Transport Infrastructure Ireland
Dublin, Ireland

MetroLink Independent Engineering Expert

Review of ROA documentation

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ABBREVIATIONS AND ACRONYMS

ABP	An Bord Pleanála
ACP	Albert College Park
ACP-IS	Albert College Park-Intervention Shaft
AEW	Advanced Enabling Works
AZ	Assessment Zone
BCS	Building Condition Survey
BS	British Standard
CEMP	Construction Environmental Management Plan
DANP	Dublin Airport North Portal
DART	Dublin Area Rapid Transit
DASP	Dublin Airport South Portal
DIN	Deutsches Institut für Normung
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMI/EMC	Electromagnetic Interference and Electromagnetic Compatibility
EPA	Environmental Protection Agency
EPB	Earth Pressure Balance
EPR	Emerging Preferred Route
ERM	East Regional Model
EU	European Union
FRA	Flood Risk Assessment
GDA	Greater Dublin Area
HGV	Heavy Goods Vehicle
IEE	Independent Engineering Expert
ISO	International Organization for Standardization
JV	Joint Venture
LGV	Light Goods Vehicle
LVT-HA	Low Vibration Track – High Attenuation
MW	Main Works
N&V	Noise and Vibration
NATM	New Austrian Tunnelling Method
NIS	Natura Impact Statement
NTA	National Transport Authority
NTS	Non-Technical Summary
OCC	Operations Control Centre
P&R	Park and Ride
P+R	Park & Ride
PDR	Preliminary Design Route
PPV	Peak Particle Velocity
PR	Preferred Route
RO	Railway Order
ROA	Railway Order Application
RSG	Residential Stakeholder Group
SAC	Special Area of Conservation
SCL	Sprayed Concrete Lining
SCL	Sprayed Concrete Lining
STMP	Scheme Traffic Management Plan

TBM	Tunnel Boring Machine
TCD	Trinity College Dublin
TII	Transport Infrastructure Ireland
TTM	Temporary Traffic Management
VDV	Vibration Dose Value

EXECUTIVE SUMMARY

This report reviews the Railway Order Application (especially the Environmental Impact Assessment Report) for the Dublin MetroLink project. It is the second formal output of a team of Independent Engineering Experts commissioned in September 2021 by TII, on behalf of residents' groups and associations and other non-commercial stakeholders with interests in the effects of the MetroLink scheme. The concept of the Independent Engineering Expert was based on the earlier innovation pioneered on the Old Metro North project in 2008-2011.

It is intended for the IEE to be available to residents as a resource to assist them in their consideration of the Railway Order application for MetroLink, and in participating in the consultation process (including, as appropriate, making written and oral submissions to An Bord Pleanála).

Following a series of in person and online meetings with residents' groups and other interested parties between November 2021 and November 2022 and the publication of the ROA, a draft EIAR review report for comment and discussion was issued on 8th November 2022 (following an earlier report about the Stakeholder Questions to TII, Report of Stakeholder Consultation before ROA – P0027301-1-H3 Rev. 0 September 2022).

Meetings were held during the weeks commencing 14th November 2022 to present the report and allow discussion and feedback. This final report takes account of the comments received from residents.

This final Report is presented in a single volume with two appendices:

- ✓ Following this executive summary, this main report provides an introduction to environmental impact assessment and the design process, together with a review of selected sections of the Environmental Impact Assessment Report and other Railway Order documentation. These take up sections 1 to 4 of this report;
- ✓ Section 5 of this report provides a summary of the particular concerns and questions of residents and other interested parties, cross references to sources of further information and brief comments where appropriate; and
- ✓ Supporting appendices for the main report, covering:
  - A. Stakeholder Meetings Records,
  - B. RFI lists with indications of the relevant parts of the EIAR which address them.

Our report is based on a review of the Environmental Impact Assessment Report (EIAR), backed up by reference to the plans showing details of the proposed railway works. All of these documents (comprising the Railway Order Application for Dublin MetroLink) may be found at https://www.metrolinkro.ie/.

Our review has considered the adequacy and clarity of each of the elements of the EIAR for topics of particular interest and concern to residents. We have also attempted to identify gaps or unanswered questions that arise from the Railway Order Application (especially the EIAR and the drawings describing the scheme).

We have some specific reservations about the breadth of coverage and/or the way in which the results of the environmental assessment have been communicated for some topic areas. However, overall, we are satisfied that no major subject for concern has been overlooked in the EIAR. The EIAR is of limited usefulness to a non-technical readership without some additional guidance, however. Of our report attempts to bridge this gap by presenting the findings of our review in three main sections following the introduction:

Section 2 includes an introduction to the Railway Order Documentation and the EIAR and explains its structure and purpose.

Section 3 includes background sections that are intended to set the scene for residents to help them appreciate the stage that the engineering design of the scheme has reached and how it will be refined between now and the construction phase, as well as providing a non-technical introduction to tunnelling and associated works, such as station and shaft construction.

In Section 4 key environmental impacts relevant to the project are described.

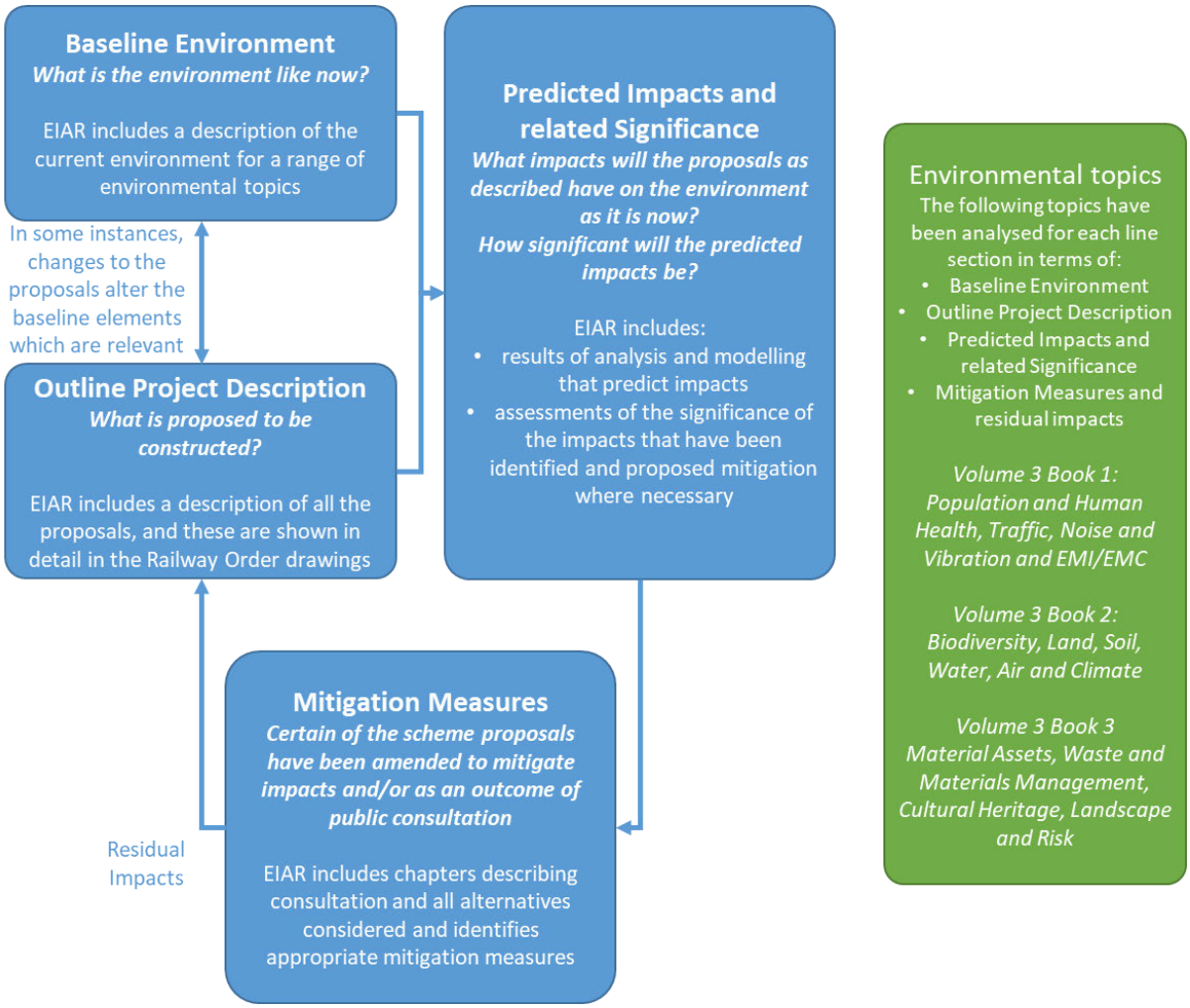
THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

We understand that the Jacobs (Ireland) part of the Jacobs-Idom Design JV has coordinated the work of its environmental experts to undertake an Environmental Impact Assessment. The findings of this assessment are reported in the 5 volume Environmental Impact Assessment Report (EIAR) for the MetroLink scheme.

The objective of the EIAR is to consider the likely impact that the proposed scheme described in the Railway Order application may have on the people who live close to it and their surroundings, and to describe the mitigating measures that can be taken to avoid (and, if not avoid, to reduce and constrain) hazards and disturbances to the local population, its resources and the natural environment. The EIAR is a central part of the Railway Order

documentation and records various conclusions reached by the Jacobs team. The EIAR does not set out in full the basis upon which those conclusions; behind it there are many other investigations and analyses that the Jacobs team used to support its work.

The Environmental Impact Assessment reported in the EIAR was carried out generally in accordance with the standard methodology indicated in the diagram below.

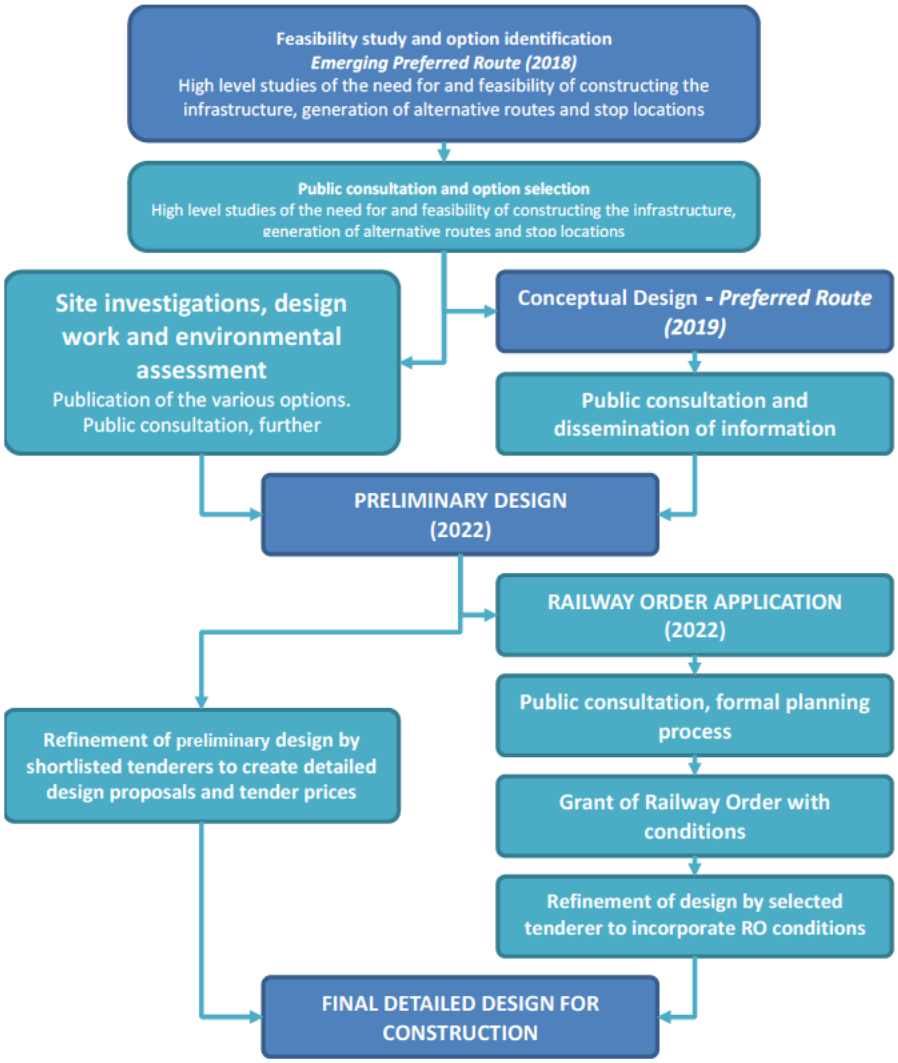


In response to comments on the discussion draft from members of the public regarding the accessibility of the EIAR, given its specialist vocabulary, we have included a section (3.2.1) that aims to assist readers by putting into context some of the specialist vocabulary used in the main parts of the EIAR (baseline studies, impact prediction, impact assessment and mitigation). The way in which the *baseline environment* is categorised by applying *baseline categorisation* to selected areas is described. Functional values for this categorisation (Very High to Very Low) are determined by reference to the *importance* and *sensitivity* of the area and the *receptors* within it as well as the presence of *existing adverse effects*.

The methodology for *impact prediction and assessment* is then described in terms of the way in which *impact magnitude* is predicted. *Impact significance* is determined on the basis of the *expected magnitude* of the impact and the *functional value* of the receptor. Each of the assessment chapters in the EIAR ends with a summary of *residual impacts* of the scheme taking into account *mitigation* (a residual impact is the degree of environmental change that will occur after the proposed mitigation measures have taken effect) and any references to extra measures that may need to be taken after mitigations if the critical effects are still too high to be acceptable.

DESCRIPTION OF PRINCIPAL PROJECT ELEMENTS

This section (3) of the report describes how the project development progresses from the feasibility stage, through the selection of an Emerging Preferred Route, to a Preliminary Design (the present stage) upon which an EIAR is developed, and both are presented to ABP as elements in the Railway Order Application. It provides an explanation of the various parts of the construction process for the project and sets out how each of the infrastructural elements of the project make up the whole, and in broad terms how they are to be delivered.



The process of the design of the Ground Works or Civil Engineering elements of the project is described at section 3.4 and discusses the issues around ground condition and settlement in more detail, along with the principles upon which building damage is assessed.

The Construction of the Civil Works – especially the Tunnels and underground stations are covered in Section 3.5 with relevant examples given of different techniques and machines used (TBMs, Road/rock headers and so forth) and discusses monitoring of the works as a key part of preventing excessive settlement during the tunnelling process and afterwards.

CONSIDERATION OF KEY ENVIRONMENTAL IMPACTS RELEVANT TO THE PROJECT

In accordance with the scope of the tender and our commission, we have concentrated our detailed review of environmental impacts relevant to the project (and deployed relevant expertise) in the following topic areas:

- ✓ Airborne noise from construction works and railway operation (also referred to as “environmental noise”);
- ✓ Vibration and groundborne noise from metro construction and operation;
- ✓ Influence of proposed works on surface water;
- ✓ Influence of proposed works on ground water; and
- ✓ Settlement of ground around tunnels and excavations;
- ✓ Temporary and permanent traffic impacts.

Each of the sections in our report is structured as follows:

i. Introduction to the subject - important concepts and terminology;
ii. Description of the assumptions made in the MetroLink assessments and the methodology used;
iii. Reference to relevant sections of the EIAR;
iv. Summary of findings of the EIAR;
v. Comment from the Independent Engineering Experts on the adequacy and clarity of the EIA (and other Railway Order documentation) in relation to the impact under consideration and identification of gaps and/or un-answered questions.

The summaries that follow focus on the ‘summary of findings of the EIAR' and ‘comment' sections in Section 4 of the report.

Airborne noise and vibration from construction works and railway operation (Section 4.1)

The EIAR identifies a number of locations where the threshold criteria for airborne noise assessment set out1 will be exceeded during the construction and operational phase, based on the assumptions that underlie the assessment, even after mitigation is taken into account. However, the TII's comments in replying to the RFIs provide reassurance that the contractor will be under an obligation to limit emissions of airborne noise so that the thresholds criteria upon which the environmental assessment is based are not exceeded.

It will therefore be for the contractor(s) to incorporate in the final detailed design and programming of the works measures to ensure that the airborne noise criteria will not be breached. In effect, the EIAR draws to the contractor's attention locations where mitigation measures additional to those that have been assumed may be needed to achieve this (e.g. by programming the construction works to avoid the cumulative effects assumed in the EIAR, by selecting different (quieter) construction plant, by adding barriers to reduce construction or operational noise, or by changing track design to reduce operational noise).

The threshold criteria for construction noise during the day and evening and weekends and at nights have been developed as a matrix based on a categorisation of the receptor sensitivity and the time of day or day of week concerned, taking into account the ambient baseline values. We have a slight concern that the Threshold Values of between 65 DBAeq and 75 DBAeq for the daytime periods are relatively high and for extended periods may be quite disturbing in certain locations when compared to National Road construction guidelines in Ireland. Operational noise thresholds have been developed based on a number of other rail projects in Ireland and the UK. General noise generation from station and passenger activities has not however been assessed yet, a point raised by residents' groups during our interactions.

In respect therefore of airborne noise impacts during the construction phase, there are a number of locations where the relevant summary tables indicate that, using the equipment inventories assumed, the assessment criteria defined and the functional values assessed, construction will give rise to residual impacts with magnitude described as ‘high', or ‘very high' on receptors of high or very high functional value (i.e. significant residual airborne noise impacts after mitigation).

There are elements that will have to be further evaluated in detail in the next project steps:

- ✓ Baseline measures should be supplemented with more points around proposed construction sites.
- ✓ Airborne noise produced by construction equipment must be analysed not only punctually at the most affected receptors, but also widely through a noise contour map.

- ✓ Operational noise results and maps should also include station noises including escalators, lifts, announcements PA, local traffic and car parking and of course passengers themselves etc. and not just rail noise
- ✓ A table of noise levels and a noise contour map must also be produced with reference to the post-mitigation results, both in the construction and in the operational phase

At certain locations along the route EIAR airborne noise modelling indicates that even with airborne noise mitigation measures deployed on site (for example, noise barriers, use of noise-controlled machinery and other measures) airborne noise impacts may exceed the trigger values set out in Appendix A of A14.6 Airborne Noise & Groundborne Noise Mitigation Policy.

In such circumstances further mitigation must be required and the operation of the Noise Mitigation Policy will become crucial in the management of the Environmental Impacts of the scheme.

Vibration and groundborne noise from metro construction and operation (Section 4.2)

The whole structure of the acoustic and vibration project has been carried out in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (i.e. the EIA Directive) (European Union 2014a).

Groundborne vibration have been studied following BS, DIN and ISO standards and also EPA Guidance note for noise.

Groundborne vibrations results for blasting activities are expressed in terms of ppv day and night, according to BS standards

Groundborne vibrations results for during Railway operations are expressed in terms of VDV day and night mms-1.75, according to BS standards

There are a number of issues relating to vibration that have to be considered. The EIAR contains references to all of them, although not always explicitly.

- ✓ Vibration during construction of the bored tunnel by the tunnel boring machines is considered in Chapter 14 of nearly all sections, as nearly all sections will have tunnel boring taking place within them.
- ✓ Consideration of vibration during construction of cut and cover tunnels and cross cut tunnels constructed by blasting are considered in Chapter 14 of those sections with such tunnel construction methods.
- ✓ Similarly, vibration during construction of stations is considered in Chapter 14 of those sections with stations.
- ✓ Vibration during construction at the tunnel launch site is in chapter 14 of the section in which the tunnel launch site occurs.
- ✓ Vibration due to surface engineering works is considered in all chapter 13 sections, as surface engineering works occur in all sections.
- ✓ Vibration during operation, whether bored tunnel, cut and cover tunnel or lines on the surface, is covered both in Chapter 13 and 14.
- ✓ Monitoring of vibration, especially blasting, is covered in Chapter 14, as are mitigation strategies that can be or will be employed to minimize the effects of vibration

If prescribed limits on vibration are exceeded (as revealed by monitoring), the principal mitigation measure during the construction phase will relate to controlling drilling and blasting so as to reduce vibration effects. It is noted in the chapters that it may be possible to use road headers as an alternative to blasting if rock conditions are suitable; road headers may give rise to significantly less vibration than blasting depending on the local circumstances.

Operational groundborne vibration can be reduced where prescribed limits on vibration are exceeded using special Low Vibration Track, similar to the one used in Cityringen and Nordhavn Branch in Copenhagen Metro, however we are of the view that under normal circumstances as long as the system is properly designed, constructed and maintained, vibrations from normal train operations should be imperceptible in the great majority of locations.

Influence of proposed works on ground and surface water (Section 4.3)

Two watercourse diversions have been proposed to allow for the construction of the proposed Park and Ride at Lissenhall and Depot at Dardistown. A tributary of the Staffordstown Stream (Lissenhall) and the Turnapin Stream (Dardistown) will be diverted. Qualitative and quantitative analysis completed for the Stage 3 Assessment carried out shows that the diversions have been designed so their banks will not be overtopped by the 0.1% Annual Exceedance Probability (AEP) flood.

Stage 3 qualitative and quantitative analysis completed for the proposed new viaduct over Broadmeadow and Ward Rivers shows that the viaduct will not impact on flood levels for the rivers.

New culverts have been proposed over Sluice River and its tributary. Qualitative and quantitative analysis completed for the Stage 3 Assessment carried out show that the proposed culverts will not impact on flood levels for the Sluice River and its tributary. This is because both culverts have been overdesigned for 0.1% AEP flood.

The proposed Tara Station is at risk of coastal flooding from the River Liffey with the effects of climate change. It is not possible to raise the street level of the Tara Station entrances to allow for the effects of climate change. Tara Station will therefore be designed to be resilient to flooding, including the provision of demountable defences across each entrance to the station.

There are a number of historical watercourses across Dublin which have been culverted or infilled. While the proposed Project crosses some of these (see Diagram 18.3 and Figures 18.3 and 18.4), there will be no interaction with the proposed Project. These watercourses will be located typically at a maximum depth of 3m below the existing surface and are sealed entities. The average tunnel depth for the proposed Project across Dublin is at least 8m to 10m below (although see below) existing ground level to the crown (top) of the tunnel and therefore will not disturb or affect any of these historical watercourses.

The drainage design proposals incorporate effective attenuation to greenfield run-off rates for new hardstanding areas. The proposed attenuation storage volumes are sized to accommodate any potential increase in surface water run-off rates up to the 100-year return period storm event with an allowance for climate change effects. Attenuation for storm water drainage is provided by a combination of attenuation ponds, collection chambers (StormTech system) and an underground attenuation tank at Dardistown Depot.

Risks from extreme weather events during construction, and mitigation measures, are assessed in Chapter 28 (Risk of Major Accidents & Disasters).

The spanning of the rivers avoids the need for instream works at the construction stage which lessens the potential for constructional and operational (permanent piers) temporary construction and permanent operational impacts, including on the down-gradient Malahide Estuary Special Area of Conservation (SAC).

As reported in Chapter 18, any lowering of groundwater levels in areas with highly deformable materials can generate significant settlements which may affect the stability of nearby buildings for example (refer Appendix A5.17 Building Damage Report).

Our view is that in the high watertable environment in Dublin, no attempt should be made to externally lower the water table by general de-watering pumping outside the Station box cavities, as this would be likely to lead to significant settlement risks to the surrounding properties.

Regarding the northern section of the alignment, the open cut solution should be thoroughly analysed for meteorological rainwater collection and drainage, and adequate structural support at the top head of the diaphragm walls. It is our view that a more general cover approach might eliminate much of the water ingress and provide excellent structural support to the D-walls, although it is likely that some penetration in the roof slabs would be necessary for safety reasons (ventilation etc.) between every 750 and 1000 metres. The top slab solution might well present a better use of the surface area for roads, green parks, social areas and even for possible new urbanizations. The costs should also be very similar because the open cut D-walls need the top supported by many, very strong structural supports.

For the Cut and Cover structures it is evident that the cut section with high D-walls offer an evident and significant “barrier effect” (which has been analysed as above) to ground water that must be mitigated. The solution proposed (200 mm drainage pipes) as it has been calculated, normally has the problem of maintenance over longer time periods in international experience, and we recommend that this issue is re-evaluated for the provision of potentially greater diameter drainage pipes, which will be much less prone to blockage with silt and other debris and will be very much easier to maintain.

Settlement of ground around tunnels and excavations (Section 4.4)

The 3 stage Building Damage Assessment process that is underway, and which will eventually incorporating monitoring, should allow the identification of buildings where damage is expected to fall into the ‘Moderate' category or worse and specific protective/mitigation measures can then be designed and implemented. Where possible, it appears that the design objectives will be to restrict building damage to the ‘Slight' category or below. This level of damage would be rectified under the proposed Property Protection Scheme.

The studies of the tunnelling matters are in line with international standards; however, we have not seen a Building Condition Survey (BCS) for each of the 219 buildings considered in Phase1. Normally this is defined for each building its own admissible level of damage Building Risk Assessment (BRA) after a comprehensive Building

Condition Survey (BCS). It is noted that most of the effects calculated by the designers are between the values from negligible to slight, which will need further examination by the Construction Contractor during the detailed design phase.

The Building Risk Assessment (BRA) for each building, will be carried out only during Phase 3 by the contractor. In International Practice this analysis for each building is normally done in the previous phases in order to fix for each building its level admissible of damage.

There are no indications on the quartz presence in the soils and rocks which gives an indication of the wear given to the cutters on front shield of the TBM head. This consideration is very important to fix in advance areas for the maintenance of the cutters worn away by quartz erosion.

The overall approach to monitoring settlement both before during and after the works, and in the longer term where the tunnel passes through clay which may consolidate over a longer period, has not been set out in detail in the EIAR, and will be for TII and the Construction Contractor to develop. It is important for Public Confidence in the scheme that this monitoring is widespread, detailed and transparent and is seen to be independent of the interested parties.

Construction traffic impacts (Section 4.5)

The topic about “Traffic and Transport” is addressed in Chapter 9 of the EIAR which describes and assesses the likely direct and indirect significant effects of the proposed Project on Traffic and Transport, in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (i.e. the EIA Directive) (European Union, 2014a).

The assessment is based on a reasonable ‘worst-case’ scenario with respect to potential impacts arising from the proposed Project as described in Chapters 4 to 6 of this EIAR.

The overall topic of traffic is very thoroughly treated (indeed it is the most voluminous of all of the sections of the EIAR) and the traffic and parking topic is extensively treated for the construction phase in the Appendix A9.5 “Scheme Traffic Management Plan”; the assessment was developed with a standard and detailed methodology for all locations, starting from definition of level of assessment, the indicators related to the specific level, and the evaluation methods for magnitude of impact.

The assessment parameters are related to the several categories: general traffic, HGV, public transport, cyclists, pedestrian & vulnerable users, commercial vehicles / loading, and parking.

The type and number of construction vehicle movements have been calculated and graphically shown, but it would be useful to have this information with monthly detail, perhaps in tabular form or indicating how long certain traffic levels are exceeded, what are the average and maximum values, etc.

In general, remedial measures are proposed in order to mitigate the impacts, including:

- ✓ a comprehensive publicity campaign prior the commencement of the construction phase;
- ✓ the establishment of a Project Construction Traffic Forum;
- ✓ the control of construction vehicles in terms of operating hours, wheel washing, respect of entrances/exits from construction sites, respect of pre-defined spoil removal routes;
- ✓ the application of short term disruption and road closures at night / weekends / during school holidays;
- ✓ the appropriate separation of public transport users, pedestrian and cyclist routes.

The assessment is completed with drawings (specifically for each location) showing the temporary traffic management during Advanced Enabling Works (AEW) and Main Works (MW) phases.

The details were provided for all the construction locations as reported in previous Table 4.2.

In relation to the drawings, they are a very useful tools in order to understand the local impact on traffic, but the following remarks can be passed:

- ✓ For all the locations the duration (indicative start and end) of the proposed phases is not clearly indicated and related to construction phases reported in EIAR Appendix A5.3 “Construction Sequence Report”;
- ✓ In this last document, for the Charlemont Station an alternative for the construction site is proposed (with some modifications in TTM strategies also), but it is not indicated if and why this alternative has or has not been selected.

Clearly the subject of traffic impact is a dynamic one, as driver behaviours adapt to changing circumstances, will need adaptation as the project progresses. The consultation with residents and businesses during this process will be essential to mitigate the emerging traffic management and related risks arising.

Issues of concern to residents (Section 5)

Following extensive Stakeholder interactions between October 2021 and the end of September 2022 and a series of structured Requests for Information (RFIs) the IEE prepared Report of Stakeholder Consultation before ROA – P0027301-1-H3 Rev. 0 September 2022, including the Appendix D "Complete set of replies received from TII".

In some of these cases TII were able to provide a definitive answer to the RFI, but in the majority of cases TII deferred their answers to the EIAR submission. Appendix B reviews whether the EIAR has provided the answers anticipated.

Sections 5.2 of this report discusses the General Issues about the process going forward through the Railway Order Application process and the Role of ABP and the Oral Hearing.

Section 5.3 deals with issues raised by residents at different locations on the proposed route (common concerns) – some of which were addressed during the RFI process and majority of the remainder during the EIAR preparation. Issues include noise and vibration, ground settlement, construction dust and other airborne emissions, construction traffic impacts, flooding risks, general human health risks (of all types), property value and insurance effects, compatibility with planning zoning and policies, control of contractor performance (especially at a site level), interaction between Contractors and Residents and the role of TII in the normal works and case of problems arising.

We would observe that some of the key issues raised by residents throughout our interactions with them have not been addressed wither before or during the EIAR stages despite our questions to TII on these matters and therefore are likely to appear as issues to be resolved further into the ROA Application Assessment by the Board, possibly at the Oral Hearing. These issues include the Choice of the R132 Alignment, the Positioning of Collins Avenue Station and the Intervention Shaft in Albert College Park and the related issue of the choice of Single versus twin bore tunnelling.

There are also however a number of other issues raised during the RFI period before ethe ROA Application was submitted, which remain outstanding from the EIAR, and these are discussed in Appendix B and in Section 5.3 of the main report, below.

The IEE has had extensive communication with the various RSGs on many of these matters during the EIAR review period, and these discussions may be reflected in the submissions that the RSGs may make to An Bord Pleanála and at the proposed Oral Hearing. It is not our intention to repeat those discussions within this document.

APPENDICES

APPENDIX A: Stakeholder meetings

This appendix shows the list of all the formal meetings held in collaboration with stakeholder groups; starting from November 2021, three rounds have been carried out (November 2021, January and October 2022) involving all the groups and some specific meetings have been requested by a single group or by TII in order to present a new group.

APPENDIX B: RFIs with the indication of the EIAR related parts

Appendix B reviews the table of RFIs and related questions and reviews the EIAR to correlate which sections of the EIAR answer the questions posed therein, or notes when such answers may not be complete or indeed present.

In general, TII have provided evidence of the project decisions or issues related to each RFI, excepted for the topic about Linear Park concept along the R132 (RFI #5). For some topics there are no specific reference in the EIAR, but TII have previously provided adequate reply and indicated the other reference documents not included in the ROA documentation.

CONCLUSION

We anticipate that our report (together with any future addenda required to cover further topic areas and our continued assistance) will provide a useful resource for residents in ongoing discussions and negotiations with TII and during the Oral Hearing. In the future, it may be useful as a source of reference during the construction phase.

1 INTRODUCTION

RINA Consulting has been retained by Transport Infrastructure Ireland (TII) as Independent Engineering Expert (IEE) to provide impartial technical advice to Residential Stakeholder Groups who may be affected by the construction and operation of MetroLink.

MetroLink is the preferred public transport project to address the transport need of the Swords / Dublin Airport / City Centre corridor, included in the National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, for the period 2016-2035 (presently under revision but still with MetroLink at its core).

The MetroLink Project is the development of a north-south urban rapid transit service that will run between Swords and Charlemont, linking Dublin Airport, Irish Rail, DART, Dublin Bus and Luas Services, creating fully integrated public transport along the 19km route. A large portion of the route will be underground including the areas where it passes under the city centre area and Dublin Airport. The underground section will terminate at Charlemont, where it will interchange with the Luas Green Line. There will be a total of 15 new stations, 3000 additional park and ride spaces and a journey time of approximately 25 minutes from Swords to the city centre. MetroLink will cater for 20,000 passengers per direction per hour, with some margin for growth, and carry up to 50 million passengers per annum.

RINA Consulting is providing a technical service for engagement with TII's indicated Residential Stakeholder Groups along the MetroLink route and review public Railway Order drawings, Environmental Impact Assessment Report documents and any other relevant published documents provided by the TII with a view to providing objective reports on various aspects of MetroLink to the Residential Stakeholder Groups (RSGs).

RINA's IEE assignment includes the following tasks:

1. Review Published Emerging Preferred Route and Preferred Route documents
2. Review Stakeholder Submission Reports regarding the Emerging Preferred Route and Preferred Route
3. Meet with Stakeholder Groups and establish objectives, protocols for engaging with Stakeholder Groups
4. Prepare a report clarifying any questions, requested information or assist in understanding other issues as may be requested by the Stakeholder Groups following the initial meetings
5. Review all public Railway Order documents provided by the Client, including design route drawings, the Environmental Impact Assessment Report, technical papers, and any other relevant documents
6. Provide report(s) on various aspects of the entire MetroLink design detailed in the documents in the Railway Order Submission on issues and associated issues with the construction and operation of MetroLink
7. Chair open sessions to discuss with relevant groups the findings of such report(s) and hold a Question & Answer session(s), as required
8. Provide an updated report on Stakeholder Group queries.

This document is related to Tasks from 5 to 8.

1.1 THE AUTHORS OF THE REPORT

The team is managed and co-ordinated by RINA Consulting and currently comprises the following experts:

- ✓ **Andrea Raffetti**, Urban Rail Engineer, Project Manager;
- ✓ **Luke Albanese**, Urban Rail Engineer, Deputy Project Manager and Rail Transport Planning Specialist;
- ✓ **Paolo Merlanti**, Geotechnical Engineer, Senior Tunnelling Specialist;
- ✓ **Massimo Saviotti**, Mechanical Engineer, Noise and Vibration Specialist;
- ✓ **Claudio Bellini**, Transportation Engineer, Transport Planning Specialist and Document Manager.

1.2 PURPOSE OF THE REPORT

This report is an output of the IEE team and is intended to be available to residents as a resource to assist them in their consideration of the Railway Order application for MetroLink, and in participating in the consultation process (including, as appropriate, making submissions to An Bord Pleanála).

The Railway Order Application, which was submitted to An Bord Pleanála on 29th September 2022, comprises the following elements:

- ✓ the draft of the proposed Railway Order;
- ✓ the "book of reference" to the plan indicating the identity of the owners and occupiers of the lands described in the plan; and
- ✓ the plans showing details of the proposed railway works;
- ✓ the statement of the effects on the environment (Environmental Impact Assessment Report - EIAR) of the proposed railway works;
- ✓ the appropriate Assessment Screening Report and the Natura Impact Statement;
- ✓ the Planning Report.

Interested parties have until 25th November 2022 to make submissions to An Bord Pleanála and this report aims to provide information and technical background that may assist them in framing these submissions and/or in ongoing discussions with TII.

1.3 SCOPE AND STRUCTURE OF THE REPORT

This report is based on a review of the ROA documents, backed up by reference to the plans showing details of the proposed railway works and by reference to published technical data and reports generated by and for the TTI design and environmental teams. Our review has considered the adequacy and clarity of each of the elements of the EIAR, for topics of particular interest and concern to residents. RINA has also attempted to identify gaps or unanswered questions that arise from it.

This Report is intended to complete the RINA activities, started with a series of interactions with the stakeholder groups, summarised in the previous "**Report of Stakeholder Consultation before ROA**" (Doc. No. P0027301-1-H3 Rev. 0, issued in September 2022) and related Appendices:

- ✓ A: Documents provided by the Stakeholder Groups during the consultation process;
- ✓ B: Database of collated questions;
- ✓ C: Complete set of RFIs submitted to TII;
- ✓ D: Complete set of replies received from TII.

The complete Report P0027301-1-H3 can be provided by RINA for consultation if required.

1.4 STAKEHOLDER CONTEXT

TII is the Statutory Agency tasked with the promotion of the MetroLink project, and in the popular perception there is often a presumption that the needs and concerns of particularly residential stakeholders, are of somewhat secondary importance in the "grand scheme of things". This is especially the case when the State is promoting infrastructure projects with a view to improvements in the life of the Nation. In order to fulfil both the spirit as well as the letter of EU and Irish law, TII has agreed to engage an Independent Engineering Expert during the legislative process preparatory period, to support the residential stakeholders likely to be affected by the MetroLink works and who would not normally be able to engage technical professionals for their needs.

The Scope of Work of the IEE is therefore exclusively related to supporting the Residential Stakeholder Groups with respect to the development of the MetroLink project and helping them to understand both the implications of the proposals for themselves, the proposed approaches to minimisation of disturbance and risk to their interests and to understanding the overall process for the project authorisation through the Railway Order Process.

The present IEE role is modelled on the work of the previous IEE on the Old Metro North project in the period 2007-20010, and we have taken the opportunity to familiarise ourselves with the main report and supporting appendices of the IEE at that time, and also to discuss the IEE role in that context with some of the Stakeholders who had interaction with the IEE on the OMN project, and to try and understand their expectations, within the context of the present Commission.

During the execution of the Commission therefore, and in the review of the existing Published Documentation on the EPR and PR stages, we have concentrated on the issues that have been raised by Stakeholders in their written submissions and in their first Stakeholder engagement meetings with the IEE Team and the many subsequent interactions with the Stakeholders, especially including questions they have raised in more detail during the actual Formal Consultation process after 29th September 2022, when the ROA Documents were lodged with ABP.

It is not the intention of the IEE to question the fundamental project rationale or engineering decisions in and of themselves, as these have been widely agreed and consulted upon through multiples layers of Government and its various Agencies and their adopted policies and subjected to extensive public consultation. All of the queries the IEE team are interested in exploring and, any comments that we make during the Commission are derived, either directly or by direct inference, from the questions and concerns expressed by the Residential Stakeholder Groups and this will extend all the way from the EPR to the RO submission, and they should be understood in that context.

1.5 ASSURANCE APPROACH

RINA as IEE has taken an 'Engineering Assurance' based approach to this Stakeholder Support role. That is to say that we have sought evidence of the data and reasoning behind key decisions and compared the evidence to what would be considered 'best practice' internationally within the EU for the justification of key decisions made on such projects, and especially where these would have a significant impact on Residential Stakeholders. Such decision-making evidence and data would normally form a key 'backbone' of the justifications set out in the Environmental Impact Assessment Report, submitted as part of the Railway Order Application for the 'Preferred Scheme' being promoted.

2 THE RAILWAY ORDER DOCUMENTATION

The Railway Order Application (ROA) was submitted to An Bord Pleanála on 29th September 2022 and previously has been noticed by the following newspapers:

- ✓ Irish Independent (17/09/2022);
- ✓ The Irish Times (17/09/2022);
- ✓ Northside People West (21/09/2022);
- ✓ Northside People East (21/09/2022);
- ✓ Southside People (21/09/2022);
- ✓ Fingal Independent (21/09/2022).

The Railway Order (RO) documentation has been published in the MetroLink RO website (www.MetroLinkro.ie) and include the following sections.

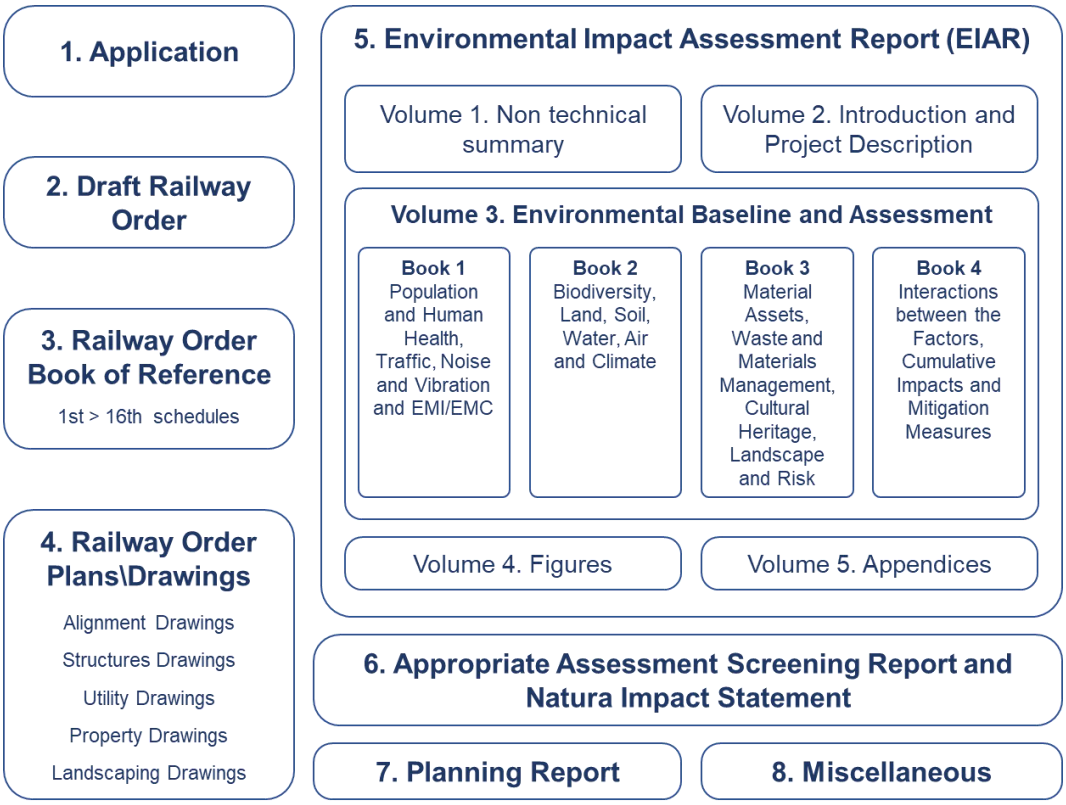


Figure 2.1: Structure of ROA documentation

1. Application

This section includes the letter sent by TII Secretary to the An Bord Pleanála Secretary, in order to submit the application by the National Roads Authority (operating as Transport Infrastructure Ireland) for the Railway (MetroLink–Estuary to Charlemont via Dublin Airport) Order.

The Case Number is ABP-302010-18.

2. Draft Railway Order

This section includes the Draft Railway Order, articulated in the following parts:

- ✓ 1 Preliminary;
- ✓ 2 Railway works, works and related provisions;

- ✓ 3 Acquisition and possession of land and rights;
- ✓ 4 Miscellaneous and general.

The related schedules are listed in the Railway Order Book of Reference.

The Railway Order will be issued in the Final version by the An Bord Pleanála, after completion of approval process, including the Reasoned Conclusion.

It will then be for the Irish Government to give its financial approval for the project to proceed.

3. Railway Order Book of Reference

This section refers to the Book of Reference and Schedules associated to the Railway Order, describing the works and listing owners and occupiers of lands by reference to the relevant plans accompanying the application.

The order book includes 16 schedules:

- ✓ Railway Works and Works authorised by this Order;
- ✓ Land which may be acquired (2 parts);
- ✓ Substratum land which may be acquired (4 parts);
- ✓ Land of which temporary possession may be taken (2 parts);
- ✓ Land over which rights of way and other easements may be acquired;
- ✓ Basements (under a public road) which may in whole or in part be acquired or affected;
- ✓ Structures to which brackets, cables, wires or other fixtures may be attached;
- ✓ Land upon which pole(s) may be erected;
- ✓ Public rights of way which may be extinguished;
- ✓ Private rights which may be extinguished;
- ✓ New roads which may be constructed;
- ✓ Public roads which may be altered;
- ✓ Agreements presented to oral hearing;
- ✓ Conditions imposed by An Bord Pleanála;
- ✓ Explanatory notes;
- ✓ Reasoned Conclusion.

4. Railway Order Plans\Drawings

The following drawings are included in this section:

- ✓ Alignment Drawings (vertical and horizontal)
  - Alignment Details Fingal County Council
  - Alignment Details Dublin City Council
- ✓ Structures Drawings
  - Structures Details MetroLink Stations Fingal County Council
  - Structures Details MetroLink Stations Dublin City Council
  - Structures Details Other Linewide Structures Fingal County Council and Dublin City Council
- ✓ Utility Drawings
  - Utilities Diversions Fingal County Council
  - Utilities Diversions Dublin City Council
  - Utilities Surface Water Fingal County Council
  - Utilities Surface Water Dublin City Council
- ✓ Property Drawings
  - Property Details Fingal County Council
  - Property Details Dublin City Council

- ✓ Landscaping Drawings
  - Landscaping Details Fingal County Council and Dublin City Council

The drawings are referred to:

- ✓ Fingal County, area ML301 to ML303, from Lissenhall to Balbutcher Lane
- ✓ Dublin City, area ML304 to ML307, from Balbutcher Lane to Ranelagh

5. Environmental Impact Assessment Report (EIAR)

The EIAR is the most complex section of RO documentation.

It is structured as follows:

- ✓ Volume 1. Non-technical summary
- ✓ Volume 2. Introduction and Project Description (chapter 1÷8)
- ✓ Volume 3. Environmental Baseline and Assessment
  - Book 1: Population and Human Health, Traffic, Noise and Vibration and EMI/EMC (chapter 9÷14)
  - Book 2: Biodiversity, Land, Soil, Water, Air and Climate (chapter 15÷20)
  - Book 3: Material Assets, Waste and Materials Management, Cultural Heritage, Landscape and Risk (chapter 21÷28)
  - Book 4: Interactions between the Factors, Cumulative Impacts and Mitigation Measures (chapter 29÷31)
- ✓ Volume 4. Figures (195 files)
- ✓ Volume 5. Appendices (142 files)

6. Appropriate Assessment Screening Report and Natura Impact Statement

The Appropriate Assessment (AA) Screening Report provides information on, and assesses the potential for, the proposed Project to impact on the Natura 2000 network.

This Natura Impact Statement (NIS) contains information required for the competent authority in undertaking Appropriate Assessment and has been prepared in accordance with the requirements of Part XAB of the Planning and Development Act 2000 (as amended), Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive), and the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) (the Habitats Regulations).

7. Planning Report

The Planning Report has been prepared to set the planning context for the development and implementation of the MetroLink project. It identifies and considers the existing policy framework for the proposed project in the context of relevant national, regional and local planning strategies, plans and policy documents.

The document includes:

- ✓ Overview description of the works;
- ✓ Planning and development context;
- ✓ Section by section assessment.

This last one considers the following topics (where applicable):

- ✓ Proposed Works;
- ✓ Zoning;
- ✓ Map-Based and Other Objectives;
- ✓ Local Area Plans/Masterplans;
- ✓ Planning History;
- ✓ Project Response.

Plannig Report Appendix includes the following figures:

1. Fingal Development Plan 2017-2023 Zonings 1;
2. Fingal Development Plan 2017-2023 Zonings 2;
3. Dublin Airport Local Area Plan 2020;

4. Estuary West Masterplan 2019;
5. Barrysparks and Crowcastle Masterplan 2019;
6. Fosterstown Masterplan 2019;
7. Dardistown Local Area Plan 2013;
8. Draft Fingal Development Plan 2023-2029 Zonings 1;
9. Draft Fingal Development Plan 2023-2029 Zonings 2;
10. Dublin City Council Development Plan 2016-2022 Zonings 1;
11. Dublin City Council Development Plan 2016-2022 Zonings 2;
12. Draft Dublin City Development Plan 2022-2028 Zonings 1;
13. Draft Dublin City Development Plan 2022-2028 Zonings 2.

8. Miscellaneous

In this section the following files are included:

- ✓ Materials palette, delineating architectural materiality vision in relation to open cut stations, common components, Estuary park & ride, cycle hubs at surface stations and landscaping
- ✓ Pre-Application Consultation File, including all the documentation provided by An Bord Pleanála, TII and Jacobs / IDOM designer JV, above ROA.

9. Other documents shared after date of application

After date of application TII shared the following documents, that do not form and are not required to form part of the application documents:

- ✓ Collins Avenue Station: Environmental Assessment Report of the Options;
- ✓ Preferred Route Public Consultation Feedback Report;
- ✓ Appendix A9.2-M Traffic and Transportation Assessment – St Stephen's Green Station
- ✓ Plannig Report Appendix

3 BACKGROUND SECTIONS

3.1 THE METROLINK PROJECT

As presented in the Volume 1 “Non-Technical Summary” (NTS), MetroLink is a transformative piece of new public transport infrastructure, the first of its kind in Ireland. It will comprise a high-capacity, high-frequency, modern and efficient metro railway, with 16 new stations running from Swords to Charlemont. The alignment will link Dublin Airport, Irish Rail, DART, Dublin Bus and Luas services and create a fully integrated public transport network for the Greater Dublin Area (GDA).

As well as linking major transport hubs, MetroLink will connect key destinations including Ballymun, the Mater Hospital, the Rotunda Hospital, Dublin City University (DCU) and Trinity College Dublin (TCD). Much of the 18.8km route will run underground, an exciting innovation for Irish public transport. When operations commence there will be trains every three minutes during peak periods. This can rise to a service every 90/100 seconds by 2060 if required. The system will be capable of carrying up to 20,000 passengers per hour in each direction. For comparison, current Luas Green Line services can carry circa 9,000 passengers per direction per hour.

When completed passengers will be able travel from Swords to Dublin city centre in approximately 25 minutes and it is estimated that MetroLink will carry up to 53 million passengers annually.

3.2 ENVIRONMENTAL IMPACT ASSESSMENT REPORT

3.2.1 Important terms and concepts used in the EIAR

This section identifies some of the specialist vocabulary and concepts that are used in the main parts of the EIAR (describing baseline studies, impact prediction and impact assessment) to assist readers in navigating through the document and interpreting its findings. There is a helpful glossary of terms included at the end of each of the books and volumes comprising the EIAR; this section aims to assist readers by putting into context some of the terms therein.

Environmental impact assessment is based on a simple source-pathway-receptor model where the “source” is the origin of the impact, the “pathway” is the transmission route of the impact to areas outside the source and the “receptor” is the natural and built environment, most notably people and the structures they occupy and use. In applying this model, the **source** of each impact arising from the scheme is identified (*e.g.* a train moving along the track at surface giving rise to noise and visual impact or a tunnel boring machine working at depth, giving rise to vibration and ground-borne noise). The location and magnitude of the source is also assessed (*e.g.* sound power level of particular equipment, numbers of vehicles on a particular stretch of road, amount of water to be discharged at a particular point *etc*) and the time for which it will be operating in a particular location.

In order for a source of impact to cause a detectable change (or effect) at any other location (*e.g.* noise or vibration generated at point A (the source) to be heard or felt at point B (the receptor)), there must be a **pathway** linking them together (*e.g.* noise is propagated through the air, vibration is propagated through the ground, the pathway for visual impact is a line of sight *etc*).

People, sensitive environments, and structures which may be affected by the impact of ‘sources' of environmental change transmitted *via* ‘pathways' are referred to as **receptors**. Examples of receptors include:

- ✓ People who live close enough to a source of noise or vibration to hear it or feel it;
- ✓ Structures that are within a zone where settlement could occur;
- ✓ Landscapes that might be changed as a result of the structures to be constructed within them;
- ✓ Air quality that may be affected by increased traffic volumes.

For each relevant environmental topic area, ‘receptors' are identified that are linked to ‘sources' *via* ‘pathways'. The magnitude and significance of predicted effects on receptors is assessed taking account of the magnitude of the source, the nature of the pathway and the sensitivity of the particular receptor to the effect under consideration.

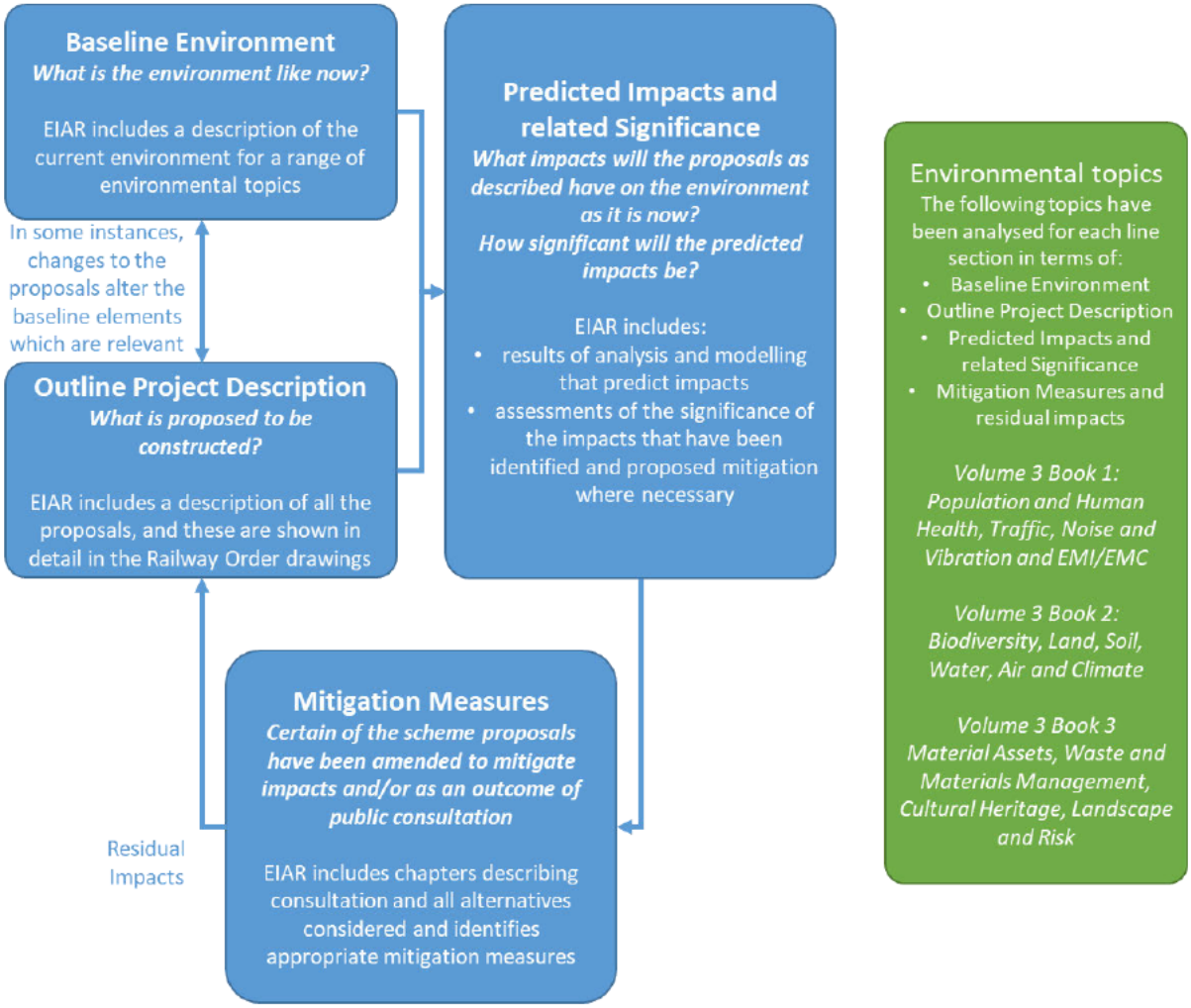


Figure 3.1: Methodology for Environmental Impact Assessment

Baseline Studies, Impact Prediction and Assessment, and Mitigations

Volume 3 of the EIAR comprises 4 books, which total 31 chapters. After a short introduction the chapter commences the technical description of the subject area. Each book covers the entire alignment including all of the 4 study areas AZ1 to AZ4 (furthest north to City Central areas respectively).

Study area	The study area is defined and the important considerations in that definition are set out. For example, in Chapter 13 (which is concerned with airborne noise and vibration) the study area has been defined based on examination of a corridor between 50 and 300 metres either side of the proposed alignment. Within this corridor, sensitive receptors have been identified and some have been selected for baseline monitoring based on their proximity to the alignment (the source of noise). Similarly, in Chapter 20 (soil and geology) a corridor 250 metres wide has been defined as the study area within which to establish the baseline environment for soils and geology.
Baseline data	This is generally provided as a table listing the information required for the baseline study and the sources of that information used by the environmental assessment team. The baseline data records are provided and interpreted visually in the figures and appendices of the EIAR in Volumes 4 and 5.

Baseline categorisation criteria	The baseline environment is categorised by allocating *functional values* to selected areas within the study area; the areas selected are those which are likely to contain receptors of particular environmental effects. A 'functional value' for a particular element or area of the baseline environment is evaluated by reference to the *importance* and *sensitivity* of the area and the receptors within it, as well as the presence of *existing adverse effects*. Importance is considered in relation to national or international statutory designations, best practice and regulations. Sensitivity considers the sensitivity of receptors to the particular environmental matter under consideration. For example, places of worship and educational facilities are considered to be highly sensitive noise receptors, whilst industrial premises are considered to be of low sensitivity. Existing adverse effects (such as existing high levels of noise) are also taken into account. Functional values are defined on a qualitative scale ranging from Very Low (I) to Very High (V). These are presented in each of the baseline chapters in Volume 1 in a table describing the criteria that have been used for categorisation and allocating a functional value in relation to the topic under consideration. For example, in relation to noise, 'locations that are highly sensitive during both day and night' are defined and given a functional value of Very High (V), whilst 'Locations that are only sensitive during the day and where the activities that are carried out can be carried out in the presence of some noise, but not high levels of noise' are given a functional value of Medium (III).
Description and categorisation of the baseline environment	Using the terminology and methodology described above, the baseline environment is described and categorised for each element of the proposed line and its associated structures and activities (generally by reference to the geographical sections of line AZ1, AZ2, AZ3 and AZ4.)

As is indicated in Figure 3.1 above, description of the 'baseline' environment for each relevant environmental topic area, together with a description of the proposals, is an essential pre-requisite for predicting the magnitude and importance of impacts and assessing their significance. In Volume 3 of the EIAR, each of the Chapters 9-27 describes the baseline environment for the range of environmental topics considered by the environmental assessment team.

This is followed by a description of the assessment methodology used and an assessment of the predicted impacts which will result before any mitigating measures are taken.

Impact assessment methodology	The impact assessment methodology is described in terms of the way in which impact *magnitude* is predicted. The assessment of magnitude of impacts takes into account the quality, type and range of impact that will occur when the project is implemented (construction and operational phase), as well as its duration (*i.e.* elapsed time and time of day or night) over which the impact will occur. For many topics, the assessment criteria are entirely descriptive (*e.g.* landscape and visual amenity criteria in tables 27.13 and 27.14, which are expressed in descriptive words such as 'Medium' or 'Significant', whilst others have quantitative (numerical) criteria (*e.g.* noise criteria listed in table 13.41 on Seatown Station are expressed in dB (like 75dB). Whether the criteria are expressed in a descriptive or quantitative manner, they are used to develop an impact magnitude scale from 'very low' to 'very high'. For example, where there will be a 'major change of view', the magnitude of the change in visual amenity is described as 'very significant and negative'. Where actual noise predicted at a receptor exceeds the relevant noise assessment criterion by between 1dB and 5db, the magnitude rating is given as 'moderate to significant' in table 13.41.
Impact assessment	Impact *significance* is determined on the basis of the expected *magnitude* of the impact and the *functional value* (see above) of the receptor. Significance is expressed slightly differently in different chapters but is generally expressed according to a scale: 'Not significant', 'Low significance', 'Medium significance' and 'High significance'. Impacts are assessed separately for the construction phase of the project and for the operation of the metro when complete.

Impact mitigation	Mitigation measures are described and there is a section (and usually a summary table) at the end of each chapter summarising the *residual impacts taking into account mitigation*. A residual impact is the degree of environmental change that will occur after the proposed mitigation measures have taken effect.

Finally, an approach to mitigating (reducing) the effects to within specified limits and for specified periods is discussed and an assessment of the residual impacts after assessment is made in each chapter, along with a discussion of whether any further actions may be necessary in certain locations and circumstances (such as temporary relocation for residents for example).

Within this basic structure, each chapter varies significantly in the way it is laid out and the background information that is provided (in Volume 3). This reflects the wide variation in topics considered, the fact that the investigation and analysis behind each chapter was undertaken by different specialist teams, and the way that each particular topic is assessed.

3.2.2 EIAR Legal Requirements and Structure

TII is required to submit the Environmental Impact Assessment Report (EIAR) to An Bord Pleanála to inform the Environmental Impact Assessment (EIA) of the proposed Project. This EIAR presents an evaluation of the likely significant environmental impacts and applicable mitigation and monitoring measures associated with the construction and operation of MetroLink. This EIAR has been completed in order to comply with and exceed the requirements of all relevant legislation and guidance.

The EIA process is undertaken by An Bord Pleanála and this EIAR has been prepared to allow An Bord Pleanála to undertake the EIA for MetroLink. It takes into account information compiled through desk-based assessment, field surveys and consultation with the public, relevant stakeholders and certain bodies. The main objectives of the EIAR are to:

- ✓ Describe the baseline (existing) conditions before any work on MetroLink has commenced and provide a description of the changes to the baseline conditions in the absence of MetroLink (Do Nothing scenario);
- ✓ Describe MetroLink, including the construction works required to build and operate MetroLink;
- ✓ Provide a description of reasonable alternatives studied in the development of MetroLink and the main reasons for choosing MetroLink;
- ✓ Describe the assessment methodologies used to assess the predicted environmental impacts of MetroLink;
- ✓ Describe environmental impacts and any likely significant effects which may arise during the construction and operation of MetroLink; and
- ✓ Propose mitigation measures to reduce or avoid any likely significant effects which may arise during the construction and operation of MetroLink.

In addition to the NTS, the EIAR includes the following volumes and books:

- ✓ 2. Introduction and Project Description
  - Ch. 1 Introduction
  - Ch. 2 Methodology used in Preparation of the EIAR
  - Ch. 3 Background to the MetroLink Project
  - Ch. 4 Description of the MetroLink Project
  - Ch. 5 MetroLink Construction Phase
  - Ch. 6 MetroLink Operations and Maintenance
  - Ch. 7 Consideration of Alternatives
  - Ch. 8 Consultation
- ✓ 3. Environmental Baseline and Assessment
  - Book 1 Population and Human Health, Traffic, Noise and Vibration and EMI/EMC
    - Ch. 9 Traffic and Transport
    - Ch. 10 Human Health
    - Ch. 11 Population and Land Use
    - Ch. 12 Electromagnetic Compatibility and Stray Current

  - Ch. 13 Airborne Noise and Vibration
  - Ch. 14 Ground-borne Noise and Vibration
- Book 2 Biodiversity, Land, Soil, Water, Air and Climate
  - Ch. 15 Biodiversity
  - Ch. 16 Air Quality
  - Ch. 17 Climate
  - Ch. 18 Hydrology
  - Ch. 19 Hydrogeology
  - Ch. 20 Soils and Geology
- Book 3 Material Assets, Waste and Materials Management, Cultural Heritage, Landscape and Risk
  - Ch. 21 Land Take
  - Ch. 22 Infrastructure and Utilities
  - Ch. 23 Agronomy
  - Ch. 24 Material & Waste Management
  - Ch. 25 Archaeology and Cultural Heritage
  - Ch. 26 Architectural Heritage
  - Ch. 27 The Landscape
  - Ch. 28 Risk of Major Accidents and Disasters
- Book 4 Interactions between the Factors, Cumulative Impacts and Mitigation Measures
  - Ch. 29 Interactions between the various environmental aspects
  - Ch. 30 Cumulative impacts of interaction between other projects and MetroLink
  - Ch. 31 Summaries of the route wide mitigation and monitoring proposed

The other Volumes include respectively:

- ✓ 4. Graphics and plans supporting the EIAR chapters, illustrating the proposed Project and environmental information;
- ✓ 5. Technical reference information supporting the EIAR chapters, such as calculations and detailed background data (as required).

Figure and appendix reference numbers correspond to the relevant EIAR chapter.

All the aspects included in the EIAR (baseline environment, predicted impacts, mitigation measures, residual impacts and cumulative impacts and impact interrelations) are referred to four Assessment Zones (AZ):

- ✓ AZ1 Northern Section;
- ✓ AZ2 Airport Section;
- ✓ AZ3 Dardistown to Northwood Section;
- ✓ AZ4 Northwood to Charlemont.

defined as reported in the following table.

Table 3.1: Assessment Zones included in the EIAR

Ref.	Geographical Section	Description of Extent of Geographical Section
AZ1	Northern Section	Estuary Station to DANP. It includes the railway crossing on a viaduct over the Broadmeadow and Ward Rivers and associated flood plains. This section will include open, retained cut, and cut and cover sections. Section AZ1 includes the Park and Ride facility at Estuary Station as well as stations at Seatown, Swords Central and Fosterstown.
AZ2	Airport Section	Section AZ2 of the proposed Project includes the ESBN connection and new substations, the DANP, the tunnel underneath Dublin Airport, Dublin Airport Station and DASP and associated intervention and ventilation tunnels.
AZ3	Dardistown to Northwood	Section AZ3 of the proposed Project covers from south of DASP to the Northwood Portal. Section AZ3 includes Dardistown station, the Dardistown Depot, ESBN connection and substations, the M50 Crossing, Northwood station and the TBM launch site at Northwood. This section will include open, retained cut, and cut and cover sections of the alignment.
AZ4	Northwood to Charlemont	Section AZ4 extends from a location south of the Northwood Portal to the tunnel termination located south of Charlemont Station, ten underground stations, and the Albert College Park Intervention shaft.

3.3 OUTLINE DESCRIPTION OF THE PRINCIPAL PROJECT ELEMENTS

The preliminary design for the MetroLink route between Estuary in the north and Charlemont in the south requires various construction approaches and techniques to deliver the scheme (The Works) to completion. Following the acquisition of the land required for the Works, in terms of sequence of construction, the initial activity is to access and take possession of the relevant sites and lands needed to deliver the Works, both permanent land and land needed on a temporary basis either for the purpose of accessing or managing the Works (Traffic Management, Storage etc).

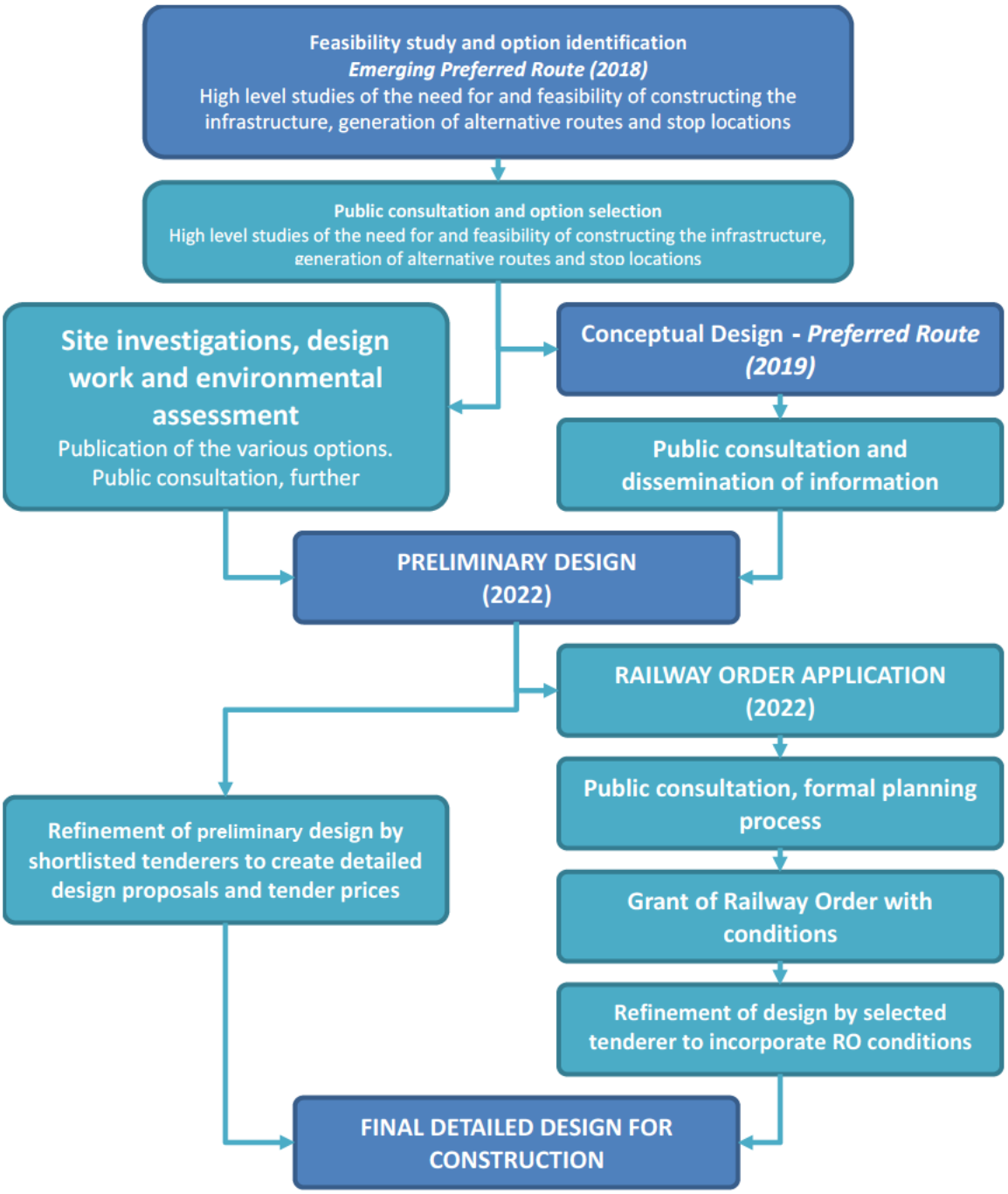


Figure 3.2: Design Development Methodology for MetroLink

In a built up urban area, typical of the vast majority of the purpose MetroLink Route, possession and access to sites for the purpose of delivery the Works will require multiply activities or sequences to allow the Works to be progressed and in the following order:

- ✓ Enabling Works - Preparation.
- ✓ Main Works - Civils.
- ✓ Main Works – Rail Systems.

The details of the Works are further broken down in Table 3.2.

The construction sequences for all the locations, considering any temporary traffic and utilities diversion works that are required at each work sites to be accessed and for the Works to be completed within those sites are reported in the EIAR Appendix A5.3 "Construction Sequence Report".

Table 3.2: Details of the works for generic construction site

Enabling Works - Preparation	Main Works – Civils	Main Works – Rail Systems
✓ Background Surveys and Environmental Baseline Monitoring ✓ Environmental Mitigation Works ✓ Utility Diversions and Protection ✓ Ground Movement Monitoring and Mitigation Works ✓ Traffic Works ✓ Establishment of Construction Site, Office and Compounds ✓ Location Dependant Access Works: • Demolition • Heritage Mitigation • Remediation of Contaminated Sites • Vegetation and Tree • Clearance, including the removal of any Invasive Alien Plant Species	✓ Road construction and traffic ✓ Subsurface Structures ✓ Tunnelling ✓ Stations ✓ Viaducts/Bridges ✓ Intervention Shafts ✓ Blasting ✓ Material Management ✓ Reinstatement of heritage ✓ Compound removal and landscaping	✓ The installation and fit-out out of railway systems ✓ The finalisation works including: • Compound removal and landscaping (Dardistown and Estuary); • Reinstatement of heritage • Systems testing and commissioning.

The details about Ground Level, Rail Level, TBM Crown Level and Depth to Tunnel Crown for all the MetroLink Route Alignment are reported in Table 3.3 (page 32).

3.3.1 Permanent Project Elements

Tunnels (details in EIAR Appendix 5.13 "TBM Tunnels Construction Report")

It is proposed to construct two geographically separate, single-bore tunnels, using a Tunnel Boring Machine (TBM). Each section of tunnel will have an 8.5m inside diameter and will contain both northbound and southbound rail lines within the same tunnel. These tunnels will be located as follows:

- ✓ The Airport Tunnel: running south from Dublin Airport North Portal (DANP) under Dublin Airport and surfacing south of the airport at Dublin Airport South Portal (DASP) and will be approximately 2.3km in length; and
- ✓ The City Tunnel: running for 9.4km from Northwood Portal and terminating underground south of Charlemont Station.

Open Cut and Cut and Cover Sections

The northern section of the alignment, particularly following the R132 corridor in Swords) is characterised by a shallow excavated alignment whereby the alignment runs below the existing ground level. Part of the cut sections are open at the top, with walls and fences along the alignment for safety and security. While other sections are “cut and cover”, whereby the alignment is entirely covered over.

Other Alignment Sections

The section of the alignment between the Northwood Portal of the City Tunnel and the Airport Tunnel Southern Portal is characterised by a significant bridge rising to cross the M50 and a surface running section across the open lands at Dardistown, which also services the Depot and Maintenance Facility.

The Northern tip of the line is characterised by the alignment emerging from cutting at Balheary recreation area and traversing the local small rivers and meadows (see below) on a low viaduct before the surface terminus at Estuary, which will be the site of the large Park and Ride facility servicing the M1 and the R132.

Tunnel Portals (details in EIAR Appendix 5.13 "TBM Tunnels Construction Report")

The openings at the end of the tunnel are referred to as portals. They are concrete and steel structures designed to provide the commencement or termination of a tunnelled section of route and provide a transition to adjacent lengths of the route which may be in retained structures or at the surface.

There are three proposed portals, which are:

- ✓ Dublin Airport North Portal (DANP);
- ✓ Dublin Airport South Portal (DASP); and
- ✓ Northwood Portal.

There will be no portal at the southern end of the proposed Project, as the southern termination and turnback would be underground, with the cutting head and front section of the Tunnel Boring Machine abandoned and walled in at that location.

Stations

There are three types of stations: surface stations, retained cut stations and underground stations:

- ✓ Estuary Station will be built at surface level, known as a ‘surface station’;
- ✓ Seatown, Swords Central, Fosterstown Stations and the proposed Dardistown Station will be in retained cutting, known as ‘retained cut stations’; and
- ✓ Dublin Airport Station and all 10 stations along the City Tunnel will be fully ‘underground stations’, constructed in the normal manner for modern European Metro systems.

Intervention Shaft (details in EIAR Appendix 8.16 “Report on the ACP Tunnel Intervention Shaft”)

An intervention shaft will be required at Albert College Park to provide adequate emergency egress from the City Tunnel and to support tunnel ventilation. Following the European Standard for safety in railway tunnels TSI 1303/2014: Technical Specification for Interoperability relating to ‘safety in railway tunnels’ of the rail system of the European Union, it has been recommended that the maximum spacing between emergency exits is 1,000m.

As the distance between Collins Avenue and Griffith Park is 1,494m, this intervention shaft is proposed to safely support evacuation/emergency service access in the event of an incident. This shaft will also function to provide ventilation to the tunnel. The shaft will require two 23m long connection tunnels extending from the shaft, connecting to the main tunnel.

At other locations, emergency access will be incorporated into the stations and portals, or intervention tunnels will be utilised at locations where there is no available space for a shaft to be constructed and located where required (see below).

Intervention Tunnels

In addition to the two main ‘running’ tunnels, there are three shorter, smaller diameter tunnels. These are the evacuation and ventilation tunnels (known as Intervention Tunnels):

- ✓ Airport Intervention Tunnels: parallel to the Airport Tunnel, there will also be two smaller diameter tunnels; on the west side, an evacuation tunnel running northwards from DASP for about 315m, and on the east side, a ventilation tunnel connected to the main tunnel and extending about 600m from DASP underneath Dublin

Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands.

- ✓ Charlemont Intervention Tunnel: The City Tunnel will extend 360m south of Charlemont Station. A parallel evacuation and ventilation tunnel is required from the end of the City

Tunnel back to Charlemont Station to support emergency evacuation of maintenance staff and ventilation for this section of tunnel.

Park and Ride Facility

The proposed Park and Ride Facility next to Estuary Station will include provision for up to 3,000 parking spaces.

Broadmeadow and Ward River Viaduct

A 260m long viaduct is proposed between Estuary and Seatown Stations, to cross the Broadmeadow and Ward Rivers and their floodplains.

Proposed Grid Connections

Grid connections will be provided via cable routes with the addition of new 110kV substations at DANP and Dardistown. (Approval for the proposed grid connections to be applied for separately but are assessed in the EIAR).

Dardistown Depot

A maintenance depot will be located at Dardistown. It will include:

- ✓ Vehicle stabling;
- ✓ Maintenance workshops and pits;
- ✓ Automatic vehicle wash facilities;
- ✓ A test track;
- ✓ Sanding system for rolling stock;
- ✓ The Operations Control Centre for the proposed Project;
- ✓ A substation;
- ✓ A mast; and
- ✓ Other staff facilities and a carpark.

Operations Control Centre

The main Operations Control Centre (OCC) will be located at Dardistown Depot and a back-up OCC will be provided at Estuary.

M50 Viaduct

A 100m long viaduct to carry the proposed Project across the M50 Motorway between the Dardistown Depot and Northwood Station.

3.3.2 Temporary Project Elements

Construction Compounds

There will be 34 Construction Compounds including 20 main Construction Compounds, 14 Satellite Construction Compounds required during the Construction Phase of the proposed Project. The main Construction Compounds will be located at each of the proposed station locations, the portal locations and the Dardistown Depot Location (also covering the Dardistown Station) with satellite compounds located at other locations along the alignment.

Outside of the Construction Compounds there will be works areas and sites associated with the construction of all elements of the proposed Project, including an easement strip along the surface sections.

Logistics Sites

The main logistics sites will be located at Estuary, near Pinnock Hill east of the R132 Swords Bypass and north of Saint Margaret's Road at the Northwood Compound. (These areas are included within the 14 Satellite Construction Compounds).

Tunnel Boring Machine Launch Site

There will be two main Tunnel Boring Machine (TBM) launch sites. One will be located at DASP which will serve the TBM boring the Airport Tunnel and the second will be located at the Northwood Construction Compound which will serve the TBM boring the City Tunnel.

Table 3.3: Estimated tunnel construction depth for the MetroLink route alignment

Milestone	Ground Level [m]	Rail Level [m]	TBM Crown Level [m]	Depth to Tunnel Crown [m]
Estuary Station	7.5	8.4	N/A	N/A
Seatown Station	12.8	4.3	N/A	N/A
Sword Central	25.2	17.7	N/A	N/A
Fostertown Station	44.6	36.5	N/A	N/A
DANP	61.7	45.0	51.7	10.0
Dublin Airport Station	67.8	44.0	50.7	17.1
Old Airport Road	59.5	42.0	48.7	10.8
DASP	60.0	42.0	48.7	11.3
Dardistown Station	61.2	55.1	N/A	N/A
M50	58.9	67.5	N/A	N/A
Northwood Station	60.5	43.6	50.3	10.2
Balbutcher Lane	65.5	41.3	48.0	17.6
Balbutcher Lane	63.3	37.9	44.6	18.7
Ballymun Station	62.6	37.9	44.6	18.0
Gateway Cres	57.7	34.7	41.4	16.3
Glasnevin Ave	51.7	27.5	34.2	17.6
Collins Avenue Station	51.4	27.5	34.2	17.3
Albert College Lawn	49.8	26.9	33.6	16.2
ACP Intervention Shaft	43.2	16.9	23.6	19.7
Griffith Ave	33.1	2.2	8.8	24.3
Home Farm Rd	25.1	-3.5	3.2	22.0
Griffith Park Station	18.8	-5.4	1.3	17.5
Tolka River	7.4	-5.4	1.3	6.1

Milestone	Ground Level [m]	Rail Level [m]	TBM Crown Level [m]	Depth to Tunnel Crown [m]
Botanic Ave	10.2	-5.4	1.3	8.8
Fairfield Rd	15.8	-3.7	3.0	12.8
Botanic Road	17.6	-2.3	4.4	13.2
Prospect Road	23.8	-.1	6.6	17.2
Glasnevin Station	25.4	.0	6.7	18.7
Munster St	24.7	.0	6.7	18.0
NCR	25.0	-2.0	4.7	20.4
Mater Station	22.7	-2.0	4.6	18.0
Nelson St	21.0	-2.7	4.0	17.1
Dorset St	17.5	-10.2	-3.5	21.0
Parnell Sq North	12.2	-17.2	-10.6	22.7
O'Connell Street Station	2.6	-19.6	-12.9	15.5
Henry St	4.7	-19.6	-12.9	17.6
Abbey St	3.7	-19.6	-12.9	16.6
Eden Quay	3.0	-19.8	-13.1	16.1
Burgh Quay	2.9	-20.6	-13.9	16.8
Tara Station	3.0	-20.6	-13.9	16.8
Leinster Street South	6.2	-23.6	-16.9	23.1
National Museum of Ireland	9.0	-18.4	-11.7	20.6
St. Stephen's Green Station	11.9	-13.2	-6.5	18.4
Earlsfort Terrace	13.5	-12.0	-5.3	18.8
Adelaide Road	14.1	-9.8	-3.1	17.2
Charlemont Station	15.8	-8.4	-1.7	17.5

3.4 THE DESIGN PROCESS FOR GROUND WORKS

The design process for ground works and in particular for Metros is a very complex activity, particularly considering the impacts that the construction activity has on residents and businesses along the alignment, which takes place over a number of increasingly detailed stages. At present the MetroLink project is at the Preliminary Design stage (in North America this is sometimes referred to as the 30% design stage although the actual degree of design detail may vary for different project elements and in different circumstances).

Usually after the authority's choice of the area that will be served by the new Metro, it is necessary to examine alternative possible horizontal and vertical alignments and where the stations will be located. Following this, it is necessary to work on the vertical alignment to consider the major factors of construction and the main characteristics of the works like tunnel, open trench, cut and cover, bridges, etc.

The vertical alignment of the underground excavations implies the knowledge of the characteristics of the soils and rock (Geology) to be excavated and sustained in order to avoid superficial settlement under the normally very urbanized areas.

This work took place during the Emerging Preferred Route and Preferred Route stages, and into Preliminary Design and will be developed in the future stages of design

The geology of the relevant soils is a major factor in decision making because especially for the tunnels, the designer study the correct cover from the top of the tunnel and the level of the base of the foundations of the underpassed buildings. To know the geology of the soils relevant the tunnel advance, the designer examines the result of soil surveys and laboratory testing carried out in advance.

For the MetroLink project, the Dublin geology is constituted mainly of limestone (the Lucan and Malahide formations) and in the upper part of Alluvial Sand and Gravels and Brown Boulder Clay. The vertical alignment should ideally pass preferably in the limestone and rise up in correspondence of the stations to reduce their depth and hence cost.

The following water factors to be examined are the:

- ✓ Hydrology (i.e. studies about the surface water conditions, flooding, etc.);
- ✓ Hydrogeology (i.e. studies on water table variations, water flow through permeable soils and faults or permeable intercalations and fissures in rock formations).

Water table considerations must be studied to understand the possibility of flooding events, the quality of the water during the use of construction materials and the settlement induced by the changing of the water levels during and after the works,

It is necessary to evaluate the changing of the water table levels and the possibility to have surface flooding phenomena. The surface hydrology in the area is governed by the flow of numerous water courses (both active and infilled) which intersect the route of the MetroLink.

Particular attention, in the Dublin area is to be given especially in the northern part between Seatown and Fostertown areas, where the possible "dam-effect" of the D-walls used for the construction of the Cut and Cover sections might be significant.

Once the horizontal and vertical alignment are primarily defined, the exact location of the stations will be developed, together with the necessary construction compounds and a consequent study of the road traffic to undertake the works and remove the spoil from excavation (i.e. about 3.000.000 metres cubed for the MetroLink), to the deposition or transfer areas.

At this point the designer will decide what kind of machinery and plant is necessary to build the new Metro based on the alignment and its soil characteristics. Typically, this will include TBMs, Hydroshield for D-walls, grouting machines, auger piling machines, concrete pumps, concrete batching plants etc.

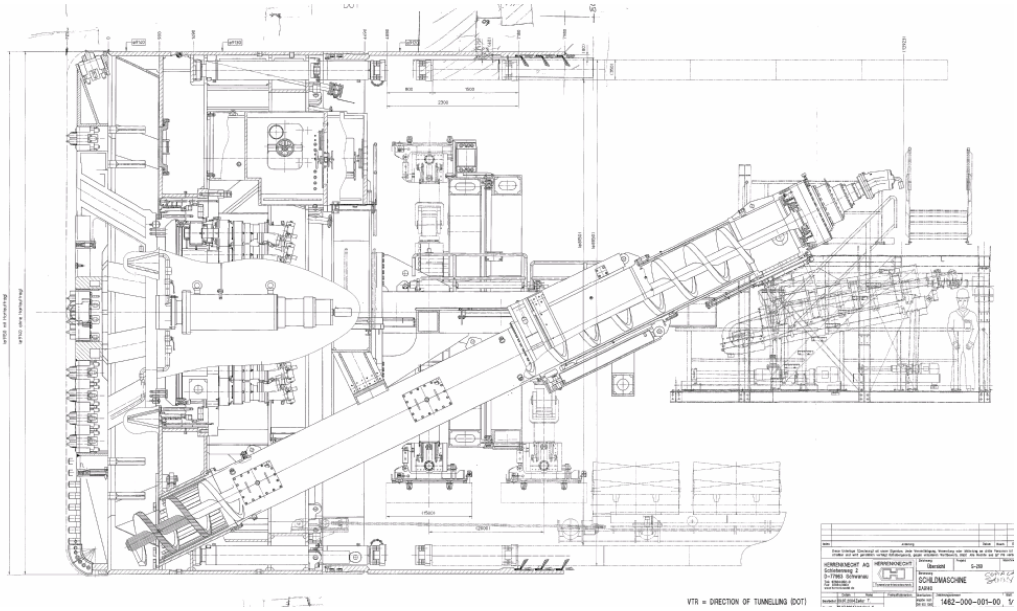


Figure 3.3: EPB-S- Metro Brescia Italy. – Longitudinal section - shield at the face of 9.15 m

The settlement under residential areas due to Mechanical Excavation by Tunnel Boring Machine (TBM) or traditional excavation (rock breaking or 'road header' machines) is a very important factor to be analysed by the designers in detail in order to have works carried out in a safe mode and to preserve the buildings from damage of any greater than very slight impacts, and in accordance with Internationally agreed Technical Standards.

In order to define the potential damage induced on an existing building, the designer suggests admissible values for the most common deformation parameters of a building subjected to differential settlement in the foundations. Based on experimental observations of both the buildings and most importantly the local geotechnical conditions and experiences, some damage categories defined by characteristic parameters are used to identify the induced deformation. Consequently, the BRA (Building Risk Assessment) for each building defined, to be respected during and after the advance of the TBM excavations. A BCS (Building Condition Survey) carried out before the works, for each building, will define the admissible category of damage.

It is clear that in the Dublin area the potential for settlement is strongly dependent on the geology of the underground area to be excavated. In solid rock conditions the settlement to be expected is much less than in sand or gravel soils. The settlement due to changes of the water table levels due to "dam effect" of the new constructions will also need to be evaluated by the designers.

The preliminary calculations carried out in the present EIAR documents, are based on a quite conservative value (i.e.1% in sand and gravel and 0,5% in rock) of the VL, volume loss that represent the part of the superficial soil subject to settlement in rapport to the all mobilized parts of the soil. See figure below.

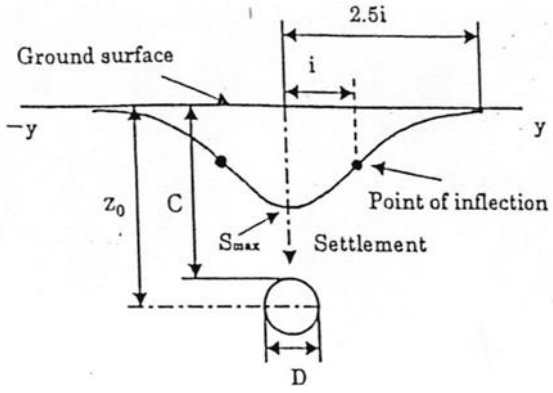


Figure 3.4: Scheme of part of the superficial soil subject to settlement

From what is reported in the literature (Mair, Taylor and Burland, 1996), the maximum unitary strain of elongation ε_{max} is correlated with the category of induced damage according to Boscardin and Cording (1989) which adopts a classification criterion that of the "increasing difficulty of repair " numbered from 0 to 5, shown in the table below.

Table 3.4: Damage categories and related descriptions

DAMAGE CATEGORY	DESCRIPTION OF DEGREE OF DAMAGE	DESCRIPTION OF TYPICAL DAMAGE AND LIKELY FORM OF REPAIR FOR TYPICAL MASONRY BUILDING	S_{max} [mm]	β_{lim} [%]	MAX TENSILE STRAIN ε_{lim} [%]	APPROX CRACK WIDTH [mm]
0	Negligible	Hairline cracks.			Less than 0.05	
1	Very Slight	Fine cracks easily treated during normal redecorations. Perhaps isolated slight fracture in building. Cracks in exterior brickwork visible upon close inspection.	10	0.002	0.05 to 0.075	0.1 to 1
2	Slight	Cracks easily filled. Redecoration probably required. Several slight fractures inside building. Exterior cracks visible: some repointing may be required for weather tightness. Doors and windows may stick slightly.	50	0.005	0.075 to 0.15	1 to 5
3	Moderate	Cracks may require cutting out and patching. Recurrent cracks can be masked by suitable linings. Tack-pointing and possibly replacement of a small amount of exterior brickwork may be required. Doors and windows sticking. Utility services may be interrupted. Water tightness often impaired.	75	0.02	0.15 to 0.3	5 to 15 or a number of cracks greater than 3
4	Severe	Extensive repair involving removal and replacement of sections of walls, especially over doors and windows required. Windows and door frames distorted. Floor slopes noticeably. Walls lean or bulge noticeably, some loss of bearing in beams. Utility services disrupted.	75	0.02	Greater than 0.3	15 to 25 but also depends on number of cracks
5	Very Severe	Major repair required involving partial or complete reconstruction. Beams lose bearing, walls lean badly and require shoring. Windows broken by distortion. Danger of instability.				Usually greater than 25 but depends on number of cracks

The design calculations also consider the effects of differential settlement between connected structural elements of the buildings and indeed between connected buildings such as a terrace.

Very important construction concepts are defined like the waterproofing methods for excavations. These must be considered carefully, as in the Dublin area under the high levels of water table with its flowing in the fractures of rock and obviously in the upper permeable sand and gravel soils prevalent under the surface in Dublin.

A complex system of monitoring (i.e., piezometers; topographic sections. etc.) is a very important component of the design for the construction organization and constant monitoring of ground movement and pressures by these means is the very basis of all modern tunnelling methodologies. This method of underground construction is called the “Observational Method” by international convention.

This means that the design is not finished at the start of the works, but depending of the monitoring readings, the design can be changed regarding for example the operational data of the TBMs or eventual soil grouting necessary to control the flowing of the water table to be carried out in the bottom of the stations, to protect building foundations or to pre-consolidate the front of excavation of tunnels excavated in the traditional mode.

At the end of the works the final version of the design drawings are marked with the actual construction details as carried out and are then known the “As Built” drawings, a key record for the future maintenance of the project into the future.

3.5 HOW TUNNELS AND UNDERGROUND STATIONS ARE CONSTRUCTED

The construction of a new underground Metro implies the use of modern technologies and underground special machinery for excavations undertaken in a safe manner during the works and during the life of the new structures in the following decades.

Tunnels

For the tunnelling it is now possible to use many different models of Tunnel Boring Machine (TBM) chosen in functionality based on the very specific characteristics of the soil and rocks to be excavated.

The main principle is to sustain, during the 'advance' of the TBM, the soil and the water muck pressure in front of the cutting head of the machine (in order to prevent settlement or collapse of the ground) by adopting the designer calculated pressure for the 'polymerized muck' in front of the TBM inside the "chamber of excavation" where the cutting head is undertaking its work.

The figure below is a finite element analysis (FEA) model that shows how the effects of the pressure and other factors given in front of the TBM is correlated to the structure of the above building.

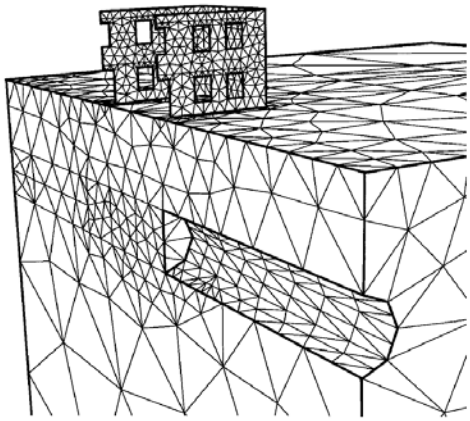


Figure 3.5: Vulnerable building" 3D FDM/FEM mesh modelling

The TBM machine can excavate under watertable conditions in many different kinds of soil. The choice of the correct kind of front wheels or ripper cutters is very important in order to excavate for example in quartz bearing soils with significant cutter wear problems.

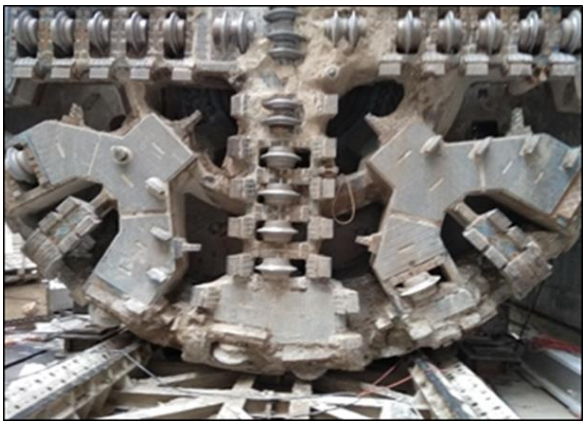


Figure 3.6: Tel Aviv Red Line Front shield cutters

It is possible to excavate under buildings with underground floors and foundations of various type (masonry, concrete, slabs, etc), also in presence of water table as shown in the figure below.

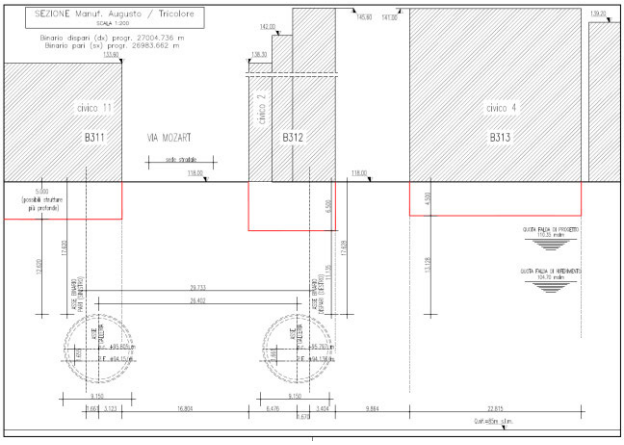


Figure 3.7: Metro Milan M4 – Twin bore tunnel diameter 9,15 m each

If the process is correctly carried out (and monitored constantly), the settlement on surface is relatively easily controlled during the advance of the TBM and the damage to buildings will be contained within the categories from 'negligible' to 'slight' (0 to 2) in the International Standard used. A post construction process of rehabilitation of any damages (small cracks < 5 mm) will be carried out by the Construction Contractor.

For the Metrolink project the designers have indicated the possibility to use a "Multi Mode TBM". (i.e. Open Mode, Slurry Mode or EPB Mode)

Open Mode: There is no additional pressure required to stabilise the cutting head and the cut material is removed from the cutting face by a screw conveyor operating at low pressure. Material is then discharged onto a belt conveyor for transport to the launch site. As no additional face pressure is required, there is no slurry added to the cutterhead and the material requires no subsequent processing and is simply stored for onward transportation to the designated disposal site. Considering the geotechnical conditions of the soil in the Dublin area, it is reasonable to think that this typology of TBM mode will not be appropriate and therefore not used.

Slurry Mode: To transport the excavated material via a pipeline from the TBM back to the surface, a bentonite slurry is used. The purpose of the slurry is to act as a transport medium to carry the excavated material; to pressurise the face of the excavation to control ground movement; and to limit wear to the TBM and slurry system components. Bentonite is blended from naturally occurring clay minerals and is supplied in a fine powder form. Polymers may also the treatment plant separates the excavated material from the bentonite slurry. The treatment process separates the excavated material by size and a number of stockpiles are produced before removal from the site. The screening technology includes hydro-vacuum cyclones, vertical separators and centrifuges to ensure that fine particles are removed. The separated bentonite slurry is held in storage tanks and then pumped back down to the TBM for re-use. Please refer to 'Appendix A5.13 - Tunnelling' for a more detailed description of the treatment process and layout of the construction site.

On completion of all tunnelling works the bentonite slurry will be disposed of to a designated waste disposal site. During tunnelling, spent bentonite that is no longer suitable for reuse will also need to be disposed of on occasions. Transport of the bentonite slurry will be by road tanker. Under Irish regulations it is classified as a non–hazardous waste. It will not be possible to reuse, recycle or recover this waste further and disposal to a licenced landfill could be required.

Detailed description on resource and waste management and potentially suitable destinations for spoil and bentonite slurry transported by road are discussed in Chapter 24 (Materials & Waste Management) and in the Excavated Materials Management Strategy (Appendix A24.1).

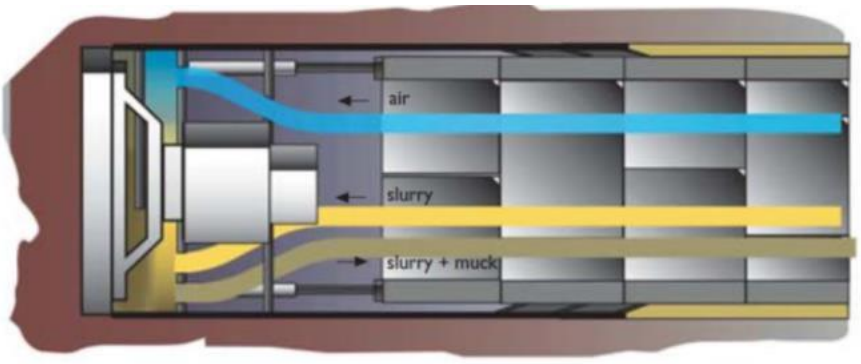


Figure 3.8: Slurry mode TBM

'Earth Pressure Balancing' (EPB) Mode: Excavated material is mixed with spoil conditioning additives to make the cut ground more consistent and easier to handle, it will reduce friction in the cutterhead and reduce tool wear and a subsequent reduction in power used to turn the cutter head. In addition, the spoil conditioning additive helps by allowing the spoil to form a pressure plug in the screw conveyor which is fundamental to the operation of an EPB TBM and its ability to maintain face pressure.

The spoil conditioning additives generally consist of a detergent that is mixed with water in foam generators on the backup gantries to produce a thick shaving-like foam than can be injected into the chamber in front of the bulkhead. In addition to the foam, polymers can be added to reduce the clogging (stickiness) of the clay. The foam breaks down after a few hours or days. All materials are non-hazardous and biodegradable with no harmful residual chemicals. Further information on the use of spoil conditioning additives is contained in Appendix A5.14 (TBM Consumables).

This material will be transported out of the tunnel on a conveyor. The excavated material is then transferred to a storage stockpile.

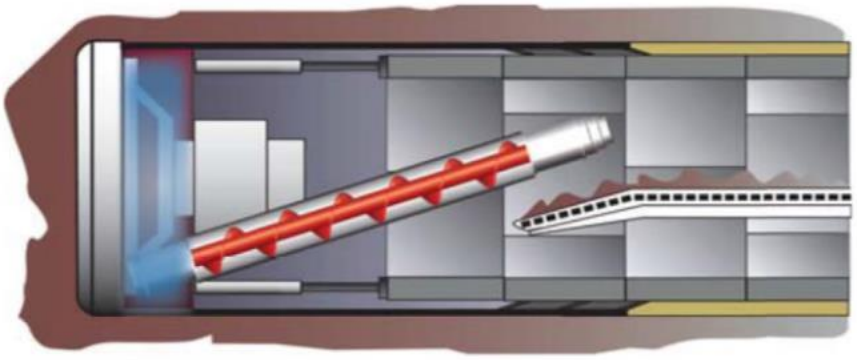


Figure 3.9: EPB mode TBM

The excavations made by TBMs take place using the cutters on the head the TBM that cut through the ground or rock. This type of action generates a rotational vibration of a periodic nature at the front which spreads underground reaching even on the surface. In urban environment such vibration, transmitted to the present structures, it can be a cause of disturbance to people and damage to buildings. The effect of vibrations related to the execution of a tunnel using TBM can be distinct in:

- ✓ environmental, linked to the perception of people;
- ✓ structural / architectural on buildings;

In general, structural damage to buildings are rarely attributable as a whole, directly, to vibratory phenomena, deriving more often from the concurrence of others causes like settlements, seismic actions, foundation adjustments, etc. Careful analysis of this is required and is presented within the EIAR in the Noise and Vibration Chapters (Chapters 13 and 14 and their supporting appendices and figures).

Stations

In a similar manner as tunnelling, the construction of the stations is a significant excavation carried out in normally very urbanized areas, The construction is normally undertaken by Diaphragm-wall (D-wall) and/or secant piling technologies carried out by modern machines (Hydro-shield) in order to excavate in loose soil or rock soil conditions keeping the same level of water table present before the works. Inflow of the water table from the bottom of the excavations must be avoided by using grouting reinforcement of the loose soils or cement injections to fill the cracks present in the rocks.

The settlement due to the station excavations normally have a horizontal component to be controlled together with the vertical component because of the flexibility of the D-walls. To reduce this kind of settlement, the Cut and Cover technique called “Top Down” with the top slab done after the D-walls execution before the excavations to the bottom of the station, cut and cover tunnel or shaft is often used. (see figure Below)

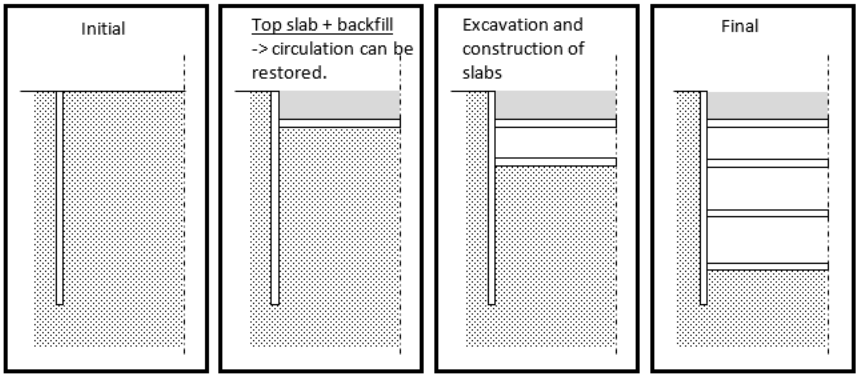


Figure 3.10: “Top Down” construction sequences

This sequence allows reducing the impact on the traffic at the surface during the construction. The vertical retaining wall is constituted by D-walls, and the top slab is implemented by phases to limit the perimeter of the worksite and traffic diversions. Once this structure is completed, one portion of the top slab can be freed to allow the circulation of vehicles, and one portion is used to serve the logistics of the working site (i.e. supply of materials, equipment access, etc.) through temporary openings on the covering slab; the jobsite area can be partially installed on the top slab to limiting the demand of dedicated space on the neighbouring areas.

Next, the excavation is executed under the top slab and the final internal structures (other floor slabs) are installed while excavating, from the top to the bottom, leaving temporary reservations where needed. For deep excavations and important vertical spacing between slabs, the use of intermediate levels of struts may be necessary and in some cases these may even be incorporated into the final station design as a ‘feature’ as in Westminster Station on the Jubilee Line Extension of London Underground.

If the station is well supported at its bottom in the rock subsoil and few horizontal and vertical settlements are expected, it is possible to use the “cut and cover” method called “Down Up” which is an open excavation and the top slab will be executed at the end of the internal final linings (see figure below).

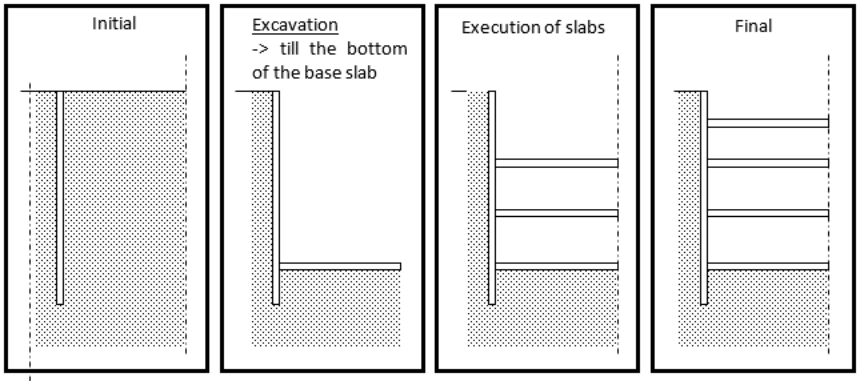


Figure 3.11: "Down Up" construction sequences

This construction method consists in the implementation of the vertical retaining supports first. Then, the excavation is carried out from the surface to the bottom with the installation of one or more levels of struts and/or temporary anchors as the excavation progresses. The final framed structure (intermediate slabs and walls) is built from bottom to top, with the installation of a waterproofing membrane around the structure.

The vertical retaining walls are normally constituted by:

- ✓ Continuous bored piles walls which are built by installing successive but unconnected piles for temporary or permanent use. Where groundwater is a hazard, dewatering or drainage are usually associated to such retaining scheme, but it is not accepted by international standards in urban areas, or grouting is used to prevent leakage and transportation of fine soil between piles. This system is usually advantageous in terms of cost and speed of execution when the groundwater level is not very high and excavation depth reaches up to 20-25m in various types of weathered to fractured rock, or soil with geotechnical characteristics as to maintain an acceptable number of struts / anchors needed to ensure the stability of the retaining wall.
- ✓ Diaphragm walls offer the considerable advantage of being used in many cases as permanent retaining system, to support earth and water pressure. In this case, the joints of the diaphragm walls panels are designed to withstand water pressure and to prevent infiltration. Nevertheless, the diaphragm walls are not a completely watertight system due to one or more of the following factors: the presence of imperfections in the wall panels, which requires repair by injection; difficulty in installing the stop-end system for the waterstop joint installation beyond certain depth limits (between 25 and 35m); inclusions of soil at the joints that prevent the proper functioning of the waterstop; etc. In D-walls coupled with a secondary wall (structural): the diaphragm wall supports earth pressure, and the inner wall supports water pressure in the long term. A waterproofing system is provided between the diaphragm walls and internal concrete walls.

During excavation under the water table, depending on the waterproof condition of the soil below the bottom slab like not cracked or fissured rock, compact clay, etc, a block of grouting or cement injections to be executed below the bottom slab, will be undertaken to avoid water flowing in during the excavations.

The station or cut and cover structure with the internal final linings, shall be verified against the possible temporary or final flotation due to the uplift of the water table pressure.

Cut and cover tunnel sections

The same principles of construction of the stations are normally applied to the Cut and Cover tunnel sections.

Tunnels excavated with traditional mining modes

In the MetroLink project there are only 4 short tunnels proposed to be implemented in a traditional advance method. In these cases (ventilation and escape tunnel in Dublin Airport, ACP Intervention Shaft connections to main tunnel, Charlemont evacuation tunnel) the main problem is to progress under water table conditions creating waterproof conditions in the soils behind the front where the appropriate machinery (i.e. rock header, rock breaker or blasting techniques are used, during the advance of the excavations.

Figure 3.12: Rock header

Depending on the ground conditions, a tunnel lining is usually required, particularly for urban environments. Typically, the tunnel excavation is supported by a primary concrete lining, installed during the tunnel advance, after which a secondary concrete lining is executed for the final structural arrangement. Waterproofing is achieved by installing a waterproofing system in between the two concrete layers.

The potential settlement at the surface and in depth due to tunnel construction interact directly with existing buildings and infrastructures, such as railways, roads and utilities. In such conditions, a control of ground deformation during tunnelling is necessary to minimise the impact of construction. This requirement can be achieved primarily by installing pre-support measures ahead of the excavation face in order to ensure the face stability and minimize ground extrusion. Additional ground treatments, usually in the form of various types of grouting, may also be required.

The evaluation of the settlements in good rock conditions, can be carried out with empirical and/or numerical methods, even assessed under conditions of "Green field" (absence of building), however, at the level of the plan foundations of the building itself.

In the case of tunnels in loose soil, the excavation with the traditional system, which requires necessarily a preventive soil consolidation treatment, can be analysed only with numerical methods.

On the other hand, in the case of tunnels excavated with TBM, which does not normally require a preventive soil consolidation treatment, these can be analysed as well as with numerical methods but also with more expeditious and conservative empirical methods.

For the failure conditions to be avoided, attention and alarm limits must then be established as part of a specifically prepared monitoring plan, which must be verified with continuity in implementation.

Ground vibration is generally considered to be the most concerning of the effects of blasting. Ground vibration from the blast can be significant but is very short-term. Ground vibration also occurs from the drilling operation but, whilst this operation may be much more continuous, the magnitude of the ground vibration is anticipated to be much lower.

The main causes of ground vibration are:

- ✓ Maximum charge per delay, length of delay and distances between charges.
- ✓ Distance between blasting site and monitoring point.
- ✓ Geological conditions; and
- ✓ Blast design parameters.

Consolidated blasting techniques are experienced in many urban tunnel excavations, and it is considered a safe mode regarding induced vibrations to buildings (only 1 or 2 times per days) even less than the vibration given by rock header/breaker or ripper demolition machines (in this case performed continuously during the day).

Intervention Shafts

Traditional excavation methods (from up to down) like stations are expected to be undertaken according to the PD documents with secant piles or diaphragm walls and internal concrete linings.

There are also modern technologies in the family of the " Raise boredrilling ", that is an underground mining drilling methodology (VSM Vertical Shaft Machine) used to create a vertical, circular excavation between two levels of an infrastructure, without the use of explosives. It is most utilized for the excavation of shafts from the

surface to underground locations for diameters from 4,5 m to 18 m (i.e. Albert College Shaft is a 15 m diameter shaft). Velocity of execution and resistance to water table ingress are the main characteristics of this technology. Its use may be considered by the construction contractor, if appropriate.

Utilities

Mitigation measures include away from the alignment where necessary to allow for future maintenance or diversion activities. In some cases, planned services disruptions will be required to facilitate the connection of existing services to the newly diverted services.

It should be emphasised that the diversion of utilities is an activity of high impact on residents and should be executed as much in advance of timing before the underground and retained cut stations, as possible.

Monitoring

All of the underground excavations have a very important monitoring plan in order to control, often in “real time” the measure of settlements and the tensile strength in the structural elements of the project and the surrounding environment. These monitoring data are controlled in remote control rooms in order to give immediate operating instructions to the construction operators. (see figure below).

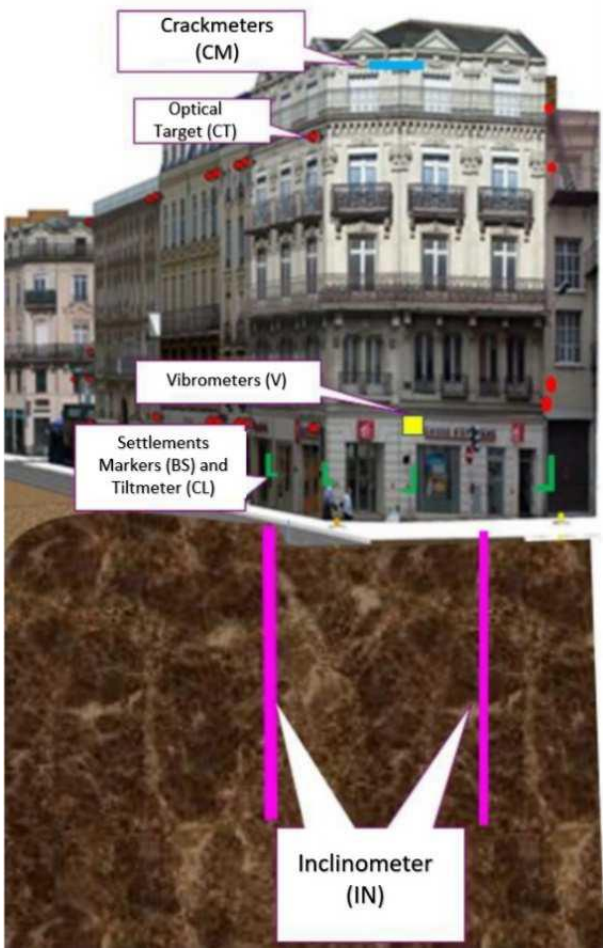


Figure 3.13: settlement monitoring system operating in “real time”

A monitoring system, therefore, to be suitably used by the project structures, must respond to specific structural requirements, such as:

- ✓ High resolution of the area type, with a suitable arrangement of control points depending on the measurement objectives; Interferometry by satellite measurements;

- ✓ High temporal resolution, with the possibility of a continuous, constant and prolonged control over time of the parameters placed under observation;
- ✓ High accuracy of the measurement performed and the possibility, therefore, of their validation for use;
- ✓ Pre-processing of the data acquired by the system so as to be comparable with a behaviour model of the structure / terrain under examination.
- ✓ During TBM excavations a real time monitoring of all the operational items given by the TBM software to an external control team with numerical and graphical reports;

The monitoring data are available even in real time to all the appointed parties responsible for the works (Constructor, Engineer, Owner).

Schedule of tunnel works

The time schedule of the excavations by TBM shall be correlated with the TBM assembly in DANP Dublin Airport launching site and excavations for 2.3 km with TBM transport to Northwood City Tunnel launching site and excavations for 9.4 km. Alternatively, two TBMs can work in parallel with a significant reduction of the overall tunnel excavation timing. A TBM advance rate of approximately 70 metres per week is forecast by TII and its designers.

4 CONSIDERATION OF KEY ENVIRONMENTAL IMPACTS RELEVANT TO THE PROJECT

4.1 AIRBORNE NOISE AND VIBRATION FROM SURFACE CONSTRUCTION WORKS AND RAILWAY OPERATION

This is the noise that might be heard at ground level and originates from the construction and operation of works that are at ground level (e.g. surface railway) or intersect ground level (e.g. a station)

Concepts and terminology

Airborne (or environmental noise) is the noise that is transmitted through the air and therefore might be heard outside or within a building. For this project, the sources of airborne noise include:

- ✓ construction works that are at or above ground level or open to the atmosphere. These will include construction of: 'at grade' and elevated track, station boxes, surface infrastructure at stations, cut and cover tunnels; and all construction activities.
- ✓ construction traffic;
- ✓ emergency ventilation fans;
- ✓ Metrolink vehicles operating at the surface or on elevated track.

Noise from construction sites (and moving Metrolink vehicles or road vehicles) is constantly varying because very few of the items of plant and machinery (sources of noise) operates continuously in the same place; they move about relative to an individual (static) receptor. In addition, the amount of noise actually emitted from each individual item may vary depending on what it is doing (e.g. more noise is emitted by a truck travelling up a slope in a low gear than when stationary with the engine running). An example noise signal is depicted in Figure 4.1

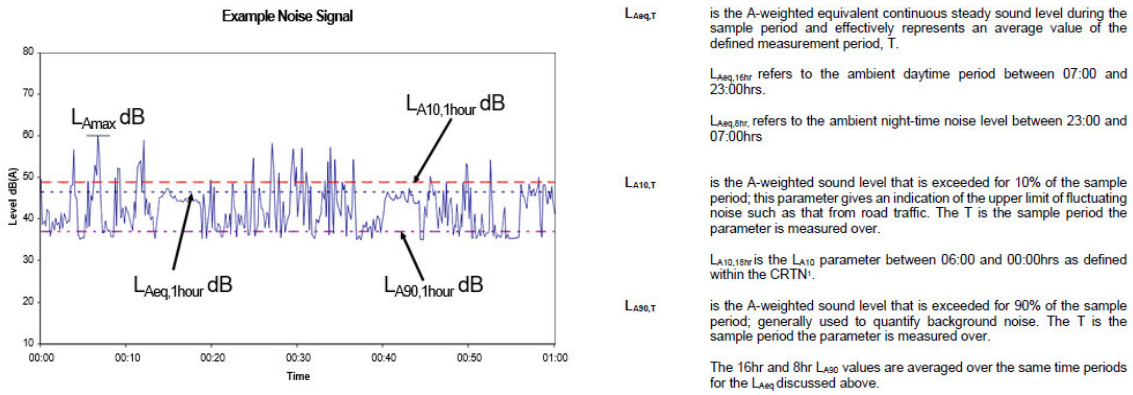


Figure 4.1: Example noise signal

Noise perceptible to humans is measured in decibels (symbol dB(A)). The "(A)" after "dB" signifies that a noise measurement (or prediction) has been "A-weighted" to approximate the frequency range of a human ear, which is relatively insensitive at low frequencies and very high frequencies. The objective of environmental noise measurements is to quantify the level of noise experienced from a human perspective (hence the need for applying a weighting to measurements made using a monitoring device that can detect the full range of frequencies to convert them into units that reflect human experience). There is an explanation of the units used to describe noise in Figure 4.2.

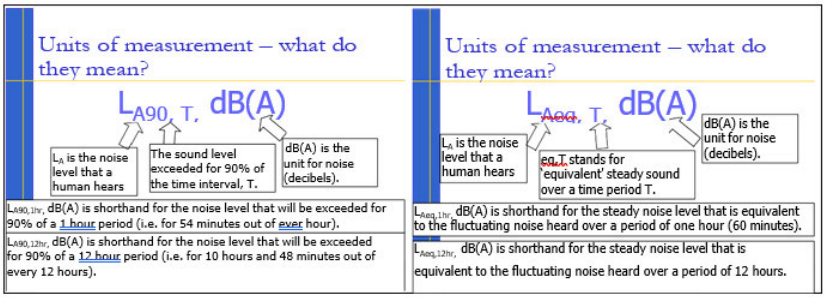


Figure 4.2: Explanation of noise measurement units

LA90,T is the normal measure used to describe the level of background noise (i.e. noise which exists in the environment before the noise being assessed is added). LAeq,T can be used to describe the ambient noise or overall noise level of an existing noise climate. LAeq,T is the way in which predicted and measured site noise levels are generally described. When comparing noise levels (e.g. actual or predicted against background), it is important to compare noise levels relating to the same time period (T value).

The modelled baseline noise maps include existing sources of major rail, road and aircraft noise within the Dublin Agglomeration area and form the basis of the Dublin Agglomeration. This information provides a useful high-level overview of noise levels in the study area. The parameters presented in terms of the noise mapping are the Lden and Lnight noise parameters which are both long term noise indicators based on annual traffic and transport modes.

Lden is the 24-hour noise rating level determined by the averaging of the Lday with the Levening (plus a 5dB penalty) and the Lnight (plus a 10dB penalty). Lden is calculated using the following formula, as defined within the Environmental Noise Regulations.

$$L_{den} = 10log\left(\frac{1}{24}\right)\left(12 * \left(10^{\frac{Lday}{10}}\right) + 4 * \left(10^{\frac{Levening+5}{10}}\right) + 8 * \left(10^{\frac{Lnight+10}{10}}\right)\right)$$

Where:

L_{day} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the day periods of a year. The 12hr daytime period is between 07:00 to 19:00hrs.

$L_{evening}$ is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. The 4hr evening period is between 19:00 to 23:00hrs.

L_{night} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year. The 8hr night-time period is between 23:00 to 07:00hrs.

Figure 4.3: Explanation of Lden parameter

The following excerpt is a table describing what given ranges of noise in dB(A) might sound like, in comparison to commonly experienced noise environments.

$L_{Aeq,T}$, dB(A)	Example
0	Absolute silence
25	Very quiet room
35 - 40	Quiet rural area during night with no wind
55	Day-time, flat to undulating topography, busy roadway 0.5km away
70	Busy restaurant
85	Very Busy pub, voice has to be raised to be heard
100	Disco or rock concert
120	Large chipping hammer. Uncomfortably loud and conversation impossible
140	Four propeller aircraft. Noise causes pain to the ears

*Adapted from EPA Guidance Note for Noise in Relation to Scheduled Activities (2nd Edition), 2006

Figure 4.4: Noise levels comparison

Each source of noise can be ascribed a 'sound power level' – the amount of noise that is emitted from an item of plant or a collection of activities going on in one place. Noise levels reduce (attenuate) with distance from a noise source. For a given noise source, reductions over and above the attenuation that takes place by virtue of the distance between source and receptor can be achieved by introducing barriers between the source and the receptor. The influence of the roughness and topography of the intervening ground can also be important. Options for noise mitigation therefore include reducing noise levels at the source and the introduction of barriers between sources and receptors.

For complex noise sources (such as construction sites), where noise is constantly varying as described above, noise assessment criteria (against which the significance of the impact of additional noise is assessed) are either expressed as a 'threshold' in dB(A) (LAeq,period), or in relation to the background or ambient noise levels. It is common to assess noise outside buildings, generally 1m from the façade or, in the free field, more than 3.5m from the façade of buildings.

The basis of the operational noise emission calculations in the part of the MetroLink line above the ground (viaduct, surface, retained cut) is generally a theoretical calculation with a modelling of train noise emissions similar to the one described in 13.2.5.2.1 Above Ground Railway Noise, Rail Noise Model, based on International Standards.

A higher level of confidence and accuracy of the evaluation of noise emitted by trains can be achieved by a specific set of measurements to be carried out in a Test Track using the same or a similar train type.

Below is a test we carried out on the type of train used in Copenhagen (Cityringen), which is likely to be somewhat similar to the MetroLink vehicle at least in broad terms. This kind of measure is valid both for noise and vibration and gives a confirmation of the accuracy and reliability of theoretical emission calculations.

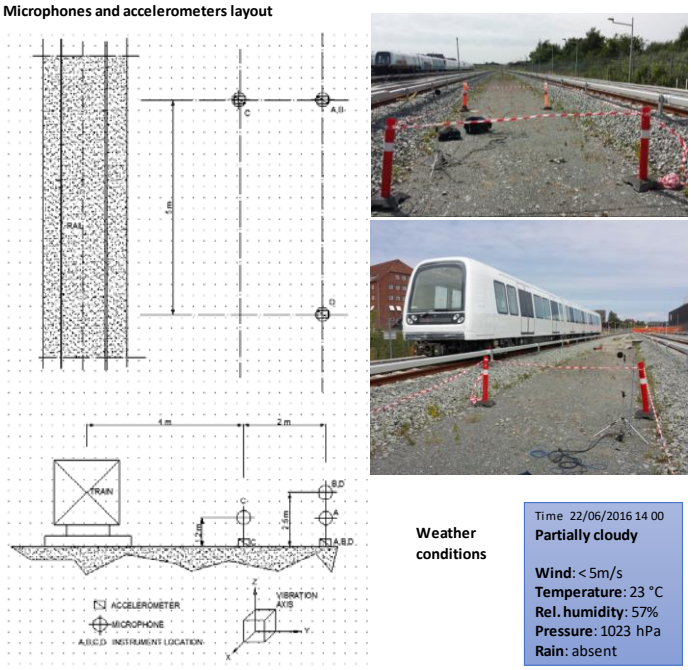


Figure 4.5: Train noise and vibration test

Baseline data

Baseline environmental noise data, measured outside noise sensitive buildings and at times corresponding to the proposed operations, are obtained as a record of what existed before works begin and are often used to assist in suggesting appropriate noise limits at noise sensitive buildings for the works. This baseline data is particularly relevant to external noise levels generated by the construction and operational phases of the development that are at or above ground level, rather than due to excavation by tunnel boring machine and the operational metro underground which can lead to "structure-radiated noise' or "groundborne noise' (terminology as used in the EIAR).

Environmental noise data is normally obtained by attended sample measurements of relatively short duration or by unattended measurements of longer duration where noise monitoring equipment is left at selected, secure locations.

It is usual to present baseline noise levels numerically, along with dates, times, weather conditions and comments about the noise climate such as "road traffic noise dominant' and "local activity'.

Assumptions and methodology applied in the EIAR

A Noise Assessment Details Report is included as Chapter 13 of Volume 3 Book 1 of the EIAR. This document sets out the methodology for the modelling of noise from the operation of the metro vehicles and noise from construction operations. The document sets out assumptions used in the environmental noise calculations including the noise from a single train passing-by and noise output levels of plant and machinery likely to be used for the construction phase. Predictive calculations have been performed to assess the potential impacts associated with above ground noise sources associated the operational phase at the most sensitive locations, and a schedule of mitigation measures has been incorporated where required, to reduce, where necessary, the identified potential airborne impacts.

Construction noise impacts have been assessed by assuming that the plant operating at the various surface construction sites along the route will be as listed in the construction plant inventories in Annex A13.7 Construction Phase modelling. These inventories list the types of plant, their sound pressure levels at 10m (i.e. the amount of noise that they will emit), the number of units assumed to be operating, and the percentage of time for which they are assumed to be operating. Using this information an ‘effective sound power level' is derived for the particular site.

It is important to note that calculation of specific construction noise levels during the Construction Phase is limited to information available at EIAR stage. Whilst the phasing of works, location of activities, plant items and work sites have been progressed to detailed stages as part of this EIAR, the nature of the source is dynamic in nature and will vary over the course of the proposed Project at any one location subject to site conditions, work scheduling, contractor proposals and potential updated technology and methodologies.

Construction noise levels will fluctuate at any one location over the full duration of the proposed Project given the variations in the items above on a week to week or month to month basis. The approach undertaken therefore is to review the likely significant effects across the proposed Project based on the extent of information that is available. This includes prediction of construction noise levels associated with the key work stages deemed representative of the likely worst-case scenarios for each work sites using expected plant types and numbers, and site layout plans provided by the design team. This approach allows the likelihood of significant effects to be identified and to address the way in which potential construction impacts will be managed, including mitigation and codes of practices that will be applied.

It is important to note on the basis of the above, the construction noise calculations undertaken as part of the assessment are used to identify the likely significant effects and inform the requirement for noise mitigation and the approach for controlling and managing significant effects. Should the project be approved, prior to the commencement of any construction works, a detailed noise assessment for each work site will need to be undertaken based on the most up to date information for each.

The noise assessment team has specified noise criteria as noise thresholds in dB(A) LAeq,period, and not by reference to the anticipated change from background noise levels. The noise assessment criteria for the construction and operational phases of the MetroLink project are set out in Tables 13.12:

Table 13.12: BS 5228-1 Example of Thresholds of Potential Significant Effect

Assessment Category & Threshold Value Period (L_{Aeq})	Construction Noise Threshold (CNT) (dB)		
	Category A [A]	Category B [B]	Category C [C]
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75
Evenings & Weekends (19:00 – 23:00hrs weekdays) (13:00 - 23:00hrs Saturdays) (07:00 – 23:00hrs Sundays)	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55
Notes	Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values	Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.	Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values. If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise

Figure 4.6: Construction noise thresholds

The construction noise thresholds (CNTs) have been applied at the façade of residential buildings, hotels and hostels, buildings in educational use and buildings in health and/or community that are noise sensitive.

Having established the functional value of receptors (through analysis of the baseline as described above), predicted the amount of construction or operational noise that will be experienced at receptors, and defined the assessment criteria, the next step is to assess the significance of the impact on the receptors.

Table 13.13: Construction Noise Significance Ratings

Range of Construction Noise level	Guidelines for Noise Impact Assessment Significance (DMRB)	EPA EIAR Significance Effects	Determination
Below or equal to baseline noise level	Negligible	Not Significant	Depending on CNT, duration & baseline noise level
Above baseline noise level and below or equal to CNT	Minor	Slight to Moderate [Note 1]	
Above CNT and below or equal to CNT +5dB [Note 2]	Moderate	Moderate to Significant	
Above CNT +5 and below or equal to CNT +15dB	Major	Significant, to Very Significant	
Above +15dB		Very Significant to Profound [Note 3]	

Figure 4.7: Construction noise ratings

There is no applicable national guidance specifying airborne noise limits from rail operations, therefore precedence from other rail projects has been used. A review of relevant criteria relating to operational train noise has been undertaken for several large-scale urban rail projects, namely Dublin Luas, Channel Tunnel Rail Link-London, and Cross Rail-London, in addition to guidance documents relating to environmental noise including the WHO Environmental Noise Guidelines) (WHO 2018).

Table 13.18 proposes airborne noise operational rail criteria based on a review of the most applicable Irish rail projects.

Table 13.18: Operational Rail Noise Threshold

Sensitive Locations	Receptor Sensitivity	Noise Criteria during Operational Phase
Locations that are highly sensitive during day and night-time periods ▪ All residential buildings; ▪ Health care facilities (hospitals, nursing homes) ▪ Hotels, student accommodation and hostels	High	Daytime: 55dB $L_{Aeq,16hr}$ (07:00 – 23:00hrs) Night-time: 45dB $L_{Aeq,8hr}$ (23:00 – 07:00hrs)
Locations that are only sensitive during daytime periods, and are sensitive to noise: ▪ Educational Establishments; ▪ Theatres ▪ Places of worship (churches & other religious buildings) ▪ Offices	High	Daytime: 55dB $L_{Aeq,16hr}$ (07:00 – 23:00hrs)
Locations that are only sensitive during day but are less sensitive to noise that the categories above: ▪ Commercial buildings ▪ Outdoor recreational areas ▪ Cinemas	Medium	Assessed on a case-by-case basis, depending on the sensitivity of the specific use, the level of sound insulation that may be afforded by the building & the prevailing noise environment
▪ Industrial Warehouses ▪ Indoor recreational areas ▪ Shopping centres/retail park	Low	

Figure 4.8: Operational Rail noise threshold

Table 13.19: Rail Noise Impact Magnitude and Significance Rating

Calculated noise level above threshold or baseline	Impact Magnitude	Significance Rating
>10dB	Very High	Very Significant
5 – 10dB	High	Significant
3 – 5dB	Medium	Moderate
1 – 3dB	Low	Slight
Less than 1dB	Very Low	Not Significant

Figure 4.9: Operational Rail noise rating

Reference to EIAR

Baseline noise monitoring reports are included in EIAR Volume 3 – Environmental Baseline & Assessment Book 1 - Chapter 13 Airborne Noise and Vibration and relative annexes A13.1, A13.2, A13.4. Noise monitoring locations can be found in Figure 13.1.

Following the noise baseline data, the EIAR Volume 3 – Environmental Baseline & Assessment Book 1 - Chapter 13 Airborne Noise and Vibration presents the results of the Predicted impact in chapter 13.5. In this chapter the following scenarios for noise are described:

- ✓ Do nothing
- ✓ Construction Phase
- ✓ Operational phase

After the above-mentioned section, in chapter 13.6 there is a detailed description of the mitigation measure that could be adopted both in construction and operational phase.

Chapter 13.7 presents the residual impacts, in qualitative terms when referring to the noise generated in the construction phase and instead with a detailed presentation of the level increase compared to the baseline noise in the operational phase.

In Annexes A13.7 and A13.8 are listed all the noise numerical results both for the construction and operational phase, for each receptor or group of receptors, with threshold comparison and predicted magnitude of impact. Please note that the results are “without” mitigation measures for the construction phase, while they are values already including the mitigation measures (residual noise levels) for the operational phase, but only regarding train noise (therefore excluding station noises, like, escalator, lifts, announcements PA, local traffic and car park, etc.).

Figure 13.3 and 13.4 presents the airborne rail noise mapping (5 dB contours) daytime and night time. For the airborne construction noise there is no contour mapping, but just an assessment location map which make reference to noise level values in Annex 13.7

Results of the assessment and comments

The whole structure of the acoustic project has been carried out in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (i.e. the EIA Directive) (European Union 2014a). There are no statutory standards in Ireland relating to noise and vibration limit values for construction works or for environmental noise relating to the Operational Phase, so the EIAR has been developed following a series of European and UK regulations and standards, listed in 13.2.2 of Chapter 13

All calculations have been made using specific acoustic software SoftNoise Predictor and spreadsheet calculations following relevant BS, ISO and CRTN methodology

Input data for construction are detailed and extensive, and sound power data of machinery were sourced from BS5228-1. The Directive 2000/14/CE is not mentioned, so it is not clear whether the sound power limits given there have been considered.

Results are presented in terms of LAeq,16h daytime and LAeq,8h nigh time and also Lden, following EU regulations.

Potentially significant issues relating to noise are listed below, along with an opinion on where in the EIAR this has been considered.

- ✓ Noise during construction of the bored tunnels, at launch and landing site of TBM has been considered in the noise chapters Airborne noise Chapter 13 of EIAR.
- ✓ Noise during construction of the cut & cover tunnel has been considered in the noise chapters Airborne noise Chapter 13 of EIAR.
- ✓ Noise during construction of the stations & ventilation shafts has been considered in the noise Chapter 13 of EIAR.
- ✓ Noise during construction of the tunnel portal site and surface engineering works has been considered in the noise Chapter 13 of EIAR
- ✓ Noise during construction due to road traffic changes has been considered in the noise chapters.
- ✓ Noise during operation of the bored tunnel has been considered in the vibration chapters.
- ✓ Noise during operation of the fans associated with the ventilation shafts has been considered in the noise chapters
- ✓ Noise during operation from the cut & cover tunnel has been considered in the vibration chapters.
- ✓ Noise during operation of the lines at surface and the elevated lines has been considered in the noise chapters & Annex
- ✓ Noise during operation of the depot has been considered

- ✓ Monitoring of noise for construction has been considered as part of the enabling works.
- ✓ Monitoring of noise for operation of the trains has not been proposed.
- ✓ Noise mitigation strategies for construction have been considered in the noise chapters.
- ✓ Noise mitigation strategies for operation of the trains have been considered in the noise chapters and Annexes

In respect of airborne noise impacts during the construction phase, there are a number of locations where the relevant summary tables indicate that, using the equipment inventories assumed, the assessment criteria defined and the functional values assessed, construction will give rise to residual impacts with magnitude described as 'high', or 'very high' on receptors of high or very high functional value (i.e. significant residual airborne noise impacts after mitigation).

There are elements that will have to be evaluated in detail in the next project steps:

- ✓ Baseline measures should be supplemented with more points around construction sites.
- ✓ Airborne noise produced by construction equipment must be analysed not only punctually at the most affected receptors, but also widely through a noise contour map.
- ✓ Operational noise results and maps should also include station noises including; escalators, lifts, announcements PA, local traffic and car parking and of course passengers themselves etc. and not just rail noise
- ✓ A table of noise levels and a noise contour map must also be produced with reference to the post-mitigation results, both in the construction and in the operational phase

The construction of MetroLink will cause airborne noise effects to those who work or live close to the construction sites. Design and mitigation measures are identified in the EIAR and outline CEMP (Construction Environmental Management Plan) to control the effects of airborne noise from within the construction site.

At certain locations along the route EIAR airborne noise modelling indicates that even with airborne noise mitigation measures deployed on site (for example, noise barriers, use of noise-controlled machinery and other measures) airborne noise impacts may exceed the trigger values set out in Appendix A of A14.6 Airborne Noise & Groundborne Noise Mitigation Policy.

In such circumstances further mitigation must be required.

After the completion of the work and the implementation of the MetroLink service to public operation, it will be important to assess the actual response of the noise and vibrations emitted and the effectiveness of the planned mitigation works.

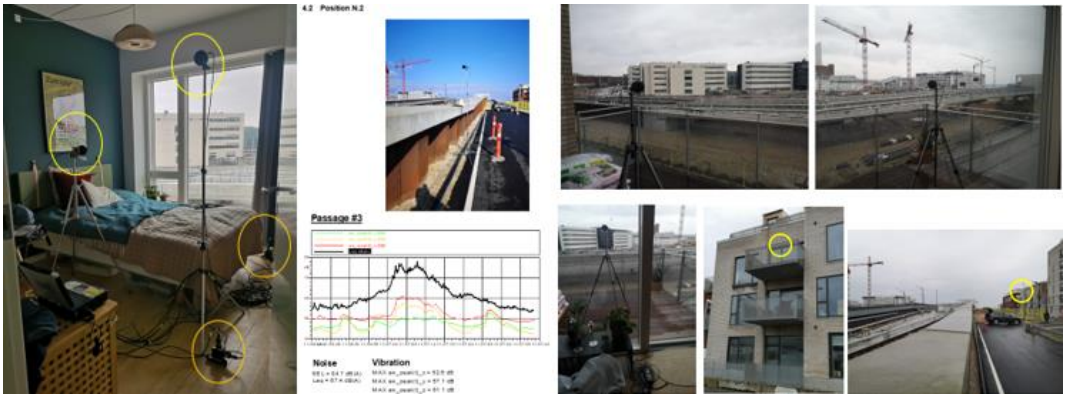


Figure 4.10: Example of operational noise and vibration test setup

4.2 VIBRATION FROM TUNNELLING AND SURFACE CONSTRUCTION WORKS AND RAILWAY OPERATION

Vibration relates to oscillation of the ground and structures, whereas noise relates to oscillation of the air. It is what might be felt rather than heard, although it can be transmuted into noise, by, for example, the rattling of objects.

Concept and terminology

Groundborne vibration from the construction and operation of the proposed Project has the potential to have an adverse effect on nearby sensitive receptors. The main vibration sources from the Construction Phase that have the potential for annoyance would be explosive blasting, TBM advancement, mechanical excavation, secant piling and diaphragm walling (D-walling). During operations, rolling stock movements are a potential source of groundborne vibration.

This assessment of the potential effects from vibration have been based on absolute levels and not a change in level. These are broken down into those relating to building damage, annoyance to people and interference with the use of sensitive laboratory equipment. The difference in the levels of magnitude between human perceptions and building damage are large, and therefore each has separate assessment criteria.

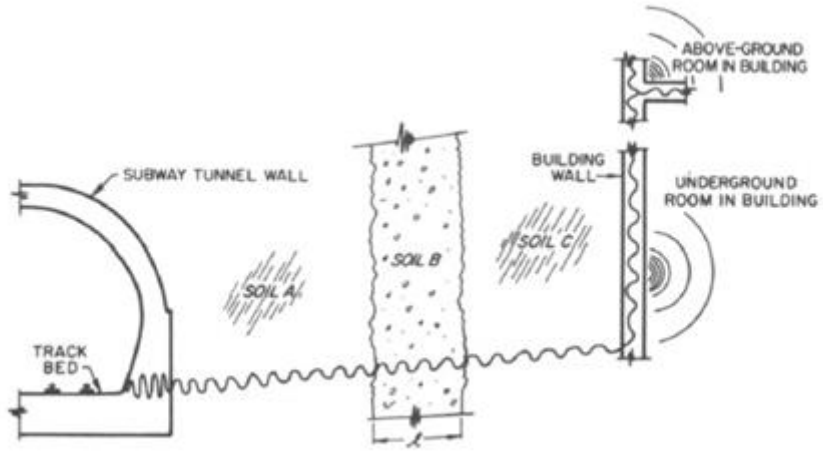


Figure 4.11: Schematic propagation of subway vibrations into buildings.

Vibration from construction sources other than blasting is assessed in the UK by means of the Vibration Dose Value (VDV) which is defined in BS 6472-1:2008 “Guide to evaluation of human exposure to vibration in buildings”.

Vibration Dose Value is based on weighted acceleration and is dependent on the number and duration of events. However, if vibration velocity does not exceed a continuous rms level of 0.5mm/s throughout an 8-hour night it will not be likely to exceed $0.1ms^{-1.75}$ VDV.

Table 14.6: Construction Vibration – Sources Other Than Blasting - Threshold of Significant Effects on Occupants of Residential Buildings

Examples	$VDV_{day}[m/s^{1.75}]$	$VDV_{night}[m/s^{1.75}]$
Dwellings	0.8	0.4

Table 14.7: Construction Vibration - Sources Other Than Blasting - Threshold of Significant Effects on Occupants of Non-Residential Buildings

Examples	$VDV_{day}[m/s^{1.75}]$	$VDV_{night}[m/s^{1.75}]$
Hospital wards; and education dormitories Assisted living, nursing homes, homeless hubs	0.2	0.1
Offices; Schools; and Places of Worship	1.6	n/a
Workshops	3.2	n/a
Vibration sensitive research and manufacturing (e.g. computer chip manufacture); hospitals with vibration sensitive equipment / operations; universities with vibration sensitive research equipment / operations	Risk assessment will be undertaken based on the information currently available for the relevant equipment / process, or where information provided by the building owner or equipment manufacturer	

The thresholds for significant effects on building structures due to transient vibration other than blasting are given in Table 14.8 based on the guidance in BS 7385-2:1993. For continuous vibration the values are reduced by 50%.

Table 14.8: Construction Vibration - Sources other than Blasting - Threshold of Significant Effects on Structures

Structure Type	Allowable Vibration (in terms of PPV) at the Closest Part of Sensitive Property to the Source of Vibration, at a Frequency of 4Hz	
	Transient Vibration	Continuous Vibration
Reinforced or framed structures. Industrial and heavy commercial buildings	50mm/s	25mm/s
Unreinforced or light framed structures. Residential or light commercial-type buildings	15mm/s	7.5mm/s
Protected and Historic Buildings	6mm/s – 15mm/s	3 mm/s – 7.5mm/s
Identified Potentially Vulnerable Structures and Buildings with Low Vibration Threshold	3mm/s	

Figure 4.12: Threshold for vibration other than blasting

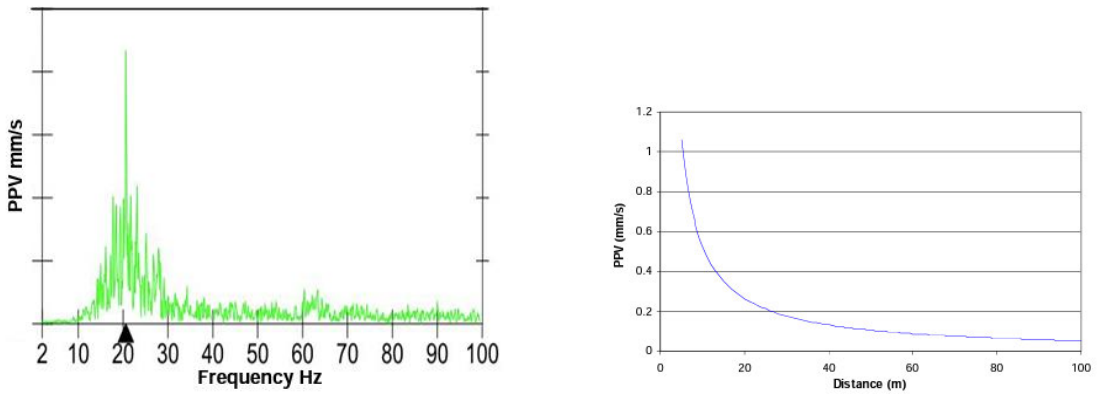


Figure 4.13: Typical TBM Frequency spectra and vibration propagation

For assessment of vibration from blasting, the metric conventionally used is peak particle velocity (PPV). The Environmental Protection Agency in the 2006 "Guidance Note for Noise in Relation to Scheduled Activities, 2nd Edition" recommends that, to avoid any risk of damage to properties in the vicinity, the vibration levels from blasting should not exceed a peak particle velocity of 12 mm/s as measured at a receiving location when blasting occurs once per week or less. However, when the frequency of vibration is less than 10Hz the peak particle velocity should not exceed 8mm/s. In the event of more frequent blasting, the peak particle velocity should not exceed 8mm/s.

Table 14.4: Construction Vibration - Blasting –– Threshold of Significant Effects on Humans

Category of Impact	Threshold PPV
Human Response: Disturbance	8 mm/s

Figure 4.14: Blasting threshold on disturbance

A significance threshold of 8mm/s PPV is used for standard buildings. For fragile buildings and structures at high risk of damage the threshold of significant effect is taken as 3 mm/s as represented in Table 14.5 below. This is based on the advice contained in the German Standard DIN 4150-3:2016 "Vibrations in buildings – Part 3: Effects on structures". It is assumed that known buildings and structures of this kind will be subject to condition surveys well in advance of the works, and any defects identified repaired (for example, loose panes in stained glass windows). The results of conditions surveys determine whether a building is classed as "vulnerable".

Table 14.5: Construction Vibration - Blasting - Threshold of Significant Impacts on Structures

Category of Building	Threshold PPV
Standard buildings	8mm/s
Listed or potentially vulnerable buildings	3mm/s

Figure 4.15: Blasting threshold on structures

The following paragraphs, taken from the National Roads Authority document "Guidelines for the Treatment of Noise & Vibration in National Road Schemes", section 2.3.4 (Construction vibration), provide an accessible introduction to the subject of construction vibration.

> *There is no published Irish guidance relating to vibration during construction activities. Common practice in Ireland has been to use guidance from internationally recognised standards.*
>
> *In the case of nominally continuous sources of vibration such as traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration. For example, blasting and piling, two of the primary sources*

of vibration during construction, are typically tolerated at vibration levels up to 12mm/s and 2.5mm/s respectively. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant of such activities during the night-time.

Guidance relevant to acceptable vibration at the foundation of buildings is contained within BS 7385 (1993): Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground-borne vibration. This states that that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings. Therefore, the guideline values should be reduced to 50% or less for more critical buildings. Critical buildings would include premises with machinery that is highly sensitive to vibration or historic buildings that may be in poor repair, including residential properties.

The German standard DIN4150 provides limits below which it is very unlikely that there will be any cosmetic damage to buildings. For structures that are of great intrinsic value and are particularly sensitive to vibration, transient vibration should not exceed 3mm/s at low frequencies. Allowable levels increase to 8mm/s at 50Hz and 10mm/s at 100Hz and above.

Reference to relevant sections of the EIAR

Baseline vibration data can be obtained for structures and residences to establish what vibration they are currently subjected to. Data can also be obtained from operating equipment to establish what vibration it generates.

Vibration data is normally obtained by measuring the movements (e.g. the ground or a building) in 3 directions simultaneously, these directions being at 90° to each other, using triaxial vibrographs. These vibrographs can be set to monitor in detail for short periods of time, (a few seconds to a few minutes) or in continuous mode in much less detail. Trigger levels may be set to monitor vibration only when it is above a set level. This data would be presented in terms of peak vibration values, frequency of oscillation, duration and time of day. In EIAR Chapter 13 annexes A13.3 and A13.5 baseline vibration monitoring reports are presented.

The EIAR Volume 3 – Environmental Baseline & Assessment Book 1 - Chapter 13 Airborne Noise and Vibration presents the results of the Predicted vibration impact in chapter 13.5. In this chapter the following scenarios for vibration are described:

- ✓ Do nothing
- ✓ Construction Phase
- ✓ Operational phase

For the construction phase only qualitative assumptions are made and, following paragraph 13.5.3.8 Operational Vibration, operational vibration levels associated with the proposed alignment are assessed in Chapter 14 (Groundborne Noise & Vibration). The are no other sources associated with the Operational Phase with potential to generate significant vibration levels.

The EIAR Volume 3 – Environmental Baseline & Assessment Book 1 - Chapter 14 Ground-borne Noise and Vibration presents the results of the Predicted impact in chapter 14.4. In this chapter the following scenarios for vibrations are described:

- ✓ Construction Phase (TBM passage and blasting)
- ✓ Operational phase

After the above-mentioned section, in chapter 14.5 there is a detailed description of the mitigation measure that could be adopted both in construction and operational phase.

Chapter 14.6 presents the residual impacts, in qualitative terms when referring to the vibration generated in the construction phase.

In Annex A14.5 are listed all the vibration numerical results both for the construction and operational phase, for each receptor or group of receptors, with predicted magnitude of impact in terms of VDV (day and night) for mechanical construction and TBM passage and ppv for blasting

Figure 14.4 presents the blasting ppv mapping, while figure 14.3 refers to vibration due to mechanical excavation.

Results of the assessment and comments

The whole structure of the acoustic and vibration project has been carried out in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (i.e. the EIA Directive) (European Union 2014a).

Groundborne vibration have been studied following BS, DIN and ISO standards and also EPA Guidance note for noise.

Groundborne vibrations results for blasting activities are expressed in terms of ppv day and night, according to BS standards

Groundborne vibrations results for during Railway operations are expressed in terms of VDV day and night mms-1.75, according to BS standards

There are a number of issues relating to vibration that have to be considered. The EIAR contains references to all of them, although not always explicitly.

- ✓ Vibration during construction of the bored tunnel by the tunnel boring machines is considered in Chapter 14 of nearly all sections, as nearly all sections will have tunnel boring taking place within them.
- ✓ Consideration of vibration during construction of cut and cover tunnels and cross cut tunnels constructed by blasting are considered in Chapter 14 of those sections with such tunnel construction methods.
- ✓ Similarly, vibration during construction of stations is considered in Chapter 14 of those sections with stations.
- ✓ Vibration during construction at the tunnel launch site is in chapter 14 of the section in which the tunnel launch site occurs.
- ✓ Vibration due to surface engineering works is considered in all chapter 13 sections, as surface engineering works occur in all sections.
- ✓ Vibration during operation, whether bored tunnel, cut and cover tunnel or lines on the surface, is covered both in Chapter 13 and 14.
- ✓ Monitoring of vibration, especially blasting, is covered in Chapter 14, as are mitigation strategies that can be or will be employed to minimize the effects of vibration

If prescribed limits on vibration are exceeded (as revealed by monitoring), the principal mitigation measure during the construction phase will relate to controlling drilling and blasting so as to reduce vibration effects. It is noted in the chapters that it may be possible to use road headers as an alternative to blasting if rock conditions are suitable; road headers can give rise to significantly less vibration than blasting depending on the local circumstances.

Operational groundborne vibration can be reduced where prescribed limits on vibration are exceeded using special Low Vibration Track, similar to the one used in Cityringen and Nordhavn Branch in Copenhagen Metro:

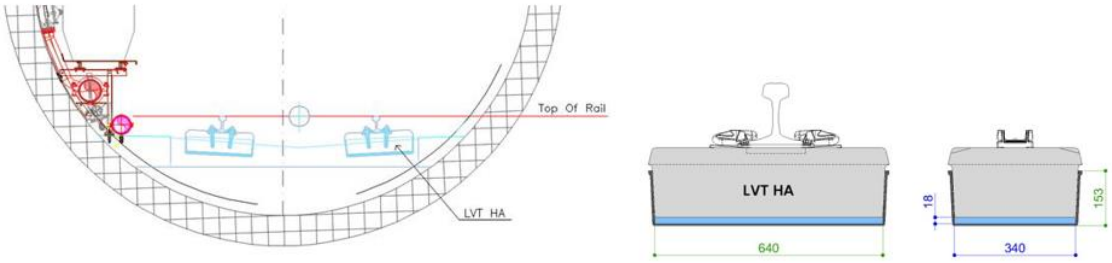


Figure 4.16: Low vibration track example

Type LVT-HA (Low Vibration Track – High Attenuation), made with separate blocks, with rail pads and rubber boot (including a resilient block pad); it is a configuration of “Booted-sleepers blocks” type. Compared to LVT-Standard solution, LVT-HA track system has increased anti-vibration performances.

4.3 INFLUENCE OF TUNNELLING ON GROUND WATER AND SURFACE WATER

Concepts and terminology

Hydrology refers to the concepts related to surface water such as floodwater and rainwater and rivers and streams, and Hydrogeology refers to the concepts surrounding the aquifers, watercourses within the subterranean rock strata and the water table, and to water flows within the strata themselves.

Hydrology

Two watercourse diversions have been proposed to allow for the construction of the proposed Park and Ride at Lissenhall and Depot at Dardistown. A tributary of the Staffordstown Stream (Lissenhall) and the Turnapin Stream (Dardistown) will be diverted. Qualitative and quantitative analysis completed for the Stage 3 Assessment carried out shows that the diversions have been designed so their banks will not be overtopped by the 0.1% Annual Exceedance Probability (AEP) flood.

Stage 3 qualitative and quantitative analysis completed for the proposed new viaduct over Broadmeadow and Ward Rivers shows that the viaduct will not impact on flood levels for the rivers.

New culverts have been proposed over Sluice River and its tributary. Qualitative and quantitative analysis completed for the Stage 3 Assessment carried out show that the proposed culverts will not impact on flood levels for the Sluice River and its tributary. This is because both culverts have been overdesigned for 0.1% AEP flood.

The proposed Tara Station is at risk of coastal flooding from the River Liffey with the effects of climate change. It is not possible to raise the street level of the Tara Station entrances to allow for the effects of climate change. Tara Station will therefore be designed to be resilient to flooding, including the provision of demountable defences across each entrance to the station.

Hydrogeology

The Hydrogeological document assesses the potential effects of the proposed project on the following topics:

- ✓ Superficial hydrogeology;
- ✓ Bedrock hydrogeology;
- ✓ Groundwater resources and groundwater quality;
- ✓ Aquifer dewatering and zone of influence of same; and
- ✓ Groundwater barrier effects.

As detailed in Section 19.1, separate assessments have been conducted for some topics which have inter-relationships with hydrogeology including hydrology, biodiversity and Soils & Geology.

General

A summary of Construction Phase impacts for watercourse crossing, culverts, and diversions (with and without mitigation and design measures) is provided in Table 18.17 Impact Assessment of Proposed Watercourse Crossings, Culverts and Diversions. In summary, the detailed groundwater contour maps (where available) for each of the AZ1-AZ4 areas are consistent and cross-referenced with the interpreted groundwater flow orientation presented in the Hydrogeological Plans for the proposed Project.

The drainage design proposals incorporate effective attenuation to greenfield run-off rates for new hardstanding areas. The proposed attenuation storage volumes are sized to accommodate any potential increase in surface water run-off rates up to the 100-year return period storm event with an allowance for climate change effects. Attenuation for storm water drainage is provided by a combination of attenuation ponds, collection chambers (StormTech system) and an underground attenuation tank at Dardistown Depot. Refer to Chapter 18 (Hydrology, Section 18.5.4.3).

Risks from extreme weather events during construction, and mitigation measures, are assessed in Chapter 28 (Risk of Major Accidents & Disasters).

The spanning of the rivers avoids the need for instream works at the construction stage which lessens the potential for constructional and operational (permanent piers) temporary construction and permanent operational impacts, including on the down-gradient Malahide Estuary Special Area of Conservation (SAC).

Key concerns from stakeholders with regard to flooding included the following (on the basis of geographical area split reference):

- ✓ AZ1 - Localised flooding potential on lands near the proposed P&R Facility site north of the Estuary Station and the need for effective water management;
- ✓ AZ2 - The need to be cognizant of planned drainage proposals in the context of the drainage network for Dublin Airport;
- ✓ AZ4 - Effects from inclement rainfall on the tributary of the [below ground] River Wad near Ballymun Road;
- ✓ AZ4 - Effects of a tributary of the [below ground] River Wad and localised flooding potential near Glasnevin;
- ✓ AZ4 - Localised surface flooding potential near the proposed Griffith Park Station;

- ✓ AZ4 - Potential impacts on existing combined sewer network in the area of Griffith Park from tunnelling and excavations; and
- ✓ AZ4 - Localised surface flooding potential near the proposed Tara Station.

There are a number of historical watercourses across Dublin which have been culverted or infilled. While the proposed Project crosses some of these (see Diagram 18.3 below and Figures 18.3 and 18.4), there will be no interaction with the proposed Project. These watercourses will be located typically at a maximum depth of 3m below the existing surface and are sealed entities. The average tunnel depth for the proposed Project across Dublin is 8m to 10m below existing ground level to the crown (top) of the tunnel and therefore will not disturb or affect any of these historical watercourses.

These measures should be read in conjunction with measures outlined in Chapter 15 (Biodiversity), Chapter 19 (Hydrogeology), and Chapter 20 (Soils & Geology).

Barrier effects modelling – which essentially simulates the potential impacts a linear/other deep structure can have on interpreted groundwater flow and anticipated groundwater movement patterns in variable geological settings – was undertaken by EIAR Guia in liaison with Jacobs IDOM. The report entitled 'Barrier Effect Assessment -Visual Modflow: Seatown-Fosterstown, Dardistown, & O'Connell Street' was completed with the objective of assessing the potential impacts on local groundwater flow patterns which could occur where permanent barriers or semi-barriers are created due to the construction of diaphragm walls for proposed station boxes and tunnel sections and/or the linear tunnel alignment itself. The report is presented as Appendix A19.9.

Reference to EIAR

The information about the influence of tunnelling on ground water and surface water are given mainly in the EIAR Volume 5 Appendix A-19 Hydrogeology and the management of flood risk during construction is detailed in Chapter 18 (Hydrology, Section 18.6.1.3) and in the outline CEMP (Appendix 5.1).

Risks from flooding during the operational phase have been assessed in Chapter 18 (Hydrology) and a Flood Risk Assessment (FRA) was carried out to identify areas at risk along the proposed Project alignment. The FRA is provided as Appendix A18.5. Areas identified as at risk in the Stage 2 FRA include:

- ✓ Drainage ditches located within the Staffordstown Stream catchment;
- ✓ Broadmeadow and Ward Rivers;
- ✓ Sluice River and tributary;
- ✓ Turnapin Stream; and
- ✓ River Liffey.

Results of the assessment and comments

The studies about Hydrology and Hydrogeology have been carried out in line with international standards. Monitoring of water table levels induced by the construction of the MetroLink must be carried out with the clear purpose of verifying during construction the conclusions on Hydrology items as reported and calculated in Chapter 18 (Hydrology, Section 18.6.1.3) and in the outline CEMP (Appendix 5.1).

The spanning of the rivers that avoids instream works is regarded by the IEE as a positive construction choice.

The average tunnel depth of 8m to 10 m below existing ground level to the crown (top) of the tunnel stated in Chapter 18 is a very low coverage that in international standards is kept at more than 1,5 m diameter of the TBM cutting head (9,2 m) below the residential foundations. Therefore, there is not a problem for superficial hydrology, but there may be issues for Hydrogeology (dam effect) and settlement.

However, this statement on cover depths in Chapter 18, does not seem to accord with the vertical alignment drawings and tabular data that show average cover depths between 12 and 18 metres (not accounting for foundation depths) below existing ground. We assume that this is an inconsistency that will need to be corrected at some point. The vertical alignment of the tunnel in between the stations, that have to be positioned as high as possible for impact and cost reasons, could be significantly lowered in generally better soil conditions (i.e., limestone) to reduce settlement and dam effects.

Flooding problems are widely analysed for each area of MetroLink new constructions and compounds. The studies are in line with international standards.

As reported in Chapter 18, any lowering of groundwater levels in areas with highly deformable materials can generate significant settlements which may affect the stability of nearby buildings for example (refer Appendix A5.17 Building Damage Report).

Our view is that in the high watertable environment in Dublin, no attempt should be made to externally lower the water table by general de-watering pumping outside the Station box cavities, as this would be likely to lead to significant settlement risks to the surrounding properties.

Regarding the northern section of the alignment, the open cut solution should be thoroughly analysed for meteorological rainwater collection and drainage, and adequate structural support at the top head of the diaphragm walls. It is our view that a more general cover approach might eliminate much of the water ingress and provide excellent structural support to the D-walls, although it is likely that some penetration in the roof slabs would be necessary for safety reasons (ventilation etc.) between every 750 and 1000 metres. The top slab solution might well present a better use of the surface area for roads, green parks, social areas and even for possible new urbanizations. The costs should also be very similar because the open cut D-walls need the top supported by many, very strong, by structural struts.

The designer's principle of positioning the alignment "low points" in the stations seems the most acceptable solution. It should be evaluated in detail because will not be easy to regulate and control with sumps the large quantity of rain water in the open cut sections between Seatown and Fosterstown stations in AZ1 area.

4.4 SETTLEMENT OF GROUND AROUND TUNNELS AND ASSOCIATED CIVIL ENGINEERING WORKS

Concepts and terminology

Ground movement impact assessment process

The ground movement impact assessment process on tunnelling and underground projects around the world is normally undertaken following three phases.

Phase 1 defines the **buildings** that could be **potentially impacted by the project**. It involves the calculation of the greenfield settlement contours using ground model parameters derived from published case history data and ground investigation work undertaken in the area, and the identification of buildings that are:

a. enclosed within the 10mm contour or with a ground settlement slope > 1 in 500, and
b. enclosed within the 1mm contour and subject to 'special' considerations. e.g., Designated Protected Structures, or prominent or sensitive buildings.

Phase 2 involves the **classification of the buildings into one of five pre-defined risk categories** (see Table 4-4) based on the predicted maximum tensile strain that would be experienced by the building if it deformed to the predicted greenfield settlement profile. This approach is highly conservative since all buildings naturally have an inherent stiffness, but it provides a robust way of assessing with confidence the impact of ground movements. Those buildings that fall into a damage category of 3 (Moderate) or greater, and those subject to 'special' considerations are carried through to Phase 3.

Phase 3 involves the **individual detailed assessment** of each identified building to determine its behaviour using detailed information and sophisticated assessment methods; this usually includes a refined ground model, detailed structural surveys, and sophisticated finite element modelling types of analyses.

This stage will be undertaken by the D&B contractor who can precisely define and refine the construction methodology, and benefit from greater design maturity, thereby being in a position to confidently use less conservative assumptions to assess the impact of construction generated ground movements. It is therefore likely that the Phase 3 assessed damage category of buildings will improve upon the results of the Phase 2 assessment. Based on the findings of the assessment, if considered necessary, protection measures will be designed to safeguard the particular buildings from unacceptable levels of damage (category 3 or above).

Factors causing ground movements

The ground movements depend on several factors including

14. Geological, hydrogeological and geotechnical conditions,
15. Tunnel geometry and depth,
16. Excavation methods, and
17. The quality of workmanship and management.

It is however clear that a shallow tunnel will tend to have a greater effect on surface structures than a deep one.

For the proposed Project, tunnel excavation in both the Boulder Clay and the underlying rock present technical challenges that the TBM is to be designed for. In terms of solid geology, the Calp Limestone has fault/ fissure/

fracture zones, adverse dipping and large weathered shale beds and bedrock fracturing can also potentially represent pressurized water discharge points. These features can lead to TBM face instability and potentially increased settlement especially where the tunnel alignment is constantly changing from south to north in variable geological settings. The features generally occur infrequently, and the use of forward probing or other ground radar detection radar means can be used to identify their presence. The proposed variable density TBM can operate in both a slurry mode and in EPB mode ensuring that the TBM is capable of coping with the changing conditions.

The tunnel excavation must be sealed from underground water to avoid a decrease in the phreatic level to minimise any settlement impacts. The problem of subsidence (including 'sink hole' generation by tunnel collapse) increases with the settlement caused by the loss of subsoil removed during excavation of the tunnel. The system will be designed to monitor excavation quantities and reconcile against theoretical quantities to ensure that over-excavation is avoided.

With regard to Sprayed Concrete Lining (SCL) tunnelling there is also a risk of encountering such charged geological units. It is planned to undertake forward probing (to identify in advance) and grouting as required to stem any such flows.

The excavation of the underground stations for the proposed Project will be below the phreatic level. For this reason, excavation methods must progress in dry working conditions with only controlled water inflow into the excavation using suitably designed retaining pile walls such as D-walls or secant pile walls with possible groundwater lowering in the general area outside the footprint. Where the construction methodology is correct and applied effectively, all excavations will be undertaken in relatively dry conditions and without significantly affecting the phreatic level. In the case where during the Construction Phase a diaphragm wall begins to leak then groundwater can flow into the open excavation. This can potentially result in some depression of the phreatic level leading to settlement issues at any existing buildings near the station excavation site. Differential ground settlement at such buildings, induced by a lowering of the phreatic level, can cause damage to the structure and/or aesthetic appearances.

Refined volume loss values for the tunnelling works considering the advances in tunnelling equipment and control due to the capability of the TBM that will be used have been adopted for the Phase 2a building damage assessment (referred as the Refined Phase 2a assessment in this report) as follows:

- ✓ due to TBM works:
  - in superficial material (soft ground) or in rock with less than half-a-diameter rock cover above the tunnel crown: 1.0%
  - in rock with a minimum of half-a-diameter rock cover above the tunnel crown: 0.5%
- ✓ due to non-TBM works: 50% more than the corresponding values for TBM works.

  From a review of the expected geology and hydrogeology along the tunnel alignment, the construction and logistics constraints, and the anticipated TBM operational procedures, it is considered likely that a variable density (VD) TBM or a Mix Shield TBM will be selected. It therefore follows that the main characteristics of the TBM required to meet the tunnel requirements will be as follows.
  - Diameter of the cutter head: 9.53m
  - Diameter of the frontal shield: 9.50m
  - Diameter at the rear of the shield: 9.48m
  - Shield length (approx.): 10.00m

Reference to EIAR

Volume 5 Appendices 3/3 n.19 Hydrogeology covers aspects about the relationship between surface settlements and tunnel excavation depth that is neither simple nor linear. Also, the document A5.17 Buildings Ground Movement Impact Assessment describes the three-phased ground movement impact assessment process that is undertaken on tunnelling and underground projects around the World.

It does not cover the assessed impact of construction generated ground movements on utilities and services which are covered by a separate assessment due to there being over 50,000 utilities to be considered along the Metrolink route.

Results of the assessment and comments

For the Cut and Cover structures It is evident that the cut section with high D-walls offer an evident and significant "barrier effect" that must be mitigated. The solution proposed (200 mm drainage pipes) as it has been calculated, normally has the problem of maintenance over longer time periods in international experience, and we recommend that this issue is re-evaluated for the provision of potentially greater diameter drainage pipes, which will be much less prone to blockage and very much easier to maintain.

The studies of the tunnelling matters are in line with international standards. However, we have not seen a Building Condition Survey (BCS) for each of the 219 buildings considered in Phase1. Normally this is defined for each building its own admissible level of damage Building Risk Assessment (BRA) after a comprehensive Building Condition Survey (BCS). It is noted that most of the effects calculated by the designers are between the values from negligible to slight, which may well need further examination by the Construction Contractor during the detailed design phase.

The Building Risk Assessment (BRA) for each building, will be carried out only during Phase 3 by the contractor. In International Practice this analysis for each building is normally done in the previous phases in order to fix for each building its level admissible of damage.

There are no indications on the quartz presence in the soils and rocks which gives an indication of the wear given to the cutters on front shield of the TBM head. This consideration is very important to fix in advance areas for the maintenance of the cutters worn away by quartz erosion.

4.5 CONSTRUCTION TRAFFIC IMPACTS

Concepts and terminology

The ERM model

The National Transport Authority's (NTA) East Regional Model (ERM) has been utilised to provide most of the input transport data for the assessment of the proposed Project.

The ERM provides a multi-modal forecasting capability required for the assessment of large-scale projects. It includes full geographic coverage of the eastern region (counties Dublin, Wicklow, Kildare, Meath, Louth, Wexford, Carlow, Laois, Offaly, Westmeath, Longford, Cavan and Monaghan), a detailed representation of the road network, a detailed representation of the public transport network and services, a detailed representation of all major transport modes including active modes, accurate mode choice modelling of residents, a detailed representation of travel demand of four time periods (AM- morning peak, 07:00-10:00, LT-lunchtime, 10:00-13:00, SR-school run, 13:00-16:00, and PM, evening peak, 16:00-19:00) and a prediction of changes in trip destination in response to changing traffic conditions, transport provision and/or policy.

The ERM has been used to provide forecast transport movements, such as passenger numbers, origin/destination and changes in travel behaviour due to the proposed Project. The ERM was calibrated by the NTA to a base census year of 2016, full details on the data collection used in the development of the model and in the validation and calibration of the model is contained within the Model Development Reports – East Regional Model (NTA 2020).

The traffic and transport impact assessment

In relation to the traffic and transport impact assessment the following items are relevant:

- ✓ **Methodology of impact assessment**, describing the objectives, the assessment levels (strategic and local), the related definition of impact category (slight, moderate, severe), the assessment indicators (related to general traffic, public transport, cyclists, pedestrian & vulnerable users, commercial and residential parking), the mitigation techniques, reduction and remedial measures;
- ✓ The **traffic model** is used in order to evaluate strategic and local impact, considering the additional construction vehicles, construction road closures and lane reductions;
- ✓ The **strategic area assessment** considers for all the construction sites and all the destination sites, the Heavy Goods Vehicles (HGVs) transporting equipment, construction materials and spoil;
- ✓ The **local area assessment** has been carried out for the following specific locations:
  - **North Section**, including Estuary to Seatown station, Seatown station to Malahide junction, Malahide junction to Pinnockhill junction and Pinnockhill junction to North Portal;
  - **Central Section**, including Dublin Airport North Portal, Dublin Airport Station, Dublin Airport South Portal, Dardistown Depot and station, M50 Bridge;
  - **South Section**, including stations of Northwood, Ballymun, Collins Avenue, Griffith Park, Glasnevin, Mater, O'Connell Street, Tara, St. Stephen Green and Charlemont.

Assessment levels

For **strategic area level**, the assessment considers the impacts on:

- ✓ **General traffic**, if the traffic flow increase (due to construction vehicles) is over 10% in uncongested areas or is over 5% in congested or sensitive areas;

- ✓ **Public transport**, if rerouting of services is implemented.

Local level assessment has been carried out for each construction site (stations, portals and construction site compounds), including the impacts on:

- ✓ **General Traffic**, considering:
  - Increase in traffic flow
  - increase in driver delay
  - diversion for local access
- ✓ **Public Transport**, considering:
  - Bus journey times
  - Alteration to bus stops
- ✓ **Cyclists**, considering:
  - Increase in traffic flow
  - Cycle volume
  - Impact measures
  - Increase in journey length
- ✓ **Pedestrian**, considering:
  - Increase in traffic flow
  - Pedestrian volume
  - Impact measures
  - Increase in journey length
- ✓ **Commercial / Retail loading**, considering
  - Diversion for access
  - Reduction of on-street loading facilities
- ✓ **Parking**, considering
  - Residential on-street loss
  - Commercial loss

The **potential magnitude** is evaluated as follows:

- ✓ **Slight** = minimal or negligible negative impact, having short duration and remediable with suitable traffic management measures;
- ✓ **Moderate** = intermediate level between slight and severe;
- ✓ **Severe** = impact affecting a substantial population and having long duration or residual impact.

The relations between level of impact (quantitative or qualitative evaluation) and potential magnitude (slight, moderate or severe) are clearly defined (please refer to Table 2-5 of EIAR A9.5).

A 2-stage approach is carried out in order to assess the impact of construction works

- ✓ During Stage 1, rating based on PDR design is provided;
- ✓ If in the Stage 1 some impacts result moderate or severe, Stage 2 is carried out considering also the TTM design.

Type and number of construction vehicles

In relation to construction phase the type and number of construction vehicle movements required are described and evaluated.

The calculation takes the total number of lorries to service each programme activity and divides this by the activity duration in ‘delivery days’. Some activities will require more deliveries at the start of the activity (for example placing rebar). Other activities will require more deliveries near the end of the activity (e.g. a concrete pour will have most deliveries on the day of the pour). Therefore, the peak movement numbers per day may be considerably higher than the average numbers shown.

The material capacity assumptions are related to the following site activities:

- ✓ site establishment,
- ✓ diaphragm walls,
- ✓ construction,
- ✓ TBM/tunnelling,
- ✓ track bed,
- ✓ track,
- ✓ groundwater disposal.

Some specific assumptions are made in relation to the construction methods for the following locations:

- ✓ Estuary Park and Ride (precast stairs and landings, columns, beams, wall panels, floor units, cladding);
- ✓ Broad Meadow Viaduct (including retaining wall, piers, abutment and deck info);
- ✓ Dardistown Depot (including roof cladding and wall cladding);
- ✓ M50 Bridge (including sheet piles, pre-welded steel beam sections and Glassfibre Reinforced Plastic formwork).

The types of construction vehicles are the following:

- ✓ Curtain Side;
- ✓ Flatbed;
- ✓ LGV;
- ✓ Ready Mix;
- ✓ Rigid Tanker;
- ✓ Tipper.

Reference to EIAR

The topic about "Traffic and Transport" is addressed in Chapter 9 of the EIAR.

This Chapter describes and assesses the likely direct and indirect significant effects of the proposed Project on Traffic and Transport, in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (i.e. the EIA Directive) (European Union, 2014a).

The assessment is based on a reasonable worst-case scenario with respect to potential impacts arising from the proposed Project as described in Chapters 4 to 6 of this EIAR.

The topic is very extensively treated (indeed it is the most voluminous of all of the sections of the EIAR) and the information are integrated in the following Appendices:

- ✓ A5.7 "Construction Vehicles, Plant & Equipment", including:
  - The material capacity assumptions related to all the construction site activities (site establishment, diaphragm walls, construction, TBM/tunnelling, track bed, track, groundwater disposal) and specific assumptions for Estuary Park and Ride, Broad Meadow Viaduct, Dardistown Depot, M50 Bridge (Appendix A, starting from page 5);
  - the type (curtain side, flatbed, LGV, ready mix, rigid tanker and tipper) and number of construction vehicle movements required in relation to construction phase (Appendix B, starting from page 14);
- ✓ A9.2 "Overall Project Traffic & Transportation Assessment", including all the Traffic and Transportation Assessments (TTAs), specific for each location (refer to Table 4.1), considering
  - Policy Context,
  - Baseline Conditions,
  - The Proposed Project,
  - Trip Generation / Trip Attraction in the future scenarios (2035 - Opening Year, 2050 - Design Year and 2065 - Forecast Year),
  - Assessment of Impacts,
  - Traffic Flow Diagrams.

- ✓ A9.3 "Transport Modelling Plan" and A9.4 "Transport Modelling Report" for further information on the ERM model runs;
- ✓ A9.5 "Scheme Traffic Management Plan", including:
  - Methodology of impact assessment,
  - Traffic model description,
  - Strategic area assessment, and
  - Local-area assessment for all the specific locations (refer to Table 4.2), included in the North, Central and South Section;
  - Temporary traffic management drawings related to Advanced Enabling Works (AEW) and Main Works (MW) phases.

Table 4.1: EIAR Appendix A9.2 references for specific TTAs

Station	Appendix	Page
Estuary Station and Park and Ride	A9.2-E	154
Seatown Station	A9.2-L	229
Swords Central Station	A9.2-N	274
Fosterstown Station	A9.2-F	325
Dublin Airport Station	A9.2-D	366
Northwood Station	A9.2-J	409
Ballymun Station	A9.2-A	456
Collins Avenue Station	A9.2-C	497
Griffith Park Station	A9.2-H	536
Glasnevin Station	A9.2-G	573
Mater Station	A9.2-I	616
O'Connell Street Station	A9.2-K	662
Tara Street Station	A9.2-O	699
St. Stephen's Green	A9.2-M	(*)
Charlemont Station	A9.2-B	751

(*): this Appendix was omitted in the first official submission and published separately on 25th November 2022

Table 4.2: EIAR Appendix A9.5 references for local area assessment

Section	AEW Summary	MW Summary	AEW TTM Drawings	MW TTM Drawings
Estuary to Seatown Station (p.57)	Table 5-26 page 89	Table 5-27 page 89	page 379	page 465
Seatown Station to Malahide Junction (p.91)	Table 5-50 page 112	Table 5-51 page 113	page 390	page 473
Malahide Junction to Pinnockhill Junction (p. 115)	Table 5-68 page 133	Table 5-69 page 113	page 394	page 478
Pinnockhill Junction to North Portal (p. 134)	Table 5-96 page 163	Table 5-97 page 164	page 399	page 482
Dublin Airport North Portal (p. 168)	Table 6-2 page 172	Table 6-3 page 172	n/a	page 489
Dublin Airport Station (p. 174)	Table 6-10 page 180	Table 6-11 page 181	n/a	page 490
Dublin Airport South Portal (p.182)	Table 6-18 page 188	Table 6-19 page 189	n/a	page 491
Dardistown Station and Depot (p. 190)	Table 6-26 page 199	Table 6-27 page 199	n/a	page 492
M50 Crossing (p. 201)	Table 6-34 page 208	Table 6-35 page 208	n/a	n/a
Northwood Station (p. 212)	Table 7-14 page 227	Table 7-15 page 227	page 406	page 494
Ballymun Station (p. 228)	Table 7-28 page 239	Table 7-29 page 240	page 414	page 496
Collins Avenue Station (p. 241)	Table 7-43 page 258	Table 7-44 page 258	page 416	page 497
Griffith Park Station (p. 259)	Table 7-58 page 272	Table 7-59 page 273	page 421	page 499
Glasnevin Station (p. 274)	Table 7-73 page 289	Table 7-74 page 289	page 424	page 500
Mater Station (p. 290)	Table 7-88 page 308	Table 7-89 page 309	page 428	page 503

Section	AEW Summary	MW Summary	AEW TTM Drawings	MW TTM Drawings
O'Connell Street Station (p. 310)	n/a	Table 7-96 page 320	n/a	page 506
Tara Station (p. 321)	Table 7-110 page 339	Table 7-111 page 340	page 444	page 507
St. Stephen's Green Station (p 341)	Table 7-125 page 355	Table 7-126 page 356	page 450	page 508
Charlemont Station (p. 357)	Table 7-140 page 372	Table 7-141 page 373	page 457	page 509

Results of the assessment and comments

The traffic and parking topic is extensively treated for the construction phase in the Appendix A9.5 "Scheme Traffic Management Plan"; the assessment was developed with a standard and detailed methodology for all locations, starting from definition of level of assessment, the indicators related to the specific level, and the evaluation methods for magnitude of impact.

The assessment parameters are related to the several categories: general traffic, HGV, public transport, cyclists, pedestrian & vulnerable users, commercial vehicles / loading, and parking.

For example:

- ✓ For **strategic area level**: increase in traffic flows, journey times or travel delay (in particular along selected strategic corridors), ratio of flow to capacity at junctions;
- ✓ For **local level**:
  - Additional distance travelled due to diversion (both for private car and public transport),
  - Increase in walking distances and quality of service for pedestrians and cyclists,
  - Increase in delays at junction (for each specific areas),
  - Changes in traffic flows on surrounding streets,
  - Change in location of bus stops,
  - Quantum of on-street parking removed,
  - Quantum of loading and taxi bays removed.

The type and number of construction vehicle movements have been calculated and graphically shown, but it would be useful to have this information with monthly detail, perhaps in tabular form or indicating how long certain traffic levels are exceeded, what are the average and maximum values, etc.

In general, **remedial measures** are proposed in order to mitigate the impacts, including:

- ✓ a comprehensive publicity campaign prior the commencement of the construction phase;
- ✓ the establishment of a Project Construction Traffic Forum;
- ✓ the control of construction vehicles in terms of operating hours, wheel washing, respect of entrances/exits from construction sites, respect of pre-defined spoil removal routes;
- ✓ the application of short term disruption and road closures at night / weekends / during school holidays;
- ✓ the appropriate separation of public transport users, pedestrian and cyclist routes.

The assessment is completed with several **drawings** (specifically for each location) showing the **temporary traffic management** during Advanced Enabling Works (AEW) and Main Works (MW) phases.

The details were provided for all the construction locations as reported in previous Table 4.2.

In relation to the drawings, they are a very useful tools in order to understand the local impact on traffic, but the following remarks can be passed:

- ✓ For all the locations the duration (indicative start and end) of the proposed phases is not clearly indicated and related to construction phases reported in EIAR Appendix A5.3 “Construction Sequence Report”;
- ✓ In this last document, for the Charlemont Station an alternative for the construction site is proposed (with some modifications in TTM strategies also), but it is not indicated if and why this alternative has or has not been selected.

5 ISSUES OF CONCERN TO RESIDENTS

5.1 INFORMATION GATHERING

The RINA IEE team led by Luke Albanese and Claudio Bellini have carried out an extensive series of stakeholder meetings since October 2021 with the Residential Stakeholder Groups (RSG) in both online and in some cases face to face conditions during the two on-site visits of the team to Dublin in November 2021 and July 2022. A record of the formal interactions is included in the **Report of Stakeholder Consultation before ROA – P0027301-1-H3 Rev. 0 September 2022**.

The Stakeholders placed an extensive series of questions with RINA and those questions were transcribed into a series of Requests for Information from TII, and various responses received. Those questions and responses are covered in our **Report of Stakeholder Consultation before ROA – P0027301-1-H3 Rev. 0 September 2022**, and circulated to the RSG groups.

In addition, the team has had many e-mail and telephone exchanges with residents on an informal basis, both before and after the RO application date of September 29th 2022.

This section of the report summarises the issues raised during the meetings (and in follow-up correspondence and conversations) and provides information to assist residents and other interested parties to navigate the Railway Order Application documents so as to find information relevant to each issue considered below.

In Section 5.2 we make some general comments concerning framing appropriate submissions to An Bord Pleanála, given the status of the design in the Railway Order Application. In Section 5.3 we summarise issues that we have found to be of general concern, and in Section 5.4 we record the key location-specific issues that have been raised with us. For each area of concern (both general and location-specific), we provide a summary of the nature of that concern (through a series of questions) or reference to the relevant sections of the EIAR (or, where appropriate, reference to the relevant paragraphs in the preceding sections of this report). In some cases, we provide a comment on the adequacy of the relevant section of the EIAR or a note of our understanding of the current status of ongoing discussions with TII.

5.2 GENERAL COMMENTS ON SUBMISSIONS

The experts working on the EIAR and the Preliminary Design appear to have generally made conservative assumptions in their assessments of the impacts of the scheme (e.g. by assuming that all noisy activities at any particular location will be going on at the same time). In other words, for key areas of concern, they have generally attempted to model a 'worst case' situation within the Preliminary design, which the contractors should be able to improve upon by design and programming. Where impacts predicted on this basis would exceed proposed threshold values, various mitigation measures have been described. This is the normal process for carrying out such works and meets our expectations of the way that they should have been carried out at this stage.

It will not be until the final design is produced by the Construction Contractors who will construct the metro that many of the questions listed in the paragraphs in Sections 5.2 and 5.3 below can be answered in detail. However, the engineers who produce the final design will have to take full account of all the conditions attached to the Railway Order. Submissions to An Bord Pleanála relating to issues of concern to residents are therefore likely to focus on all or some of the following:

- ✓ Requests for particular environmental limits to be prescribed in conditions, in general, at particular locations, at particular times of day etc (e.g. maximum vibration levels at inhabited properties).
- ✓ Requests for specific mitigation measures to be required to be included in the detailed design (e.g. screening, limitations on hours of working etc).
- ✓ Requests for conditions to be imposed requiring monitoring schemes for major measurable impacts (e.g. noise, vibration, settlement, dust, air quality, groundwater levels etc) to be agreed and implemented before construction proceeds, accompanied by proposals as to public disclosure of the information, responsibilities for undertaking the monitoring and the locations of monitoring equipment).
- ✓ Requests requiring TII to establish a means for obtaining a technical response to enquiries and concerns from those affected by the works.
- ✓ Requests for conditions to be imposed requiring TII to set up a complaints procedure and dispute resolution process relating to all significant impacts, to be agreed and implemented before construction proceeds.
- ✓ Requests for conditions to be imposed requiring TII to operate a Property Protection Scheme to ensure that property owners who experience damage to their properties have their problems rapidly addressed.

- ✓ Requests for An Bord Pleanála to require design changes to avoid significant effects and improve the scheme

It is common practice for significant progress to be made between residents (and other parties) and the promoting authority (TII in this case) by reaching agreement on at least some of these issues by discussion and negotiation in the period between the close of Submissions to An Bord Pleanála and any Oral Hearing proposed.

Such discussions and negotiations tend to be particularly successful in agreeing appropriate monitoring schemes, agreeing how community liaison and sharing of monitoring information will be managed, and agreeing property protection arrangements. Where agreement cannot be reached, discussions and negotiations will be helpful in focusing on the issues to be resolved by An Bord Pleanála in its determination of the application and setting of conditions.

5.3 ISSUES OF GENERAL CONCERN AT MORE THAN ONE LOCATION

This section summarises the key issues and concerns that were expressed by the RSGs all along the line, and in fact make up the majority of the queries and observations made by the Stakeholders and summarised into the appropriate RFIs.

In general, TII have provided evidence of the project decisions or issues related to each RFI, excepted for the topic about Linear Park concept along the R132 (RFI #5). For some topics there are no specific reference in the EIAR, but TII have previously provided adequate reply and indicated the other reference documents not included in the ROA documentation.

Table 5.1: RFI for which TII did not provide evidence

RFI	Topic	IEE Questions	TII Responses
#5	Linear Park	Please provide all reports, working notes, appraisal data and consultation results concerning the development of the 'Linear Park' concept along the R132. In addition, please demonstrate how the Linear Park concept is in compliance with Fingal County Council's current Development Plan (Part FCC DP 17-23 Parks and Open Spaces).	There is not response from TII to this query.

Table 5.2: RFI for which TII provided evidence but there no reference in the EIAR

RFI	Topic	IEE Questions	TII Responses
#12	Impact on property values	What effect will this project have on property values before, during and after project completion? Some residents may wish to consider selling up and moving rather than face major disruption for a period of 7-10 years. Please provide Private Property Assessments that show these effects including the likely impacts of house insurance premiums for those above or close to the line.	TII have not carried out any such analysis. For information, previous analysis of property prices for those properties in proximity to Luas or Dart stations carried out by daft.ie can be found at The Daft.ie DART & Luas House Price Map: By Stop https://www.blog.daft.ie/post/the-daft-ie-dart-luas-house-price-map-by-stop
#13	Penalties	Please can TII give an indication about: ✓ Details of mechanisms of penalties for contractors and subcontractors who does not adhere to contractual conditions	All contractors and subcontractors engaged on the MetroLink scheme will be contractually required to adhere to the conditions set by the Railway Order. Exact mechanisms or penalties for non-compliance will be determined once

RFI	Topic	IEE Questions	TII Responses
		relating to the EIAR and Stakeholder Impacts?	drafting of the contractual documents have been completed.
#20	Question from Charlemont area resident's group	11. EVALUATION OF DAMAGE, COMPENSATION DISTURBANCE, AND DEVALUATION OF PROPERTY. ✓ Precise details for evaluation of damage to property. ✓ Precise details of evaluation of compensation. ✓ Precise details for evaluation of permanent devaluation of property ✓ Implications for house insurance/damage. ✓ Caretaking of abandoned houses during re-locations. ✓ Security of houses during re-locations.	Detail on the process developed for evaluation of damage to property and the evaluation of compensation is contained within the POPS or Compulsory Purchase Order (CPO) guidance documents (depending on the specific circumstances involved) available on www.metrolink.ie Where there is a direct acquisition requirement, whether in whole or in part, from a particular property then the party(s) with a legal interest will be served with a Notice to Treat. The compensation code provides that the affected party is entitled to professional representation, to act on his/her behalf in the negotiation and settlement of the claim. Equally TII will be represented in the negotiation process. The overarching objective of this process is to reach an agreement that is fair and equitable and in line with the principle of equivalence. See CPO guidance document on the Your Property section of the website for further information Detail on the implications for house insurance/damage to property and the evaluation of compensation is contained within the POPS or Compulsory Purchase Order (CPO) guidance documents (depending on the specific circumstances involved) available on www.metrolink.ie Where TII takes control of a property, or assistance is requested by the relevant party as part of ongoing engagement, a contract is already in place with a property firm in relation to any property and facilities management requirements that may arise. The approach will be informed by the nature and characteristics of the individual property concerned and the time durations involved.
#20	Question from Charlemont area resident's group	Does the POPS (Property Owners Protection Scheme) include the security, insurance, maintenance, and upkeep related to existing but temporarily vacated properties?	The Property Owners Protection Scheme does not include these elements in the process.
#20	Question from Charlemont area resident's group	The stakeholder group is interested to receive and analyse the comprehensive breakdown of the cost to tunnel south from St Stephen's Green to Charlemont, and also the cost to build out the Charlemont station?	The capital cost of the station box at Charlemont is approx. €200 million, with the tunnel section between St Stephens Green to Charlemont (including the turnback tunnel) is approx. €25 million. These figures exclude risk, inflation and VAT.

RFI	Topic	IEE Questions	TII Responses
#21	Question from Griffith Avenue & District Residents Association	The local stakeholder group is interested to receive and analyse: ✓ the legal requirements under planning for size of footprint required for an emergency shaft; ✓ the reasoning for the large footprint as DFB did not request this during the pre-design phase. Therefore, as IEE we request the relevant information demonstrating the evidence and the reasoning behind the footprint requirements for the ACP IS, and particularly the requirements of the Dublin Fire Brigade.	As DFB have noted, the design for the shaft and external footprint is wholly the responsibility of TII and our designers, Jacobs/IDOM and an indicative footprint was developed in 2019 based on best practise that fire tenders and other emergency response vehicles will require direct access to the shaft entrance and a suitably sized hard standing area adjacent to the emergency stairs and lift access point was included in this early design. As noted in our response to RFI 19, the current shaft design reflects the consultations held with DFB including a requirement is that externally, the Intervention Shaft must facilitate hard standing access for fire service appliances within 20m of the entrance to the shaft. In addition, the provision of a second vehicle entrance/exit from the intervention shaft from R108 was developed due to concerns expressed by DFB on ability of fire tenders and other large appliances to turn within the hard-standing area.

5.3.1 Airborne noise during construction and operation

Noise during construction of the metro

All of those who have expressed an opinion at this stage are concerned about noise from construction works. The following questions have been raised:

- ✓ How noisy will the work be?
- ✓ What kind of noise profiles are likely to be generated by different activities (e.g. heavy digging, rock blasting, piling, truck movements etc.)
- ✓ When will noisy operations take place (e.g. hours of working)?
- ✓ How long will each noisy operation go on for and what will be the cumulative effects of construction operations going on concurrently?
- ✓ How will noise emissions be controlled, particularly for 'unsocial hours' activities where ambient noise levels are low?
- ✓ What limits will be set for noise, how will they be monitored and how will breaches of noise conditions be dealt with?
- ✓ Will residents have access to noise monitoring information so that they can see for themselves if noise limits have been exceeded? If not, will there be any independent monitoring of noise emissions and how will this be communicated to residents?
- ✓ What arrangements will be in place for receiving and dealing with complaints about noise?

Noise during operation of the metro

There is also concern about noise during operation of the metro, as summarised in the following questions:

- ✓ Will movement of trains through the underground sections of the metro (and at stations) be audible at street level?
- ✓ Where the metro runs at or near the surface in open cut sections, will it be possible to hear it above existing noise levels, especially at night? If so, how much noisier will it be than it is now?

- ✓ Will the operation of the ventilation system for tunnels and underground stations give rise to noise on a continuous or intermittent basis? If so, will it be possible to hear it above existing noise levels, especially at night?
- ✓ Will the maintenance activities on the system generate any extra noise over and above the ambient noise levels, particularly at night?

Comment

The questions listed above are reasonable long term concerns which ought to be addressed satisfactorily during the remainder of the planning and design process. Chapter 13 of the EIAR and its Appendices addresses the Airborne Noise aspects of the project with baseline surveys forming the data upon which modelling of future effects has been undertaken and necessary mitigations proposed. This is normal practice in any significant infrastructure project.

We agree with the authors of the noise sections in the EIAR and do not consider that there should be any airborne noise from the operation of underground sections of the metro in themselves and it should be possible for the design of the ventilation systems to be such that noise nuisance is not caused, although we also agree with the RSGs that the incidental noises from station operation in particular should have been more explicitly addressed in the EIAR, as at present these appear to have been largely omitted.

5.3.2 Vibration and ground borne noise during construction and operation

Vibration and ground borne noise during construction

Vibration and ground borne noise during construction works is of great concern to those who live above or close to proposed bored tunnels and the excavations required for underground stations and cut and cover tunnels. This is particularly the case in the areas of Dublin where the TBM bored tunnels will be constructed underneath Victorian (or older) housing stock, and where residents may have doubts about the longer term structural integrity of their building foundations if disturbed.

The following questions have been raised:

- ✓ When will operations that will give rise to vibration and ground borne noise take place (e.g. hours of working)?
- ✓ How long will the TBM take to traverse any particular area, particularly where it might be below a given house or row of terraced housing?
- ✓ Will the TBM be perceptible as it traverses underneath my property, and if so at what level?
- ✓ How long will each noisy operation go on for and what will be the cumulative effects of construction operations going on concurrently?
- ✓ Will vibration cause structural damage to houses, especially vulnerable older properties whose foundation conditions are not known (or where there are believed to be no foundations)?
- ✓ What limits will be set for vibration and ground borne noise, how will they be monitored and how will breaches of conditions be dealt with?
- ✓ Will residents have access to vibration monitoring information so that they can see for themselves if prescribed limits have been exceeded? If not, will there be any independent monitoring of vibration and ground borne noise and how will this be communicated to residents?
- ✓ What arrangements will be in place for receiving and dealing with complaints about vibration and ground borne noise?
- ✓ How far away from the centre lines of the tunnel will vibration occur?
- ✓ Is there a depth below which no vibration will be felt at the surface?
- ✓ If structural damage occurs, what arrangements will be in place to ensure that this is assessed and repaired speedily?

Comment

These are the most common and normal types of questions dealt with on every tunnelling scheme with respects to Construction vibration in urban areas, and the EIAR in Chapter 14 goes into some detail to address these issues in a technical manner both analytically and in terms of potential mitigations where these may be required.

In addition, the IEE, whose tunnelling experience on Metro schemes is very extensive has been able to discuss some of these issues in the meetings to date, and expects to do so in significantly more detail approaching the Oral Hearing.

In terms of possible building damages, TII is developing a Property Protection Scheme and has already undertaken some surveys at a representative sample of buildings (different types, ages, styles, materials, construction techniques etc) to establish their characteristics and potential vulnerability to damage caused by vibration and settlement at Stages 1 and 2 of the building damage assessment.

Later stages of this scheme are likely (and indeed should) involve much more detailed condition surveys, by the Construction Contractor and their designers, of all properties within a pre-defined zone above and either side of the proposed bored tunnel and adjacent to underground stations and other deep excavations such as the Albert College Park Intervention Shaft.

Vibration and ground borne noise during operation of the metro

Those who live immediately above the line of the bored tunnels have expressed concern about the possibility of feeling vibration when trains pass beneath in the tunnels. In addition to the nuisance aspects of such vibration, they are worried about potential health risks of being exposed to continuous low level vibration and ground borne noise when trains pass beneath, and about diminution of property values as compared with properties that are not immediately above or adjacent to the tunnel.

Providing the trains and tracks are designed, operated, and maintained as described in the EIAR, there should be no vibration or ground borne noise generated by the operation of the metro in underground tunnels. It will be necessary for the successful contractor to design and construct the works such that this is the case and for the maintainer of the system to ensure that track and train maintenance (particularly of the train running gear and wheels) is kept up to the correct standards to eliminate any such possibilities.

Locations which are assessed as particularly sensitive are likely to need a resilient trackform which will attenuate vibration more than is normally the case (see section 4.2 and figure 4.16 above). Such locations could include hospitals, scientific research institutes, underground cinemas or theatres and in rare cases certain types of residential location (such as those that might be situated above unusually tight curves in the track or leading pointwork or crossovers).

5.3.3 Dust and other airborne emissions during the construction and operational periods

There is a general concern about the health and nuisance impacts of dust and other airborne emissions that may arise from this project. The EIAR has considered the following air quality issues:

- ✓ Nuisance dust from excavation, transport and spoil handling operations;
- ✓ Internal combustion engine (ICE) vehicle exhaust emissions.

Air quality matters are covered in the following sections of the EIAR:

- ✓ Volume 3, Chapter 10 (Human Health), Sections 10.4-10.7
- ✓ Volume 3, Chapter 16 (Air Quality) particularly and
- ✓ Volume 4 Figures to Chapters 10 and 16 (information supporting the human health and the air quality chapters)
- ✓ Volume 5, Appendices to Chapters 10 and 16 (information supporting the human health and the air quality chapters)
- ✓ Also relevant is Volume 3, Chapter 9 (Traffic), where measures to be taken to reduce traffic congestion (and therefore emissions) are considered.

Whilst much of the emphasis of investigation and modelling has been on changes in air quality resulting from changes to traffic movements associated with the operation and construction of the scheme, a significant amount of consideration has also been given to the main issue that residents are concerned about, that is any fugitive dust that could settle on their property, causing a nuisance or a health hazard.

Section 16.5.2.12 Construction Dust analyses this issue in some detail and Table 16.44 summarises this issue in Geographical Terms. Most of the largest impacts in dust generation terms are earthworks and spoil removal activities by tipper truck.

The experts that undertook the assessment consider that the generation of dust from construction operations, whilst inevitable, should be successfully mitigated and its spread limited through appropriate measures. The

mitigations are described at section 16.6.1.1 Construction Dust Mitigation Measures and will involve a good deal of planning, monitoring and mitigating set out in a proposed Air Quality Management Plan for each relevant work site that will generate dust. Some of the mitigation measures likely to be used have been described in Appendix 16.4 and will include:

- ✓ Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind.
- ✓ Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- ✓ Any blasting will be completed by specialised contractors with a specific blasting dust management plan;
- ✓ Liaison with local authorities and community groups;
- ✓ Hoarding will be provided around the construction compounds;
- ✓ It is anticipated that methods of collecting rainwater and recycling for general site use, will be adopted where practical. Requirements for dewatering installations at deep station and tunnel portals can also provide a valuable source of water for general site use.

Emissions of dust and fine particulates via the ventilation system from the operating metro is assessed to be of negligible significance for this electrically powered railway system in the EIAR, a conclusion with which we broadly concur. The EIAR indicates that dust arising from the operation of trains on the above ground sections is also expected to be negligible.

Comment

It will not be until a contractor is appointed and completes a final design for the works that detailed plans for management of potentially dusty activities can be made. Whilst we agree that the control of nuisance dust is largely a matter of good site housekeeping (as in the list provided in the EIAR), combined with appropriate screening and avoidance of dusty activities, these need to be anticipated and integrated into site design and site management plans.

It is good practice for baseline monitoring of dust to be carried out before construction work commences and for meteorological data to be collected (at weather stations) as a basis for predicting the range of directions of spread. Dust monitoring will be needed throughout the construction period as a means for establishing the amount of dust that is leaving each relevant site and triggering improvements in dust control at source.

Although it seems likely that above ground and open cut sections of the metro will not give rise to dust emissions, confirmation of this through monitoring would be desirable.

5.3.4 Construction traffic impacts and pedestrian safety during the construction period

As anticipated in the paragraph 4.5, a local area assessment for all the specific locations has been carried out and the summary results have been included in the Appendix A9.5 “Scheme Traffic Management Plan” (see previous Table 4.2 for reference details).

The Table 5.4 provide an overview of traffic impacts due to MetroLink construction works, considering the rating levels reported in the following table.

Table 5.3: Impact category description

Rating Level	Description
Slight	Slight impacts are those which should result in minimal or negligible negative impact for the transport network users. In particular, construction activity will generate many slight effects that are typically of short duration and can be remedied with suitable traffic management measures
Moderate	Moderate impacts are those which, depending on their intensity or the sensitivity of location to vehicular or pedestrian activity the duration of the effect, should be recorded in an assessment but which do not rank as significant themselves
Severe	The severe level equates to impacts that are residual or of long duration, of a high magnitude and / or affecting a substantial population

Table 5.4: Overview of MetroLink construction works on the transport network

Station / Location / Section	General Traffic	HGV	Public Transport	Cyclists	Pedestrian & Vulnerable Users	Commercial Vehicles / Loading	Parking
Estuary Station to R132 Crossing North							
Estuary Court to NDC compound							
Malahide Junction to Pavillons							
Pinnockhill Junction to R132 Crossing South							
North Portal							
Dublin Airport							
South Portal							
Dardistown							
M50 Crossing							
Northwood							
Ballymun							
Collins Avenue							
Griffith Park							
Glasnevin							

Station / Location / Section	General Traffic	HGV	Public Transport	Cyclists	Pedestrian & Vulnerable Users	Commercial Vehicles / Loading	Parking
Mater							
O'Connel Street							
Tara							
St Stephen's Green							
Charlemont							

In the following table all the impacts assessed as severe rating are summarised, including the table reference of Appendix A9.5, in order to have more details about the impact assessment.

Table 5.5: Summary of the impacts assessed as severe rating

Location	Road user	Criteria	TTM Design	Residual / Comment	Table reference
Estuary Station	General Traffic	Diversion for local access	Closure of Ennis Lane, which links the R132 to Balheary Road	Residual impact	5-10 p. 69
Estuary Signalised Junction	General Traffic	Increase in traffic flow (PCUs)	Loss of turning movements to and from the R125 (west) junction arm	Residual impact	5-15 p. 75
		Diversion for local access	Loss of turning movements to and from the R125 (west) junction arm	Residual impact and mitigation required	5-16 p. 76
Seatown Signalised Junction	General Traffic	Increase in traffic flow	Reduced capacity on all arms of Seatown Junction including the loss of turning movements to and from the Seatown Road (east) junction arm	Residual impact	5-44 p. 105
		Increase in driver delay			
		Diversion for local access	Restrictions of movements on Seatown junction	Residual impact and further mitigation required	5-45 p. 106
Pinnockhill Signalised Junction	General Traffic	Increase in traffic flow	Full closure of the R125 south arm during main works. Reduced general traffic lane on R132 southbound and northbound on approach to junction	Residual impact	5-78 p. 145
		Increase in driver delay			

Location	Road user	Criteria	TTM Design	Residual / Comment	Table reference
		Diversion for local access	Diversion of approx. 1.5km due to R125 south closure		5-79 p. 146
Nevinstown Signalised Junction	General Traffic	Increase in traffic flow	Closure of L2305 arm. Existing 4 arm junction reduced to a 3-arm junction with a left out slip onto R132 southbound, south of the junction	Residual impact	5-84 p. 152
		Diversion for local access	Closure of L2305 causing approx. 1.4km diversion to Pinnockhill junction / Airside roundabout	Residual impact	5-85 p. 153
Dardistown Station and Depot	HGV	Increase in HGV flows	Increase in the volume of HGVs on the local road network	Residual impact	6-27 p. 199
Northwood (AEW)	General Traffic	Increase in traffic flow	R108 partially reduced to 2 lanes in each direction during all phases	Residual impact	7-3 p. 216
	Cyclists	Safety	Removal of southbound cycle facility during phase 3. Cycle lane / ways provided in all phases	Residual impact	7-6 p. 218
		Infrastructure impact measure	Existing level of cycle infrastructure retained during all phases		
	Pedestrians	Increase in journey length	Footways provided in all phases. Footpath closures during phase 2 and 3. Signalised crossing closure during phase 2		
Northwood (MW)	HGV	Increase in HGV flows	No proposed TTM	Residual impact	7-9 p. 222
Collins Avenue	General Traffic	Increase in traffic flow	Reduced capacity on R108 Ballymun Road. One lane for general traffic in each direction	Residual impact	7-38 p. 252
		Increase in driver delay			
	Parking	Public parking / residential parking loss	Severe loss of parking spaces in local area. No proposed TTM	Residual impact	7-42 p. 257
Glasnevin	Cyclists	Infrastructure impact measure	Full section closure of Royal Canal Way	Residual impact and further mitigation required	7-71 p. 287

Location	Road user	Criteria	TTM Design	Residual / Comment	Table reference
	Pedestrians	Infrastructure impact measure	Footways retained. Partial closure of Royal Canal Way	Residual impact	
Mater	HGV	Increase in HGV flows	No proposed TTM	N/A	7-83 p. 303
	General Traffic	Diversion for local access	Closure of Eccles Street to general traffic (emergency vehicle access only)	Residual impact	7-84 p. 304
Tara	HGV	Increase in HGV flows	No proposed TTM	Residual impact	7-105 p. 332
St. Stephen's Green	General Traffic	Diversion for local access	Closure of Hume Street and diversion via Pembroke Street and Leeson Street	Residual impact	7-115 p. 346
Charlemont (AEW)	General Traffic	Increase in traffic flow	Closure of Dartmouth Road. Temporary signals at Dartmouth Square West / Dartmouth Road junction	Residual impact	7-129 p. 362
Charlemont (MW)	General Traffic	Increase in traffic flow	Partial closure of Dartmouth Road. Moderate change in local traffic distribution	Residual impact	7-135 p. 368

Comment

The traffic studies in the EIAR are the some of the most comprehensive in the document and supported by the most detailed information. Proposed construction traffic routes associated with each of the proposed construction sites are described in detail and shown on drawings in the EIAR (Volume 3, Book 1, Chapter 9 Traffic and Transport (Main Report), Volume 4, Chapter 9 Traffic and Transport (Figures and maps – see figure 9.9) and Volume 5, Chapter 9 Traffic and Transport (Appendices – see Appendix 9.5 Scheme Traffic Management Plan).

Residents living in streets around the proposed shaft and station excavations and on the proposed route for tunnelling spoil from Albert Park, Griffith Park and Glasnevin (north up the Ballymun Road and north up the Finglas Road R135/N2) and Mater are extremely concerned about the impact of construction traffic (including private vehicles belonging to site workers) in the following respects:

- ✓ The inadequate widths of urban streets to accommodate heavy goods vehicles;
- ✓ The noise, dust, emissions and road congestion impacts of additional traffic on the roads;
- ✓ Danger to pedestrians using the streets being used for construction traffic bringing materials to the sites or removing spoil. The concern particularly relates to school students and their parents and carers on their way to and from school and particularly for special needs users and residents and the elderly and frail;
- ✓ Increased problems with parking private cars if construction workers park in streets around the proposed construction sites;
- ✓ Coordination with the proposed CBC corridor construction in the Ballymun Road/Mobhi Road axis.

5.3.5 Potential for the construction works to cause or exacerbate flooding

Following the design concepts written in the EIAR for the MetroLink project, it is possible that there will be slight variations in the water table levels and slight phenomena of localized potential superficial floodings. The designer has reported calculations and analyses reporting and evaluating the risks. A surface and groundwater monitoring and management plan must be developed in order to check the hydrological and hydrogeological factors in real time for both the construction phase, and longer terms during operations.

5.3.6 Potential for the tunnelling works to cause settlement

It is necessary to make a distinction about tunnelling by a TBM mechanized tunnelling system and a traditional excavated tunnelling (sometimes described as NATM) system.

In case of TBM tunnelling it is necessary to constantly monitor the operational data of the 'advance' of the TBM and make any corrections on the base of this 'real time' monitoring of all the excavation factors, including the settlement monitoring and adjust the ground pressures accordingly, mitigating any settlement risks to a very significant degree, with the aim of restricting any building damages to category 2 or below.

In case of traditional tunnelling, it is necessary to adapt the typical sections of reinforcement like steel frames and Sprayed Concrete Linings (sometimes called 'shotcrete') to the real geological conditions observed continuously at the front of excavation. This tunnel advance method is called "Observational Method**"** and provides the necessary evidence to change the typical advance reinforcing sections according to geology and hydrogeology of the soil at the front of excavation and also behind it in the not jet excavated ground. Monitoring the deformations of the excavated tunnel gives the security that the provisions of the designer are confirmed.

For the shaft construction Instead of traditional excavation methods (from up to down) like secant piles or diaphragm walls and internal concrete linings, there are modern technologies in the family of the " Raise bore drilling ", that is an underground mining drilling methodology (VSM Vertical Shaft Machine) used to create a vertical, circular excavation between two levels of an infrastructure, without the use of explosives. It is most commonly utilized for the excavation of shaft s from the surface to underground locations for diameters from 4,5 m to 18 m. Conceptually this is like a vertical TBM

Adopting the above methodologies is possible to limit the surface settlements to acceptable values, although the high water table in the Dublin area means that certain methods may be preferred over others, particularly for shaft sinking, as they are more easily able to prevent water ingress into the groundworks during construction. The final decision on these things will be made by the Construction Contractor during the detailed design phase and it is therefore important that residents are kept fully aware of the progress of that phase as it progresses.

TII reply to RFI 7 also includes the following commitment:

*"..The Property Owner Protection Scheme (POPS), which is easily accessible, cost-free and open to all relevant property owners will be launched prior to the construction phase of the project. Under this scheme**, property owners can choose one of three independent survey companies to undertake a condition survey on their property**. The panel surveyor shall recommend the repairs required where they assess that damage to the property has been caused by the construction of MetroLink.*

The premise of the scheme is that any property owner of a private property located within the scheme area, may sign up to the POPS and avail of free, independent condition surveys of their property. ***Condition survey data will be gathered before, during and for one year after MetroLink is operational.."*** (our italics and highlights).

Residents may also avail of their own professional service providers if they choose as well, but at their own cost.

5.3.7 Potential effects of tunnel construction and metro operation on human health

The following issues have been identified as direct or indirect health concerns:

- ✓ Increased airborne particulates (PM10 and PM2.5) around ventilation shafts during operation and associated with construction traffic during construction;
- ✓ Electromagnetic radiation originating at the railway line and its associated electrical services (this concern relates particularly to sections of the line in bored tunnels where they pass directly beneath properties, but also to emissions from surface sections of the line);
- ✓ Stress and anxiety associated with anticipation of the scheme and exposure to a range of emissions and effects from its construction and operation;
- ✓ Effects of long term exposure to low level vibration and ground-borne noise during the operation of the MetroLink system;
- ✓ Danger to pedestrians along construction traffic routes;
- ✓ Potential for increase in radon risk; and
- ✓ An expectation that activity at major construction sites in green areas of the city could lead to migration of rat populations to residential areas and school grounds, based on received understanding of the DPT project effects.

Comment

Volume 3, Chapter 10 of the EIAR dedicated to Human Health effects and the baseline studies and environmental assessments in the Other Chapters of Volume 3 (particularly Chapters 9,11,12,13,14,16 18,19, 20 and 28) identify a range of issues as effects on human beings (land-use; socio-economics; noise; vibration; radiation and stray current; and traffic, air quality and geotechnical and water effects as well as risks of major accidents).

All of the matters listed above are addressed in these chapters with the exception of the explicit mention of potential rat migration which may be covered by Chapter 15 Biodiversity. At section 15.4.2.4.4 Other Mammal Species the report states under Disturbance/Displacement the following:

> In conjunction with any displacement effects associated with habitat loss, increased human presence and/or noise and vibration associated with construction works, has the potential to displace mammal species from both breeding/resting places and from foraging habitat.
>
> However, as disturbance will be intermittent and temporary (in the majority of locations) it is extremely unlikely to result in any long-term effects on the local mammal population or their conservation status. In addition, there is an existing relatively high level of human, noise and light disturbance within the immediate environment of the proposed Project (i.e. R132, Swords, Dublin Airport, M50 Motorway and Ballymun) and as such it is likely that mammal species present are habituated to a certain degree of disturbance. Therefore, disturbance/displacement during construction is unlikely to result in a significant negative effect, at any geographic scale.

Whether therefore there is an intention to monitor rodent displacement is not clear in the report as of the present time. It is recommended that TII make their intentions clear on this matter as many RSGs have expressed concerns about the subject.

Impact on property prices and local planning zones

In terms of the value of property over tunnels, whilst there is not a direct engineering relationship with these, we would expect each City to have its own property market characteristics and thus it can be difficult to generalise. However, our observations internationally suggest that the increase in accessibility of areas served by Metro systems does seem to have a generally (or even strongly) positive effect on property values on the alignments served (indeed in the case of London's new Elizabeth Line, this value is being 'captured' by means of local taxation in order to partly pay for the cost of this very large project), although specific locations may differ, and there is a concern from some residents that locations right next to station entrances can be rather negatively affected due to the level of increased activity and the issues related to this.

Some residents were also interested in effects on their house insurance premiums, and while as IEE we cannot directly comment, this observation was passed to TII, who we understand will discuss the matter with representatives of the Irish insurance industry.

In terms of Local Planning Zones TII have stated as part of a response to RFI 8 with respect to the Fingal Development Plan,

"The Fingal Development Pan for 2017-2023 was developed with an indicative route of the New Metro North scheme (approximately the Emerging preferred Route).

Since the publication of the 2017-2023 plan, TII have been consulting with Fingal County Council on the development of the MetroLink preferred route and this route will be reflected in the 2023-2029 Fingal Development Plan."

The EIAR Documents make it clear (NTS, Chapters 2, 3 and 4) that the Overall Planning Framework of land use and the Local Authorities is very closely integrated into the design and planning of the MetroLink concept.

Control of contractor performance and what will happen if things go wrong

A key issue raised during the planning and execution of any major Civil Engineering based contract and asked as part of RFI13. We understand that TII has not yet finalised its procurement strategy and processes for MetroLink and it is the mechanism of procurement which will to a large extent dictate the specifics of Contractual Management and any Penalty Regime.

TII have however said that

.".All Contractors and Subcontractors will be contractually required to adhere to the conditions set by the Railway Order. Exact Mechanisms or Penalties for non-compliance will be determined once drafting of the contractual documents has been completed…" (RFI Reply 13).

As part of the same reply TII have addressed concerns related to changes in the Schedule for the proposed project:

"..Changes in programme schedules in mega projects such as MetroLink will arise for a variety of reasons. Every effort is made to meet indicative targets and programmes but unfortunately circumstances will arise from time to time which will result in changes to schedules – all contractors working on MetroLink will be required to maintain lines of communication with stakeholder groups to ensure such events are quickly communicated…"

A draft high level schedule is provided by TII as Appendix 5.2 Construction Programme including Tunnel Elements. We would however note that this is only an initial estimate and does not contain the key construction dependencies (some of which are discussed in Appendix 5.3 Construction Sequence Report), and it will be the responsibility of TII and its Contractors to present information as clearly and in as timely a manner as possible into the Public Domain. The Construction Contracts should prioritise this, as often the nature of such arrangements tends to lead to a reluctance to share this kind of key information in public for Contractual and Commercial reasons, particularly on the part of the Contractor but sometimes also on the part of the Promoter (who in this case is TII) for similar reasons and also to assuage Political commitments that may have been given. However at this stage we note that the Government and TII have rather wisely given only a range of possible durations for the MetroLink works. As the project develops further this likely range will be able to be narrowed substantially.

We would expect the planning for this constant information-provision to and communication with the Public to be the subject of a detailed Stakeholder Management Plan shared between TII and the Contractors and under an advanced stage of development by TII at present. Such a system might typically involve the following key features amongst others, (all of which have been requested by the RSGs, many frequently):

- ✓ A 24 hour 'hotline' with a guarantee that the phone will be answered
- ✓ Dedicated case officers to interface with the Public
- ✓ An agreed process for considering and responding to complaints and concerns.
- ✓ A commitment to putting right any damage caused without involving those affected in disputes about liability.
- ✓ Wide distribution of clear and unambiguous literature informing people how they can make a complaint or raise a concern.
- ✓ Nomination of local representatives to be points of contact for residents, TII and the Contractors.
- ✓ Regular updates as to progress of the works and the forward plans, particularly as they will affect residents (*e.g.* regular updates as to where the TBMs are working on a particular day and the forward plan over the following days or weeks).
- ✓ Dissemination of monitoring information in a timely and transparent way.

5.4 LOCATION-SPECIFIC ISSUES

In the section below we highlight issues that have been raised by Stakeholders in their interaction with the EIAR documentation again or in addition to the ones already raised as part of the Stakeholder Engagement and the RFI process, which will be addressed as an Appendix in our Final Report on the RO Application and can be seen in our Initial **Report of Stakeholder Consultation before ROA – P0027301-1-H3 Rev. 0 September 2022**

The specific issues listed below relate only to the particular interests of the Residential Stakeholder Groups and are not comprehensive with respect to all issues that all other stakeholders may have raised on the same or any other parts of the route.

5.4.1 Estuary Station & P+R

Residents asked a question about whether the proposed Park and Ride facility for 3000 cars would be placed on the existing Balheary Recreation grounds, an impression that they had apparently gained from certain local authority planning documentation, possibly relating to the proposed new Swords Outer Link Road.

The Alignment, Structures and Landscaping drawings for Fingal, which show Estuary Station clearly indicate that the proposed multi-storey Park and Ride site, and that for which TII are seeking powers does not lie on the Balheary Recreation Grounds, but rather it lies directly next to Estuary Station on the eastern side, bounded by Ennis Lane on the west and the R132 on the east, several hundred metres to the north of Balheary Recreation grounds which are shown as being renovated for the same recreational purposes as now (GAA sports and soccer).

5.4.2 Route along R132 and Boundary Walls to Estuary, Ashley and Seatown Estates

Continuing from earlier questions related to the same subjects, the residents of the R132 estates have expressed significant concerns throughout our interactions, with the concepts related to the alignment, which is proposed to be constructed in retained cut or as cut and cover through their common green spaces, presently enclosed by the normal Dublin Suburban Estate boundary walls and used, in large measure by local children as safe and observable common play areas.

Whilst they do not, in principle, object to the land being used in this way for the common good of the Metro construction, and accept the fact that this is TII's preferred option they are concerned about a number of specific issues:

- ✓ That the existing vegetation and boundary walls will not be reinstated after the works are complete
- ✓ That the green spaces will be used as construction compounds for the duration of the project
- ✓ That the alignment in cut and cover may offer significant barrier effects on the well-known ground and surface water movements in the area, causing possible extra flooding
- ✓ Temporary and permanent parking management in the areas nearest the Metro stations
- ✓ Loss of grade separated crossings of the R132

Earlier concept drawings had shown that the boundary walls would be omitted from the finished detail, a situation the residents were extremely unhappy with since they feel that the safety of their children and others would be compromised from its present situation, as a result of open access to the R132 a busy dual carriageway and the possibility of 'through' foot traffic attracting undesirable elements through their estates in an uncontrolled manner.

Examination of the final alignment and landscape drawings shows that many of the boundary walls are now being proposed for re-instatement, however it is also clear that in several cases a significant number of wall penetrations will likely be made (in the case of Ashley Avenue, a total of 7 wall penetrations is being proposed, for Estuary and Seatown 2 each), in addition to the provision of new hard paved walking routes out onto the R132 which while excellent for pedestrian desire lines are likely to very substantially reduce the amenity of the common green areas for the residents. In our view it should be possible to reach a reasonable compromise on these issues and provide good access to Metro for pedestrians while retaining both a reasonable element of amenity and security for the local residents.

A closely related subject was the matter of the choice of the 'off street' alignment for Metro as opposed to the former (elevated) alignment in the middle of the R132. While TII have provided some material on this matter (in Chapter 7, section 7.7.9.2 Consideration of Alternatives along the R132) we have asked for more details of the multicriteria analysis undertaken along with its supporting information as, from our perspective and considering the upcoming reconstruction of the R132 into significantly a narrower road, the justification for the choice of preferred eastern alignment conclusion is not obviously apparent to us especially given the enormous disruption likely to be occasioned to the residents of the area for what will be a possibly very extended period. TII have committed to providing this during the present Phase of the Project.

As an alternative to the cut and cover construction method, some RSGs have requested and evaluation of a TBM bored tunnelling solution with the same TBM used under the Dublin Airport area. The advantages are to be evaluated in reference to a reduction of the "dam effect" for the water table flowing and a possible time and cost reduction of the metro line in this AZ1 area and the perceived greatly reduced impact on the residents of the bored tunnel alternative. We cannot find mention of a bored tunnel alternative having been considered, and in the context of such an important planning decision we agree that this should be addressed in the EIAR.

5.4.3 Collins Avenue Station

The most contentious station location for residents along the route that we have encountered is the proposed 'preferred' positioning of Collins Avenue station, in front of the Church of Our Lady of Victories on the Ballymun Road slightly to the south of the traffic junction with Collins Avenue. The location of this station has we understand been contentious as far back as the old Metro North proposals, more than a decade ago.

This subject is related also in part to the choice of the single tunnel bore configuration and hence the need for an emergency intervention shaft in Albert College Park (see below).

There are different views on this subject. The concerns of several of the residents' groups opposed to the 'preferred positioning' include:

- ✓ The closing off of one of the two entries for road traffic into their estate on a permanent basis and the loss of some residential parking spaces
- ✓ The extreme proximity of the southern end of the works to buildings containing frail elderly residents
- ✓ The potential for significant difficulties for schoolchildren and special needs users crossing the road in front of the works or being dropped off at school and day care facilities
- ✓ The proximity of the station to the major traffic intersection and the likely traffic disturbance this will cause over an extended period (especially when the CBC proposals are also considered)
- ✓ The possibility of the station entrance being a source of antisocial activity in an area where this could be an issue

These residents' groups have proposed an alternative location for the station, at the western side of Albert College Park, with the intervention shaft moved north of the intersection approximately into the car park of Ballymun library.

Not all residents in the area share the same view of the positioning of Collins Avenue Station however and others support the proposed preferred location and opposes the concept of a station within Albert College Park, considering that the much larger footprint of a station construction site (as opposed to the Intervention Shaft construction site, which is rather smaller by comparison) and hence the likely longer term major damage to this much loved and well used amenity that would be engendered by the construction of a station at this location. They also have concerns about the possibility of a station design damaging the future status of the park itself, depending upon its design.

The Chapter 7 Consideration of Alternatives does not contain an entry for Collins Avenue Station, although TII have committed to making available what they describe as the considerable body of assessment work undertaken to date during this phase and have already released a draft environmental appraisal by the design team: ML1-JAI-EGN-MS09_XX-RP-Z-00001 | P01 dated 2020/02/06. This draft report, although useful and informative in its own right, does not appear, in our view, to give clear support to either the preferred or proposed alternative options in its appraisal table, however.

It would be normal practice to use a multi-criteria type of analysis for this kind of work and a series of supporting reports about the relevant issues that would include issues such as: walk in catchment, overall forecast patronage, local planning issues, temporary and permanent traffic management, environmental and social inclusion issues, constructability and schedule related issues amongst others.

It is our view that whatever the merits of either (or any other) proposed location, TII must be able to demonstrate in the round the totality and consistency of the considerations it has used to make its decision for the Railway Order Application process, in the same way that it has done for Tara Street, or Charlemont for example. It is surprising therefore and perhaps an oversight, given the history of this station that no such supporting documents or analysis have been made available to date or in the initial EIAR submission documents.

5.4.4 Albert College Park Intervention Shaft (ACP-IS)

Somewhat related to the position of Collins Avenue Station is the requirement for an Intervention (Emergency Access) Shaft in the southwestern corner of Albert College Park. This requirement is the result of the decision to use the single bore twin track tunnel approach for constructing the MetroLink.

While this is not the most common tunnelling approach used in Europe for such Metro systems there is in increasing number of examples of such systems in recent years, especially where mini or midi automated Metro systems such as MetroLink are concerned, which have been successfully constructed and operated in this manner. Each approach (twin bore single track or single bore twin track) has its advantages and disadvantages, but one consequence of the single bore tunnel is the requirement to be able to evacuate in an emergency to the surface (or another place of safety) in the event of an underground fire or explosion, a second tunnel bore not being available for this purpose. (An apparent consideration used by owners and contractors in the twin or single bore tunnel choice, is concerned to the reduction of perceived construction risk in favour of a preferred solution which may depend on the circumstances of the project.)

Under the circumstances where the choice for a specific technical tunnel configuration alternative has a significant effect on the Residential Groups concerned, the IEE has requested TII to provide the assessment used in making this significant technical decision and has discussed the matter with TII and its engineering consultants, and although this subject is not covered to any great extent in the EIAR, TII have committed to making this assessment available.

The technical standards being adopted for this project relate to a European Technical Standard for Interoperability and would require a distance of no more than 1000 metres between the proposed stations at Collins Avenue and

Griffith Park, which is not possible with the present arrangements, hence an Intervention Shaft is proposed at the maximum northerly distance possible from the platform end of Griffith Park Station, in Albert College Park.

The residents' groups concerned (3 main local and two slightly further to the north) have a number of issues with the proposals.

Again, some residents tending to favour a station in ACP rather than the IS (or in addition to the station at Collins Avenue, at least as future provision) and others not, but we will not repeat these as they are covered in the section above and by TII responses to RFI 8.

All of the RSGs do however have concerns about the existing proposals for the ACP-IS which include:

- ✓ Size of the worksite
- ✓ Size of the temporary property requirement in the Park
- ✓ Permanent size of the IS site (particularly the size of the emergency parking area and the access and exit roads)
- ✓ Noise and vibration as a result of the works
- ✓ Noise and vibration from the Shaft Ventilation system
- ✓ Hours of working at the site
- ✓ Use of blasting for some of the shaft sinking and tunnelling activities
- ✓ Local flooding risks
- ✓ Local traffic management

The EIAR addresses only some of these issues raised by the RSGs, and there is significant concern from the residents particularly about issues relating to

- ✓ Size of the worksite
- ✓ Size of the temporary property requirement in the Park
- ✓ Permanent size of the IS site (particularly the size of the emergency parking area and the access and exit roads)

Which are not covered by the EIAR but have been addressed to a lesser extent in the RFI process and in subsequent questions to TII.

We also have some concerns about the apparent lack of baseline monitoring data for Airborne Noise in the Hampstead Road area and to the rear of ACP, a situation that should be rectified prior to the main construction works planning commencing.

5.4.5 Griffith Park Station

The main issues of concern which RSGs have expressed with this station relate to the significant movement of construction vehicles into and out of the site onto Mobhi Road, with the potentially overlapping CBC works being a concern with respect to local traffic management.

The overall routing of the large number of spoil removal vehicles out of station sites at Griffith Park, Glasnevin and Mater particularly up St Mobhi Road towards the M50 is a very significant concern to residents in the area with a preference for routing an alternative way onto the M50.

In addition, the Tunnel Finishing Works mentioned in section 5.5.3.1.8 have been proposed for the Griffith Park site, potentially making for an even higher level of activity at this location for a longer period, with heavy construction vehicles, cranes and so forth causing the normal concerns of noise and vibration, traffic disruption, dust etc. from the site to be increased.

5.4.6 Glasnevin Station

We include the area directly to the north of Glasnevin station in this section, as residents have been involved in both the station and the tunnelled alignment.

Several groups of residents are concerned. One in the Prospect area to the north of the station site, another group directly abutting the site in the Dalcassian apartment development who will be most immediately affected by the works and a third representing residents along the Canal on both sides and within the area to the south of it.

The first group in particular have expressed significant concerns about the possibility of settlement and noise and vibration caused by the TBM advance directly beneath their potentially poorly founded, early and mid-Victorian terraced houses, both in the short and longer terms as the clay ground consolidates over time in the years following construction. This part of the alignment is in 'mixed' ground (part in rock, part in the overburden) and such concerns are not therefore unreasonable. We have been having ongoing technical dialogue with this group in respect of the meaning of the relevant portions of the EIAR, particularly Chapter 5 and its appendices including A 5.17 the Building Damage (Assessment) Report. We highlight in Section 5.6 of this report above, the commitments given by TII in respect of the POP and the surveying of buildings along the alignment. It will be necessary to undertake a relevant BCS (Building Condition Survey) for each building, in particularly in this residential area, before, during and after the TBM excavations.

In the case of the residents most directly affected by the station construction itself, in the Dalcassian development, significant concerns about the reality of living directly next to a major construction site have been expressed especially given the length and complexity of the construction proposed. Substantial reservations about the suitability of the POPS or other proposed arrangements by TII to take care of their likely needs for the construction period and its likely coverage have also been shared. We understand that the residents are engaging directly on this matter with TII.

Other concerns expressed by these residents relate to issues which include:

- ✓ The loss of residents' temporary (and potentially some permanent) parking facilities,
- ✓ Construction traffic management into and out of what is an extremely congested piece of road by the Cross Guns Bridge
- ✓ The potential positioning of D-walling bentonite silos and filtration plant directly in front of their apartments causing a significant loss of light
- ✓ The height of the site boundary separation fence and its proximity to their apartments
- ✓ The overall 'mass' and scale of the station building and its apparent lack of coherence with the Victorian nature of the area
- ✓ The proposed design and scale of the dividing wall/emergency evacuation building between the Dalcassian development and the station building replacing a line of mature trees.

The third group of residents, flanking and to the south of the Canal have expressed serious concerns about the associated railway construction works, especially if these are likely to be carried out on a 24/7 basis for many months. They are also concerned about the proposed temporary canal crossing and the routing of the spoil removal trucks and other heavy construction machinery in their residential areas to the South of the Canal, as well as the status of the canal navigation itself and whether the existing biosphere will be returned to its 'as is ' status after the works have finished.

5.4.7 Mater Station

Issues arising from the D7 residential area concerning Mater station and the tunnelling in the Victorian housing stock are somewhat similar to those at Glasnevin, with a good deal of concern being expressed around:

- ✓ Settlement both short and longer term
- ✓ Noise and Vibration during construction and operation
- ✓ Residential and site parking management during construction
- ✓ Pedestrian management during construction
- ✓ Traffic management during and after construction
- ✓ Longer term local parking management
- ✓ The number and size of construction vehicles attending Mater site, their hours of working etc.
- ✓ The process of spoil removal during the station construction
- ✓ Construction dust management
- ✓ The architectural heritage of the Four Masters Park and its long term accessibility

The presentation of the ROA alignment and Structures drawings and the Photomontages supporting these, have given rise to concerns particularly on the last point with residents. The RSG group noting that the proposed station skylights into the park are large structures that will render much of the park green space effectively unusable, the design of the main station canopy blocks their views of the historic Mater Hospital and the support buildings (lift and

intervention shafts) meet, in their view a rather low architectural threshold, particularly considering the very historic nature of the area.

Several residents were of the view that the entrance to the station should be repositioned facing the front of the Mater Hospital, at right angles to the platforms and at the far end of the park.

While we can only comment on the engineering aspects of the station, we imagine that TII will wish to discuss these matters in some detail with the local residents.

5.4.8 Charlemont Station

Several groups are represented together around the proposed southern terminus of the line. The issues raised by the groups fall into 3 distinct types:

1. Policy issues (the terminus shouldn't be at Charlemont, it should be somewhere else like St. Stephen's Green)
2. Broad Design issues (the interchange with the Green Line, the longer term operation of the Green Line, the orientation of the terminating tunnels towards the potential linkage with the Green Line)
3. Engineering, Construction and related issues, which have become particularly focussed since the publication of the EIAR.

The EIAR does, cover the issues relating to the first point, particularly in Chapter 7, Consideration of Alternatives, and we are aware of a significant amount of effort having been put into this subject during the project development process but fundamentally this is a Policy related issue.

The EIAR does not as far as we understand, go into significant details about how the particular design of the Charlemont station and interchange was developed but we would expect this to have been the result of a substantial and iterative design process working within the constraints set out for the project.

In respect therefore of the last set of issues, the RSGs had issued a very substantial and detailed set of questions which were placed into RFI 20, which received a detailed response from TII. The questions covered issues which included:

- ✓ Construction Depth
- ✓ Soil Conditions
- ✓ Settlement (several questions also relating to the existing Hines development)
- ✓ Hydrogeology
- ✓ Piled Wall Deformation
- ✓ The POPs and CPO processes and related issues (several questions)
- ✓ Local traffic and parking management over the construction period
- ✓ The cost of Construction for the Civil elements of Charlemont Station
- ✓ Changes to the services on the Green Line

Other significant concerns we have noted relate to Operational Noise and Vibration from both the trains and the ancillary station equipment such as escalators, lifts and so forth, and related activities such as maintenance.

Since the publication of the EIAR a number of residents, particularly those facing the proposed site from the Dartmouth Road side have expressed great concerns about the possible construction methodologies for the site (2 possible methodologies are shown in the documentation, but neither is indicated as the most likely) and these concerns include issues such as:

- ✓ The likely period of closure of Dartmouth Road
- ✓ Residential and site parking management during construction
- ✓ Access to their properties during construction, especially for large deliveries, removals vehicles or similar
- ✓ The proximity of site boundary fencing to the front of their properties during construction
- ✓ Heavy plant and spoil vehicle traffic management during construction
- ✓ Noise and vibration during construction, particularly to the front of and directly under their houses where the emergency access tunnel will be dug, possibly by road header of by explosive tunnelling
- ✓ Noise relating to operation of the station, and indeed the noise and activity level from passengers entering the station opposite their houses

- ✓ Monitoring both during and after construction

While the EIAR does address some of these issues, of necessity it is of a rather general nature at this stage, and considerable detail will be needed to provide reassurance to the residents as the project progresses through detailed design into construction.

5.4.9 Construction traffic impact assessment in City Centre Area AZ4

The general construction traffic impact assessment is presented in the EIAR (Volume 3 - Book 1 - Chapter 9).
At strategic level (paragraph 9.6.1.1.6) the road network will be impacted by the construction of all stations/sections associated with the proposed Project. The following figure presents the proposed haul routes to and from the sites. The M1 and M50 Motorway will be utilised as haul routes to access the spoil site.

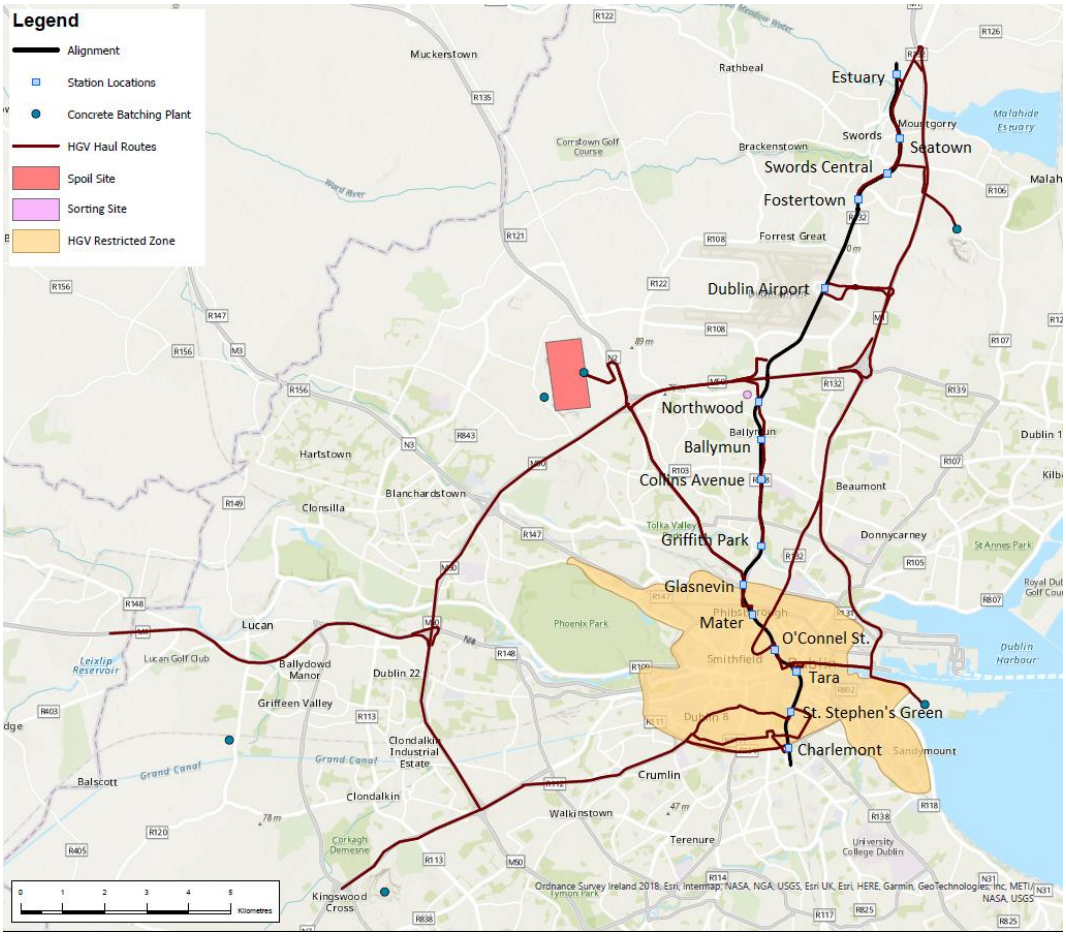


Figure 5.1: HGV Routing Options (EIAR Figure 9.9)

The two Main Works Construction Period scenarios (closures in the central and southern sections, and closures in the northern sections) results were analysed to identify instances of either:

- ✓ An increase in flow greater than both 20 PCUs and 5% of the equivalent Do Minimum flow; and
- ✓ An increase in delay greater than three minutes.

The STMP (Appendix A9.5) provides details of the proposed haulage route for the construction vehicles (paragraph 4.2, page 27) and related impacts (paragraph 4.4, page 32).
In addition, a local area assessment has been carried out (paragraph 9.6.1.2).
The following topics are presented:

- ✓ a summary of the construction vehicles numbers associated with the construction sites in this section; the daily range of movements are noted, however much of the Construction Phase has daily movements below this range.

- ✓ a summary of the significance of the impacts on general traffic during both enabling work and main work phases, including description, magnitude, sensitivity and significance for each impact; the appraisal methods for the assessment of impacts is reported in paragraph 9.4.8.

The references (numbers of table and page of EIAR) for each Assessment Zone are reported in the following table.

Table 4.6: References for the local area assessment included in the EIAR

Volume 3 - Book 1 - Chapter 9	AZ4 City Section
Construction Vehicles Movements	Table 9.89 (page 146)
Summary of Construction Impacts on General Traffic - Enabling Works and Main Works	Table 9.90 (page 147)

In particular for the AZ4 City Section (including the stations of Northwood, Ballymun, Collins Avenue, Griffith Park, Glasnevin, Mater, O'Connell Street, Tara, St. Stephen's Green and Charlemont) the construction impacts on general traffic are reported in the following tables.

Table 4.7: Construction Vehicles Movements - AZ4 City Section

	Total	Average Daily Range	Maximum Daily Movements	Duration of Maximum Weekly Movements
Ballymun	~ 45,000 movements	40-60 movements per day	124 movements per day for approximately 1 day	602 movements for approximately 2 weeks
Collins Avenue	~ 52,000 movements	40-80 movements per day	118 movements per day for approximately 16 days	588 movements for approximately 2 weeks in total
Griffith Park	~ 66,000 movements	40-80 movements per day	164 movements per day for approximately 2 days	934 movements for approximately 1 week
Glasnevin	~ 58,000 movements	50-100 movements per day	200 movements per day for approximately 2 days only	924 movements for approximately 2 weeks
Mater	~ 51,000 movements	40-70 movements per day	216 movements per day for approximately 2 days	788 movements for approximately 2 weeks
O'Connell Street	~ 70,000 movements	50 -100 movements per day	178 movements per day for 1 day	880 movements for approximately 1 week

	Total	Average Daily Range	Maximum Daily Movements	Duration of Maximum Weekly Movements
Tara Street	~ 57,000 movements	30-60 movements per day	130 movements per day for approximately 6 days	632 movements for approximately 2 weeks
St Stephen's Green	~ 44,000 movements	20-60 movements per day	136 movements per day for approximately 4 days	634 movements for approximately 2 weeks
Charlemont	~ 50,000 movements	20-50 movements per day	210 movements per day for approximately 2 days	1,392 movements for approximately 1 week

Table 8.4: Summary of Construction Impacts on General Traffic - Enabling Works - AZ4 City Section

Link	Description	Magnitude	Sensitivity	Significance of Impact
R108 Ballymun Road- Ballymun Station	Removal of general traffic lane on R108 northbound and southbound carriageway	Medium- reduction in capacity to one lane in each direction	Medium- Regional Road Network	Short-term Moderate Negative
R108 Ballymun Road /R103 Collins Avenue Junction	Reduced capacity on R108 during various phases. One lane for general traffic in each direction results in increased delays and traffic flow	Medium- delays of 2-4 minutes	High- Regional road network but proximity to school	Short-term Moderate Negative
Local Access to Albert College Court	Diversion of 750m and increase to driver delay	Medium	High- Local Access route	Short-term Moderate Negative
R108 St Mobhi Road	Removal of southbound bus lane increases traffic flows on traffic lanes	Low- 5/6% increase in flows	High- Regional Road network, proximity to schools and Bon Secours Hospital	Short-term Slight Negative
R108 St Mobhi Road	Removal of southbound bus lane increases driver delays on traffic lanes	Negligible- delay of one second	High- Regional Road network, proximity to schools and Bon Secours Hospital	Short-term Slight Negative

Link	Description	Magnitude	Sensitivity	Significance of Impact
Whitehall College of Further Education	Shuttle signals for access to college	Low- access maintained, only occurring at evenings and weekends	Low- low demand on evenings/weekends	Short-term Slight Negative
R108 Prospect Road-	Removal of one bus lane northbound on Prospect Road	Low- increase of 3% on traffic flows (40 second delay)	High- Regional Road network but proximity to heavy rail interchange	Short-term Slight Negative
Eccles Street	Temporary shuttle signals on Berkeley Road during Phases 2.1 to 2.5	Medium- up to 42% increase in volume on eastbound lane	High – Local road	Short-term Moderate Negative
O'Connell Street	Minor increase in HGV volume during peak periods	Low- 3% of mode share	Medium- Local Road in Dublin City Centre with restricted vehicle access	Short-term Slight Negative
R802 Tara Street (and Main Works)	Road closure along Luke Street between Townsend Street and Poolbeg Street. Lane loss on Tara Street	Low- redistribution of traffic on Tara Street Corn Exchange Place- negligible delays	High- Regional Road in Dublin City Centre	Short-term Slight Negative
Merrion Row	Closure of Hume Street will increase traffic flows and driver delays	Medium - 7-12% in traffic flows	High- Local Road in Dublin City Centre	Short-term Moderate Negative
R138 St Stephen's Green East	Lane reduction will increase traffic flows and driver delays.	Low- 45second delay	High Regional Road in Dublin City Centre	Short-term Slight Negative
Hume Street- Local Access	Closure of Hume Street and diversion via Pembroke Street and Leeson Street	High- 900m diversion	High- Local Road in Dublin City Centre	Short-term Significant Negative
Grand Parade	Closure of Dartmouth Road leads to ~10% increase in flows on Grand Parade, however only 12s delay	Medium- 10% increase in flows but 12s delay	High – Regional Road network in Dublin City Centre	Short-term Moderate Negative

Table 4.9: Summary of Construction Impacts on General Traffic - Main Works - AZ4 City Section

Link	Description	Magnitude	Sensitivity	Significance of Impact
R108 Ballymun Road – Ballymun Station	Removal of one general traffic lane on R108 in each direction	Low- reduction in capacity to one lane in each direction	Medium- Regional Road Network	Short-term Slight Negative
R108 Ballymun Road /R103 Collins Avenue Junction	Increase in traffic flow due to diverted local traffic and increase in HGVs	High- junction will operate over capacity	High-Regional Road network but proximity to school	Short-term Significant Negative
R108 Ballymun Road /R103 Collins Avenue Junction	Reduced capacity on R108 results in increased delays	High- delays of up to 7mins	High-Regional Road network but proximity to school-	Short-term Significant Negative
Local Access to Albert College Court	Diversion of 750m and increase to driver delay	Medium- 750m diversion	High- Regional Road network, proximity to schools	Short-term Moderate Negative
R108 St Mobhi Road	Removal of southbound bus lane increases traffic flows on traffic lanes	Low- 11-13% increase in flows	High- Regional Road network, proximity to schools and Bon Secours Hospital	Short-term Slight Negative
R108 St Mobhi Road	Removal of southbound bus lane increases driver delays on traffic lanes	Negligible- delay of one second	High- Regional Road network, proximity to schools and Bon Secours Hospital	Short-term Slight Negative
R108 Prospect Road	Current traffic layout maintained, slight increase in flow and multiple site entrances	Low- no lane closures	High- Regional Road network but proximity to heavy rail interchange	Short-term Slight Negative
Mater -Phase 1	All traffic movements maintained on Berkeley Road and Eccles Street	Low- 11 second delay	High – Local Road network	Short-term Slight Negative
Mater-Phase 2	Restricted access to Eccles Street from Berkeley Road	Medium – increase of 9% traffic flow on Berkeley Road	High-Local Road network	Short-term Moderate Negative
Mater-Phase 3	Restricted access to Eccles Street from Berkeley Road	Medium – increase of 9% traffic flow on Berkeley Road	High-Local Road network	Short-term Moderate Negative

Link	Description	Magnitude	Sensitivity	Significance of Impact
O'Connell Street	Minor increase in HGV volume during peak periods	Low- 3% increase in HGV flows	Medium- Local Road in Dublin City Centre with restricted vehicle access	Short-term Slight Negative
Luke Street/R802 Tara Street	Road closure along Luke Street between Townsend Street and Poolbeg Street, lane loss on Tara Street	Medium-500m diversion but minimal impact on driver delay	High- Local and regional roads in Dublin City Centre	Short-term Moderate Negative
R138 St Stephen's Green East and Merrion Street Upper	Reduced capacity along SSG East, loss of one lane northbound and partial loss of one bus lane southbound	Low- minimal queuing on northbound approach to Hume Street junction	High-Regional Road in Dublin City Centre	Short-term Slight Negative
Dartmouth Road	Partial closure of Dartmouth Road. Moderate levels of diversion required, however banned right turn out of Northbrook Road increases journey time	Medium- diversion of approx. 700m	High – Regional Road network in Dublin City Centre	Short-term Moderate Negative

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RINA Consulting S.p.A. | Società soggetta a direzione e coordinamento amministrativo e finanziario del socio unico RINA S p A.
Via Cecchi, 6 - 16129 GENOVA | P. +39 010 31961 | rinaconsulting@rina.org | www.rina.org
C.F./P. IVA/R.I. Genova N. 03476550102 | Cap. Soc. € 20.000.000,00 i.v.

Appendix A

Stakeholder meetings

Doc. No. P0027301-1-H4 Rev. 1 - December 2022

Table 1: Complete schedule of the meetings held with residents

Group	First round	Second round	Additional meetings before ROA	Third Round	Additional meetings after ROA
Ashley Avenue	13/11/2021	26/01/2022	-	04/10/2022	-
Ballymun Road and Albert College	12/11/2021	28/01/2022	-	05/10/2022	16/11/2022
Charlemont and Dartmouth	-	01/02/2022	-	06/10/2022	15/11/2022
Dalcassian Downs	-	-	06/07/2022	07/10/2022	-
District 7	-	31/01/2022	-	25/10/2022	-
Estuary	13/11/2021	20/01/2022	-	11/10/2022	-
Griffith Avenue and District	11/11/2021	27/01/2022	16/12/2021 12/04/2022 15/06/2022	12/10/2022	-
Hampstead	10/11/2021	25/01/2022	-	13/10/2022	-
Phibsboro Village Tidy Towns	-	-	-	-	14/11/2022
Prospect ACA	10/11/2021	24/01/2022	-	14/10/2022	-
Seatown	13/11/2021	19/01/2022	-	17/10/2022	-
Wadlei and Hillcreast	11/11/2021	27/01/2022	-	18/10/2022	-

Table 2: First Round - November 2021 - Introductory meetings to explain the RO process, the role of the IEE Team and to record resident's concerns

Date	Group	Attendance
10/11/2021	Hampstead	[redacted]
10/11/2021	Prospect ACA	[redacted]
11/11/2021	Griffith Avenue and District	[redacted]
11/11/2021	Wadlei and Hillcreast	[redacted]
12/11/2021	Ballymun Road and Albert College	[redacted]
13/11/2021	Ashley Avenue	[redacted]
13/11/2021	Estuary	[redacted]
13/11/2021	Seatown	[redacted] group of approximately 10-20 residents with some turnover during the meeting

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Table 3: Second Round - January 2022 –Review of Published EPR and PR documents

Date	Group	Attendance
19/01/2022	Seatown	[redacted]
20/01/2022	Estuary	[redacted]
24/01/2022	Prospect ACA	[redacted]
25/01/2022	Hampstead	[redacted]
26/01/2022	Ashley Avenue	[redacted]
27/01/2022	Griffith Avenue and District	[redacted]
27/01/2022	Wadlei and Hillcreast	[redacted]
28/01/2022	Ballymun Road and Albert College	[redacted]
31/01/2022	District 7	[redacted]
01/02/2022	Charlemont and Dartmouth	[redacted]

Table 4: Third Round - October 2022 – Presentation of IEE Report about stakeholder consultation before ROA and details about written submission process

Date	Group	Attendance
04/10/2022	Ashley Avenue	[redacted]
05/10/2022	Ballymun Road and Albert College	[redacted]
06/10/2022	Charlemont and Dartmouth	[redacted]
07/10/2022	Dalcassian Downs	[redacted]
11/10/2022	Estuary	[redacted]
12/10/2022	Griffith Avenue and District	[redacted]
13/10/2022	Hampstead	[redacted]
14/10/2022	Prospect ACA	[redacted]
17/10/2022	Seatown	[redacted]
18/10/2022	Wadlei and Hillcreast	[redacted]
25/10/2022	District 7	[redacted]

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Via Cecchi, 6 - 16129 GENOVA | P. +39 010 31961 | rinaconsulting@rina.org | www.rina.org
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Appendix B

RFIs with the indication of the EIAR related parts

Doc. No. P0027301-1-H4 Rev. 1 - December 2022

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#1	Documents related to EPR and PR phases	It would be useful to receive the following documents: ✓ General • ML1-JAI-FAE-ROUT_XX-ST-Y-00001 | Safety Strategy ✓ Geotechnical • ML1-JAI-GEO-ROUT_XX-DR-Y-00123 | Barrier effect mitigation measures • ML1-JAI-GEO-ROUT_XX-DR-Y-00013 | Geological Long Section - Phase 1 • ML1-JAI-GEO-ROUT_XX-DR-Y-00037 | Geological Long Section - Phase 2 • ML1-JAI-GEO-ROUT_XX-DR-Y-00014 | Hydrogeological Plan • ML1-JAI-GEO-ROUT_XX-DR-Y-00015 | Hydrogeological Long Section • ML1-JAI-GEO-ROUT_XX-SU-Y-00006 | Factual Report AGI-3-Concept Design-2018 ✓ Tunnel • ML1-JAI-STU-ROUT_XX-DR-Y-00003 | Greenfield Settlements MAP – Lay out • ML1-JAI-STU-ROUT_XX-DR-Y-00004 | Typical cross sections of the TBM tunnel • ML1-JAI-STU-ROUT_XX-DR-Y-00006 | TBM - Tunnel. Ring General Layout - Distribution of the different segments on the TBM ring	All documents were provided	Not applicable

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
		• ML1-JAI-STU-ROUT-XX-DR-Y-00016 - TBM Tunnel. Ring Details - Details of screws and other auxiliary elements for segments connection • ML1-JAI-STU-ROUT-XX-DR-Y-00018 | TBM Tunnel.Monitoring. Special Buildings - Typical instrumentation for buildings during tunnel construction • ML1-JAI-STU-ROUT-XX-DR-Y-00025 | General Arrangement. Plan Layout - Drawing including the tunnel alignment in plan view superposed with the ground orthoimage ✓ Shaft • ML1-JAI-STU-ROUT_XX-M2-Y-000042 | Albert College Park Intervention Shaft. - Construction sequence - Construction method statement of the shaft		
#2	Documents related to EPR and PR phases	Working notes or reports relating to the siting of Collins Avenue Station during the overall EPR development process	The document ML1-JAI-EGN-MS09_XX-RP-Z-00001 was provided	Collins Avenue Station is explained in Volume 2, Chapter 05, section 5.10.3. Its construction sequence is shown in Volume 5, Chapter 05, Appendix 5.3, section 8.4
#3	Twin bore tunnel VS single bore tunnel	Reason for the switch from twin to single bore tunnel	The following documents were provided: ✓ ML1-JAI-ARC-ROUT_XX-RP-Y-00001 | Value Engineering Report ✓ ML1-JAI-FAE-ROUT_XX-RP-Y-00001 | Proposed Ventilation Strategy – Smoke Control	The reason for the switch from twin to single bore is explained in Volume 2, Chapter 07, section 7.7.2.1

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			✓ ML1-JAI-FAE-ROUT_XX-RP-Y-00002 | Assessment Design Fire for Rolling Stock ✓ ML1-JAI-FAE-ROUT_XX-RP-Y-00003 | Firefighting Track Design Principles ✓ ML1-JAI-STU-ROUT_XX-RP-Y-00015 | Tunnel Fire Safety Pros and Cons of a Single Bore Tunnel Arrangement	
#4		Please provide all appraisal reports, working notes and technical and costing data which support the decision-making process summarized at Appendix E Alignment Along the R132, of the Jacobs Idom Preferred Route Design Development Report ML1-JAI-CPS-ROUT_XX-RP-Y-00001 | P02 2019/04/05.		The summary of the Area C analysis, which the Alignment Along the R132 falls in, can be found in Volume 2, Chapter 07, Section 7.6.4.3.3.
#5	Linear Park	Please provide all reports, working notes, appraisal data and consultation results concerning the development of the 'Linear Park' concept along the R132. In addition, please demonstrate how the Linear Park concept is in compliance with Fingal County Council's current Development Plan (Part FCC DP 17-23 Parks and Open Spaces).	There is not response from TII to this query.	There is no EIAR reference for this topic
#6	Collins Avenue station	Why this [Collins Avenue] station proposal now only has 1 entrance as opposed to the 2 proposed in OMN, especially with the proposed growth of the DCU site and new residential estates surrounding it.	With regards to the proposed alternative, this particular station location was assessed as part of the Alignment Options Study in 2018 as part of route options B0, B5 and B8. While alignment options containing this station location were assessed on a	Route options are described in Volume 2, Chapter 07, Section 7.6.4.2, Table 7-8 and are represented in Diagram 7.3 in the same section. Subsurface structures are detailed in Volume 2, Chapter 05, Section 5.5.2.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			route wide basis rather than via individual stations, the initial phase before developing the "spider web" of potential routes was the assessment of possible Metro Station Zones (MSZs). DCU Ballymun Road was assigned MSZ 7, with DCU Collins Avenue allocated MSV 9. During this pre-route establishment phase, each MSV was assessed for potential trip demand (number of potential trips in a 24 hour period). This demand (2035) was extracted from the National Transport Authority's Eastern Regional Model.and a representative centroid selected in each MSV. For DCU Ballymun Road, the number of potential trips within a 24hour period was estimated at 12,250, while for DCU Collins Avenue, the figure was estimated at 17,250. While both station zones were not directly assessed against each other, this estimated difference in trip generation between the zones was factored into the Multi Criteria Analysis carried out against prospective routes. Furthermore, environmental impacts of constructing the station within the environs of the park and the proximity of the DCU Collins Avenue station to orbital bus routes operating along Collins Avenue were also differentiating factors between the two MSZs. Regarding the provision of a single entrance at Collins Avenue, given the relatively short station box length, direction of greatest demand coming	Collins Avenue station is explained in Volume 2, Chapter 05, section 5.10.3

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			from Collins Avenue/DCU Helix and the provision of 2 x escalators and 2x stairs from surface to concourse, a single entrance was deemed to be fully capable of meeting projected demand. For more information, please find attached to this RFI the Preliminary Design sub-surface station chapter setting out the key design principles for this station (and other sub-surface stations along the scheme).	
#7	Content of Environmental Impact Assessment Report (EIAR)	Please Confirm that the EIAR will cover at least the following phases: ✓ Preparatory works ✓ Tunnel construction and spoil extraction ✓ Equipment installation ✓ Commissioning ✓ Operation	The EIAR will address the entire lifecycle of the project, including those described above.	✓ Preparatory works are described in Volume 2, Chapter 05, section 5.4. ✓ Tunnel construction is covered by Volume 2, Chapter 05, sections 5.5.3, 5.8 and 5.10. ✓ Spoil extraction is mentioned in Volume 2, Chapter 05, section 5.5.13; annex A5.13, section 4.5; and detailed in Volume 03, Book 03, Chapter 24. ✓ Equipment installations are covered in Volume 2, Chapter 05, from section 5.5.15 to section 5.5.23 ✓ Testing, Commissioning and Decommissioning are covered in Volume 2, Chapter 5, section 5.5.25 ✓ Operational Phase activities are detailed in Volume 2, Chapter 06.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#7	Content of Environmental Impact Assessment Report (EIAR)	Please confirm that the EIAR will include inter alia:		
		✓ Location of assessment points, along the entire metro route (including stations and shafts for ventilation) ✓ Type of impact (noise, vibration, atmospheric emission, settlements, etc.) ✓ Level of tolerance and acceptability (with reference to Irish Law and / or international good practices)	The EIAR will describe and/or assess each of these elements listed above.	Location of assessment points can be found in Volume 2, Chapter 04, section 4.4; and detailed on figures 1.1 and 4.1. The different type of impacts (i.e. noise, vibration, emissions, inter alia) have a dedicated chapter in Volume 3, where every impact is detailed. Levels of tolerance and acceptability are specified into every-impact chapter – e.g., for air quality these can be found on Chapter 16, section 16.3.2.1, for noise and vibration these can be found on Chapter 13, section 13.2.6.1 and Chapter 14, section 14.4, etc.
		✓ Mitigation measures and compensation scheme details for unacceptable impacts and damages including the length of time the compensation scheme will run for after the system is completed	The Property Owners Protection Scheme has been introduced to provide the comfort to any property owner of a private property located within the scheme area that there is a fast, free, independent survey service and redress scheme available to them on an individual basis to look after their concerns about any structural impact from the construction of MetroLink. The Property Owner Protection Scheme (POPS), which is easily accessible, cost-free and open to all relevant property owners will be launched prior to the construction phase of the project. Under this scheme, property owners can choose one of three independent survey companies to undertake a	✓ Mitigation and monitoring measures are provided in the "mitigation measures" section in each chapter from 9 to 28 in Volume 3. All of these measures are summarised in Chapter 31. ✓ There is not an explicit reference for the compensation scheme except for the Land Take, explained in section 21.6.1.2 in Chapter 21, Book 3, Volume 3..

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			condition survey on their property. The panel surveyor shall recommend the repairs required where they assess that damage to the property has been caused by the construction of MetroLink. The premise of the scheme is that any property owner of a private property located within the scheme area, may sign up to the POPS and avail of free, independent condition surveys of their property. Condition survey data will be gathered before, during and for one year after MetroLink is operational.	
		✓ Possibility of temporary relocation of residents who are subjected to unacceptable impacts and the criteria for assessing these	This will be addressed within the EIAR as part of the RO submission.	Relocation is mentioned in Volume 3, Book 1, Chapter 11, section 11.6.1.2. "Where this option is recommended, a consultation process will be established between TII, the contractor and the building occupants / owners".
		✓ Restoration of the existing situation, if it is modified by the construction activities	Where feasible, any temporary land take acquired for the purposes of constructing MetroLink will be reinstated on a like-for-like basis. This will be described within the EIAR.	Restoration of the existing situation is mentioned in Volume 3, Book 3, Chapter 21, section 21.6.2.3
#8	Alignment options	Does the current preferred route of the project not take full account of the current Fingal Co. Co. Development Plan 2017-2023, in particular for the Ashley Area?	The Fingal Development Pan for 2017-2023 was developed with an indicative route of the New Metro North scheme (approximately the Emerging preferred Route). Since the publication of the 2017-2023 plan, TII have been consulting with Fingal County Council on the development of the MetroLink preferred route and this route will be reflected in the 2023-2029 Fingal Development Plan.	The project has considered the Fingal Development Plan both 2017-2023 and 2023-2029, as specified in Volume 2, Chapter 03 sections 3.6.2.1.7 and 3.6.2.1.8

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#8	Alignment options	Some Bus Connects and the Metro appear to have parallel alignments in our area. What integration and coordination between the two systems is being planned for? We are the only area which will have a CBC directly above a Metrolink - have TII adequately referenced this in their decision making on PR? Does it make sense to have these significant overlaps in service provision?	Throughout the development of MetroLink, there has been close coordination with the BusConnects team working on behalf of the National transport Authority, including sequencing of the works, placement of BusConnects bus stops with regards to the proposed MetroLink station locations etc. While there are some sections of the alignments with an overlap in service provision between MetroLink and BusConnects, this significantly improves the level of integration between these two transport systems, allowing MetroLink passengers to easily interchange with an upgraded BusConnects core radial corridor with improved dedicated bus and cycle lanes, and connections to orbital routes providing an integrated service across the city, and vice versa.	Integration of the project with other transport modes is specified in Volume 2, Chapter 6, section 6.8.1
#8	Shaft and venting	In the current Metrolink project, residents suggested to TII that the proposed intervention shaft structure already planned for Albert College Park could be up-scaled to a fully functioning station. What is the actual cost difference between the two options? Has this been properly costed?	The capital cost difference between an intervention shaft (of the size proposed for Albert College Park) to a MetroLink station is estimated to be € 92.5m. This figure excludes indirect cost, land and property, risk inflation and VAT.	The Albert College Park intervention structure is explained in Volume 2, Chapter 4, section 4.10.2, 4.17.5 and Chapter 7, section 7.7.11.1. However, there is not EIAR reference for the costs.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#8	Shaft and venting	Given that it will only have 60 metre platforms and 1 entrance would it not make sense to have another station in ACP rather than an intervention shaft? What would be the cost difference between these 2 options? What would it cost to make provision for a future station in ACP even if not activated at the present time?	The capital cost difference between an intervention shaft (of the size proposed for Albert College Park) to a MetroLink station is estimated to be € 92.5m. This figure excludes indirect cost, land and property, risk inflation and VAT. Providing for a future proofed station at Albert College Park would not make economic (or operational) sense given the proximity to the neighbouring stations.	The Albert College Park intervention structure is explained in Volume 2, Chapter 4, section 4.10.2, 4.17.5 and Chapter 7, section 7.7.11.1. However, there is not EIAR reference for the costs.
#8	Shaft and venting	Intervention Shaft access point during the operational phase – will these be used for routine access by maintenance teams?	The shafts will not be used by maintenance teams for routine access onto the system. Occasional maintenance attendance at the intervention shaft access point will be required periodically.	Intervention shafts are explained in Volume 2, Chapter 5, section 5.5.11. However, there is not an explicit EIAR reference to answer the question.
#9	Spoil extraction	Will the shaft site be used for extraction spoil from the TBM tunnel especially from some of the more constrained station sites?	The shaft site at Albert College Park will not be used for the extraction of spoil from the TBM tunnel. All TBM extracted spoil will be returned through the TBM tunnel to Northwood for management in accordance with all relevant legislation.	There is not an exact EIAR reference to answer the query. However, waste transfer stations are covered by Volume 5, Chapter 24, Appendix A24.1, section 4.6 The quote "The construction compound site at Northwood will be the temporary storage location for all excavated material throughout the Construction Phase of the proposed Project" can be found in Volume 5, Chapter 24, Appendix 24.1, section 4.3
#9	Spoil extraction	Routes of spoil extraction: ✓ a) are they dependent on NTA CBC implementations?	MetroLink and BusConnects will follow different timelines for construction therefore it can be assumed that they are independent of each other, however, all interface issues between the projects are captured in the EIAR chapters.	There is not an explicit reference in the EIAR to answer the question. However, the cumulative impacts of interactions between other projects and Metrolink can be found as Chapter 30 in Volume 3, Book 4.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
		✓ b) will they be part of RO or decided at a later stage by DCC/TII?	A Scheme Traffic Management Plan (STMP) setting out all traffic management arrangements during construction will be included in the RO.	The STMP can be found on Volume 5, Chapter 09, Appendix 9.5
		✓ c) will spoil /construction traffic routes be part of RO?	Yes, they will be included in STMP.	Traffic routes can be found in Volume 5, Chapter 09, Appendix A9.5, section 4.2 and Volume 4, Chapter 9, Figure 9.9
		✓ d) Can TII or NTA provide a map of how soil to be removed?	This will be included in STMP and the relevant chapters of the EIAR which all form part of the RO.	This can be found in Volume 2, Chapter 05, Sections 5.5.2.2 – diagram 5.10; 5.5.2.3 – diagram 5.13; 5.5.2.5 – diagram 5.14
		✓ e) Can Four Masters tunnel spoils be removed elsewhere via another site station like Des Kellys location to reduce truck traffic in our locality?	The Four Masters tunnel spoils will be removed directly from the site station location via the tunnel to Northwood for management in accordance with all relevant legislation.	There is not an exact EIAR reference to answer the query. However, waste transfer stations are covered by Volume 5, Chapter 24, Appendix A24.1, section 4.6 The quote "The construction compound site at Northwood will be the temporary storage location for all excavated material throughout the Construction Phase of the proposed Project" can be found in Volume 5, Chapter 24, Appendix 24.1, section 4.3
#9	Spoil extraction	Can TII provide a SPOIL MANAGEMENT PLAN, including the following details: ✓ Sites used for extraction spoil and relative quantities of heavy vehicles	The extraction of spoil, the estimated number of heavy vehicles and associated vehicles movements will be addressed in the STMP and the relevant chapters of the EIAR which all form part of the RO.	Sites used for extraction soil can be found on Volume 4, Chapter 9, Figure 9.9. Quantities of heavy vehicles can be read on Volume 5, Chapter 05, Appendix 5.7, Section Appendix B.
		✓ Traffic routes for heavy vehicles and operating program (night / day / all day)	Traffic routes for heavy vehicles and an outline of their operating programme will be included in the Scheme Traffic Management Plan (STMP) which will be included in the RO.	Traffic routes for heavy vehicles can be found in Volume 5, Chapter 09, Appendix A9.5, section 4.2 and in Volume 4, Chapter 9, Figure 9.9. The delivery hours of the heavy vehicles

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
				depend on the standard working hours as specified in Volume 5, Chapter 5, Appendix 5.13., section 7.3.1
		✓ Sites used for spoil relocation	Sites proposed for soil relocation will be captured within the EIAR.	The sites used for spoil relocation can be found in Volume 4, Chapter 24, Figures 24.1 and 24.2
#9	Tunnel	Estuary Residents will accept the alignment if it is entirely cut and covered. Can TII confirm that this is the case?	While the entire MetroLink alignment along the R132 is not entirely cut & cover, the section of the alignment from the point the track crosses under the R132 directly adjacent to Estuary Court to the Seatown Station is contained in a cut & cover structure.	Cut and Cover Seatown Road/Roundabout Crossing for the Seatown West and Estuary Court Satellite Compound is explained in Volume 2, Chapter 05, section 5.7.6.1.1
#9	Tunnel	Duration of TBM pass-through, in particular for Dartmouth area?	Anticipated TBM production rate is to be 70 meters/week.	The Constructing Programme, in which the tunnelling times can be found, corresponds to Volume 5, Chapter 05, Appendix 5.2
#9	Works boundary	Will the EIAR/railway Order Application Contain a Detailed Construction Code of Practice/Construction Plan? What will it contain? Will it include where exactly any works boundary fences will be placed while the works are being completed?	The EIA process will assess all likely significant effects on the environmental through all phases of the project. This includes the construction phase and a specific construction phase management plan, the Construction Environmental Management Plan has been developed to provide a framework that outlines how contractors working on MetroLink shall manage and where practicable minimise potential negative environmental effects during the construction phase. The construction phase will include all site preparation, enabling works, demolition, material delivery and storage, waste storage and removal, construction activities, line wide installation and commissioning,	The construction phase is detailed in Volume 2, Chapter 05 and its relative appendixes (Volume 5, Chapter 05).

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			post project restoration and any associated engineering works. This document will be included as part of the overall RO submission. Land references and all temporary land take will be shown on the RO drawings and will indicative of the works boundary during the construction stage.	
#10	Content of Environmental Impact Statement	Please provide the main information about EIA/EIS, in particular: ✓ Contents of EIA/EIS ✓ Documents included ✓ Data collected ✓ Experts involved ✓ Multi-criteria Assessments Undertaken	The EIAR is organised into over 30 separate chapters, each chapter focussed on a particular area of assessment (such as landscape, air quality, biodiversity etc) and the impact assessment process, including the documents included, data collected (and methodology used) and any multi criteria analysis carried out set out in each. Each chapter provides a description of the assessed environmental impact across the entire scheme.	Volume 1 – Non-Technical Summary summarises the contents of the EIAR and it explains them from a general point of view.
#10	Content of Railway Application Order	Please provide the main information about documents included in the RO Application. In particular confirm that the following ones will be included: ✓ Site Survey Report and Geotechnical Data	A summary of all advanced Surveys completed will be incorporated within the various chapters and appendices in the EIAR.	Data Collection for Soils and Geology can be found in Volume 3, Book 2, Chapter 20, Section 20.2.3. Summary of Relevant Exploratory Hole Locations and Monitoring Data, regarding Soils and Geology, corresponds to Volume 5, Chapter 20, Appendix 20.2.
		✓ Location and typology of electricity substations	Details on the proposed electrical Substations will be confirmed as part of RO submission	Location and typology of electricity substations can be found in Volume 2, Chapter 04, Section 4.12.3; Volume 2, Chapter 05, Section 5.5.18; Volume 4, Chapter 22, Figure 22.2; Volume 4, Chapter 22, Figure 22.5

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
		✓ Construction methodologies (in terms of used technologies and indication of working hours) ✓ Routes for extracted spoil	The Construction Phase EIAR Chapter will include details on construction methodology A Scheme Traffic Management Plan (STMP) describing these proposed routes will be included in the RO.	Construction methodologies are explained in Volume 1, Chapter 05, Section 5.5 Traffic routes for extracted soil can be found in Volume 5, Chapter 09, Appendix A9.5, section 4.2 and in Volume 4, Chapter 9, Figure 9.9.
#11	Trees replacement and new planting	Please provide the main information about ENVIRONMENTAL IMPACT ASSESSMENT REPORT – MITIGATION ACTION PLANS, including: ✓ Trees replacement and new planting ✓ Biodiversity compensation ✓ CO2 compensation (considering the reduction due to removal of trees and existing vegetation) ✓ Acoustic barrier effect mitigation (of existing trees and vegetation) both during and after construction ✓ Reduction of construction site footprint ✓ Alternatives to proposed laydown and storage areas considered	All information above will be included in the EIAR as part of the RO submission.	✓ Trees replacement is described in Volume 2, Chapter 5, Section 5.4.3 ✓ Biodiversity compensation is described in Volume 3, Book 2, Chapter 215, Section 15.8. ✓ CO2 compensation is mentioned in Volume 3, Book 2, Chapter 17, section 17.6. ✓ There is no EIAR reference for the acoustic barrier effect mitigation for existing trees and vegetation. ✓ There is no EIAR reference in regards of the reduction of construction site footprint. ✓ Consideration of Alternatives is covered by the whole Chapter 07 in Volume 2. The specific alternatives considered can be found in Volume 2, Chapter 07, section 7.3.1.
#12	Archaeology and Heritage	Please confirm that the EIAR will provide ARCHAOLOGICAL SURVEYS of the route. Please provide indication of the number and locations of these surveys and the levels of detail within them.	The EIAR will contain details the multiple phases of archaeological investigations undertaken along the route of the proposed scheme and these will be included with the RO submission. As the proposed scheme shares a somewhat common alignment with old Metro North, a substantial	The number, locations and details of the archaeological surveys can be found on Volume 3, Book 3, Chapter 25.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			amount of the aforementioned archaeological surveys had taken place prior to the development of MetroLink. The combined archaeological investigations for old Metro North and MetroLink comprise Geophysical Surveys, Wade and Metal Detection Surveys, Archaeological Monitoring of Geotechnical Investigation's and Utility Slit Trenches in addition to the undertaking of Advance Targeted Test Excavations and Intensive Archaeological Test Excavations. The MetroLink Archaeological Surveys comprise: 1. Geophysical Surveys a. Four Phases of Works from St Stephen's Green to Lissenhall 2. Wade Survey a. Broadmeadow River- areas not previously covered by the old Metro North Survey(Licence Area 4) 3. Advance Targeted Archaeological Test Excavations a. Estuary Park & Ride (Lissenhall; Licence Area 1) b. Griffith Station (Home Farm Football Pitch; Licence Area 3) c. Dardistown Depot (Licence Area 4) 4. Archaeological Monitoring of Geotechnical Investigations d. Five Phases of Works from St Stephen's Green to Lissenhall	

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			(works ongoing, reports incorporated into GI documents) Reports from the previous archaeological investigations carried out during Metro North can be found on TII's website at https://www.tii.ie/tii-library/archaeology/	
#12	General impact during construction phase	If one house on a terrace is within the zone of influence should the full terrace not be included- (Stella avenue for example)	It is assumed that the zone of influence refers to settlement – in which case where a single house on a terrace falls within this zone, the POPS scheme (see response to RFI 7 for a description) considers the entire terrace rather than just the single dwelling in terms of potential impact.	There is no explicit answer to the query in the EIAR. However, Measures for Property Owners are explained in Volume 3, Book 1, Chapter 11, section 11.6.1.1. Besides, Property protection is explained in Volume 3, Book 3, Chapter 21, section 21.6.1.4. Furthermore, the contractor will always ensure good housekeeping practices, as explained in Volume 5, Chapter 5, Appendix 5.1, section 5.4
#12	General impact during construction phase	Please provide the main information about ENVIRONMENTAL IMPACT ASSESSMENT REPORT – MITIGATION ACTION PLANS, including: ✓ Trees replacement and new planting ✓ Biodiversity compensation ✓ CO2 compensation (considering the reduction due to removal of trees and existing vegetation)? ✓ Acoustic barrier effect mitigation (of existing trees and vegetation) both during and after construction? ✓ Reduction of construction site footprint	All information above will be included in the EIAR as part of the RO submission	✓ Trees replacement is described in Volume 2, Chapter 5, Section 5.4.3 ✓ Biodiversity compensation is described in Volume 3, Book 2, Chapter 215, Section 15.8. ✓ CO2 compensation is mentioned in Volume 3, Book 2, Chapter 17, section 17.6. ✓ There is no EIAR reference for the acoustic barrier effect mitigation for existing trees and vegetation. ✓ There is no EIAR reference in regards of the reduction of construction site footprint. ✓ Consideration of Alternatives is covered by the whole Chapter 07 in Volume 2. The specific alternatives

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
		✓ Alternatives to proposed laydown and storage areas considered		considered can be found in Volume 2, Chapter 07, section 7.3.1.
#12	General impact during construction phase	Construction Code of Practice includes the issues related to small tight site?	The Construction Phase EIAR Chapter will include details on construction methodology	Construction methodologies are detailed in Volume 2, Chapter 05. However, there is not a direct approach to answer the query.
#12	General impact during construction phase	Construction Code of Practice includes the issues related to work during weekend?	The Construction Phase EIAR Chapter will include details on construction methodology. Proposed standard working hours during the weekend will be set out in the EIAR.	There is not a proper answer to the question within the EIAR. However, Construction working hours are explained in Volume 2, Chapter 05, Section 5.2.4, in which it is explained that on Saturdays the working hours will be from 7:00 to 13:00 and that on Sundays and Public Holidays any works will be carried out,
#12	General impact during operational phase	Will homes on Hampstead need to be evacuated if incidence in the tunnel and fans need to clear smoke	No evacuation of houses is envisaged as being required in the event of a fire incident in the tunnel, however, further analysis is underway to confirm the extent of possible fires and the consequential extent of smoke exhausted – TII to revert.	There is not a proper answer to the query in the EIAR. Operational-Phase Ventilation shafts are however mentioned in Volume 3, Book 2, Chapter 16, section 16.5.3.11
#12	General impact during operational phase	Please provide details of the IMPACT MONITORING PLAN for the following phases: ✓ Preparatory works ✓ Tunnel construction and spoil extraction ✓ Equipment installation ✓ Commissioning ✓ Operation The plan should include:	The EIAR will detail a range of mitigations measures including environmental monitoring. These will include specific monitoring locations, tolerances acceptable and frequencies. Any alterations to those will be informed by any RO granted by ABP and any such related conditions.	Every environmental aspect (Volume 3) has its own chapter regarding the 'Mitigation Measures'. Furthermore, Inspections, Auditing and Monitoring Compliance are mentioned in Volume 5, Chapter 05, Appendix 5.1, section 4.2

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
		✓ Location of monitoring points, along the entire metro route (including stations and shafts for ventilation) ✓ Type of monitored impact (noise, vibration, atmospheric emission, settlements, etc.) ✓ Level of tolerance and acceptability (with reference to Irish/EU Law and / or international good practices) ✓ Frequency of monitoring and proposed length of monitoring ✓ Procedures for consultation of the monitored data ✓ Mitigation measures and actions in case of overcoming of maximum impact level		
#12	Impact on property values	What effect will this project have on property values before, during and after project completion? Some residents may wish to consider selling up and moving rather than face major disruption for a period of 7-10 years. Please provide Private Property Assessments that show these effects including the likely impacts of house insurance premiums for those above or close to the line.	TII have not carried out any such analysis. For information, previous analysis of property prices for those properties in proximity to Luas or Dart stations carried out by daft.ie can be found at The Daft.ie DART & Luas House Price Map: By Stop https://www.blog.daft.ie/post/the-daft-ie-dart-luas-house-price-map-by-stop	There is no reference in the EIAR for this topic.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#12	Monitoring	Please provide details of the IMPACT MONITORING PLAN for the following phases: ✓ Preparatory works ✓ Tunnel construction and spoil extraction ✓ Equipment installation ✓ Commissioning ✓ Operation The plan should include: ✓ Location of monitoring points, along the entire metro route (including stations and shafts for ventilation) ✓ Type of monitored impact (noise, vibration, atmospheric emission, settlements, etc.) ✓ Level of tolerance and acceptability (with reference to Irish/EU Law and / or international good practices) ✓ Frequency of monitoring and proposed length of monitoring ✓ Procedures for consultation of the monitored data ✓ Mitigation measures and actions in case of overcoming of maximum impact level In particular will homes on Hampstead need to be evacuated if incidence in the tunnel and fans need to clear smoke?	The EIAR will detail a range of mitigations measures including environmental monitoring. These will include specific monitoring locations, tolerances acceptable, frequencies will be informed by any RO granted by ABP and any such related conditions.	Every environmental aspect (Volume 3) has its own chapter regarding the 'Mitigation Measures'. Furthermore, Inspections, Auditing and Monitoring Compliance are mentioned in Volume 5, Chapter 05, Appendix 5.1, section 4.2 Regarding the evacuation, there is not a proper answer to such query in the EIAR. Operational-Phase Ventilation shafts are however mentioned in Volume 3, Book 2, Chapter 16, section 16.5.3.11

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#13	Penalties	Please can TII give an indication about: ✓ Details of mechanisms of penalties for contractors and subcontractors who does not adhere to contractual conditions relating to the EIAR and Stakeholder Impacts?	All contractors and subcontractors engaged on the MetroLink scheme will be contractually required to adhere to the conditions set by the Railway Order. Exact mechanisms or penalties for non-compliance will be determined once drafting of the contractual documents have been completed.	There is no reference in the EIAR for this topic.
		✓ Communication plan for stakeholder, including changes to programme schedules and their reasons	TII has engaged extensively with stakeholders along the route. The section on Consultation in the EIAR will capture the extent of the consultation and communication with stakeholders. This will be published as part of the Railway Order application process later this year. Changes in programme schedules in mega projects such as MetroLink will arise for a variety of reasons. Every effort is made to meet indicative targets and programmes but unfortunately circumstances will arise from time to time which will result in changes to schedules – all contractors working on MetroLink will be required to maintain lines of communication with stakeholder groups to ensure such events are quickly communicated.	The Aarhus Convention, which is a convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, is explained in Volume 2, Chapter 08, Sections 8.2.1. Best practice communications and communication channels are detailed in the same chapter in sections 8.2.4 and 8.3.4. respectively.
#13	Timing	Please provide the complete timeframe of the project, including the following phases: ✓ Design and permitting ✓ Bord Pleanala approval ✓ Preparatory works ✓ Station and Tunnel construction (area by area)	The complete timeframe, broken down per phase as detailed above, is currently being finalised and will be provided as part of the RO submission.	There is not a proper reference to answer the query in the EIAR. However, the construction programme can be found in Volume 5, Chapter 5, Appendix 5.2

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
		✓ System fit-out (area by area) ✓ Equipment installation ✓ Testing and Commissioning ✓ Start of operation		
#14	Resident access	Please provide the TRAFFIC MANAGEMENT PLAN during construction and operations phases, in particular indicating (area by area): ✓ If the resident accesses are close to the construction sites, how they will be regulated? How will access times be kept to a minimum? ✓ Will local parking restrictions (residents only) need to be introduced? ✓ What are the traffic limitations or reductions in the in the area adjacent to the works? Will any roads be temporarily or permanently narrowed? Will there be a loss of on-street parking in the temporary and permanent situations?	The management of traffic during construction and operational phases will be included within the Scheme Traffic Management Plan and the relevant chapters of the EIAR.	Traffic Management Plan can be found in Volume 5, Chapter 9, Appendix 9.5. in which section 5 to 7 contain the specifics for the different local areas.
#15	General impact on construction phase	Residents noted that the Dublin Port Tunnel and other works had resulted in significant activity by rodents and other small vermin. What does TII propose to do to monitor and control such vermin during and after the construction works for MetroLink?	With the construction methodology of MetroLink, with sealed concrete lined tunnels, sealed concrete station structures and the length of the overall underground section, the likelihood of similar rodent activity affecting residents in proximity of the works is deemed to be much less than Dublin Port Tunnel. Regardless, throughout the works, residents will have a clear line of communication to report any such issues.	The evaluation of impacts related to 'other mammal species', which is the category rodents fall in, can be found in Volume 3, Book 1, Chapter 15, Section 15.4.3.4.4

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#15	Mitigation measures for noise and vibration	What mitigation measures will be put in place so as to prevent any vibrations either during the construction phase or in the future operation of the Metro link, being felt in houses once the track is in use (for example floating track or specific operational measures and so forth)?	The Vibration and Groundborne noise chapters of the EIAR will detail the expected impacts during construction, largely through the operation of the TBM (which will be of a transitory nature). During operation, no perceptible vibration or ground borne noise from train operation of the scheme is expected. A significant source of vibration and noise during train running is corrugation of the track through wear, which will require infrequent rail grinding operations, a potential source of vibration and noise. Nearly affected residents will be consulted before these types of maintenance activities take place.	Mitigation measures for Airborne Noise and Vibration can be found in Volume 3, Book 1, Chapter 13, section 13.6; and for Ground-borne Noise and Vibration in Volume 3, Book 1, Chapter 14, section 14.5.
#16	Traffic management and disruption	If the road traffic projections for our area turn out to be inaccurate and residents suffer a much greater traffic density than forecast, with the consequences of congestion, delay and hampered accessibility to our area - who is responsible for introducing any corrective traffic management measures and over what time period?	A detailed traffic assessment has been undertaken for the project and details of this assessment have been discussed with local authorities i.e. DCC, FCC. The outcome of these studies did not indicate any significant impact. Similar to Luas Cross City, during the construction stage a traffic forum will be set up with representatives from TII, the Contractors, the local authority and An Garda Síochána to quickly react and respond to any changing circumstances.	In relation to this topic the following documents (EIAR Appendices – Volume 5) are available: ✓ A5.7 “Construction Vehicles, Plant & Equipment” ✓ A9.2 “Overall Project Traffic & Transportation Assessment”, ✓ A9.3 “Transport Modelling Plan” and A9.4 “Transport Modelling Report” for further information on the ERM model runs; ✓ A9.5 “Scheme Traffic Management Plan”
#17	Traffic modelling	Albert College Residents Association and Ballymun Road (North) Area Association have expressed some significant doubts related to the transport modelling approach employed in the EPR stage by ARUP – in other	The Regional Model System is a suite or transportation models covering Ireland which are developed by NTA. The Eastern Regional Model (ERM) is one of this family and covers much of East and Central Ireland, in particular Dublin and	The Regional Modelling System is explained in Volume 3, Book 1, Chapter 09, section 9.4.3.1. The Transport Modelling Plan and the Transport Modelling Report can be

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
		words using a strategic approach to look at different alignments but extrapolating these results to the actual station demand, which was both not detailed enough for the purpose, likely gives a misleading result, is now probably outdated and does not accurately reflect the future passenger demands in the area, especially given the future educational and residential development plans for the area, which are substantial. The IEE agrees that this is a matter that should be better supported with demand forecasting analysis at the appropriate level of detail.	its surrounding area. The model has been used to identify and assess proposed improvements in the country's travel infrastructure (covering both highways and public transport) over recent years. The modelling processes used to identify the optimal locations for the stations have been developed over a number of iterations to reflect the choices travellers make in terms of destination choice, mode choice and route choice. The decision processes are sophisticated and are based on best practice within the industry. The models use zones to represent spatial areas as origin and destination points of any journey. The spatial geography is detailed in the urban area in order to support accurate journey costs and realistic choices between alternatives. The model zones in turn are built from smaller units based on the national Census geography; these are used to collate future anticipated land-use developments, populations and employment. The calibration and validation of ERM gives a representation of travel which responds appropriately to cost and delay change, the addition of infrastructure, policy initiatives and changes over time. ERM's level of detail (in terms of its data inputs, spatial resolution, modelling processes and calibration) means that it is well suited to assess or appraise policies, schemes and proposed transport infrastructure, such as the Metrolink.	found respectively as Appendix A9.3 and Appendix A9.4 in Volume 5, Chapter 09.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#18	Alignment options	District 7 Community Alliance suggested an alternative of the alignment in their area, which seem to be appropriate for a response. The proposed alignment is much straighter on the eastern side of Botanic Road, passing straight down from the Griffith Park stop, under the Smurfit site and interchanging with IE under the present tennis courts, again a good construction site compared with the one proposed by TII. The line could then travel straight under the Canal, the corner of Mountjoy and have a station at the 'Musgraves' site, avoiding the difficulties associated with passing under so much poorly founded housing with a very curved alignment and giving a far better site for constructing the station behind Mater, rather than in Four Masters Park.	TII and Irish Rail had carried out initial feasibility assessment of the **Glasnevin Interchange Station** in 2019 in order to explore all feasible options in vicinity of Cross Guns bridge that would meet NTA requirements for passenger interchange between Irish Rail and MetroLink. Option of locating Irish Rail passenger platforms east of Cross Guns Bridge was explored but found not feasible for following reasons: a. Length of Irish Rail platforms of 174m would require significant property take along Whitworth Road / David Park. b. Irish Rail would require four platforms (width of 4m each) to fulfil operational requirements set out by NTA transport modelling. This would inevitably impact on MGWR retained cut space proofing, resulting with reduced width of the Royal Canal Greenway and removal of Whitworth Road along proposed IE platforms. c. Vertical alignment of Irish MGWR (falling toward Docklands) and GSWR (climbing towards Drumcondra Station) would be on the IE design and operational limits (maximum gradient of 1:60 on plain line and 1:120 within the platforms). The MGWR vertical realignment would extend further east by 700m to Drumcondra bridge. This results with maximum gradient of 1.8% and would impose operational	The different considerations regarding Glasnevin station are covered in Volume 2, Chapter 07, section 7.6.5

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			restriction of MGWR rail line for particular rolling stock. d. Level difference between proposed MGWR and GSWR platforms would require stairs and ramps for accessibility. It was concluded that the position of the MetroLink Station East of Cross Guns Bridge, was not optimal and Glasnevin interchange platforms should be located on the west side of Cross Guns Bridge. Musgrave Site alternative station location TII have previously assessed a station location at the Musgrave site in 2020 (below) in lieu of the currently proposed Mater Station in its current location. The findings from the desktop study are as follows: a. Proposed Musgrave Station would be constrained by limiting horizontal curve alignment of 350m to the north, which would allow to place "East Glasnevin Station" on straight section of the alignment. Position of the proposed station would be east of tennis courts and would significantly impact on the residential area north of GSWR. b. Placement of Irish Rail platforms would be impact on surrounding area (see below). c. The tunnel section between the proposed station beneath the Musgrave site and the Glasnevin "East" Station would be only 350m	

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			which would impact on the efficiency of MetroLink operational pattern (90 seconds headway) and passenger demand. d. Omitting Mater Station from the scheme would result with 1230m long tunnel between the station at the Musgrave site and O'Connell Station. Consequently, an intervention shaft would be required between stations to satisfy safety requirements of maximum 1,000m distance between emergency exits.	
#19	Albert College Park Tunnel Intervention Shaft	In relation to Albert College Park Tunnel Intervention Shaft, could the site be reduced in footprint substantially?	TII and our designers, Jacobs/IDOM, have been very closely consulting with Dublin Fire Brigade throughout the development of the design of the Albert College Park intervention shaft, and the current design reflects this engagement in terms of space and access requirements for the shaft in the event that fire brigade intervention is required at this location. As such, TII do not consider the reduction in the surface footprint of the intervention shaft as feasible.	In relation to this topic the following document is available: Appendix A8.16 "Report on the ACP Tunnel Intervention Shaft"

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#20	Question from Charlemont area resident's group	In relation to our activities related to IEE Services for the MetroLink project, we have collected the relevant issues during the interaction with resident's group at Dartmouth Road, Dartmouth Square West, and general Charlemont area. In relation to establish before and after levels, and subsequent deformation, due to deep construction projects adjacent an important public infrastructure (the Luas line), some levelling surveys has been conducted, on a weekly basis, in the vicinity of the Luas railway embankment, and the Dartmouth Road Street frontage, for the duration of the piling and excavation process on the Hines building site. The local stakeholder group is interested to receive and analyse the type of collected engineering data, and clear explanations of expected, and realised, surface deformations resulting from any settlement activity.	This information has been collected by the contractor constructing the Hines development at Charlemont – as such this information should be requested directly from Hines.	Settlement activity is covered by Volume 5, Chapter 05, Appendix A5.17, sections 4.2.2, 4.2.6, 4.7, and its Appendixes C and D.
#20	Question from Charlemont area resident's group	1. DEPTH OF PROPOSED EXCAVATIONS, ✓ Depth of secant piles at east and south boundary, ✓ Depth of station box excavation at east and south boundary.	South boundary: approximately 33.00 meters below ground level (pls see attached drawing - ML1-JAI-ARC-MS16_ZZ-DR-Y-00215) East boundary: approximately 32.00 meters below ground level (pls see attached drawing – B106.165-2005), piles head are at 3.2 meters below ground level	There is no reference in the EIAR in these regards. However, secant piling is addressed in Volume 2, Chapter 05, section 5.5.2.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			Both South and East: approximately 27 meters (under platform level- pls see attached drawings ML1-JAI-ARC-MS16_ZZ-DR-Y-00215 and ML1-JAI-ARC-MS16_ZZ-DR-Y-00210). However, the section of the station box along the southern end of the laneway wall: 18 meters from the surface (pls see attached drawings ML1-JAI-ARC-MS16_ZZ-DR-Y-00212)	
#20	Question from Charlemont area resident's group	2. SOIL CONDITIONS, ✓ Soil analysis of complete zone of excavation. ✓ Soil analysis of zone of tunnel boring. ✓ Soil analysis of proposed zone of ventilation tunnel	The developed technical analysis of geotechnical ground conditions within the zone of station excavation and construction, and the bored tunnel sections will be contained within the EIAR documentation.	The Chapter 20: Soils and Geology covers the different soils analysis for the project.
#20	Question from Charlemont area resident's group	3. PROJECTED SOIL SUBSIDENCE, ✓ Engineering review of projected subsidence, ✓ Review of proposed remediation.	The developed technical analysis of expected settlement both within the zone of station excavation and construction, and the bored tunnel sections will be contained within the EIAR documentation. With regards to remediation, all properties in the vicinity of the works will be included within the Property Owner's Protection (POP) scheme – as part of the POP scheme, all properties will be surveyed pre, during and post works to assess for any damage caused by the works and remediation carried out on that basis.	Settlement activity is covered by Volume 5, Chapter 05, Appendix A5.17, sections 4.2.2, 4.2.6, 4.7, and its Appendixes C and D. Measures for Property Owners are explained in Volume 3, Book 1, Chapter 11, section 11.6.1.1. Besides, Property protection is explained in Volume 3, Book 3, Chapter 21, section 21.6.1.4.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#20	Question from Charlemont area resident's group	4. WATER TABLES, ✓ Review of existing established water table, water courses. ✓ Projection of future water table, changes, and consequences.	The developed technical analysis of the current baseline conditions of hydrology and hydrogeology within the Charlemont area, along with the projected impacts of the scheme on these elements will be contained in detail within the EIAR documentation.	The existing phreatic level (water table), can be found in the geological cross sections in Volume 05, Chapter 20, Appendix 20.9 Groundwater baseline environment and impacts can be found in Volume 3, Book 2, Chapter 19. The Groundwater Protection Response Matrix for Metrolink corresponds to Appendix A19.7 from Volume 5, Chapter 19
#20	Question from Charlemont area resident's group	5. PRECISE TUNNELLING SYSTEMS PROPOSED, ✓ TBM proposed ✓ Shield procedure ✓ Ring erection ✓ Gap grouting and time scale ✓ Remediation procedures and face pressures.	Technical details relating to the TBM type, the construction methodology for the delivery and assembly of the TBM, details on the rings and erection of same, and outline information relating to grouting will be contained within the EIAR. Expected settlement resulting from the TBM operation is also contained within the EIAR.	Tunnelling details can be found in Volume 2, Chapter 05, section 5.5.3 and further explained in the appendix 'Tunnelling' which corresponds to Volume 5, Chapter 05, Appendix 5.13. The proposed type of tunnel boring machine (TBM) is detailed in Volume 2, Chapter 05, section 5.5.3.1.3.
#20	Question from Charlemont area resident's group	6. PROJECTED SECANT WALL DEFORMATIONS. ✓ Projected secant wall deformation at east boundary. ✓ Projected wall deformation at south boundary. ✓ Projected soil settlement in consequence thereof. ✓ Remediation proposals.	Secant wall design technical note from Byrne Looby, the piling design consultant working on behalf of Hines is attached to this RFI response. The structural walls to be constructed as part of MetroLink are proposed to be diaphragm walls. Any settlement impacts arising from this construction methodology is assessed and described within the EIAR. As above, all properties in the vicinity of the works will be included within the Property Owner's Protection Scheme (POPS) scheme – as part of the POPS,	The Settlement activity is covered by Volume 5, Chapter 05, Appendix A5.17, sections 4.2.2, 4.2.6, 4.7, and its Appendixes C and D.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			all properties will be surveyed pre, during and post works to assess for any damage caused by the works and remediation carried out on that basis.	
#20	Question from Charlemont area resident's group	7. ZONE OF SETTLEMENT. ✓ Precise maps of projected zone of settlement. ✓ Settlement slump trough graphs. ✓ Precise indication of properties to be affected ✓ Scale of projected settlements.	(Response to Qs 7, 8, 9 and 10): The developed technical analysis of expected settlement, the predicted zone of settlement (including graphical representation) and the projected settlement within that zone will be contained within the EIAR documentation, including full details of the methodology employed to develop the predicted settlement analysis. Settlement analysis is based on a conservative face-loss figure (depending on projected ground conditions) during the tunnelling operation (rather than for specific stages of the TBM operation such as shield pass, ring erection etc.). In addition, the EIAR will include a report titled "Damage Assessment Report of Buildings and Other Assets" describing the methodology proposed in assessing building types within the expected zone of settlement influence, the surveys caried out, a description of the staged assessment of representative buildings (including buildings requiring additional assessment in future phases of the project as certainty develops around construction methodology and types of plant to be employed by the	The Building Damage Report corresponds to the Appendix A5.17 in Volume 5, Chapter 05. In which the Subsidence damage assessment methodology can be found in section 4, its results and discussion in section 5. Its section 6 covers bridges and other assets. The Settlement activity is covered by Volume 5, Chapter 05, Appendix A5.17, sections 4.2.2, 4.2.6, 4.7, and its Appendixes C and D.
#20	Question from Charlemont area resident's group	8. RANGE OF PROJECTED SETTLEMENT. ✓ Range of projected settlement for individual houses in slump zone.		The Settlement activity is covered by Volume 5, Chapter 05, Appendix A5.17, sections 4.2.2, 4.2.6, 4.7, and its Appendixes C and D.
#20	Question from Charlemont area resident's group	9. CHARACTER OF ADJACENT BUILT ENVIRONMENT ✓ The existence of foundations. ✓ Analysis of foundations for all effected properties. ✓ Projections for settlement for all effected properties. ✓ Remediation proposals for all effected properties.		Result of Phase 2a Building Damage Assessment for Representative Buildings can be found in Table 5.2 in Volume 5, Chapter 05, Appendix A5.17

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#20	Question from Charlemont area resident's group	10. PROJECTED DURATION OF SETTLEMENT, ✓ Precise projections for duration of TBM pass. ✓ Projections for settlement at shield pass, ✓ Projections for settlement at ring erection. ✓ Projections for duration of damage and settlement in future years.	contractors). Monitoring of any impacts on residential properties pre, during and post works and remediation of same will be managed within the POPS.	The duration in months of the tunnelling activities can be found in Volume 5, Chapter 05, Appendix 5.2. Tunnelling Progress Rates can be found in Volume 5, Chapter 05, Appendix A5.13, section 6.3
#20	Question from Charlemont area resident's group	11. EVALUATION OF DAMAGE, COMPENSATION DISTURBANCE, AND DEVALUATION OF PROPERTY. ✓ Precise details for evaluation of damage to property. ✓ Precise details of evaluation of compensation. ✓ Precise details for evaluation of permanent devaluation of property ✓ Implications for house insurance/damage. ✓ Caretaking of abandoned houses during re-locations. ✓ Security of houses during re-locations.	Detail on the process developed for evaluation of damage to property and the evaluation of compensation is contained within the POPS or Compulsory Purchase Order (CPO) guidance documents (depending on the specific circumstances involved) available on www.metrolink.ie Where there is a direct acquisition requirement, whether in whole or in part, from a particular property then the party(s) with a legal interest will be served with a Notice to Treat. The compensation code provides that the affected party is entitled to professional representation, to act on his/her behalf in the negotiation and settlement of the claim. Equally TII will be represented in the negotiation process. The overarching objective of this process is to reach an agreement that is fair and equitable and in line with the principle of equivalence. See CPO guidance	There is not a EIAR reference in these regards

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
			document on the Your Property section of the website for further information Detail on the implications for house insurance/damage to property and the evaluation of compensation is contained within the POPS or Compulsory Purchase Order (CPO) guidance documents (depending on the specific circumstances involved) available on www.metrolink.ie Where TII takes control of a property, or assistance is requested by the relevant party as part of ongoing engagement, a contract is already in place with a property firm in relation to any property and facilities management requirements that may arise. The approach will be informed by the nature and characteristics of the individual property concerned and the time durations involved.	
#20	Question from Charlemont area resident's group	In relation to Dartmouth Road closure (probably for 2-5 years), the stakeholder group is interested to receive and analyse the following information: ✓ how do resident access their properties - NTA state the footpath will remain open, but what about driveways and vehicular access for deliveries? ✓ How will residents be able to park close to their homes? ✓ What is the international precedence on this?	As presented to the Dartmouth Square West and Dartmouth Road Residents on 19/01/2022 (please see attached copy of the presentation), only southern footpath will be kept open during the construction of the southern section of the MetroLink Station box. No access to driveways will be available however TII is committed to provide alternative parking facilities during this period and alternative arrangements for deliveries.	Traffic Management for the Charlemont Station area is covered by Volume 5, Chapter 09, Appendix A9.5 – Scheme Traffic Management Plan in its section 7.11 Parking Impact is addressed in Volume 3, Book 1, Chapter 09, section 9.4.8.2.1.6. The residual impacts during construction phase is mentioned in section 9.8.1.6.

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#20	Question from Charlemont area resident's group	Does the POPS (Property Owners Protection Scheme) include the security, insurance, maintenance, and upkeep related to existing but temporarily vacated properties?	The Property Owners Protection Scheme does not include these elements in the process.	There is no EIAR reference for this topic
#20	Question from Charlemont area resident's group	The stakeholder group is interested to receive and analyse the comprehensive breakdown of the cost to tunnel south from St Stephen's Green to Charlemont, and also the cost to build out the Charlemont station?	The capital cost of the station box at Charlemont is approx. €200 million, with the tunnel section between St Stephens Green to Charlemont (including the turnback tunnel) is approx. €25 million. These figures exclude risk, inflation and VAT.	There is no EIAR reference for this topic
#20	Question from Charlemont area resident's group	In relation to proposed action to increase capacity of Luas trains, in order to transfer passengers to Metro at Charlemont, the following question are proposed: ✓ Will trams have a destination of Charlemont only to service metro? ✓ What additional volumes are proposed? What frequency? ✓ What are the detailed proposals from NTA/TII of the physical space and engineering requirements to facilitate the proposed additional trains to turn back just north of Charlemont? ✓ How to they propose to find space, deal with the gradient and turning radius, as the Luas approaches Adelaide road?	Modification of the Luas Green Line services, including the provision of future turnbacks and increased frequencies, are currently under assessment by TII and NTA.	There are not explicit answers for these questions. However, Charlemont station is covered by Volume 2, Chapter 4, section 4.17.12 and Chapter 5, section 5.10.13

RFI	Topic	IEE Questions	TII Responses	EIAR Reference
#21	Question from Griffith Avenue & District Residents Association	The local stakeholder group is interested to receive and analyse: ✓ the legal requirements under planning for size of footprint required for an emergency shaft; ✓ the reasoning for the large footprint as DFB did not request this during the pre-design phase. Therefore, as IEE we request the relevant information demonstrating the evidence and the reasoning behind the footprint requirements for the ACP IS, and particularly the requirements of the Dublin Fire Brigade.	As DFB have noted, the design for the shaft and external footprint is wholly the responsibility of TII and our designers, Jacobs/IDOM and an indicative footprint was developed in 2019 based on best practise that fire tenders and other emergency response vehicles will require direct access to the shaft entrance and a suitably sized hard standing area adjacent to the emergency stairs and lift access point was included in this early design. As noted in our response to RFI 19, the current shaft design reflects the consultations held with DFB including a requirement is that externally, the Intervention Shaft must facilitate hard standing access for fire service appliances within 20m of the entrance to the shaft. In addition, the provision of a second vehicle entrance/exit from the intervention shaft from R108 was developed due to concerns expressed by DFB on ability of fire tenders and other large appliances to turn within the hard-standing area.	There is no reference in the EIAR in these regards.

RINA Consulting S.p.A. | Società soggetta a direzione e coordinamento amministrativo e finanziario del socio unico RINA S p A.
Via Cecchi, 6 - 16129 GENOVA | P. +39 010 31961 | rinaconsulting@rina.org | www.rina.org
C.F./P. IVA/R.I. Genova N. 03476550102 | Cap. Soc. € 20.000.000,00 i.v.