aligned road. These design decisions were raised as concerns by observers in East Wall and examined in detail during the course of the oral hearing. From the traffic operational perspective I make the following comments on the design layout.

- Although subject the change during the course of the oral hearing, the ultimate position between the applicant and DCC was that the new bridge should have a clear span of 10.5 metres. This is to accommodate the realigned road with a 6.5 metre carriageway and two 2.0 metre wide footpaths. However the railway order drawings show that one of the footpaths would be laid out as a 3.3 metre wide cycleway so as to become part of project being considered by DCC, the Sutton to Sandyford Cycleway. It did however emerge that this project would not be progressed in the immediate future, and that different routes are to be investigated in this part of the city. My view is that Ossory Road is an important link for sustainable travel between East Wall and the city centre, including public transport interchanges such as Connolly Station. Cycle facilities such as originally proposed are therefore of general benefit to local users, as well as having the potential to be used for longer distance routes. I therefore suggest the new bridge as dimensioned in the railway order drawings is appropriate (with overall footpath/carriageway/cycleway width of 10.6 metres), so that it does not preclude the incorporation of a cycle facility on this road in the future.

- In terms of traffic routings in the East Wall area I do not foresee any changes as a consequence of the bridge re-location. The design layout has been checked by the applicant and the new junction is capable of accommodating the swept paths of all vehicles types turning, including articulated vehicles. Any larger vehicles routing to and from Church Road are likely to continue to use Moy Elta Road since it is wider than Strangford Road East.

4.5 Local Issues - Maintenance Facility Area

The proposed Maintenance Facility would be located off Abercorn Road within the existing CIE North Wall Yard and accessed via the existing gated entrance. There would be 16 car parking spaces and 15 cycle parking spaces available. The facility would operate 24 hours a day for staff working on a three shift basis. Given that there would be some increased usage of the gated entrance it is proposed to remove around four on-street parking spaces on Abercorn Road. As this would significantly improve visibility for vehicles leaving the facility this is deemed appropriate in the interests of road safety. The Railway Order Application also shows traffic calming proposals for East Church Street. However it is clear from submissions made at the oral hearing these proposals would be unlikely to gain full public acceptance in the area. The applicant confirmed the reason for the traffic calming was to deter access to and from the Maintenance Facility via this route. However it is considered that routing via Sheriff Street Upper could be effectively achieved by appropriate signage (*eg* "No Left Turn" signs at exit) together with enforcement at the manned gate. I therefore suggest the traffic calming proposals are removed from the railway order drawings.

4.6 Local Issues – Docklands Station

It is proposed to locate the Docklands Station immediately to the south of Spencer Dock LUAS stop with dual access points at Mayor Street and also through the LMS building from North Wall Quay. Such a location means there is good walk-in access from all the Docklands development area to the north of the river and also a significant part to the south, which could be gained via Samuel Beckett Bridge. A substantial part (around 75%) of the East Wall community also lies within a 1 kilometre walk of the station entrance, albeit the routing is not on the natural "desire line". This is a consequence of the existing available crossings of railway lands in the area. Whilst East Wall observers to the Railway Order Application made requests that a footbridge at Blythe Avenue be provided to allow greater accessibility to Docklands Station, it is considered that such provision is not an essential "mitigation" to overcome a particular impact. The submitted design does not preclude the provision of a pedestrian facility as a separate project in the future, possibly as part of the initiative to create a linear park along the edge of the Royal Canal. Such a concept was introduced in the East Wall Area Action Plan in 2004. Whilst the provision of such a facility would lead to better accessibility between East Wall and the IFSC area generally, it would not shorten the distance to the proposed underground station at Docklands for East Wall residents. This is demonstrated in Figure 4.1 below.

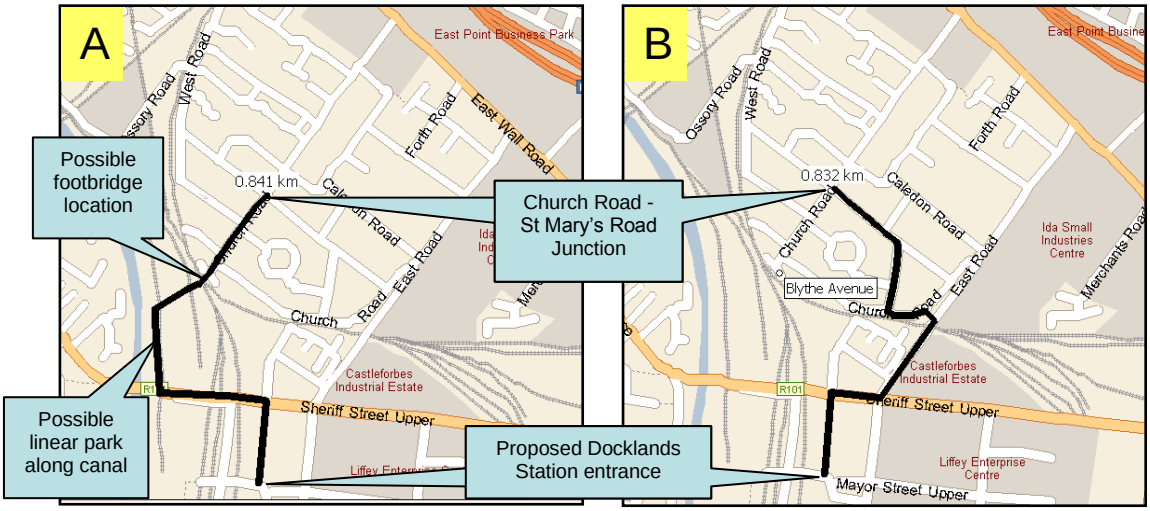

Figure 4.1 Pedestrian Routes between proposed Docklands Station entrance and Church Street - St Mary's Road junction in centre of East Wall community

A : via possible future linear park and footbridge at Blyth Avenue - approx 0.8 km

B : via existing East Road bridge - approx 0.8 km

I therefore conclude that a footbridge should not be considered as a means of mitigating or improving access between the proposed Docklands Station and East Wall.

Given the increased pedestrian activity along North Wall Quay, the applicant is proposing to widen the footpath to 5 metres width and provide raised pedestrian crossings at local road junctions. The applicant's predictions also indicate a substantial increase in pedestrian flows along Mayor Street to and from the East, mainly a consequence of complete build out of that element of Docklands development by the assessment year 2030. The existing north and south footpaths in Mayor Street are approximately 2 and 3 metres wide respectively. Presumably the south footpath would be widened as part of the overall development of the area in the future. Although no footpath widenings are proposed in the Railway Order Application, this route should be monitored after opening of DART Underground and throughout the operational stage to ensure pedestrian facilities are commensurate with actual level of usage in terms of road safety, in particular at the crossing facilities at the New Wapping Street junction.

Also subject to ongoing monitoring of demand is the provision of cycle parking, which has been agreed with DCC to be 40 spaces in the opening year. In general, the applicant has stated a commitment to regular operational reviews in consultation with DCC at all stations and facilities. Such reviews would identify any pedestrian, cycling and parking issues to be addressed.

4.7 Local Issues – Pearse Station

The entrance to the proposed station at Pearse will be located on the corner of Boyne Street and Sandwith Street. This site has been chosen by the applicant following a series of iterations during the scheme development stages. The main operational issue is that it is some 200 metres walk distance from platforms in the existing station that will

be re-designated for Maynooth – Greystones DART services. At oral hearing local observers contended that another site (at Cumberland House) would be more proximate and therefore more efficient to those interchanging between DART services. Whilst the applicant produced engineering and environmental reasons why the alternative site was not feasible, in transport interchange terms there would still be approximately 100 to 150 metres walk distance required between DART services. Overall interchanging between services that run to an 8 minute frequency could mean a walk and wait combined time of between 4 and 11 minutes. My conclusion is that saving approximately 50 to 100 metres walk distance would be unlikely to significantly alter the user's perception of interchange time and therefore there is no appreciable advantage in siting the station at Cumberland House.

At the front of the proposed station it is proposed to construct a "raised table" at the Sandwith Street / Boyne Street junction and provide traffic signals in order to accommodate significant levels of pedestrian crossing activity. This is considered an appropriate mitigation, although these features should be subject to monitoring of effectiveness during the operational stage. These works would also include the widening of footpaths in front of the station and the provision of six vehicular drop off/pick up parking bays. Two disabled parking bays would also be provided.

The applicant has also appraised the impact of increased numbers of pedestrians on the adjacent street network that would be used to access areas such as Merrion Square, Trinity College, City Quay and Grand Canal Square. Footpath sections on Pearse Street, Sandwith Street to the south of the new station and Fenian Street are predicted to perform with a Level of Service D during the morning peak period in assessment year 2030. Whilst it is deemed acceptable that no physical mitigation measures are included in the railway order, it is emphasized that these areas should be monitored to ensure road safety issues do not emerge once the underground is operational. It is also noted that, due to the changed pattern of DART services, Westland Row's level of service improves from existing LOS E (where pedestrians have been observed to step onto the road to pass slower walkers) to LOS D in the 2030 scenario.

4.8 Local Issues - St Stephen's Green Station

The proposed new station at St Stephen's Green has two entrances located to the north and west of the park that would be shared with Metro North. The Metro North project would implement the pedestrianisation of this corner of the Green to allow high volumes of passengers to safely move between business and retail areas and public transport loading points. The DART Underground would also introduce extra pedestrian flows into this locality, one of the busiest areas of the city centre. The local assessment contained in the EIS has been presented on the basis of DART Underground, Metro North and LUAS BXD are all fully operational in this area by the assessment year 2030. Therefore, in pedestrian flow terms, this represents a "worst case" scenario. Given there are wide footpaths generally present in the vicinity, the applicant's assessment determined the existing infrastructure could adequately accommodate extra usage. Whilst I broadly agree, I do have some concern relating to the western footpath in Dawson Street. Presently this has high levels of pedestrian traffic accessing both bus stops and shops, some of which place furniture on the footpath which is approximately 2 to 3 metres wide. The predicted extra demand associated with DART Underground would result in a theoretical level of service D, however assuming there will continue to be people both waiting at bus stops and accessing shops in the future there is a reasonable chance some pedestrian congestion could be experienced. This should therefore be a key area for ongoing monitoring.

DART Underground would initially provide 60 extra cycle parking spaces at the station, these being in addition to the 60 provided by the Metro North project. Thereafter the usage would be monitored and, as demand increases, extra spaces would be provided so that by 2030 there would be a total of 150 spaces made available as a consequence of the DART Underground scheme.

There would also be a requirement to remove two on-street parking spaces adjacent to the proposed ventilation / intervention shaft along St Stephen's Green North in order to accommodate emergency vehicle access at the shaft. This loss in spaces, in terms of the overall level of parking in the area, is considered to be insignificant.

4.9 Local Issues – Christchurch Station

The Christchurch DART Underground station would be located underneath the existing amphitheatre with the Dublin City Council civil offices at Wood Quay. This location is at the heart of medieval Dublin giving easy access to attractions such as Christchurch Cathedral, Dublin Castle, Temple Bar, and the Four Courts areas. However levels of pedestrian traffic generated are significantly lower than those predicted for St. Stephen's Green. The applicant's accessibility audit identified several mitigation measures that have been included in the Railway Order:

- relocation of a traffic signal pole at corner of O'Donovan Rosa Bridge and Wood Quay together with some footpath widening;
- provision of a handrail on the steep incline of Winetavern Street to aid the elderly and disabled; and
- raised table traffic calming to provide a pedestrian crossing at the Fishamble Street / Essex Street junction.

Some 20 cycle parking spaces would be provided in the opening year at the new station. The underground station would also have a ventilation / intervention shaft on Cook Street. In order to allow for emergency access six on-street parking bays would be relocated to the opposite side of the street. This side is currently used for coach parking, so that the number of coach spaces would be reduced from nine to seven. This impact is not considered to be significant.

4.10 Local Issues – Heuston Station

The DART Underground Station would be located beneath the existing Heuston Station with escalators and elevators provided in the south-eastern corner of the station concourse. The main transportation impact is an approximate doubling in pedestrian usage of the station and its environs. The applicant's accessibility analysis has taken into account pedestrian desire lines to Phoenix Park and St James's Hospital as well as for planned development at St James's Brewery. The railway order contains three mitigation measures in order to provide an appropriate level of service to pedestrians in the 2030 assessment year:

- re-configuration of taxi rank queuing area to increase footpath width;
- installation of central median pedestrian guard to ensure pedestrians crossing St Johns Road use the existing formal crossing facilities; and

- installation of a new signallised pedestrian crossing on Wolfe Tone Quay at the Frank Sherwin Bridge.

Given the already significant cycle parking facility at the station (320 sheltered spaces) and it's currently observed under-utilisation there are no formal proposals for additional cycle parking in the Railway Order. However given the facility's relatively remote location at the station car park it is proposed to provide new advisory cycle lane markings along the access road, together with improved directional signing.

4.11 Local Issues – Inchicore Station

In terms of the railway order Inchicore Station is a terminal station located within the existing CIE rail works site. It has however been planned to allow for a future through line connection to the Kildare Line, as well as considering the opportunity for development in and around the new station, although no formal proposals for this have been published to date. The railway order contains proposals for a new access from Kylemore Way to a drop off / pick up facility at the new station. This facility would have no public parking, with only some taxi staff, disabled and cycle parking being provided. The access would also cater for bus, cycle and pedestrian access. Cycle and pedestrian access would also be available via a designated network through CIE land that would permit access throughout underground operational periods. This network would give connections to residential areas such as the Inchicore Estate and the village beyond, Tyreconnell Park and Ballyfermot.

Access to Ballyfermot would be via the existing railway footbridge known locally as the Kyber Pass that is presently used by CIE staff passing through a security gate. This gate would remain open to the public during DART operation hours but would be locked overnight. Concern was raised by observers that the extra usage of this pedestrian route could lead to an increased level of anti-social behavior. Pedestrian usage is predicted to be 300 pedestrians in the morning peak hour in 2030. The applicant responded that the opposite may occur – improved perception of personal safety due to a higher and more frequent level of usage. My opinion is that, with continued use of CCTV monitoring, the situation is unlikely to be made significantly worse by the provision of the DART station.

A similar concern regarding anti-social behavior was raised by observers with respect to pedestrians routing via the existing roadway at the rear of Abercorn Terrace. In this instance the predicted flow is 600 pedestrians per hour. The existing footpath of this public road, subject to some maintenance and tidy up, is adequate to accommodate such a level of usage. Given there are a number of gates into the rear gardens of Abercorn Terrace properties, residents felt there would be security concerns (*eg* risk of burglary). Again the applicant responded suggesting increased usage could lead to less risk of such an event occurring. It is difficult to predict if there is more or less risk at this stage. I therefore recommend that this route should be monitored, particularly in the initial operational stage, so that the need for any specific mitigation (eg CCTV monitoring) can be identified, in conjunction with Dublin City Council.

The construction of a new access road means that the Sherlings Steelworks property would be significantly altered. The main access and circulation effects are:

- new local industrial access road created off Kylemore Way;
- loss of some of Sherling's car parking; and
- loss of existing circulation / turning area in front of Sherling's building.

Sherling Group raised concerns about these matters and the need to re-configure the internal workings and site layout of their premises. Whilst these would be dealt with as part of the land acquisition process beyond the railway order stage the applicant did present details of how the yard could be re-configured to allow for maneuvering of large articulated vehicles. The applicant also confirmed that the new link road, as well as Jamestown Road that serves other industrial units further west, would be taken in charge by the Council following construction. The new access road and its junctions have also been subject to swept path analyses to ensure large vehicles could negotiate these without hitting kerbs. It would also be possible for users of Jamestown Road (such as OZO 24/7 Collect and Rescue) to turn and reverse along Jamestown Road as they do at the moment.

My main issue at Inchicore is that it would be possible that the residential streets in Tyreconnell Park area are used for commuter parking. This possibility would need to be monitored such that if such issues emerged, proposals should be brought forward in conjunction with Dublin City Council and the community to implement a residential permit parking scheme.

Some observers thought the new station should have park and ride facilities. I do however concur with the applicant's response that the station should be described as an "inner suburban railway node" as it is within the city area, and not on the edge, therefore not suited as a location to promote such a form of mode transfer.

Given the anticipated level of drop off (buses, taxis and cars) the applicant has checked out the impact on the critical access junction in the area, at Kylemore Road / Kylemore Way. The level of drop off is predicted to result in a 22% in traffic volume. The junction currently operates well within its capacity and the applicant's assessment has shown that it would continue to do so with the addition of Inchicore Station traffic.

5 TRANSPORT ASSESSMENT - CONSTRUCTION STAGE

5.1 General Construction Strategy

The applicant has set out a number of general concepts that would be applied to all construction sites and that would be incorporated into the Scheme Traffic Management Plan (STMP) prepared by the future contractor. These are summarized as follows:

- Normal HGV movement hours at construction sites would be 7am to 7pm Monday to Friday and 7am to 3pm on Saturday and Sunday. It may however be necessary to work and deliver outwith these hours, such events would be minimized and subject to approval through the STMP process.
- Construction traffic generation has been appraised on a series of worst case scenarios including the assumption that all spoil is removed by road haulage, an additional allowance of 10% for unscheduled deliveries, a general allowance of 20% for light goods vehicle activity (10% at Eastern Portal site) and, specifically at the Eastern Portal, a further factor of 50% to stress test the local network.
- As a general traffic management measure, site traffic would be controlled during the AM and PM peak periods to reduce impacts on the local network. The EIS stipulates that construction traffic flows into and out of sites would be controlled to a lower level than average hourly flows throughout the rest of the day, specifically 80% at the Eastern Portal site and 70% at other sites.
- Construction site workers would be discouraged from using private vehicles as staff parking would not generally be provided at works sites. In order to avoid any overspill parking in adjacent areas the contractor would provide transport to augment public transport services. Details of such provision would be contained in the "Construction Stage Mobility Management Plan" that would form part of the STMP, and thereby be subject to approval by Dublin City Council.
- The contractor would be required to establish a project specific "Traffic Management Committee" made up of stakeholders including CIE/IE, An Garda Siochána, Dublin City Council, National Roads Authority, Railway Procurement Agency, Dublin Bus and any other relevant authorities. The purpose of the Traffic Management Committee would be to review, monitor and co-ordinate traffic management during the construction periods, including providing the information to the general public and commercial / business communities throughout the DART Underground works duration.
- Construction vehicles would be required to use designated primary and national routes for accessing construction sites. The contractor would be granted a permit by Dublin City Council in order to allow construction traffic to enter the city centre area and in particular to make use of the Quays as a primary access route.
- The contractor's STMP would be a comprehensive document based on the commitments contained in the EIS augmented by detailed arrangements agreed in consultation with the roads authority, Dublin City Council. It would therefore take cognisance of specific circumstances immediately in advance of works such as traffic management for other projects. The STMP would also be subject to review by the Independent Environmental and Archaeological Monitor. Furthermore CIE/IE would engage a team of engineers to review data submitted by the contractor, liaise with authorities and interested parties and monitor the implementation (technically and environmentally) of the STMP. Should it be necessary CIE/IE would have the right under the contract to suspend the whole or part of the works.

5.2 Monitoring

The STMP would confirm the level of on-site monitoring to be carried out and reported by the contractor. The applicant's monitoring witness outlined some basic requirements at the oral hearing:

- hourly or daily construction vehicle trip generation recorded at each construction site;
- on-street parking beat surveys to establish usage of available spaces in areas around construction sites notably Inchicore, Christchurch, Pearse, Docklands and West Road (West). These would be undertaken before construction activity commenced and be repeated on a six month basis thereafter;
- annual junction traffic surveys at sensitive junctions in the vicinity of construction sites, with specific junctions agreed with DCC during the STMP preparation stage; and
- annual construction staff travel surveys - the contractor would be required to conduct "travel to work" surveys to monitor staff travel patterns so as to inform the preparation and updating of the Construction Stage Mobility Management Plan.

Results of the above surveys would be reported to the Traffic Management Committee for their consideration. The reports would also be available to all those with an interest, including public and commercial communities.

5.3 Site Materials Transport Removal Options

The applicant has stated that a waste management hierarchy would be applied such the need for removal of spoil from site would be minimized. The waste hierarchy is as follows (listed in order of preference):

- Prevention
- Minimisation
- Re-use
- Recycling
- Energy recovery
- Disposal

The applicant has calculated that of the 1.48million cubic metres of excavated material generated by the project approximately 9% would be re-used on site. There is therefore a large quantum of spoil to move to external locations such as other construction sites, recycling plants or landfill facilities. Over an assumed 3 years this would average 450,000 cubic metres per annum. In order to provide scope for the contractor to manage excavated spoil in such a way as to move it up the waste hierarchy, the EIS addresses spoil removal by rail transport as well as by road haulage. The applicant has also presented several possible sites in the Greater Dublin area that could accept the surplus material, whilst also acknowledging other sites could be proposed by the

contractor. All destination sites would be subject to the appropriate planning and waste permitting /licensing procedures being in place.

For the rail option the excavated material arising at Docklands / Eastern Portal could be removed via a railhead created at the neighbouring East Wall freight yard (the applicant confirmed that there would be insufficient space available for such an activity at the Eastern portal site itself). Excavated material arising at Inchicore could be removed from within the Inchicore Works. Both sites would need to be re-configured to provide rail sidings and loading stations. For the spoil removal by rail scenario it is predicted there would be four trainloads per day at East Wall and two trainloads per day at Inchicore. The applicant has confirmed that it would be feasible to slot spoil trains in between existing passenger and freight services without causing disruption to the rail timetable. Road transportation would continue to be necessary for spoil removal for other station and shaft sites in the city.

For the road haulage alternative the applicant has undertaken comprehensive traffic analyses in relation to the road network surrounding the various sites which are summarized in the following sections. In terms of the strategic road network there is a relatively small increase in overall traffic flow levels. The applicant has carried out an appraisal assuming all road haulage travels to the M50 and beyond. In this the total number of HGV movements on the major routes in the city has been estimated to be:

- 130 hgvs per hour on Port Tunnel / N1 route
- 76 hgvs per hour on N4 route
- 28 hgvs per hour on N7 route

At one or two extra vehicles per minute such increases are unlikely to be noticeable and would not affect the carrying capacity of the strategic road network.

5.4 West Road (West) Realignment & Operational Control Centre

Traffic generation associated with the construction strategy is shown in Table 5.1.

Overall works duration	20 months - West Road Realignment 20 months - Operational Control Centre
Duration of peak activity	15-20 months (for West Road Realignment)
Hourly truck movements during peak activity (two way)	14
Construction staff	20
Car parking provision	none

Table 5.1 Construction Traffic Generation for West Road Realignment and Operational Control Centre

All construction vehicle access to this site would be via East Wall Road leading to Dublin Port Tunnel. No traffic would pass through the East Wall residential area, apart from using the northern section of West Road which has housing on one side. West Road itself would be subject to a traffic signallised shuttle arrangement for 4 months to allow works access to the proposed bridge site. During this period access would be

maintained to all properties and existing on-street parking would be retained. The shuttle working arrangement has been rated by the applicant as being a moderate impact to road users, including buses. However the disruption is not likely to cause any significant queuing at the traffic signals as base traffic flows, and those generated by construction, are relatively low. At the oral hearing the applicant emphasized to observers that access to property, including the Ossory Business Park, would be available throughout all phases of the West Road realignment works. The construction of the OCC would occur following completion of the realignment works with hourly truck movement being around 50% of the peak activity associated with the realignment works.

5.5 Maintenance Facility

Construction access for the proposed maintenance facility would be taken via the Eastern Portal site. There would however be a relatively short initial period of approximately three months during which traffic would access the overall site via the gate on Abercorn Road, that is until the Upper Sheriff Street ramp is constructed. Once the ramp is operational only LGV and staff vehicles would be permitted to use the existing gate.

5.6 Docklands Station & Eastern Portal Sites

Traffic generation associated with the construction strategy is shown in Table 5.2.

Overall works duration	70 months in total: - 68 months for station box - 32 months for Eastern Portal elements
Duration of peak activity	22 - 24 months
Hourly truck movements during peak activity (two way)	86 on Upper Sheriff Street* 20 on North Wall Quay
Construction staff	250
Car parking provision	40 dedicated spaces for staff & visitors

* assuming all tunnel spoil is removed by road

Table 5.2 Construction Traffic Generation for Docklands & Eastern Portal

This, the most major construction site of all, can be divided into three parts: Docklands Station southern box between North Wall Quay and Mayor Street, Docklands Station northern box between Mayor Street and Upper Sheriff Street and the Eastern Portal which lies immediately to the north of Upper Sheriff Street. At oral hearing the applicant's traffic witness explained how access would be taken using the graphic reproduced below as Figure 5.1.

Figure 5.1 – Docklands Site Access (taken from Applicant's Traffic Witness Presentation at Oral Hearing)

Construction access to the northern box would be gained from the Eastern Portal area by passing beneath the existing Upper Sheriff Street bridge. A temporary access ramp would be formed onto Upper Sheriff Street from the Eastern Portal site that would become the access point for both the Eastern Portal and northern box sites. The southern box site would be accessed off North Wall Quay. In addition a back up / emergency access route would be provided going east through railway lands to link with East Wall Road. This would only be used if the Upper Sheriff Street ramp became blocked. All construction traffic would access these points from the east, *ie* via Dublin Port Tunnel or East Link bridge, so there would be no traffic impacts towards the city centre.

The applicant undertook several traffic surveys to establish the base loading on local network and its key junctions. To this was added estimated flows associated with committed development in the area which is likely to happen prior to DART underground construction. It was then possible to predict the resulting "impacts" of construction traffic in the AM and PM peak hours as being:

- on Upper Sheriff Street a 10% increase immediately east of the proposed ramp;
- on Upper Sheriff Street, to the east of New Wapping Street, a 27% increase (since the base flow is considerably less);
- only minor increases in traffic levels on North Wall Quay (up to 2%).

All Upper Sheriff Street junctions, including the ramp access, have been assessed by the applicant and none are predicted to reach their capacity as a consequence of construction traffic. Whilst some queues will continue to form at the New Wapping Street / East Road junction, these should clear within one green cycle. The possibility of construction traffic rat-running via Abercorn Road and East Church Street to avoid such queuing would be negated by stating in Scheme Traffic Management Plan that this would be a prohibited route.

In order to accommodate HGV access at the Upper Sheriff Street entrance it would be necessary to suspend 10 car parking spaces for the duration of the works. This is not anticipated to be significant because of the current low parking space utilisation.

Observers in the area asked the applicant about alternative construction access proposals during the course of the oral hearing. This was mainly to overcome the perceived impacts on residential property such as Packenham House that lies directly opposite the proposed site access. Whilst an access to the south side of Upper Sheriff Street currently seems achievable such land is allocated for development, which is presumed to happen in advance of DART Underground. Also Spencer Dock Development Company tabled an alternative strategy that totally avoids access being taken from North Wall Quay. However the applicant explained it would be impractical to link the northern and southern box sites with a haul route under the live LUAS lines. Given the relatively low impact on North Wall Quay I consider the applicant's access strategy for this overall area to be the most suitable.

Concern was also raised by East Wall residents relating to applicant's decision to drive tunnels from East Wall portal only and not Inchicore as well, as was originally planned. In road network terms this decision does not result in any increased intensity of spoil removal traffic on a day-by-day basis, the main consequence being a lengthening of the tunnel drive period and associated peak construction traffic activity duration by 6 months.

5.7 Pearse Station & Bass Place Ventilation / Intervention Shaft

Traffic generation associated with the construction strategy is shown in Table 5.3.

Overall works duration	65 months
Duration of peak activity	20 months
Hourly truck movements during peak activity (two way)	32
Construction staff	100
Car parking provision	none

Table 5.3 Construction Traffic Generation for Pearse

The proposed works at Pearse would primarily comprise the northern station box and two ventilation / intervention shafts; one located within the main compound at the Sandwith Street / Boyne Street junction and one located at the corner of Bass Place and Fenian Street. A passenger subway is also proposed under Sandwith Street to provide connection between the proposed station and the existing DART station. The most practical way of constructing this subway is to totally close Sandwith Street for a

period of 4 months. This would be undertaken during the summer months (when traffic flows are generally lower) in order to minimise level of disruption. Given that traffic would be diverted via Erne Street the applicant appraised the operation of the Pearse Street traffic signallised junction by including for the re-routed traffic. This identified the need to temporarily ban the right turn from Erne Street Upper to Pearse Street (East) and improve the corner radius on south west corner of the junction. It would also be necessary to temporarily alter lanes in Pearse Street by removing the outbound bus lane to create two general plus one bus lane inbound. It was found that only with these mitigation measures in place would the junction operate with an acceptable level of queuing. These mitigation measures have been discussed and agreed with DCC and Dublin Bus.

The Bass Place works also require the closure of that road for almost the entire duration of the works. Local traffic accessing property in the area would be diverted via Boyne Street. Both these roads are lightly trafficked. The main mitigation measure proposed is the removal of 11 pay and display parking bays in Boyne Street to provide safe paths and maneuvering space for construction vehicles. It is acknowledged that the section of Boyne Street immediately east of Bass Place would experience significantly higher traffic levels due the Bass Place closure of around 100 vehicles per hour during morning and evening peak periods, with only a small element of this being construction traffic. This level of flow is however well within the operating capacity of Boyne Street.

In terms of the local road network, access to the site is physically constrained by the presence of low-height railway bridges over Sandwith Street and Erne Street. The clearance height for Westland Row bridge is higher at 4.93m which is deemed acceptable to construction vehicles and agreed with DCC as being the principal access route to the site. Construction vehicles from the north and east would therefore use Pearse Street, Westland Row and Fenian Street to access the site compounds at Pearse. The applicant has constructed a localised traffic model (using TRANSYT software) to confirm that key junctions in the area continue to operate effectively with the additional construction traffic loading. However there would be the need to remove a total 39 on-street parking in the local area, mainly to allow for the efficient passage of construction vehicles. The applicant's surveys indicate sufficient parking capacity is available locally to absorb the temporary loss of these spaces, as well as offering to bring forward additional parking management measures should the local community wish to do so.

5.8 St Stephen's Green Station

Traffic generation associated with the construction strategy is shown in Table 5.4.

Overall works duration	66 months
Duration of peak activity	27 months
Hourly truck movements during peak activity (two way)	20
Construction staff	75
Car parking provision	none

Table 5.4 Construction Traffic Generation for St Stephen's Green

The construction traffic assessment contained in the EIS focuses on the eastern ventilation shaft site since it is assumed the main station box will be constructed as part of the Metro North project. It also assumes Metro North and DART Underground works would run concurrently with access for construction traffic taken using the same routings. However DART construction traffic would only result in less than 0.5% increase traffic flows in the area, and therefore not be significant. Although St Stephen's Green North would be reduced in width from three lanes to two lanes, an assessment presented in the EIS shows the link would remain within operating capacity.

Construction vehicles would enter the ventilation shaft compound on St Stephen's Green North via a gate opposite the Kildare Street junction and thereafter exit at gate on the northwest corner of the site near Dawson Street. Access and egress would be controlled by flagmen to ensure the safe passage of pedestrians, as well as ensuring buses can continue to access the stop near the proposed exit. Mitigation measures proposed by the applicant are as follows:

- provision of a temporary 2m wide footpath provided to replace existing 5.5m wide footpath adjacent to the site (resulting in a Level of service C);
- relocation of two bus stops from St Stephen's Green North to Dawson Street and St Stephen's Green East, as agreed with Dublin Bus. The applicant has appraised the extra walking distances, which are up to 250m extra, to be a moderate impact to bus users;
- temporary removal of 32 on-street pay and display spaces on St Stephen's Green North and East, an effect not judged to be significant given the amount of parking available in the area;
- the provision of a truck stacking area on St Stephen's Green East.

5.9 Christchurch Station & Cook Street Ventilation / Intervention Shaft

Traffic generation associated with the construction strategy is shown in Table 5.5.

Overall works duration	67 months
Duration of peak activity	16 months
Hourly truck movements during peak activity (two way)	22
Construction staff	100
Car parking provision	none

Table 5.5 Construction Traffic Generation for Christchurch

As well as the main construction site at the civic offices there would be a ventilation / intervention shaft constructed on the edge of Cook Street mainly within the grounds of the Church of the Immaculate Conception. All construction traffic to both sites would route via the Quays arriving via Bridge Street and Cook Street and leave using Winetavern Street. The works on the Cook Street shaft would extend into the

carriageway such that a temporary traffic signal shuttle arrangement would be required. Given that traffic flows on Cook Street would remain low, there are no operational issues anticipated with this traffic management measure. Further temporary traffic management measures identified include:

- relocation of pedestrian crossing on Winetavern Street approximately 5m to south to accommodate proposed construction access adjacent to car park exit;
- provision of a flagman at the construction access to control vehicle entry and exit and ensure the safe passage of pedestrians;
- incorporation of pedestrian crossing stage in Cook Street temporary signals since a section of the northern footpath would be closed;
- suspension of five of the nine tourist coach bays in Cook Street, some of which clash with the temporary traffic management, some to accommodate displaced parking and some to allow for stacking space for construction vehicles.

5.10 Island Street Intervention Shaft

Traffic generation associated with the construction strategy is shown in Table 5.6.

Overall works duration	35 months
Duration of peak activity	4 months
Hourly truck movements during peak activity (two way)	18
Construction staff	40
Car parking provision	none

Table 5.6 Construction Traffic Generation for Island Street

Access to this site would be taken from the Quays, however given that many of the routes in this area are one-way a number of roads such as Oliver Bond Street, Bridge Street, Cook Street and Bridgefoot Street to the south of the site would be used by construction traffic. Access into the site would be via Bridgefoot Street (north) with an exit formed onto Island Street with vehicles turning right onto Bridgefoot Street to access the wider road network. No operational issues are anticipated given the relatively low traffic generation associated with this site. Proposed traffic management measures for the construction stage are as follows:

- suspension of two on-street parking spaces on Island Street at site exit;
- suspension of six on-street parking spaces on Bridgefoot Street to allow for construction vehicle stacking;
- closure of footpaths immediately adjacent to the construction site, with pedestrians directed to cross to use other footpaths.

5.11 Heuston Station

Traffic generation associated with the construction strategy is shown in Table 5.7.

Overall works duration	64 months
Duration of peak activity	20 - 25 months
Hourly truck movements during peak activity (two way)	28
Construction staff	150
Car parking provision	15 dedicated spaces for staff & visitors

Table 5.7 Construction Traffic Generation for Heuston

The construction activity at Heuston would primarily be confined within a linear site running parallel to the St John's Road dual carriageway. An access gate into the site would be created 300m west of the Military Road junction and an extra arm added to this junction to form the site exit. Site vehicle movements at both locations would be controlled by a flagman and the Military Road traffic signals reprogrammed to allow for a green stage for site traffic. This would have no effect on junction capacity as the green time would align with the all-red pedestrian signal stage. The applicant confirmed there would be no conflict between crossing pedestrians and site traffic in this scenario. Other traffic management measures for the construction stage are as follows:

- relocation of pedestrian crossing on St John's Road by approximately 4m to east to provide queuing space for one HGV that would left turn out of the site exit;
- provision of a temporary footpath adjacent to the site hoarding in the western ventilation shaft area;
- Taxi bays would be moved to east to make up for the loss of parking bays at the western ventilation shaft site hoarding.

5.12 Memorial Park Ventilation / Intervention Shaft

Traffic generation associated with the construction strategy is shown in Table 5.8.

Overall works duration	34 months
Duration of peak activity	4 months
Hourly truck movements during peak activity (two way)	18
Construction staff	40
Car parking provision	none

Table 5.8 Construction Traffic Generation for Memorial Park

Construction traffic would access this site via separate left-in / left-out slip roads created on the N4 Con Colbert Road dual carriageway. The majority of traffic would arrive via the M50 and the N4. Exiting traffic would require to turn at the N4/R111 junction at Island Bridge to return to the M50. No operational issues are anticipated at this location.

5.13 Sarsfield Road Strengthening Works

Traffic generation associated with the construction strategy is shown in Table 5.8.

Overall works duration	3 months
Duration of peak activity	3 months
Hourly truck movements during peak activity (two way)	8
Construction staff	50
Car parking provision	none

Table 5.8 Construction Traffic Generation for Sarsfield Road

As part of the overall construction strategy it is proposed to strengthen the two existing retaining walls on Sarsfield Road in advance of the tunnel boring machines passing under this area. The strengthening would be carried out in two stages, each involving reducing the existing carriageway to one lane and implementing shuttle working controlled by traffic signals. With Sarsfield Road being relatively lightly trafficked the main impact of this traffic management arrangement is on bus services 78a and 79. Westbound services would experience a delay of up to 1 minute, with no delay encountered by eastbound services since the signals would be linked to those at the adjacent junction.

5.14 Inchicore Station & Ancillary Works

Traffic generation associated with the construction strategy is shown in Table 5.9.

Overall works duration	55 months
Duration of peak activity	18 - 20 months
Hourly truck movements during peak activity (two way)	42
Construction staff	150
Car parking provision	70 dedicated spaces for staff & visitors

Table 5.9 Construction Traffic Generation for Inchicore

Access routes for this site would be from the south only, via the newly created permanent access road linking with Kylemore Way and thereafter connecting to the N7 and the M50 via Kylemore Road. Access to the shaft works in the Inchicore playing fields would also be provided via this route and not through the Inchicore Estate, apart from using a short section of Inchicore Parade next to the railway works gate. The 7% increase in traffic at the Kylemore Road / Kylemore Way junction would not significantly increase queuing and this junction such that it would remain within capacity. A temporary truck stacking space that could accommodate 10 vehicles is proposed on Kylemore Way. Even though Inchicore is second busiest site in terms of construction traffic movement, there are no significant impacts to pedestrians, cyclists, bus or taxi associated that require mitigation.

6 SUMMARY AND CONCLUSION

6.1 Transport Policy Background

DART Underground is compliant with policies set out in various documents produced by central and local government organizations. The current draft Transport Strategy recently produced by the National Transport Authority called "2030 Vision" demonstrates continued commitment to DART Underground as a key measure representing "a cornerstone of the future transport system for the Greater Dublin Area".

6.2 Applicant's Transport Assessment Methodology

I have considered the modelling and appraisal of transport effects associated with DART Underground construction and operation and conclude that they are appropriate for the reporting of impacts and mitigation at Railway Order stage. The methodologies applied are both comprehensive and robust, albeit that forecasts of future traffic conditions should always allow for a degree of uncertainty, particularly in relation to land use changes, traffic growth and implementation of other transport projects.

6.3 Transport Assessment – Operational Stage

The forecasting work undertaken suggests the system is being designed at an appropriate capacity having the ability to carry 12,000 passengers per hour per direction. In considering the receiving environments adjacent to the six proposed stations, the applicant has identified a range of mitigation measures to allow for safe and efficient access for users. They have also made a commitment to monitor for any problems and to liaise with Dublin City Council in resolving issues that arise. I have identified several areas where problems may occur and that may need to be dealt with in the operational stage of the scheme:

- southern footpath on Mayor Street to east of proposed Docklands Station;
- at the new Pearse Station footpaths on Pearse Street, Sandwith Street and Fenian Street;
- the western footpath in Dawson Street immediately north of St Stephen's Green, particularly if DART Underground, Metro North and LUAS BXD are all implemented; and
- the footpath at the rear of Abercorn Terrace, a key pedestrian route leading to the Inchicore Station

From a transport planning perspective I consider the layouts shown in the railway order drawings are, in general, appropriate. I do however consider that the traffic calming proposed for Abercorn Road should be removed and replaced with an alternative traffic management plan that restricts maintenance facility access being taken through the residential area to the north.

6.4 Transport Assessment – Construction Stage

In terms of the city's road network, construction stage traffic impacts for this major tunneling project are relatively minor, which is mainly a consequence of individual station works sites being located off-road. Most sites are also in close proximity to major traffic routes such as the Port Tunnel, the Quays, the N4 and the N7. The EIS appraises options for spoil removal by rail and road, thereby leaving flexibility for a future contractor to develop specific proposals. In the road –only scenario the quantum of construction traffic generated would not cause any operational / capacity issues. The most significant factor would be the long duration of construction traffic activity, spanning over several years. Peak activity would however be concentrated, for example over 22-24 months at the eastern portal site, the busiest site in relation to construction traffic generation. My consideration is that increased heavy goods vehicle activity would be most evident along lightly trafficked residential streets, such as those around the works site at Pearse.

With regard to details for traffic management during construction the applicant has committed that the future contractor would be required to produce a Scheme Traffic Management Plan that is approved by Dublin City Council, as roads authority. As a starting point the mitigation set out in the EIS represents a minimum standard that would be acceptable. The planned Traffic Management Committee would also provide a mechanism that ensures that the actual works are not of a greater impact than that assessed at the Railway Order stage.

6.5 Conclusion

DART Underground would provide a significant enhancement to Dublin's public transport network and would immediately attract significant additional usage and a reduction in travel by car. The proposed layout is such that no major road network modifications are necessary, with local improvements around new stations mainly being to accommodate increased pedestrian and cycle activity. The overall benefit of DART Underground to the Greater Dublin transport network can be judged to be very positive.

I have reviewed the documentation submitted with the Railway Order application in relation to traffic matters, considered the evidence and observations presented at oral hearing and confirm that the appraisals undertaken by the applicant are both comprehensive and robust. In my view the design layouts and construction proposals demonstrate the applicant's approach to traffic and transportation issues has been appropriate in terms of mitigating any potential effects on the receiving environment.