Our Case Number: ABP-314724-22

Your Reference: Earldev Properties Unlimited Company

An Bord Pleanála

John Spain Associates
39 Fitzwilliam Place
Dublin 2
D02 ND61

Date:

Re: Railway (Metrolink - Estuary to Charlemont via Dublin Airport) Order [2022]
Metrolink. Estuary through Swords, Dublin Airport, Ballymun, Glasnevin and City Centre to Charlemont, Co. Dublin

Dear Sir / Madam,

An Bord Pleanála has received your recent submission and oral hearing request (including your fee of €100) in relation to the above-mentioned proposed Railway Order and will take it into consideration in its determination of the matter.

The Board will revert to you in due course with regard to the matter.

Please be advised, there is no fee for an affected landowner, listed on the schedule, to make an observation on this case. Further note, there is also no fee required to request an oral hearing, therefore, a cheque refund of €100 is enclosed.

The Board has absolute discretion to hold an oral hearing in respect of any application before it, in accordance with section 218 of the Planning and Development Act 2000, as amended. Accordingly, the Board will inform you on this matter in due course.

Please be advised that copies of all submissions/observations received in relation to the application will be made available for public inspection at the offices of the relevant County Council(s) and at the offices of An Bord Pleanála when they have been processed by the Board.

More detailed information in relation to strategic infrastructure development can be viewed on the Board's website: www.pleanala.ie.

If you have any queries in the meantime, please contact the undersigned. Please quote the above mentioned An Bord Pleanála reference number in any correspondence or telephone contact with the Board.

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The Secretary
An Bord Pleanála,
64 Marlborough Street,
Dublin 1

Date: 16/01/2023
Our Ref: BC 22102

Dear Sir or Madam,

RE: SUBMISSION ON THE METROLINK ON BEHALF OF EARLDEV PROPERTIES UNLIMITED COMPANY IN RELATION TO PROPERTY AT 13-14 EARLSFORT TERRACE, REAR OF 15-18 EARLSFORT TERRACE AND 17-19 HATCH STREET LOWER, DUBLIN 2 (AND ALSO KNOWN AS 10 EARLSFORT TERRACE)

ABP Ref. NA29N.314724

Description - MetroLink Railway Order – Estuary through Swords, Dublin Airport, Ballymun, Glasnevin and City Centre to Charlemont, Co. Dublin

Submission on behalf of: Earldev Properties Unlimited Company, 1 Stokes Place, 94 St. Stephen's Green, Dublin 2.

Introduction

Our client, Earldev Properties Unlimited Company, welcomes the opportunity to make a submission on the Railway Order for the MetroLink line.

Our client has a number of observations and concerns in relation to impact of the proposed Railway Order and the MetroLink project on its above property.

Earldev has appointed a multi disciplinary team to assess the potential impacts from the Railway Order documents, including:

- 1) John Spain Associates – Contact: Blaine Cregan – Executive Director
- 2) PUNCH Consulting Engineers- Contact: Robert Coughlan – Technical Director
- 3) Byrne Wallace LLP – Contact: Fergal Ruane - Partner and Head of Projects and Infrastructure
- 4) Ciarán Sudway & Associates Limited – Contact: Ciarán Sudway – Director
- 5) AGL Consulting Geotechnical Engineers – Contact: Conor O'Donnell - Managing Director
- 6) ARUP – Contact: Anthony McCauley - Façades Lead

- 7) Rascor Ireland- Contact: John Byrne – Director

Our client is also aware that a separate submission may be made by the tenant of the subject building, Arthur Cox Solicitors and a submission will also be made by the adjoining landowner.

This submission is broken down under the following headings:

1. Site and Impacts of Metrolink
2. Engineering considerations
3. Additional Information and Conditions Sought
4. Planning policy
5. Development potential
6. Concluding comments

Our client also wishes to request that an Oral Hearing is held in respect of the Railway Order application so that the points raised within this submission can be further clarified and addressed at the hearing for the benefit of all parties. The proposal is of both national and local significance and accordingly warrants an Oral Hearing.

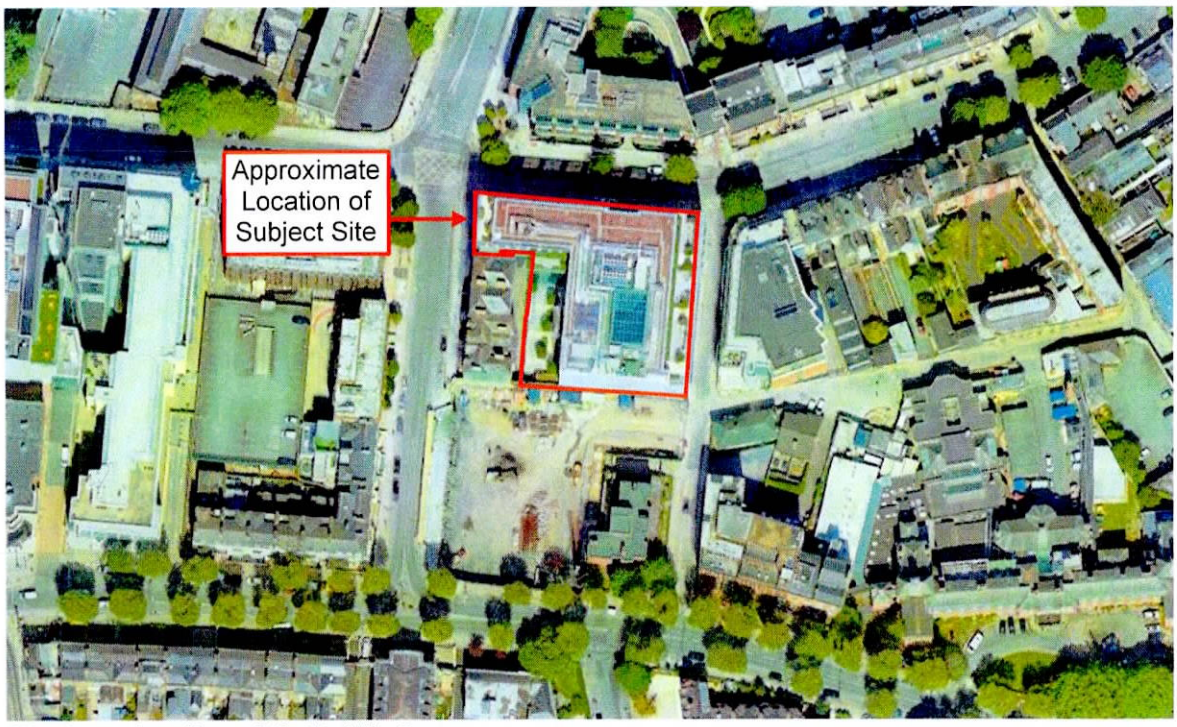
We enclose the fee of €50.00 in respect of this submission (although we note that no fee is payable for landowners affected) a further fee of €50.00 in respect of the Oral Hearing request is also enclosed.

The following is enclosed with this submission:

- Observation and Oral Hearing request fee (€100)
- Memorandum prepared by Punch Consulting Engineers with associated Appendices from AGL, Arup Facades and Rascor Ireland

Site and Impacts of Metrolink

The site is located at 13-14 Earlsfort Terrace, Rear of 15-18 Earlsfort Terrace and 17-19 Hatch Street Lower, Dublin 2 (and also known as 10 Earlsfort Terrace). The site is currently occupied by a 7 no. storey office building, The Arthur Cox Building, built in recent years under planning Reg Refs. 5257/08 and 3171/14. The existing building is currently occupied by a firm of solicitors.



Site Location (in red) in Dublin 2.

The site is located in Dublin 2, and therefore benefits from excellent access to existing public transport and services. It is acknowledged that the city centre location of the site necessarily means that there may be ongoing construction activity in the area at any given time.

However, our client has serious concerns in relation to the identified noise and associated disruption contained within the Railway Order documentation. A "Very High Adverse (significant)[1]" residual impact is identified to a neighbouring building (20 Earlsfort Terrace). Whilst this impact is noted as being short term, there is no clarity or estimate provided beyond this in relation to the duration of the works due to take place in the vicinity of our client's property.

Our client also has a concern in relation to the assessment and quantification of the impacts contained within the submitted Railway Order documentation, as our clients building has not been specifically assessed, only a neighbouring building, as set out in the enclosed reports.

By way of example, it does not appear that the depth of substructure and basements for the subject building (which extend to at least 13 metres below the surface of the land) have not been taken into consideration, which is of particular concern to our client as this is likely to exacerbate the predicted and residual impacts. Additionally, it is acknowledged in the submitted documentation that no mitigation measures are proposed for the above property, aside from stakeholder consultation. Further mitigation in the form of increasing the depth of the construction activities below the building should be extensively explored.

The Railway Order applies for a vertical deviation of 5 metres upwards. Whilst it is understood a deviation may be required due to detailed design or conditions encountered, the result of such a deviation in relation to the subject property is potential minimal distances (of as little as approximately 350 millimetres) of clearance between the MetroLink construction activities and the subject building substructure with increased significant impacts arising in relation to noise, vibration and associated building damage.

[1] Table 14.49 of the EIAR titled *"Summary of Residual Impacts during Tunnel Boring in AZ4"*

Given the subject building is one of relatively few identified as being potentially subject to building damage, it is submitted further and specific assessment is warranted with respect to noise, vibration and building damage as set out in the accompanying technical analysis undertaken by Punch Consulting Engineers, and that this is undertaken as part of the Railway Order process.

Engineering Considerations

The technical assessment undertaken by Punch Consulting Engineers accompanies this submission which sets out the engagement with National Roads Authority, operating as Transport Infrastructure Ireland ("TII") to date, a review of the documentation submitted and requests certain elements are addressed further. Additional specialist reports inform the overall Punch Consulting Engineers Assessment, including reports from Arup Facades and AGL Consulting Geotechnical Engineers.

The Punch Consulting Engineers sets out a number of queries, which have separately issued to TII, the TII response and further queries which arise where more information is sought or no response was provided.

Given the tunnel is proposed to pass below the site (with vertical and horizontal deviations sought), settlement and resulting damage to the building is of particular concern, as set out in the following extract of the AGL Report:

"We are concerned about the level of settlement and building damage that has been estimated to occur at the Arthur Cox Building as part of the Phase 2a building damage assessment. Although the building is new, is in good condition and has been constructed using high quality materials and modern building techniques, there are particular aspects of the design that could make it susceptible to damage from settlement and cracking due to tunnelling. Specifically:

- *The basement has been constructed as a watertight reinforced concrete "bath" structure which extends below the groundwater table. A sealant was injected behind the walls for waterproofing, however the basement does not have a continuous impermeable membrane forming a waterproof seal behind the walls. This design relies heavily on the structural integrity of the concrete to prevent groundwater ingress and flooding in the basement. Therefore, even minor cracking <1mm on the concrete walls and floor slab can compromise the waterproofing of the basement. Leaks are difficult to repair due to the groundwater pressures. Therefore, small cracks could have a disproportionate impact on the function of the building.*
- *Secondly, there is a perimeter secant pile wall around the basement, as shown in Figure 3, which is load bearing and supports parts of the façade and external columns. There is a high percentage of glass on the façade, which would make it sensitive to differential settlements. Also, there is a concentration of load on the toe of the piles, which will be closer to the crown of the tunnel. This means that the settlement of the piles could significantly exceed the estimated greenfield settlements that could occur at the ground surface. Furthermore, if the tunnel alignment is raised to the upper Limit of Deviation (LOD), which is 5m above the alignment shown on the planning drawings, then the toe of the piles will be only approx. 1.35m above the crown of the tunnel. This is a significant concern as it could lead to excessive settlement and damage of the façade. It could also impact the stability of the tunnel bore during and after construction with concentrated loading on the tunnelling lining."*

The potential damage to the facades is further set out in the Arup Facades Report which notes *"the baseline for anticipated damage has been established as a masonry clad building*

from 1977. There does not appear to be any consideration for how a modern glass clad building will react to the proposed differential settlements". In considering how the subject building may be impacts, Arup Facades note:

"Modern façades such as those installed on the Arthur Cox-ETHS Building are carefully designed to accommodate project specific building movements. The anticipated structural movements & tolerances for the primary structural frame are defined by the structural engineer. The environmental loading associated with the anticipated wind loading and thermal expansion are defined for the proposed cladding systems.

The cladding systems are bespoke to the building and designed to accommodate a defined set of movement criteria. The façade systems and associated bracketry are then detailed to accommodate those defined movements such that the cladding can perform over its design life as these loads are applied. The accommodation of the floor slab movements resulting from changing occupancies for example.

The anticipated additional differential settlement, resulting from the installation of Metrolink has, as detailed in the report the potential to work loose pointing and cause racking of doors and windows within their frames such that they may stick, when considered for a masonry clad building. We would have a concern that when this level of potential damage is extrapolated to suit a modern office development that there are additional areas of potential damage to consider such as:

- *Short term (During the construction of Metrolink) – Damage to glass; damage to stone cladding – Caused from unanticipated differential settlement exceeding current allowances*
- *Long term (Design life of cladding) – Damage to glass; damage to stone cladding – Caused by the differential settlement cause from the construction of Metrolink reducing the existing movement accommodation of the installed systems.*

The differential settlement of this building will have to be carefully monitored and the risk of damage in both the short and long term assessed based on the movements recorded to determine the full impact and risk of damage over the design life of the cladding."

AGL further raise concerns in relation to the assessment of building damage contained within the EIAR in relation to the subject site, stating:

"Although the BDR states that the detailed Phase 2b and Phase 3 building damage assessments will be carried out by the detailed designer for the D&B Contractor prior to construction, we would note that there are significant limitations to the Phase 2a preliminary assessment that has been carried out for the Arthur Cox Building in the EIAR, i.e.:

- *The assessment is based on the response of the building to greenfield settlements that could occur at ground level assuming that the building foundations can articulate (bend) to the curvature of the settlement profile at that level.*
- *In reality the response of the Arthur Cox building will be determined by the distribution of settlements at basement level, specifically the at the underside of the floor slab, which is 8.5m below street level."*

Given the low clearance between the tunnel and building sub structure, which is compounded if the upward or horizontal deviations are utilised (set out in the accompanying reports), further consideration of the potential impacts on the subject building are necessary having regard to the AGL Report:

"The Wider Effects Report (WER) in Appendix A5.19 to Ch.5 in Volume 5 of the EIAR identifies constraints to the application of the Limits of Deviation (i.e. where changes to the

tunnel alignment are not permitted), and it also includes a screening assessment to identify possible impacts to the application of the LoD (i.e. where changes in the alignment could have an impact on the assessment outcomes in the EIAR). It is significant to note that:

- *The Arthur Cox Building has not been identified as a constraint to the application of the vertical alignment of the tunnel, despite the potential proximity of the perimeter load-bearing piles to the tunnel crown; and*
- *No potential for significant additional impact on settlement or building damage has been identified if the LoD are applied to move the tunnel alignment upwards or downwards.*

These are significant omissions to the EIAR assessment of building damage, particularly for the Arthur Cox Building."

It is respectfully submitted to An Bord Pleanala, that based on the submitted Railway Order documentation, the subject property stands to be significantly impacted by the proposal and that the submitted assessments may be insufficient to provide an accurate assessment of the predicted and residual impacts. Having regard to the foregoing it is respectfully requested that the applicant undertakes additional assessment to quantify the impacts of the Metrolink and explore option to reduce the residual impacts to not significant.

Additional Information and Conditions Sought

Having regard to the accompanying technical reports, a summary is provided below of additional information sought which it is respectfully submitted is necessary at this stage in order for assessment of the proposals by our client's technical advisors.

Additionally, matters which are requested to, at a minimum, be addressed by means of conditions in any granted Railway Order are also set out herein.

Please note, this section forms a summary of the accompanying technical engineering reports, which should be referenced in detail, and should any conflicts arise, the technical assessments should take precedence.

Additional Information Sought

Settlement and Building Damage

As set out in the Punch Consulting Engineers Report, it was stated by TII that *"no structural impact has been predicted to occur to this building resulting from the construction works based on a preliminary damage assessment".* This however conflicts with the Building Damage Report which does identify impacts. This should be clarified. It is however noted that as set out below, updates to the Building Damage Report to reflect the constructed building should be undertaken.

In relation to settlement and associated building damage, the following additional information is sought (extract of AGL Report recommendations):

- *"The Phase 2a assessment in the BDR [Building Damage Report] should be updated to assess the potential damage that could occur to the building for the greenfield settlements at underside of the basement floor slab;*
- *The assessment should take into account the potential impact of raising the tunnel profile within the LoD;*

- *The BDR should identify the Arthur Cox building as a Special Structure on the list in Appendix B-2 due to the basement, which is greater than 4.0m deep (i.e. a Case B Special Structure in accordance with Section 4.1 of the BDR);*
- *The BDR should also identify the specific structural characteristics of the basement and perimeter secant pile wall in determining the sensitivity of the structure to tunnel-induced settlements;*
- *The Wider Effects Report (WER) should identify that raising or lowering the tunnel profile within the LoD could have an impact on the tunnel-induced settlements and building damage assessment in the EIAR;*
- *We would strongly recommend that the Arthur Cox building should be added to the list of constraints in Section 1.4 of the WER to identify that there is no scope to raise the vertical profile of the tunnel within the LoD either from the specimen design level, or above a level at which there is a risk of negligible damage to the building, whichever is lower;"*

The following limitations in the submitted documentation are identified by AGL, which should be addressed in revised documentation:

"We also note the following limitations to the information presented in the EIAR that make it difficult to carry out an independent assessment of the settlement and building damage due to tunnelling:

- *The ground investigation information has not been included in the appendices to Chapter 20 – Soils & Geology, so it is not possible to verify the interpreted geological cross sections (Appendix A20.9);*
- *Not all of the site investigation points on the SI location plans (Figure 20.6) have been included on the interpreted geological cross sections, and most of the SI data shown on the sections does not extend down to the tunnel horizon;*
- *The tunnel alignment drawings do not show the chainage along the centreline of the tunnel, which makes it difficult to identify the location of the building;*
- *Most of the alignment plan drawings, including the drawings showing settlement contours (Figure 20.16), are out of date and do not show the current layout and extent of the Arthur Cox building which was completed in 2017."*

Potential further mitigations should be explored, as set out in the Punch Consulting Engineers Report:

"TII look to re-routing the proposed tunnel out onto the street of Earlsfort Terrace itself or drop the proposed tunnel level where building damage will not be a significant issue to this unique site along the proposed Metrolink route."

<u>Construction and Operational Impacts on Building</u>

As set out in the Punch Consulting Engineers Report, the following information on building condition surveys are sought:

"Confirmation required on Condition Survey form and frequency prior and during the construction stage of the proposed Metrolink Tunnel

Confirmation required on Condition Survey form and frequency during the operation stage of the proposed Metrolink Tunnel"

Construction and Operational Impacts on Building Occupants

As set out in the Punch Consulting Engineers Report, site specific assessments are required in relation to noise and vibration impacts, having regard to the as built structure. This is necessary in order to fully evaluate such potential and post mitigation residual impacts.

Asset Protection Policy

In relation to the imposition of limitations on development in proximity to the tunnel, the TII referenced Asset Protection Policy is requested. It is essential as part of the Railway Order application and oral hearing process that our client is provided by TII with comprehensive information in a timely manner so that our client can gain a full understanding of the likely restrictions on future development of their asset. As noted in this submission, the existing building has been designed to accommodate additional floors in the constructed structural elements. Full redevelopment of the site for high rise development may also be considered in the future. Imposed limitations by the Metrolink would have a considerable impact on the value of our client's asset.

Requested Conditions

Should permission be forthcoming for the Railway Order, the following conditions are sought by our client in order to safeguard its property and its future use:

Specific Assessment and Limitations in relation to 13 & 14 Earlsfort Terrace

As set out in the Punch Consulting Engineers Report:

13 and 14 Earlsfort Terrace requires individual attention from TII as a standalone unique structure in the design of the proposed Metrolink Tunnel

An assessment of the proposed Metrolink in relation to the close proximity of the basements structure and secant piled wall.

Independent settlement, noise and vibration assessments should be undertaken on the actual building (basement, superstructure and facades) in the design of the proposed Metrolink Tunnel

Category 3 independent checking to be undertaken as a minimum checking process

Confirmation any anticipated negative impacts on the building and its tenants at 13 and 14 Earlsfort Terrace, Dublin 2 during the construction phase of the proposed Metrolink

Confirmation any anticipated negative impacts on the building and its tenants at 13 and 14 Earlsfort Terrace, Dublin 2 during the operational phase of the proposed Metrolink.

There is no evidence of undertakings to confirm the quality of the rock at the tunnel level. We request that geophysical surveys are carried out on the rock at tunnel level from the existing basement. 2d Resistivity and Seismic Refraction surveys are suggested to determine the rock mass characteristics.

A limit of upward deviation be applied at 13 and 14 Earlsfort Terrace to protect the existing structure, should the tunnel design be fully validated by TII at this level where no building will occur with the construction of the proposed Metrolink

As set out in the AGL Report recommendations:

"Prior to construction a detailed Phase 3 assessment should be carried out to confirm that there will be a negligible risk of damage to the building during construction. The assessment methodology should be sufficiently detailed and comprehensive take into account:

- *the estimated ground movements at the level of the basement and perimeter secant pile wall;*
- *the specific structural characteristics of the building, basement, foundations and perimeter secant pile wall; and*
- *The soil-structure interaction between the building and the ground."*

Structural and Condition Surveys

As set out in the Punch Consulting Engineers Report, condition surveys are expected to be undertaken prior to and during construction works:

ii) In the Damage Assessment Report of Building document, it places the Arthur Cox Building (B-238) in Damage Category B. This conflicts with TII initial response, which states no structural impact has been predicted. This needs to be fully clarified by TII. No damage to the building will be tolerated by our client
iii)Visual condition surveys of the building are expected prior to and during construction works.
There must be photographic condition surveys carried out by professional independent parties procured TII/Main Contractor to ensure any potential damage to the building is accurately recorded.
iv) We request this information as soon as possible to ensure the integrity of the building is maintained during the construction phase of the works.
v) We request TII to confirm when guidelines regarding the process for remediation will be released, should remediation be required. It is our understanding these guidelines are under development by TII based on information from https://www.metrolinkro.ie/ . We reiterate that damage to the building cannot be accepted but we need to understand the guidelines nonetheless."

Provision for Future Building Loading

In relation to the development potential of the site, a condition requiring the tunnel design to cater for additional floors on the subject development (as set out in the Punch Consulting Engineers Report) is requested:

The tunnel design shall cater for the provision of additional floors to the Arthur Cox building

Planning Policy

The proposed Railway Order application will be decided under the planning policy of the 2022-2028 Dublin City Development Plan. With respect to the subject site, the following provisions are of particular note.

Land use Zoning

Land Use Zoning of Site – Extract Zoning Map E (Dublin City Development Plan 2022-2028) – Approximate Outline of Subject Property in Blue

The site is primarily zoned Z6 'Employment/Enterprise' under the 2022-2028 Development Plan, with an objective *"To provide for the creation and protection of enterprise and facilitate opportunities for employment creation."* The Development Plan further states in relation to Z6 lands that *"The primary objective for this zone is to facilitate long-term economic development in the city. It is important that these remaining Z6 zoned lands provide for intensive employment and accommodate a wide range of local services."*

The existing site is occupied by a significant office building, and is therefore achieving the zoning objective for the site. As the office building is operational and occupied, it is important that any proposed construction works under the building are minimally disruptive.

A small portion of the site, has a Z8 zoning objective *"To protect the existing architectural and civic design character, and to allow only for limited expansion consistent with the conservation objective."*

Shape and Structure of the City

The Development Plan actively promotes the facilitation of a compact, sustainable city. This includes a recognition of the need to increase density in our city centre where appropriate, in line with national and regional planning policy. The Development Plan also promotes the strengthening of the inner city and city centre, with a focus on high quality architecture and public realm. The 15 minute city is also mentioned. It is noted that the proposed metro will assist in the achievement of these objectives, particularly as sustainable travel relates to compact growth and the 15 minute city. Our client would however request that the predicted significant adverse impacts during the short term are fully mitigated to the maximum extent feasible, in order to ensure the site is protected.

City Economy and Enterprise

The Development Plan promotes continued economic and employment growth, and has set out a number of planning policies to help achieve this. This includes promoting the role of Dublin as the national economic driver, taking a positive approach to large-scale commercial applications, and promoting and facilitating FDI.

Sustainable Movement and Transport

The Development Plan supports an integrated approach to land use and transport planning, with a focus on supporting the delivery of sustainable transport in the city. In order to support the compact growth of the city, the Development Plan recognises the need to shift towards more sustainable modes of transport, including decarbonising the existing transport network. The Development Plan also supports the delivery of the metro proposals, in addition to other sustainable transport infrastructure and active travel proposals. Our client acknowledges the importance of sustainable travel in the delivery of compact growth, however, would request that the Board has regard to the specific requirements of the existing office building and existing occupiers in this location, and the need to ensure our client's tenants are not unduly affected by the proposed construction works.

Development Potential

It is noted that the existing office building has been designed and constructed to accommodate the loading factor from additional floors. It is our client's intention to realise this development potential in the future, subject to business requirements, in line with national, regional and local planning objectives for densification of development. This development potential should be allowed for in the design of the tunnel so as not to restrict such future development. It is not clear what future restrictions may be placed on development above the metro tunnel, and it is important that this should be clarified at this stage, as it is a material consideration in assessing the submitted proposal, to understand impacts on economic development and infrastructure over and proximate the metro line. As noted further in the Appendix 1, it is understood that TII is currently developing an Asset Protection Policy outlining the constraints on future developments in proximity to the MetroLink works, including developments above the tunnel alignment. It is essential this Policy is provided to affected property owners in ample time before the Oral Hearing so that they may adequately assess the potential impact of the Policy and the MetroLink project on their properties.

Concluding Comments

It is respectfully submitted to An Bord Pleanala, that based on the submitted Railway Order documentation, the subject property stands to be significantly impacted by the proposal and that the submitted assessments may be insufficient to provide an accurate assessment of the predicted and residual impacts. Having regard to the foregoing it is respectfully requested that the applicant undertake additional assessment to quantify the impacts of the Metrolink and explore option to reduce the residual impacts to not significant.

Our client acknowledges that a scheme of this scale will result in impacts however these should be carefully managed and mitigated to minimise the effects on the surrounding landholdings. While our client is currently assessing the impact of these issues on the subject property, due to the lack or unavailability of key information from TII at this stage this exercise is ongoing and our client is not yet in a position to ascertain all immediate and future impacts on its property due the proposed Railway Order and MetroLink project.

We must therefore reserve all of our client's rights in relation to the issues that might arise at a later point in respect of the MetroLink project and our client reserves the right to raise additional issues and/or elaborate further on the above issues as necessary should the Board decide to hold an oral hearing or require any clarification and would welcome any responses from the applicant. Our client also reserves the right to maximise the development potential above and below ground of the lands in question.

Punch Consulting Engineers have identified a number of very important matters relating to the implementation and construction of the Scheme which pose a significant threat to the structural integrity of the buildings during the construction phase. Until these concerns are satisfactorily addressed, the value of the Earldevs asset will also be materially affected and until these matters are addressed, or the Scheme completed, Earldev are not in a position to realise the full value of their asset in the marketplace. Whilst this impact on the value of the property may only be of a temporary nature, the Board has a responsibility to ensure that this period of value sterilisation is kept to a minimum. We would respectively request that the Board does not approve the Scheme and the Railway Order, until such time as the Board is satisfied that the acquiring Authority has the necessary funds to commence and complete the Scheme expeditiously if the Railway Order is confirmed.

The Board will be cognisant of the fact that the first iteration of the Metro Scheme took many years to go through the design and approval stage and was subsequently withdrawn due to a lack of funding. The uncertainty created by approving Compulsory Purchase Orders which are not funded in advance or in an expeditious manner following the grant of a Railway Order creates difficulties for landowners, such as Earldev, which go far beyond the scope of compensation and places an unfair burden on landowners that go beyond the exigencies of the common good.

We request that the Board requests TII to issue the detailed information and assessments sought in this submission to our client in advance of any Oral Hearing and provide an opportunity for our client to respond to this further information and assessment.

Furthermore, we request that the Board conditions TII as part of any proposed Railway Order to satisfactorily address the concerns raised in this submission and in particular that TII ensure that an appropriate design and method statement for the works in the vicinity of the subject property is agreed with our client in advance of the works taking place. This condition is of particular importance to our client as TII has in recent weeks stated that it was not in a position to meet our client prior to the submission deadline to address its concerns.

We trust this submission will be taken into consideration in assessing the proposals.

The assessment of compensation would not be limited to the content of this submission.

Yours sincerely,

John Spain Associates

APPENDIX 1 - MEMORANDUM PREPARED BY PUNCH CONSULTING ENGINEERS WITH ASSOCIATED APPENDICES FROM AGL, ARUP FACADES AND RASCOR IRELAND

Memorandum

Project Title	Project Metrolink - 13 and 14 Earlsfort Terrace , Dublin 2	**From**	Robert Coughlan, PUNCH Consulting Engineers
Project No	222202	**To**	An Bord Pleanála
Subject	Technical Submission to Railway (Metrolink–Estuary to Charlemont via Dublin Airport) Order 2022 at The Arthur Cox Building, 13 and 14 Earlsfort Terrace which includes the Rear of 15-18 Earlsfort Terrace and 17-19 Hatch Street Lower (and also known as 10 Earlsfort Terrace), Dublin 2, D02 T380	**Cc**	
Date	12-01-2023		

1.0 Introduction

PUNCH Consulting Engineers (PUNCH) have been appointed by Earldev Properties Unlimited Company (EPUC) to produce a Technical Submission to An Bord Pleanála in response to the Railway (Metrolink–Estuary to Charlemont via Dublin Airport) Order 2022 and its potential impacts at The Arthur Cox Building, 13 and 14 Earlsfort Terrace. This also includes the Rear of 15-18 Earlsfort Terrace and 17-19 Hatch Street Lower (and also known as 10 Earlsfort Terrace) Dublin 2, D02 T380, together referred to in this document as "13 and 14 Earlsfort Terrace".

This Technical Submission has been prepared by PUNCH Consulting Engineers with the assistance of the Project Team appointed by EPUC. The project team consists of:

1) John Spain Associates – Contact: Blaine Cregan – Executive Director
2) PUNCH Consulting Engineers- Contact: Robert Coughlan – Technical Director
3) Byrne Wallace LLP – Contact: Fergal Ruane - Partner and Head of Projects and Infrastructure
4) Ciarán Sudway & Associates Limited – Contact: Ciarán Sudway – Director
5) AGL Consulting Geotechnical Engineers – Contact: Conor O'Donnell - Managing Director
6) ARUP – Contact: Anthony McCauley - Façades Lead
7) Rascor Ireland- Contact: John Byrne – Director

The National Roads Authority, operating as Transport Infrastructure Ireland) (TII), applied for a Railway Order to An Bord Pleanála on the 30th September 2022. This order was for a Railway Metrolink–Estuary to Charlemont via Dublin Airport. On the 20th September 2022, as an owner of land at 13 and 14 Earlsfort Terrace, Dublin 2, EPUC were served with an Information Pack relating to the Railway Order application. The submission is based on information received in that Information Pack, correspondence with Transport Infrastructure Ireland since July 2022 and information on https://www.metrolinkro.ie/ .

We understand by Jerdip Properties Unlimited Company, as building sole tenant, may also make a submission to ABP in relation to the building. We request that both submissions are read in conjunction with each other but highlight clearly that these reports are separate and should be treated fully individually.

It is essential that each of the points raised in this submission are addressed in full by TII. It is noted that the comments in this submission will expand following further engagement with TII.

The Arthur Cox Building at 13 and 14 Earlsfort Terrace requires individual attention as a standalone structure from TII and would request that An Bord Pleanála condition same in any grant of the Railway Order.

We request that An Bord Pleanála impose specific conditions in relation to this unique site and structure. We would request that specific conditions are applied to the building's basement, superstructure and facades with regards to settlement, vibration and noise.

Due to the potential damage to the building, we request TII look to re-routing the proposed tunnel out onto the street of Earlsfort Terrace itself or drop the proposed tunnel level where building damage will not be a significant issue to this unique site along the proposed Metrolink route.

The extract below shows the proposed tunnel route with vertical deviations highlighted in relation to the existing basement structure, which clearly highlights both our clients and professional design team's concerns with its close proximity.

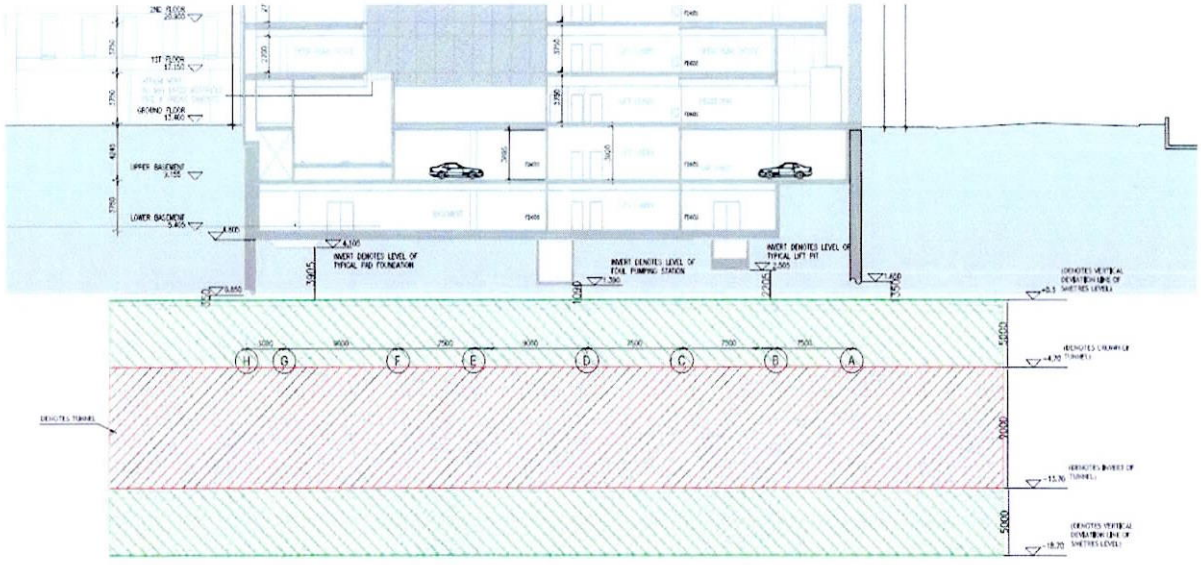


Figure 1: Proposed Metrolink Tunnel Route against Existing Double Basement Structure

It is noted that all drawings in the Railway Order show the old building layout which was demolished circa 2014. This is a concern as the Arthur Cox Building at 13 and 14 Earlsfort Terrace has complex and sensitive basement, pile and façade structures in relation to the proposed tunnel. We expect the Arthur Cox Building to be replaced on all relevant drawings and the correct building parameters used in the assessment of the building going forward.

We wish to confirm our client requests an Oral Hearing is held in respect of the Railway Order application and again the justification for this is outlined further in this submission.

2.0 PUNCH Consulting Engineers Interactions with Transport Infrastructure Ireland (TII) to Date

PUNCH Consulting Engineers were requested by EPUC to liaise with TII in June 2022, to gain an understanding of the proposed Metrolink proposals under 13 and 14 Earlsfort Terrace, Dublin 2. It is noted that this instruction was given by EPUC to PUNCH, based on verbal information received for the proposed tunnel and its proposed route. There was no communication or correspondence from TII on the proposed tunnel prior to PUNCH making an initial approach.

On the 5th July 2022, there was an introductory meeting on Microsoft Teams between Mr. Engin Sinopluoglu of TII and Mr. Robert Coughlan of PUNCH Consulting Engineers. Mr. Sinopluoglu explained that TII were in the process of collating information for the buildings and infrastructure impacted by the proposed tunnel and sought to assist them accordingly. PUNCH outlined the structural form of the building including the bearing strata as Limestone Rock and provided details of perimeter of the site as a Secant Piled Wall socked into rock, which facilitated the double basement construction.

A follow up meeting between Mr. Engin Sinopluoglu and Mr. Peter Kolar of TII and Mr. Robert Coughlan of PUNCH was undertaken on the 19th July 2022. TII presented a preliminary proposed tunnel route beneath 13 and 14 Earlsfort Terrace and its interface with the Arthur Cox Building.

Mr. Sinopluoglu confirmed at the meeting that PUNCH could contact Metrolink's Independent Experts in relation to any technical queries. There was a follow up e-mail from Mr. Sinopluoglu on the 19th July 2022, stating that the Independent Experts were dealing with residential groups only at that stage, however he could be contacted directly with any queries relating to this commercial building.

PUNCH issued a preliminary Technical Query List to TII on the 26th of October 2022. Part responses to this query list was received from Metrolink on 11th November 2022 and on 21st November 2022 This submission takes account of these engagements and responses.

The original deadline for submissions to An Bord Pleanála on the Railway Order was Friday 25th November 2022. On the 25th November 2022, this deadline was extended to Monday 16th January 2023. EPUC saw this extension as an opportunity to discuss further with TII the observations set out in 3.0 and requested a meeting on the 9th December 2022. Unfortunately TII stated by e-mail on the 14th December 2022 that they did not have the capacity to schedule a meeting before the consultation period to An Bord Pleanála expires.

3.0 Technical Observations

The following is the preliminary technical query list which we require to be fully assessed and resolved by TII to our client's satisfaction prior to the proposed Oral Hearing. This list has been responded in part from TII during our previous correspondence and these responses are included below where applicable, along with further comments/requests from PUNCH:

a. **Tunnel detail design procurement approach i.e. client design or contractor design. When is the contractor expected to be appointed?**

TII Response 11th November 2022 - Transport Infrastructure Ireland (TII) applied for a Railway Order for the project on 30 September 2022. The planning process with An Bord Pleanála is likely to take 12-18 months to complete. Once an Enforceable Railway Order has been granted, main infrastructure contractors can be appointed who will develop detailed designs for the tunnel infrastructure prior to construction commencement.

PUNCH Further Comments:

i) A detailed design programme for the tunnel under The Arthur Cox Building, 13 and 14 Earlsfort Terrace is required.

ii) If the tunnel design is by the main contractor, TII to confirm how soon after the grant of the Railway Order a Main Contractor will be appointed?

iii) TII to confirm when EPUC will receive a full design package for the works?

iv) TII to confirm what information EPUC will receive prior to the Oral Hearing?

v) Assuming the detailed design is by the Main Contractor, TII to confirm the extent to which the Main Contractor will be required to engage with EPUC during the detailed design process?

vi) We request that An Bord Pleanála impose specific conditions in relation to this unique site and structure. These conditions need to fully reflective in the production of tender documents for the project.

b. **Confirmation of Civil and Structural Design Firm for the Metrolink tunnel under 13 and 14 Earlsfort Terrace, Dublin 2.**

TII Response 11th November 2022 - Jacobs/IDOM have developed the civil and structural design to a level sufficient for a Railway Order. TII will further develop these designs to a level of detail sufficient for tendering in the next phase of the project and these designs will ultimately be developed to a detailed design for construction by the main infrastructure contractors.

PUNCH Further Comments:

Refer PUNCH Comments in 3c below

c. Confirmation of Geotechnical Design Firm for the Metrolink tunnel under 13 and 14 Earlsfort Terrace, Dublin 2.

TII Response 11th November 2022 - Jacobs/IDOM have developed the geotechnical design to a level sufficient for a Railway Order. TII will further develop these designs to a level of detail sufficient for tendering in the next phase of the project and these designs will ultimately be developed to a detailed design for construction by the main works contractors.

PUNCH Further Comments:

i) TII indicate that the design has been "developed to a level sufficient for a Railway Order". An area of concern is around the Oral Hearing process and the lack of clarity as to precisely "what" ABP is being asked to approve in the Railway Order.

ii) There is no commitment from TII in relation to the commencement date or duration for the proposed detailed design and construction works. This is a significant concern as this site is not a typical site along the selected route. We request a condition to confirm that our site's individual characteristics are incorporated into tender documents and a timeline for same.

iii) The lack of clarity in relation to these matters means that our client is not in a position to identify and raise issues which might potentially be caused by the proposed Metrolink works and operations.

d. Confirmation of the Technical Design Checking Process for the proposed Metrolink. It is assumed a Category 3 checking process will be undertaken by independent Civil, Structural and Geotechnical Engineers?

TII Response 11th November 2022 - All designs will be subject to checking and certification in line with international best practise prior to construction.

PUNCH Further Comments:

i) The response above does not answer the query and we request that the critically important Technical Design Checking Process for the works is clearly set out by TII.

ii) Category 3 independent checking is expected as a minimum checking process. We ask TII to confirm the checking process and we request An Bord Pleanála to condition same in any grant of the Railway Order.

e. Confirmation that a full copy of the detail design package in relation to the Metrolink beneath the building be issued to Earldev Properties Unlimited Company.

TII Response 11th November 2022 - TII will provide and request any necessary information during the detail design stage as part of the stakeholder consultation process.

PUNCH Further Comments:

i) The response above does not answer the query in our opinion.

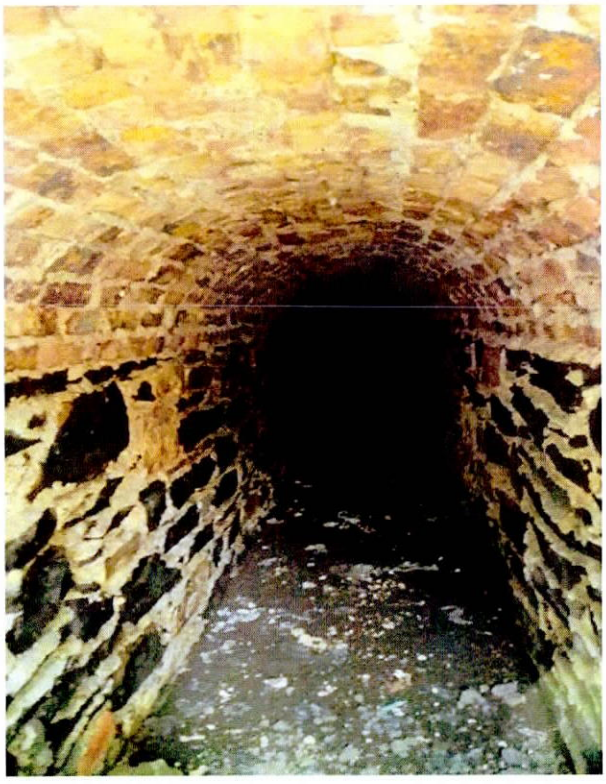
ii) We would expect to see a full copy of the detailed design package which allows for an independent assessment to be carried out by EPUC as they wish. We request confirmation of timelines from TII for this package.

iii) The design should be site specific for 13 and 14 Earlsfort Terrace and take into account the concrete frame size/depth, the loadbearing secant pile walls, the water table and diverted River Stein culvert which runs under the building. We request that An Bord Pleanála condition same.

iv) The secant piled wall supports not only temporary lateral loads, but the permanent column loads of the building (refer to Photograph 1) . The base level of the loadbearing piles are a significant concern in relation to the proposed tunnel depth and location.

Photograph 1: Secant Piled Wall Supporting Perimeter Columns

v) The culvert of the Old River Stein originally ran through the site prior to construction of the Arthur Cox Building construction (refer to Photograph 2)



Photograph 2: Old River Stein Culvert Running Through the Site Prior to Construction of the Arthur Cox Building

vi) The construction of the secant piled wall required the culvert to be diverted under the new basement (refer to Figure 1) .

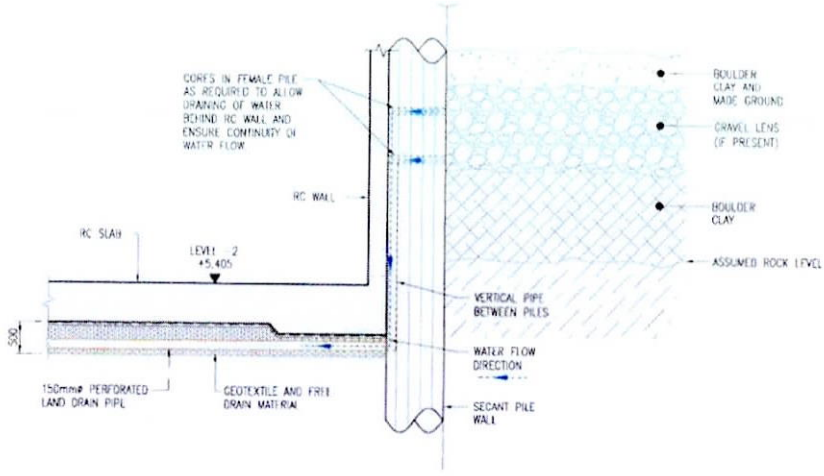


Figure 2: Diverted River Stein Culvert

f. Details of proposed condition surveys for 13 and 14 Earlsfort Terrace, both in advance of and during the construction works, along with the frequency of such surveys. Although damage to the building will not be tolerated, details to be provided of remediation process/methodology should this be required.

TII Response 21st November 2022 - As set out in the Building Damage Report (linked in response to question h), no structural impact has been predicted to occur to this building resulting from the construction works based on a preliminary damage assessment. Due to the basement depths and secant walls, this building will be subject to a further detailed structural survey and structural assessment of building response to ground movements by the Main Works Contractor prior to construction. Based on this assessment, the Main Works Contractor will propose any implementation of protection and mitigation measures and provision of building specific monitoring regime if required during the tunnelling works, including frequency of surveys as required.

TII are in the process of drafting guidelines for regarding the process for remediation in the unlikely event of impact to commercial properties. Once this has been prepared, it will be issued publicly.

PUNCH Further Comments:

i) The response above does not answer the query in our opinion.

ii) In the Damage Assessment Report of Building document, it places the Arthur Cox Building (B-238) in Damage Category B (Refer to Appendix A) . This conflicts with the above response, which states no structural impact has been predicted. This needs to be fully clarified by TII and request this is conditioned by An Bord Pleanála.

iii) Visual condition surveys of the building are expected prior to and during construction works. There must be photographic condition surveys carried out by professional independent parties procured TII/Main Contractor to ensure any potential damage to the building is accurately recorded.

iv) We request this information as soon as possible to ensure the integrity of the building is maintained during the construction phase of the works.

v) We request TII to confirm when guidelines regarding the process for remediation will be released, should remediation be required. It is our understanding these guidelines are under development by TII based on information from https://www.metrolinkro.ie/ . We reiterate that damage to the building cannot be accepted but we need to understand the guidelines nonetheless.

vi) The initial TII response in vague and concerning and ask An Bord Pleanála to recognise same.

g. Details of proposed condition surveys for 13 and 14 Earlsfort Terrace during the operational phase along with the frequency of the surveys and proposals of when these surveys would cease. Although damage to the building will not be tolerated, details to be provided of remediation process/methodology should this be required.

TII Response 21st November 2022 - As per the response to query f, TII are in the process of drafting guidelines for regarding the process for remediation in the unlikely event of impact to commercial properties. Once this has been prepared, it will be issued publicly.

PUNCH Further Comments:

i) Visual condition surveys of the building are expected prior to and during construction works. There must be photographic condition surveys carried out by professional independent

parties procured TII/Main Contractor to ensure any potential damage to the building is accurately recorded.

ii) It is expected that such condition surveys will continue post construction and through the tunnel operational stages and request that TII confirm the proposed frequency of these surveys during the operational phases of the Metrolink project

iii) We request this information as soon as possible to ensure the integrity of the building is fully maintained during the operational phase of the works.

iv) We request TII to confirm when guidelines regarding the process for remediation will be released, should remediation be required. It is our understanding these guidelines are under development by TII based on information from https://www.metrolinkro.ie/ . We reiterate that damage to the building cannot be accepted but we need to understand the guidelines nonetheless.

h. Confirmation of any predicted vertical settlement of the existing structure at 13 and 14 Earlsfort Terrace.

TII Response 11th November 2022 - The predicted vertical settlement arising from the tunnelling works can be found In Appendix 5.17 (Building Damage Report) of the EIAR linked here:

PUNCH Further Comments:

i) The predicted settlement is a concern from available information on https://www.metrolinkro.ie/. The settlement contours on Figure 20.16, sheet 29 of 30 (Refer to Appendix B), suggest settlement of 40-45mm in the calculated settlement trough. PUNCH Consulting Engineers engaged the professional services of AGL Consulting Geotechnical Engineers to assist with this submission. AGL's report issued on the 24th November 2022 can be found in Appendix C which examines in greater detail the predicted settlement of the proposed works and their findings are equally concerning. Below are some of the extract findings from the AGL report:

(a) We are concerned about the level of settlement and building damage that has been estimated to occur at the Arthur Cox Building as part of the Phase 2a building damage assessment.

(b) The assessment is based on the response of the building to greenfield settlements that could occur at ground level assuming that the building foundations can articulate (bend) to the curvature of the settlement profile at that level. In reality the response of the Arthur Cox building will be determined by the distribution of settlements at basement level, specifically the at the underside of the floor slab, which is 8.5m below street level.

(c) The increased depth and curvature of the settlement profile at basement level would result in a higher level of strain and damage to the structure if it was assessed using the same procedures in the BDR, possibly putting it into Damage Risk Category 3 or higher.

ii) There is no evidence of undertakings to confirm the quality of the rock at the tunnel level. We request that geophysical surveys are carried out on the rock at tunnel level from the existing basement. 2d Resistivity and Seismic Refraction surveys are suggested to determine the rock mass characteristics and ask An Bord Pleanála to condition same.

iii) If a dense rock with little fractures is encountered, this will lower the risk of potential ground movement and would verify the Ground Loss % used in the design of the tunnel.

iv) If a dense rock with little fractures is encountered, this potentially magnifies the noise and vibration levels through our building further which is a significant concern.

v) The distance (cover) from the soffit of basement and pile structures to the crown of the tunnel should be used to determine the differential settlement of the proposed works.

vi) PUNCH request to review proposed positions of Settlement Monitors and Monitor types as part of the detailed design review and certainly prior to works starting on site.

i. Confirmation of predicted vibration and noise under the existing structure at 13 and 14 Earlsfort Terrace from the proposed works.

TII Response 11th November 2022 - The predicted groundbourne noise and vibration levels arising from the construction (and operation) proposed works can be found in Appendix 14.5 (Groundborne Noise and Vibration Blasting Modelling Results) of the EIAR linked here:

PUNCH Further Comments:

i) There is a concern in relation to the identified noise and associated disruption contained within https://www.metrolinkro.ie/. A "Very High Adverse (significant)" residual impact is identified in the documentation. This is not acceptable to us.

ii) Whilst this impact is noted as being "short term", there is no clarity or estimate provided beyond this in relation to the duration of these works and associated negative impacts.

iii) A further area of concern is Figure 12.2, Sheet 29 of 30, Construction Noise Assessment Locations (Refer to Appendix D) which shows there were no construction noise receivers placed on or surrounding our clients building. This is a huge concern as we cannot see how the predicted noise limits can be determined without a noise receiver on our client's building or surrounding buildings.

iv) We request An Bord Pleanála condition an independent noise and vibration assessment of the building based on the individual site specifics and the building form itself.

v) It is assumed that these noise levels of 50dB (refer to Appendix E) are calculated on a Phase 1 Greenfield base level. The building and its secant piles are founded in rock. The concrete frame is also a very dense form of construction. If the rock is dense, there is a very efficient direct transmission path for noise and vibration through the building. Therefore, we are concerned noise and vibration levels could be greater than calculated and need this concern to be robustly allayed by TII prior to commencement of work.

vi) PUNCH request to review proposed positions of Noise Monitors and Monitor types prior to works starting on site.

vii) PUNCH request to review proposed positions of Vibration Monitors and Monitor types prior to works starting on site.

j. Confirmation that the tunnel can be constructed in the proposed position/depth considering the depth of the existing rock, existing piles and formation level of the double basement.

TII Response 11th November 2022 - TII's Engineering Designer for the Railway Order design have developed the design for the tunnel alignment considering the geotechnical ground conditions and in consideration of the depth of basement for this building. The design for the tunnel and additional detailed geotechnical analysis and design will be further developed in the next phases of the project.

PUNCH Further Comments:

i) PUNCH Consulting Engineers have serious concerns over the proposed tunnel level relative to that of the double basement structure and secant piled wall of 13 and 14 Earlsfort Terrace. Refer Appendix F of this submission for drawings illustrating the close proximity of the tunnel to the existing basement structure.

i) The proposed crown of the tunnel is approximately 6m below the lowest structural element in the basement and 5.35m below the lowest pile level. We believe the proposed tunnel location is too close to the building's substructure. We request immediate engagement with TII to allay these concerns.

ii) The existing double basement is waterproofed with a Rascor White Tank Injection System and relies solely on the reinforced concrete structure to prevent water ingress. Hence, this form of waterproofing is very sensitive to ground movements and the design of the tunnel must take this into account. The basement is designed for a crack width of 0.2mm and the information received state cracking of 1-5mm may occur. This will cause determinantal damage to the basement structure.

vii) Refer to letter in Appendix G from Rascor Ireland confirming the potential impacts on their basement waterproofing system with the proposed Metrolink works. Below is some of the extract findings from the Rascor Letter:

1) *The basement of the Arthur Cox building is designed for 0.2mm crack width as required for waterproof concrete structures utilizing the structurally designed reinforcement in the elements and strategically positioned crack-inducing injecting units. If cracking of 1-5mm occurs due to the new conditions arising from the tunnel construction, it would permanently damage the waterproofing system and the basement structure.*

Photograph 3: Rascor White Tank Injection System in Basement Slab

iii) The basement structure is-below the water table level and the basement slab is very sensitive to vibrations and any adverse cracking to the slab would cause significant water ingress issues.

iv) The design should be site specific, taking into account the concrete frame size/depth, the loadbearing secant pile walls which supports perimeter column loadings from the building, the water table and diverted River Stein culvert which runs beneath the building. We request An Bord Pleanála condition a site specific assessment of the proposed tunnel depth.

k. Confirmation that the permissible vertical deviation as outlined in Section 6(d)ii of the Draft Railway Order of 5m upwards has been fully considered on the proposed tunnel design taking account of the existing Secant Piled Wall and Basement Structure.

TII Response 11th November 2022 - While the draft Railway Order for MetroLink includes a vertical limit of deviation of 5m upwards for the tunnel, this deviation will invariably be constrained at a number of locations across the proposed scheme, including where proximity to building basements or piles requires consideration (as is the situation beneath 13 and 14 Earlsfort Terrace)

PUNCH Further Comments:

i) We question why TII are asking ABP to approve a scheme which is vague and uncertain. TII are asking ABP to approve a Scheme with a vertical deviation of 5m, despite having the knowledge that this is not possible under 13 & 14 Earlsfort Terrace due to the proximity of the secant piles and basement.

ii) If the 5m deviation vertically is applied upwards, the proposed crown of the tunnel is approximately 1m below the lowest structural element in the basement and 0.35m below the lowest pile level. (Refer to Appendix F). This cannot to tolerated and will damage the building.

iii) Page 3 of the Wider Effects Report Limit of Deviation Environmental Impact Assessment Report Volume 5 - Technical Appendix (Refer to Appendix H), lists a number of locations where it is not possible to apply Limits of Deviation due to constraints in the immediate vicinity of the proposed alignment. This is also discussed in detail in the AGL Consulting report in Appendix C. We request An Bord Pleanála condition a limit of upward deviation be applied at 13 and 14 Earlsfort Terrace to protect the existing structure, should the tunnel design be validated by TII at this level.

iv) In the Damage Assessment Report of Building document, it places the Arthur Cox Building (B-238) in Damage Category 2 (Refer to Appendix A). This category is classed as Slight and described as:

> *"Redecoration probably required. Several slight fractures inside building. Exterior cracks visible some re-pointing may be required for weather tightness. Doors and windows may stick slightly".*

It states that crack widths between 1-5mm may form. This level of damage is hugely concerning and not acceptable to our client.

v) It appears from the report that the baseline for anticipated damage has been established as a masonry clad building from 1977. There does not appear to be any consideration for how a modern glass clad building will react to the proposed differential settlements. Our façade consultant has serious concerns of the potential damage outlined above could have on the

building. Refer to Appendix I from ARUP Facades for letter confirming Façade concerns. Below are some of the extract findings from the ARUP Facades Letter:

(a) *The façade to the Arthur Cox-ETHS building is not a masonry façade, it is comprised of large stone cladding and floor to ceiling glazing elements. These large cladding elements are more sensitive to differential movements. For example, a small differential movement across the base of one of the floor-to-ceiling glass panes results in a significantly larger movement at the top of the frame due to the aspect ratio of the glass.*

(b) *The anticipated additional differential settlement, resulting from the installation of Metrolink has, as detailed in the report the potential to work loose pointing and cause racking of doors and windows within their frames such that they may stick, when considered for a masonry clad building. We would have a concern that when this level of potential damage is extrapolated to suit a modern office development that there are additional areas of potential damage to consider.*

vi) It is noted that the track level at St. Stephens Green is circa 2m below the level proposed at 14 and 14 Earlsfort Terrace. If the building is at risk of damage as outlined, we request that the level of the tunnel at 13 and 14 Earlsfort Terrace is reduced to a depth where damage to the building is negligible.

vii) Based on our serious concerns outlined above of potential damage to the building, we request TII look to re-routing the proposed tunnel out onto the street of Earlsfort Terrace itself and ask An Bord Pleanála to consider same.

l. Confirmation of the calculated loads from the existing building at 13 and 14 Earlsfort Terrace that have been used in the tunnel design. Please also note Point m below.

TII Response 21st November 2022 - The design of the tunnels takes account of all required load cases, temporary and permanent, including existing building loading and potential future development that may arise in a city. The design of the tunnel is not designed for individual building loads since this is not necessary or practicable, and instead utilises load cases that provide an envelope within which the loads from all existing buildings are taken account of, as well as potential future development that may arise in a city.

PUNCH Further Comments:

i) This is hugely concerning that the tunnel design is not designed for individual building loads as TII contends such an approach is not necessary or practicable.

ii) We believe that we have clearly outlined why this individual building requires a full independent assessment.

iii) We request that An Bord Pleanála impose specific conditions in relation to this unique site and structure.

m. The structure has been designed for a number of additional floors and the client intends to extend the height of the building in the future accordingly. TII to confirm that the loadings for the additional floors will be included in design of the tunnel?

TII Response 21st November 2022 - TII confirm the loadings for the additional floors will be included in the design of the tunnel (also see response to (l) above.

For our records, it would be helpful if the following information could be provided:

i. when do you intend to increase the height of the building?

ii. whether planning consent has been sought or received for this extension; and

iii. confirmation that the existing foundations do not need to be modified for the proposed extension.

PUNCH Further Comments:

i) We request this confirmation as soon as possible to ensure the planned future building vertical expansion is included in the design of the tunnel. The structure was designed to cater for additional floors without any modifications to the sub or superstructure and it would not be accepted by our client if any restrictions were attempted to be put in place.

n. TII will need to provide full details of the constraints the tunnel will impose on the future development potential/value of the site. This will need to set out the engagement process which the client/site owner will need to undertake for the preparation of any future planning applications.

TII Response 11th November 2022 - TII are currently developing an Asset Protection Policy outlining the constraints on future developments in proximity to the MetroLink works, including developments above the tunnel alignment. Once complete, this will be publicly published.

PUNCH Further Comments:

ii) It is assumed that this Policy would have been developed before requesting ABP for the approval of the Railway Order.

iii) As outlined above the building has been designed to cater for additional floors and it's the client's intention to complete these works.

iv) The Development Plan does not put an upper limit height of buildings within the area. As an example, there is a building, Four Park Place, which is 11 stories in height circa 100 metres from the building. Our client would not wish to be restricted by any measures which constrain the future development potential for the site

v) PUNCH note the building limitations on the Dublin Port Tunnel is a building constructed within 25m of the Port tunnel cannot exceed 22.5 kN/m^2 loading over the crown of the tunnel . A similar limitation would have a huge impacts on the site's value and potential.

vi) We request the Asset Protection Policy is released as soon as possible and well in advance of future Oral Hearings. TII to confirm when this will be available?

o. Written confirmation of any anticipated negative impacts on the building and its tenants at 13 and 14 Earlsfort Terrace, Dublin 2 during the construction phase. This should include but not be limited to noise and vibration levels of the proposed construction works.

TII Response 11th November 2022 - Please see responses to questions h and i for links to EIAR appendices outlining the predicted groundbourne noise and vibration and settlement levels in proximity to the building. Other environmental impacts from construction can be found in Volume 3 (Environmental Baseline and Assessment) of the Environmental Impact Assessment Report.

PUNCH Further Comments:

i) The answer here does not appear to address the question and gives little comfort . The tenant is one of the country's leading Solicitor firms and would require breakdown of any negative impacts it may experience during the construction works.

ii) It would be requested An Bord Pleanála condition same.

p. Written confirmation of any anticipated impacts on the building and its tenants at 13 and 14 Earlsfort Terrace, Dublin 2 post construction and during the operational phase. This should include but not be limited to noise and vibration levels.

TII Response 11th November 2022 - Please see responses to questions i for links to EIAR appendices outlining the predicted groundbourne noise and vibration during the operational phase in proximity to the building.

PUNCH Further Comments:

i) The answer here does not appear to address the question and gives little comfort . The tenant is one of the country's leading Solicitor firms and would require breakdown of any negative impacts it may experience during the operational phase of the Metrolink.

ii) It would be requested An Bord Pleanála condition same.

q. Confirmation that the structural integrity of the building at 13 and 14 Earlsfort Terrace will not be affected in any way by the proposed works during the construction phase and during the operational phase.

TII Response 11th November 2022 - As set out in the Building Damage Report (linked in response to question h), no structural impact has been predicted to occur to this building resulting from the construction works. This particular building has been defined as requiring additional assessment due to the basement depths and secant walls. The flow chart below (taken from the Building damage Report) provides context on the next stages of building assessments to be carried out in the next stages of the project.

PUNCH Further Comments:

i) In the Damage Assessment Report of Building document, it places the Arthur Cox Building (B-238) in Damage Category B . This conflicts with the above response, which states no structural impact has been predicted. This needs to be clarified by TII.

ii) We note that because of the foundations proximity to the tunnel it is classed as an "At Risk" building and that the Phase 3 assessment of the building will be undertaken. This Phase 3 assessment, as we understand it, will be a detailed assessment of the Ground Movement Response to the Arthur Cox Building, 13 and 14 Earlsfort Terrace specifically. We request timelines of when this will be carried out by TII.

iii) Our client will not accept building damage and the integrity of the basement cannot be compromised in any way.

4.0 Conclusions

i) Our client wishes to request that an Oral Hearing is held in respect of the Railway Order application, so that the points raised within this submission can be further clarified and addressed in detail at the hearing for the benefit of all parties. The project is of both Local and National significance and accordingly warrants an Oral Hearing.

ii) We wish to develop and resolve each of the observations made in this submission with TII in advance of any future Oral Hearing and request immediate engagement with TII accordingly.

iii) We wish to express that there are serious concerns of the design to date and the fact the existing building has not been considered is hugely worrying. This building is not a standard building compared with others along the proposed Metrolink Alignment and this needs to be clearly recognised by TII and request An Bord Pleanála condition this.

iv) There is no commitment from TII in relation to the commencement date or duration for the proposed detailed design and construction works. We request this information from TII and request An Bord Pleanála condition this.

v) We request An Bord Pleanála condition that the site be assessed individually due to the scale and form of the building in the relation to the proposed tunnel depth and works to be complete before Oral Hearing. This is examined and noted in finer detail in the AGL Consulting report. (Refer to Appendix C)

vi) We also request An Bord Pleanála condition independent separate assessments of settlement, noise, vibration and damage on the building based on discussions above and works to be complete before any Oral Hearing.

vii) We would also request confirmation when Tender Documents will be issued by TII? We further request that site and individual assessments on the building are included fully in the tender documents to ensure the integrity of the building is in no way compromised by the proposed Metrolink works

viii) There are serious concerns based on information received that the building will be damaged by the proposed Metrolink works. Although classed as "Slight", it suggests crack widths of 1-5mm may form. These crack widths would have serious consequences on the basement waterproofing protection and building frame facades and cannot be tolerated. Refer to the Rascor Ireland letter in Appendix G and the ARUP Facades letter in Appendix I.

Yours sincerely

Robert Coughlan

Robert Coughlan
BE CEng MIEI MIStructE
Technical Director
PUNCH Consulting Engineers

Appendix A – Extract of Damage Assessment Report of Building and Other Assets

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Ref	Chainage	Description	Height (m)	Number of Floors	Length (m)	Depth of basement (m)	Initial Phase 2a Assessment Damage Category	Refined Phase 2a Assessment Damage Category	RPS, NIAH, RMP or other heritage (Y/N/unknown)	Continue to next assessment phase? (Y/N)	Comments
B-207	19997	Residential	7.0	2	10.5	0.0	N/A	N/A	N	N	Outside 1mm contour
B-208	19999	Residential	7.0	2	10.4	0.0	N/A	N/A	N	N	Outside 1mm contour
B-209	19949	Commerce & Residential	11.0	3	14.5	0.0	N/A	N/A	N	N	Outside 1mm contour
B-210	19908	Commerce & Residential	8.3	2	11.9	0.0	N/A	N/A	N	N	Outside 1mm contour
B-211	19915	Commerce & Residential	8.3	2	7.8	0.0	N/A	N/A	N	N	Outside 1mm contour
B-212	19831	Residential	11.1	3	3.4	-2.3	N/A	N/A	Y	N	Outside 1mm contour
B-213	19820	Residential	11.1	3	4.5	-2.3	N/A	N/A	Y	N	Outside 1mm contour
B-214	19820	Commerce & Residential	9.4	2	18.0	0.0	N/A	N/A	N	N	Outside 1mm contour
B-215	19820	Commerce & Residential	9.4	2	17.6	0.0	N/A	N/A	N	N	Outside 1mm contour
B-217	19700	Kids Inc - Creche & Montessori, Ranelagh	10.0	3	21.5	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-218	19660	Residential	8.2	2	12.2	0.0	N/A	N/A	N	N	Outside 1mm contour
B-219	19660	Residential	8.1	2	12.3	0.0	N/A	N/A	N	N	Outside 1mm contour
B-220	19620	Residential	11.4	3	10.2	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-221	19620	Residential	11.4	3	11.0	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-222	19540	Residential	11.4	3	7.1	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-223	19540	Residential	11.4	3	7.6	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-224	19520	Residential	7.0	2	6.9	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-225	19520	Residential	7.0	2	6.7	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-228	19300	Carrolls Building	24.5	7	48.3	0.0	2 (Slight)	2 (Slight)	Y	Y	Special building Case A too (refer to section 4.1)
B-230	2840	Hertz, Swords Business Park, Swords, Co. Dublin	12.0	2	196.4	0.0	2 (Slight)	2 (Slight)	N	Y	Damage category 2 or below Case A (refer to section 4.1)
B-231	7040	Our Lady Queen of Corballis Heaven, Corballis Road North, Dublin Airport, Swords Co. Dublin	7.0	2	47.2	0.0	N/A	N/A	Y	N	Outside 1mm contour
B-232	11480	The Sentinel Building, Gateway View, Dublin 11 - Apartments 1-8 & Retail Unit	31.5	9	11.2	0.0	1 (Very Slight)	0 (Negligible)	N	N	Damage category 2 or below
B-233	11500	Apartments 40-42, Gateway View Dublin 11	12.2	4	11.1	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-234	14820	Unknown	7.1	2	7.9	0.0	N/A	N/A	N	N	Outside 1mm contour
B-235	15460	54 Goldsmith St, Phibsborough, Dublin 7	3.5	1	14.7	0.0	2 (Slight)	1 (Very Slight)	N	N	Damage category 2 or below
B-236	15620	15 Berkeley Road, Phibsborough, Dublin 7	7.0	2	17.2	0.0	1 (Very Slight)	1 (Very Slight)	N	Y	Damage category 2 or below Case A (refer to section 4.1)
B-237	15680	Residential	7.0	2	13.0	0.0	1 (Very Slight)	1 (Very Slight)	N	Y	Damage category 2 or below Case A (refer to section 4.1)
B-238	18980	Arthur Cox Building	40.0	7	17.8	-8.1	2 (Slight)	2 (Slight)	N	Y	Case B (refer to section 4.1)
B-239	13120	Residential	8.7	2	5.0	0.0	0 (Negligible)	0 (Negligible)	N	N	Damage category 2 or below
B-240	7060	Presbytery, Corballis Road North, Dublin Airport, Swords Co. Dublin	7.0	2	18.2	0.0	1 (Very Slight)	1 (Very Slight)	Y	Y	Special building

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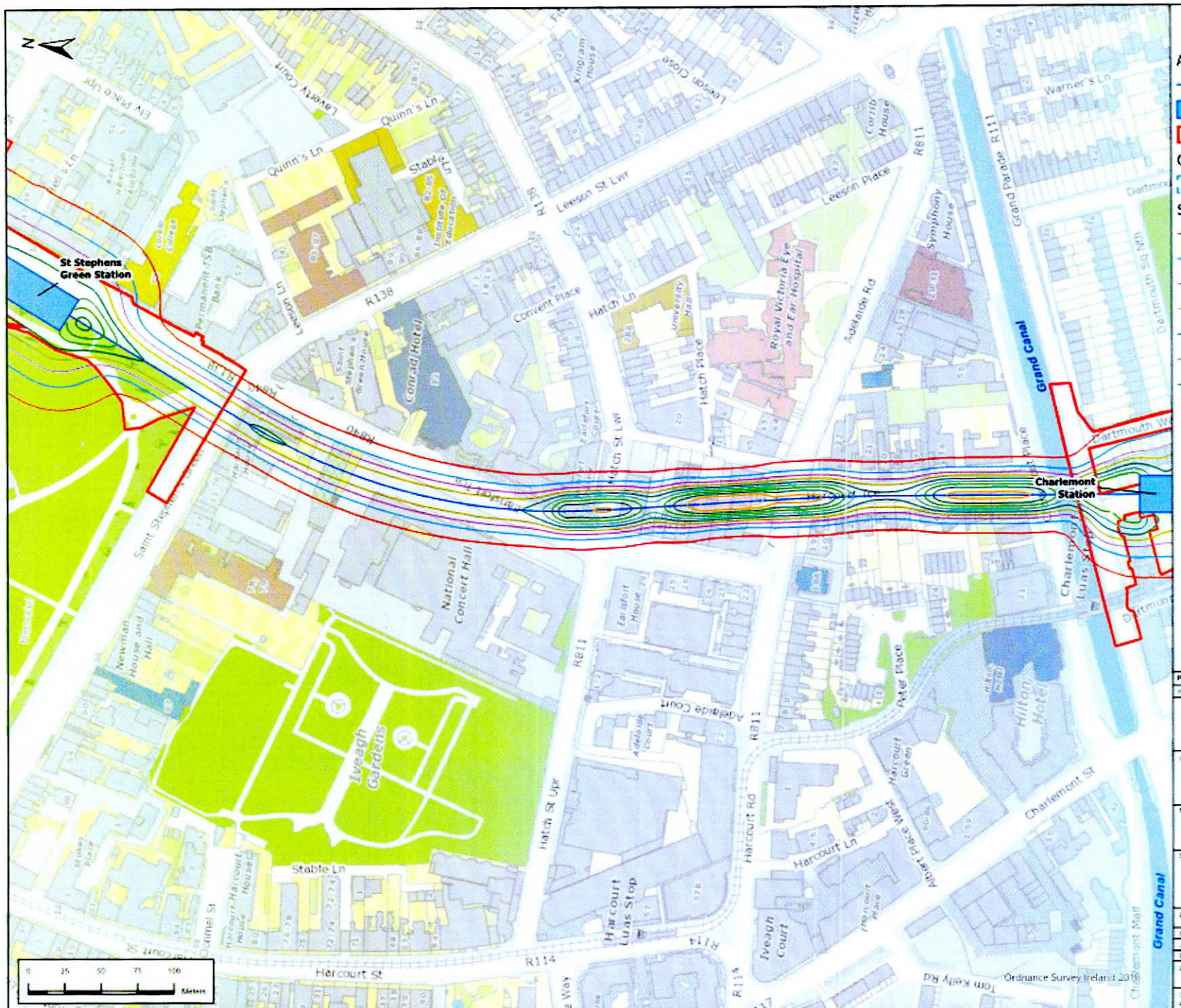
BUILDING CODE	BUILDING DESCRIPTION			BUILDING LOCATION			BUILDING INFORMATION			
	NAME	CONSIDERATION	CATEGORY	Chainage	Dmin (m)	Dmax (m)	Height (m)	N° Floors	Length (m)	Depth (m)
B-238	Arthur Cox Building	0	0	18+980	0.00	17.81	40.0	7	17.81	-8.10
B-239	Residential	Residential	0	13+120	10.51	15.50	8.7	2	4.99	0.00
B-240	Presbytery, Corballis Road North, Dublin Airport, Swords Co. Dublin	Presbytery	Church	7+060	42.92	61.12	7.0	2	18.20	0.00
B-241	Hotel Winns	Hotel	0	17+020	0.00	4.26	21.0	6	4.26	-3.00
B-242	Residential	0	0	19+760	51.95	61.79	10.5	3	10.08	0.00
B-243	Unknown	0	0	14+840	121.02	133.44	7.9	3	12.42	0.00
B-244	Residential	Residential	0	14+100	0.00	11.03	7.0	2	11.03	0.00
ST-1	Airport Road	Road	Road	8+320	0.00	115.66	0.0	0	115.66	0.00
ST-2	Ballymum's Road Gas Station	Petrol Station	Petrol Station	12+860	26.55	49.28	0.0	0	62.96	0.00
ST-3	Mobhi's Road Bridge	Bridge	Single Span	13+900	17.66	37.03	0.0	0	21.75	0.00
ST-4	Railway	Railwway	Railway	14+880	0.00	116.51	0.0	0	116.51	0.00
ST-5	Near Cross Guns Quay (nearly B-202) / Floodgates	Watergate	Watergate	14+940	0.00	41.06	0.0	0	41.06	0.00
ST-6	O'Conell Street cross	Main Street	Road	16+900	0.00	57.64	0.0	0	57.64	0.00
ST-7	Bridge between O´Conell Street and Butt Bridge	Bridge	Multiple Span	17+120	9.11	67.72	0.0	0	48.05	0.00
ST-8	Bridge over Pootberg Street corner with Lucke Street	Bridge	Single Span	17+380	22.81	42.47	0.0	0	36.33	0.00
ST-9	Bridge over Townsend Street	Bridge	Single Span	17+500	23.05	31.94	0.0	0	21.13	0.00
ST-10	Bridge Over Shaw Street	Bridge	Single Span	17+580	25.39	41.19	0.0	0	38.89	0.00
ST-11	Bridge over Dartmouth Road	Bridge	Single Span	19+420	7.68	21.74	0.0	0	17.42	0.00
ST-12	Bridge over Northbrook Road	Bridge	Single Span	19+520	9.42	21.13	0.0	0	15.15	0.00
ST-13	Bridge over Ranelagn Road	Bridge	Single Span	19+780	24.89	39.94	0.0	0	53.47	0.00
ST-14	Bridge over Cullenswood Road	Bridge	Single Span	19+943	2.69	14.67	0.0	0	15.83	0.00
ST-15	Embankment carrying LUAS, masonry faced circa 4-5m in height, interspersed with ST-11 to ST-14	Embankment	Embankment	19+350 – 19+750	0	35	5	0	400	0

Specific Building	Parameter	Critical Segment	Start [m]	End [m]	Curvature	Max Slope	Max Settlement [mm]	Max Tensile Strain [%]	Min Radius of Curvature (Hogging) [m]	Min Radius of Curvature (Sagging) [m]	Damage Category
	Min Radius of Curvature (Hogging)	2	1.3161	15.476	Hogging	0.0013944	12.729	0.03766	8904.7	-	0 (Negligible)
	Min Radius of Curvature (Sagging)	-	-	-	-	-	-	-	-	-	-
B-238	Max Slope	2	11.666	24.465	Sagging	0.0035255	37.127	0.084266	-	1106.5	2 (Slight)
	Max Settlement	2	11.666	24.465	Sagging	0.0035255	37.127	0.084266	-	1106.5	2 (Slight)
	Max Tensile Strain	1	0	11.666	Hogging	0.003512	22.526	0.091991	2510.6	-	2 (Slight)
	Min Radius of Curvature (Hogging)	3	24.465	39.758	Hogging	0.0035255	22.484	0.086642	2481.8	-	2 (Slight)
	Min Radius of Curvature (Sagging)	2	11.666	24.465	Sagging	0.0035255	37.127	0.084266	-	1106.5	2 (Slight)
B-147	Max Slope	1	0.63901	18.749	Hogging	0.0027837	21.409	0.082142	3797.9	-	2 (Slight)
	Max Settlement	2	18.749	34.225	Sagging	0.0027837	35.374	0.051998	-	1695.3	1 (Very Slight)
	Max Tensile Strain	1	0.63901	18.749	Hogging	0.0027837	21.409	0.082142	3797.9	-	2 (Slight)
	Min Radius of Curvature (Hogging)	1	0.63901	18.749	Hogging	0.0027837	21.409	0.082142	3797.9	-	2 (Slight)
	Min Radius of Curvature (Sagging)	2	18.749	34.225	Sagging	0.0027837	35.374	0.051998	-	1695.3	1 (Very Slight)
B-148	Max Slope	1	0	10.529	Sagging	4.80E-04	2.1536	0.023084	-	11336	0 (Negligible)
	Max Settlement	1	0	10.529	Sagging	4.80E-04	2.1536	0.023084	-	11336	0 (Negligible)
	Max Tensile Strain	1	0	10.529	Sagging	4.80E-04	2.1536	0.023084	-	11336	0 (Negligible)
	Min Radius of Curvature (Hogging)	-	-	-	-	-	-	-	-	-	-
	Min Radius of Curvature (Sagging)	-	-	-	-	-	-	-	-	-	-
B-149	Max Slope	1	0	0.80982	Sagging	0.0021328	20.392	0.0015888	-	26179	0 (Negligible)
	Max Settlement	1	0	0.80982	Sagging	0.0021328	20.392	0.0015888	-	26179	0 (Negligible)
	Max Tensile Strain	2	0.80982	19.331	Hogging	0.0021328	18.67	0.06187	5584.5	-	1 (Very Slight)
	Min Radius of Curvature (Hogging)	2	0.80982	19.331	Hogging	0.0021328	18.67	0.06187	5584.5	-	1 (Very Slight)
	Min Radius of Curvature (Sagging)	-	-	-	-	-	-	-	-	-	-
B-150	Max Slope	1	0	1.5245	Sagging	0.0014762	26.028	0.14025	-	46442	2 (Slight)
	Max Settlement	1	0	1.5245	Sagging	0.0014762	26.028	0.14025	-	46442	2 (Slight)
	Max Tensile Strain	1	0	1.5245	Sagging	0.0014762	26.028	0.14025	-	46442	2 (Slight)
	Min Radius of Curvature (Hogging)	-	-	-	-	-	-	-	-	-	-
	Min Radius of Curvature (Sagging)	-	-	-	-	-	-	-	-	-	-
B-228	Max Slope	1	0	16.33	Sagging	0.00727	31.844	0.031428	-	91.156	0 (Negligible)
	Max Settlement	1	0	16.33	Sagging	0.00727	31.844	0.031428	-	91.156	0 (Negligible)
	Max Tensile Strain	2	16.33	48.526	Hogging	0.0012618	19.772	0.098396	3586	-	2 (Slight)
	Min Radius of Curvature (Hogging)	2	16.33	48.526	Hogging	0.0012618	19.772	0.098396	3586	-	2 (Slight)
	Min Radius of Curvature (Sagging)	1	0	16.33	Sagging	0.00727	31.844	0.031428	-	91.156	0 (Negligible)
B-151	Max Slope	1	0	12.672	Sagging	0.0010204	37.218	0.096401	-	4181.7	2 (Slight)
	Max Settlement	1	0	12.672	Sagging	0.0010204	37.218	0.096401	-	4181.7	2 (Slight)
	Max Tensile Strain	1	0	12.672	Sagging	0.0010204	37.218	0.096401	-	4181.7	2 (Slight)
	Min Radius of Curvature (Hogging)	-	-	-	-	-	-	-	-	-	-
	Min Radius of Curvature (Sagging)	1	0	12.672	Sagging	0.0010204	37.218	0.096401	-	4181.7	2 (Slight)
B-152	Max Slope	1	0	9.235	Sagging	3.30E-04	2.6011	0.021665	-	32622	0 (Negligible)
	Max Settlement	1	0	9.235	Sagging	3.30E-04	2.6011	0.021665	-	32622	0 (Negligible)

Appendix B – Volume 4, Chapter 20- Fig 20.16, sheet 26 of 30



Legend

Alignment
- Tunnel
- Station Locations
- Project Boundary

Geographic Split
- AZ4 Northwood to Charlemont

Settlement Contours
- 1mm
- 5mm
- 10mm
- 15mm
- 20mm
- 25mm
- 30mm
- 35mm
- 40mm
- 45mm
- 50mm
- 60mm
- 70mm
- 80mm
- 90mm
- 100mm
- 110mm
- 120mm
- 130mm
- 140mm
- 150mm

P02	8/12/2022	Final Issue	JL	RH	RH	NC
Rev	Date	Purpose of revision	Drawn	Checked	Rev'd	Appd

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METROLINK

Figure 20.16 Settlement Contours
Sheet 29 of 30

Final

DO NOT SCALE

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Appendix C – AGL Consulting Geotechnical Engineers Report

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Ref: 22-229 L001

24th November, 2022

Attn. Mr. Robert Coughlan

Re: Project Metrolink - Impact of settlements related to tunnelling on the Aurthur Cox Building at 13-14 Earlsfort Terrace

Dear Robert,

You requested that we comment on the potential impact that the settlements predicted for tunnelling under the Arthur Cox Building at 13-14 Earlsfort Terrace could have on the building, particularly considering the proximity of the basement and perimeter piles to the crown of the tunnel.

We reviewed the following relevant information from the Railway Order Documents that are available on the website of An Bórd Pleanála (Case Reference NA29N.314724), specifically from the Environmental Impact Assessment Report (EIAR):

- Building Damage Report Appendix A5.17 to Ch.5 in Volume 5 of the EIAR)
- Wider Effects Report (Appendix A5.19 to Ch.5 in Volume 5 of the EIAR)
- Geological Cross Sections (Appendix A20.9 to Ch.20 in Volume 5 of the EIAR)
- SI Location Plans (Figure 20.6 for Ch.20 in Volume 4 of the EIAR)
- Settlement Contours (Figure 20.16 for Ch.20 in Volume 4 of the EIAR)

The following is a summary of the relevant findings of the Building Damage Report (BDR):

- Figure 20.16 of the report presents contours of "greenfield settlements" for the preliminary (Phase 1) assessment of settlements that could occur along the alignment of the tunnel during construction. These are the theoretical settlements that could occur at the ground surface on a greenfield site due to ground loss along the tunnel bore during tunnelling. These are based on empirical relationships derived from published case histories and do not take into account the influence of overlying structures.
- Figure 1 of this letter shows the estimated greenfield settlements at the Arthur Cox Building. They are presented as 5mm contours for a trough of settlements centred about the tunnel with the maximum value at the tunnel centreline, as illustrated by the inset figure.
- The maximum settlements under the building are estimated as 25-45mm along the tunnel centreline, reducing to <5mm over a distance of about 25m to either side of the tunnel.

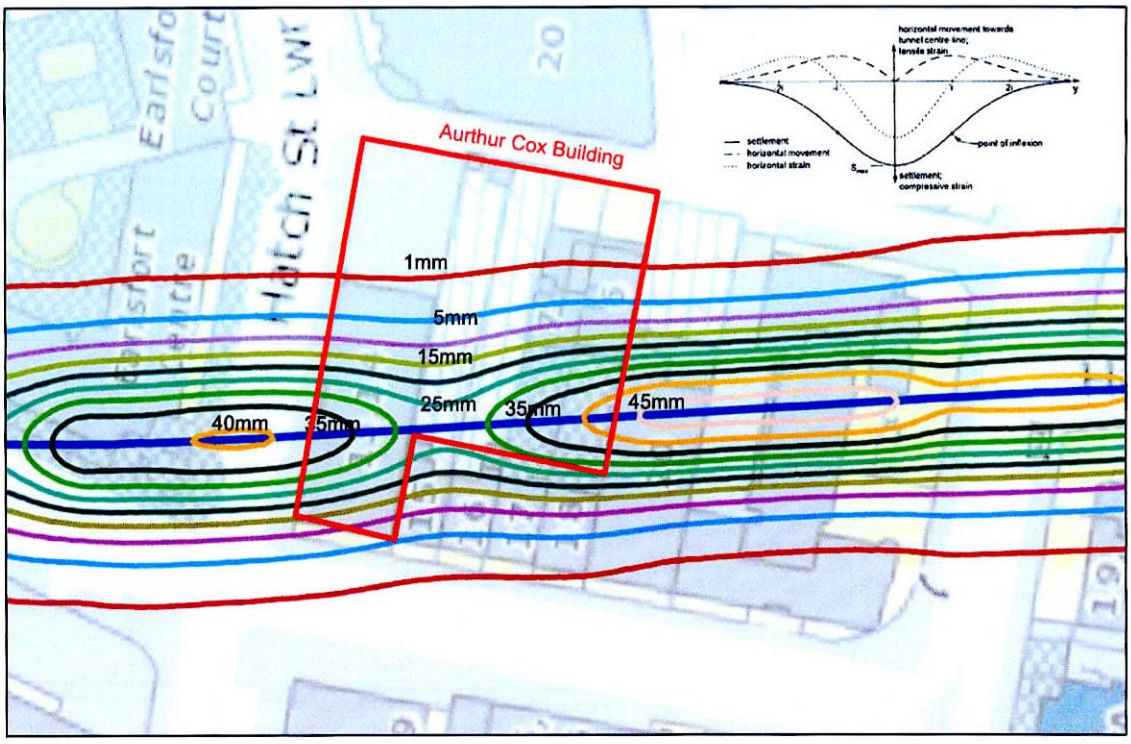


Figure 1 – 5mm settlement contours at Aurthur Cox Building (≈Ch. 18950-19000) [Phase 1 Greenfield Settlements]

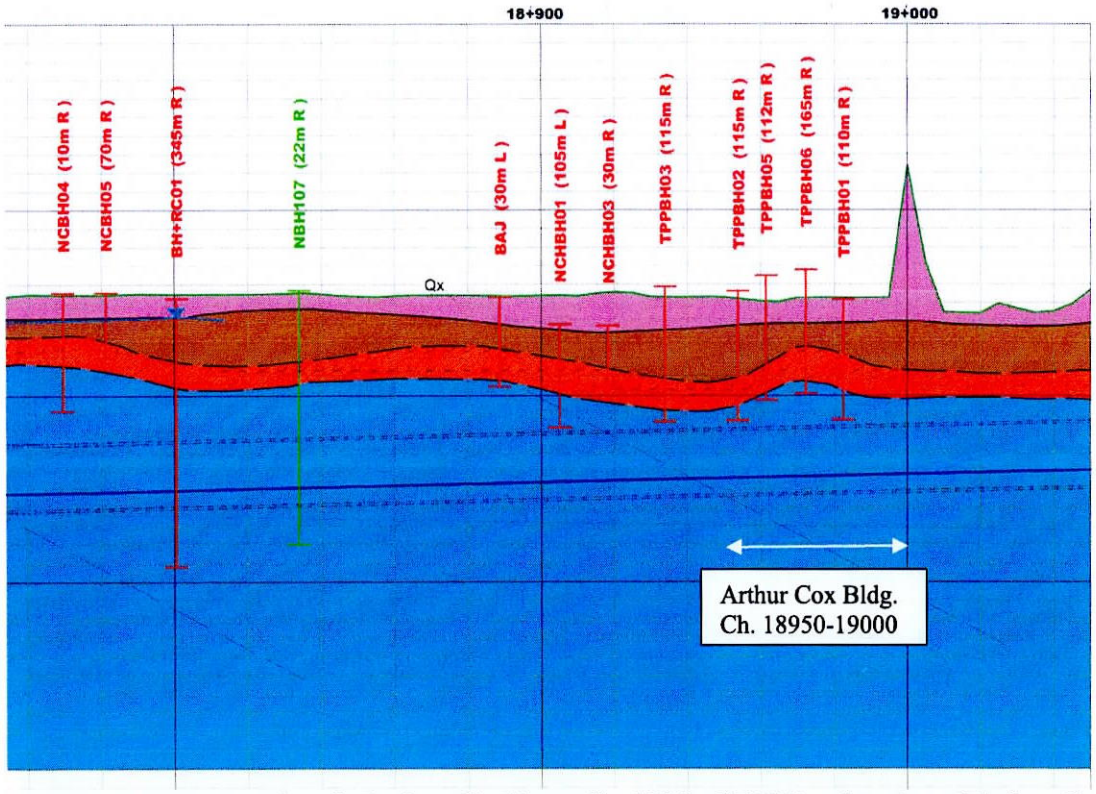


Figure 2 – Interpreted geological profile (Appendix A20.9 of EIAR) at location of Arthur Cox Building

- The calculated maximum settlements are a function of the ground conditions at and above the tunnel horizon, and the estimated volume of ground loss which is expressed as a percentage of the face area of the 9.5m diameter tunnel as follows:
    - 1.5% where the tunnel is in rock but the depth of rock cover above the tunnel is <4.5m (i.e. 50% of the tunnel diameter); and
    - 0.75% where the tunnel is in rock with >4.5m cover.
- The range of maximum settlements calculated for the section of the tunnel under the Arthur Cox Building (approx. Chainage 18+900m to 19+000m) is directly proportional to the assumed % ground loss. Therefore, the settlement contours on Figure 1 reflect the following assumptions that were made in the calculations for the BDR, as summarised in Table 5.1 of the report:
    - Ch. 18900 to 18960: **1.50%**
    - Ch. 18960 to 18980: **0.75%**
    - Ch. 18980 to 19100: **1.50%**

  Figure 2 of this letter shows the interpreted ground profile along the centreline of the tunnel from Appendix A20.9 of the EIAR.
- The BDR presents a preliminary assessment of the potential damage that could occur to representative or "special" buildings along the alignment of the tunnel based on the deformations and strains that could occur if the buildings distorted to the profile of the estimated greenfield settlements at the ground surface. Special buildings are buildings that require special consideration due to specific characteristics such as the condition of the building or the depth of the foundations. This is Phase 2a of the building damage assessment.
- The Aurthur Cox building has been specifically identified in the BDR as a "representative" building along the tunnel route for the Phase 2a building damage assessment (Building B238 at Ch. 18+980 on Table 5-2).
- The building is also recognised on Table 5-2 as a "special" building due to the 8m deep basement (i.e. Case B with a foundation level deeper than 4.0m). However, it is not specifically listed on the register of special structures in Appendix B-2.
- Based on the Phase 2a assessment Table 5-2 of the BDR states that damage to the Aurthur Cox Building could fall within Damage Risk Category 2, which is defined as **Slight** in Table 4-4 of the report, as follows:

Building and Structure Damage Classification (after Burland et al (1977) and Boscarding and Cording (1989))					Approximately Equivalent Ground Settlements and Slopes (after Rankin 1988)	
Risk Category	**Degree of Damage**	**Description of Typical Damage and Likely Forms of Repair for Typical Masonry Buildings**	**Approx. Crack Width (mm)**	**Limiting Max Tensile Strain (%)**	**Max Slope of Ground**	**Maximum Settlement of Building (mm)**
2	Slight	Cracks easily filled. Redecoration probably required. Several slight fractures inside building. Exterior cracks visible some re-pointing may be required for weather tightness. Doors and windows may stick slightly	1 to 5	0.075 to 0.15	1:500 to 1:200	10 to 50

- A refined Phase 2a assessment was carried out for a small number of buildings (9No.) that were assessed to fall within Damage Risk Category 3, which did not include the Arthur Cox Building. For the refined analyses the % ground loss was reduced to the following tighter tolerances that are considered to reflect recent advances in tunnelling methodology, construction controls, and the type of tunnel boring machine (TBM) that will be used on the Metrolink Project:
    - **1.0%** where the tunnel is in rock but the depth of rock cover above the tunnel is <4.5m (i.e. 50% of the tunnel diameter); and
    - **0.50%** where the tunnel is in rock with >4.5m cover.

  This is consistent with experience on the Dublin Port Tunnel, where settlements due to tunnelling in rock were consistent with a ground loss of 0.5% (Ref.1)
- If these tighter tolerances are applied at the Arthur Cox building, as suggested in the BDR, they would reduce the maximum calculated range of greenfield settlements by 1/3 from 25-45mm to about **15-30mm**.
- This is the extent of the building damage assessment that has been carried out at Preliminary Design stage for the EIAR in the Railway Order planning documents. The BDR states that, prior to construction, the detailed designer of the successful Design & Build Contractor will review and refine the Phase 2a assessment with any additional information or analysis that is required (the Phase 2b assessment). At that stage, a detailed Phase 3 assessment, which takes account of the individual characteristics of a building and the site-specific ground conditions, will only be carried out on any building that falls into the Damage Risk Category 3 based on the Phase 2b assessment.

Review and Comment:

- We are concerned about the level of settlement and building damage that has been estimated to occur at the Arthur Cox Building as part of the Phase 2a building damage assessment. Although the building is new, is in good condition and has been constructed using high quality materials and modern building techniques, there are particular aspects of the design that could make it susceptible to damage from settlement and cracking due to tunnelling. Specifically:
    - The basement has been constructed as a watertight reinforced concrete "bath" structure which extends below the groundwater table. A sealant was injected behind the walls for waterproofing, however the basement does not have a continuous impermeable membrane forming a waterproof seal behind the walls. This design relies heavily on the structural integrity of the concrete to prevent groundwater ingress and flooding in the basement. Therefore, even minor cracking <1mm on the concrete walls and floor slab can compromise the waterproofing of the basement. Leaks are difficult to repair due to the groundwater pressures. Therefore, small cracks could have a disproportionate impact on the function of the building.
    - Secondly, there is a perimeter secant pile wall around the basement, as shown in Figure 3, which is load bearing and supports parts of the façade and external columns. There is a high percentage of glass on the façade,

Ref.1: "Investigating property damage along Dublin Port Tunnel alignment," Andrea Gillarduzzi, *Proceedings of the Institute of Civil Engineers, Forensic Engineering 167, Issue FE3, pp119-142, August 2013.*

which would make it sensitive to differential settlements. Also, there is a concentration of load on the toe of the piles, which will be closer to the crown of the tunnel. This means that the settlement of the piles could significantly exceed the estimated greenfield settlements that could occur at the ground surface. Furthermore, if the tunnel alignment is raised to the upper Limit of Deviation (LOD), which is 5m above the alignment shown on the planning drawings, then the toe of the piles will be only approx. **1.35m** above the crown of the tunnel. This is a significant concern as it could lead to excessive settlement and damage of the façade. It could also impact the stability of the tunnel bore during and after construction with concentrated loading on the tunnelling lining.

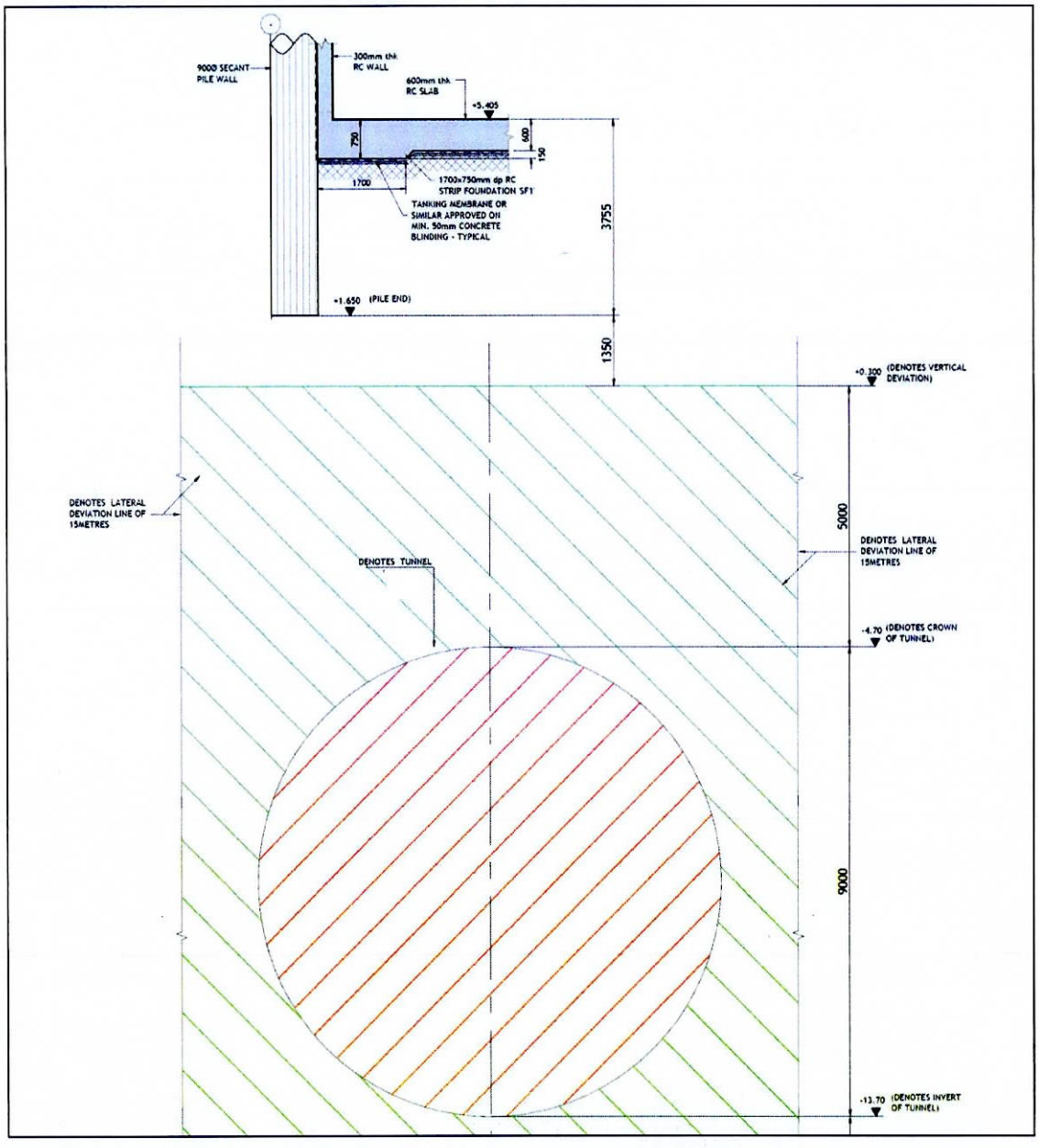


Figure 3 – Profile of tunnel, basement and secant pile wall at the Aurthur Cox Building

- Although the BDR states that the detailed Phase 2b and Phase 3 building damage assessments will be carried out by the detailed designer for the D&B Contractor prior to construction, we would note that there are significant limitations to the Phase 2a preliminary assessment that has been carried out for the Arthur Cox Building in the EIAR, i.e.:
    - The assessment is based on the response of the building to greenfield settlements that could occur at ground level assuming that the building foundations can articulate (bend) to the curvature of the settlement profile at that level.
    - In reality the response of the Arthur Cox building will be determined by the distribution of settlements at basement level, specifically the at the underside of the floor slab, which is 8.5m below street level.
    - Figure 4.1a and 4.1b show the calculated distribution of settlements at street level (18.0m cover to tunnel) and at the underside of the basement floor slab, where the depth of cover to the tunnel reduces to 9.5m. The settlements have been calculated for the same criteria in the Phase 2a preliminary assessment in the BDR assuming 0.75% and 1.5% ground loss for the range of interpreted ground conditions.

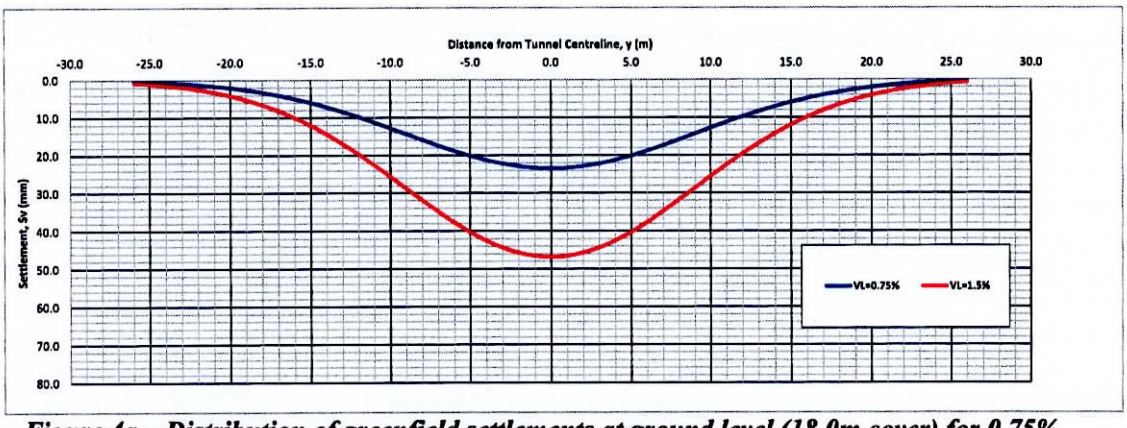


Figure 4a – Distribution of greenfield settlements at ground level (18.0m cover) for 0.75% and 1.5% Volume Loss (VL)

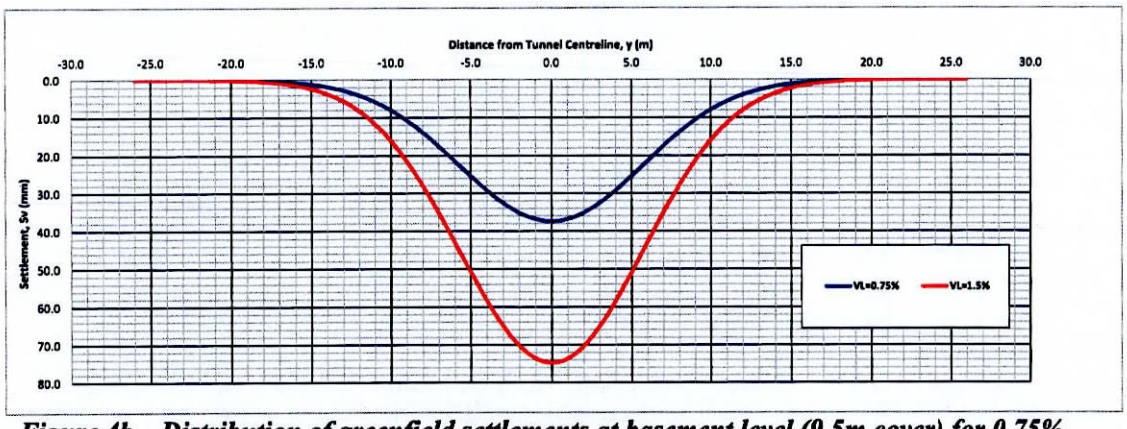


Figure 4b – Distribution of greenfield settlements at basement level (9.5m cover) for 0.75% and 1.5% Volume Loss (VL)

- The greenfield settlements at street level range from about 25-45mm and are spread out over a distance of 25m to either side of the tunnel centreline, as shown in the BDR. However, at the underside of the basement floor slab the maximum settlements for the same range in ground loss are ≈50% greater (**37.5mm-75.0mm**) and they are concentrated over a narrower corridor that extends only **15m** to either side of the tunnel centreline.
- The increased depth and curvature of the settlement profile at basement level would result in a higher level of strain and damage to the structure if it was assessed using the same procedures in the BDR, possibly putting it into Damage Risk Category 3 or higher.
- The settlement would become even more pronounced if the level of the tunnel was raised to the level of the upper Limit of Deviation (LoD), which is 5.0m above the specimen design level shown on the alignment drawings. In this case the depth of cover of the tunnel below the basement would reduce to 4.5m, the maximum settlements would increase by a further **50%** to **60-115m**, and they would be spread out over a reduced distance of **10m** to either side of the tunnel centreline.
- In all of these cases, the estimated greenfield settlements under the perimeter secant pile wall would be higher because the toe of the wall is 3.0m below the underside of the basement floor slab. The load-bearing piles would have a concentration of stress at the base of the piles which would increase settlements further and, in an extreme case, could impact the stability of the tunnel bore, particularly if the tunnel was raised to the upper LoD where the crown would only be 1.35m below the base of the piles.

- The Wider Effects Report (WER) in Appendix A5.19 to Ch.5 in Volume 5 of the EIAR identifies constraints to the application of the Limits of Deviation (i.e. where changes to the tunnel alignment are not permitted), and it also includes a screening assessment to identify possible impacts to the application of the LoD (i.e. where changes in the alignment could have an impact on the assessment outcomes in the EIAR). It is significant to note that:
  - The Arthur Cox Building has not been identified as a constraint to the application of the vertical alignment of the tunnel, despite the potential proximity of the perimeter load-bearing piles to the tunnel crown; and
  - No potential for significant additional impact on settlement or building damage has been identified if the LoD are applied to move the tunnel alignment upwards or downwards.

  These are significant omissions to the EIAR assessment of building damage, particularly for the Arthur Cox Building.
- The Phase 2a building damage assessment in the BDR assumes that the building articulates to the shape of the settlement profile over the tunnel. In reality, the stiffness of the reinforced concrete basement structure will help to redistribute these ground movements to spread them out and to reduce the strain in the structure. However, a detailed analysis would be required to model this soil-structure interaction so this would only be done at Phase 3 of a building damage assessment.

- We also note the following limitations to the information presented in the EIAR that make it difficult to carry out an independent assessment of the settlement and building damage due to tunnelling:
    - The ground investigation information has not been included in the appendices to Chapter 20 – Soils & Geology, so it is not possible to verify the interpreted geological cross sections (Appendix A20.9);
    - Not all of the site investigation points on the SI location plans (Figure 20.6) have been included on the interpreted geological cross sections, and most of the SI data shown on the sections does not extend down to the tunnel horizon;
    - The tunnel alignment drawings do not show the chainage along the centreline of the tunnel, which makes it difficult to identify the location of the building;
    - Most of the alignment plan drawings, including the drawings showing settlement contours (Figure 20.16), are out of date and do not show the current layout and extent of the Arthur Cox building which was completed in 2017.

Recommendations:

Given the limitations to the building damage assessment for the Arthur Cox building in the EIAR, we would recommend that:

- The Phase 2a assessment in the BDR should be updated to assess the potential damage that could occur to the building for the greenfield settlements at underside of the basement floor slab;
- The assessment should take into account the potential impact of raising the tunnel profile within the LoD;
- The BDR should identify the Aurthur Cox building as a Special Structure on the list in Appendix B-2 due to the basement, which is greater than 4.0m deep (i.e. a Case B Special Structure in accordance with Section 4.1 of the BDR);
- The BDR should also identify the specific structural characteristics of the basement and perimeter secant pile wall in determining the sensitivity of the structure to tunnel-induced settlements;
- The Wider Effects Report (WER) should identify that raising or lowering the tunnel profile within the LoD could have an impact on the tunnel-induced settlements and building damage assessment in the EIAR;
- We would strongly recommend that the Aurthur Cox building should be added to the list of constraints in Section 1.4 of the WER to identify that there is no scope to raise the vertical profile of the tunnel within the LoD either from the specimen design level, or above a level at which there is a risk of negligible damage to the building, whichever is lower;
- Prior to construction a detailed Phase 3 assessment should be carried out to confirm that there will be a negligible risk of damage to the building during construction.

The assessment methodology should be sufficiently detailed and comprehensive take into account:

- the estimated ground movements at the level of the basement and perimeter secant pile wall;
- the specific structural characteristics of the building, basement, foundations and perimeter secant pile wall; and
- The soil-structure interaction between the building and the ground.

Yours Sincerely,

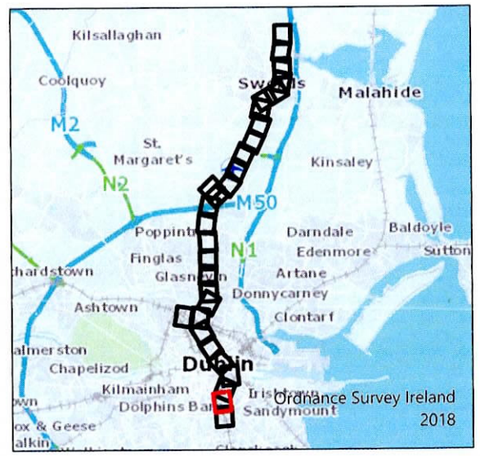
Conor O'Donnell
Managing Director
BA, BAI, MS, FGS, C.Eng, MIEI, FConsEI

Appendix D – Figure 12.2, Sheet 29 of 30, Construction Noise Assessment Locations

Legend

Alignment

- Tunnel
- Station Locations
- Construction Noise Receivers



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	1/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII (Transport Infrastructure Ireland)

Project: METROLINK

Drawing Title: Figure 13.2 Construction Noise assessment locations
Sheet 29 of 30

Drawing Status	FINAL	
Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT-XX-DR-Y-13038	Rev P02

This drawing is not to be used in whole in or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

Path: \\europe.jacobs.com\Dublin\Data\IE\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\Ch 13 - Fig 13.2 Construction Noise assessment locations.aprx

0 25 50 75 100 Metres

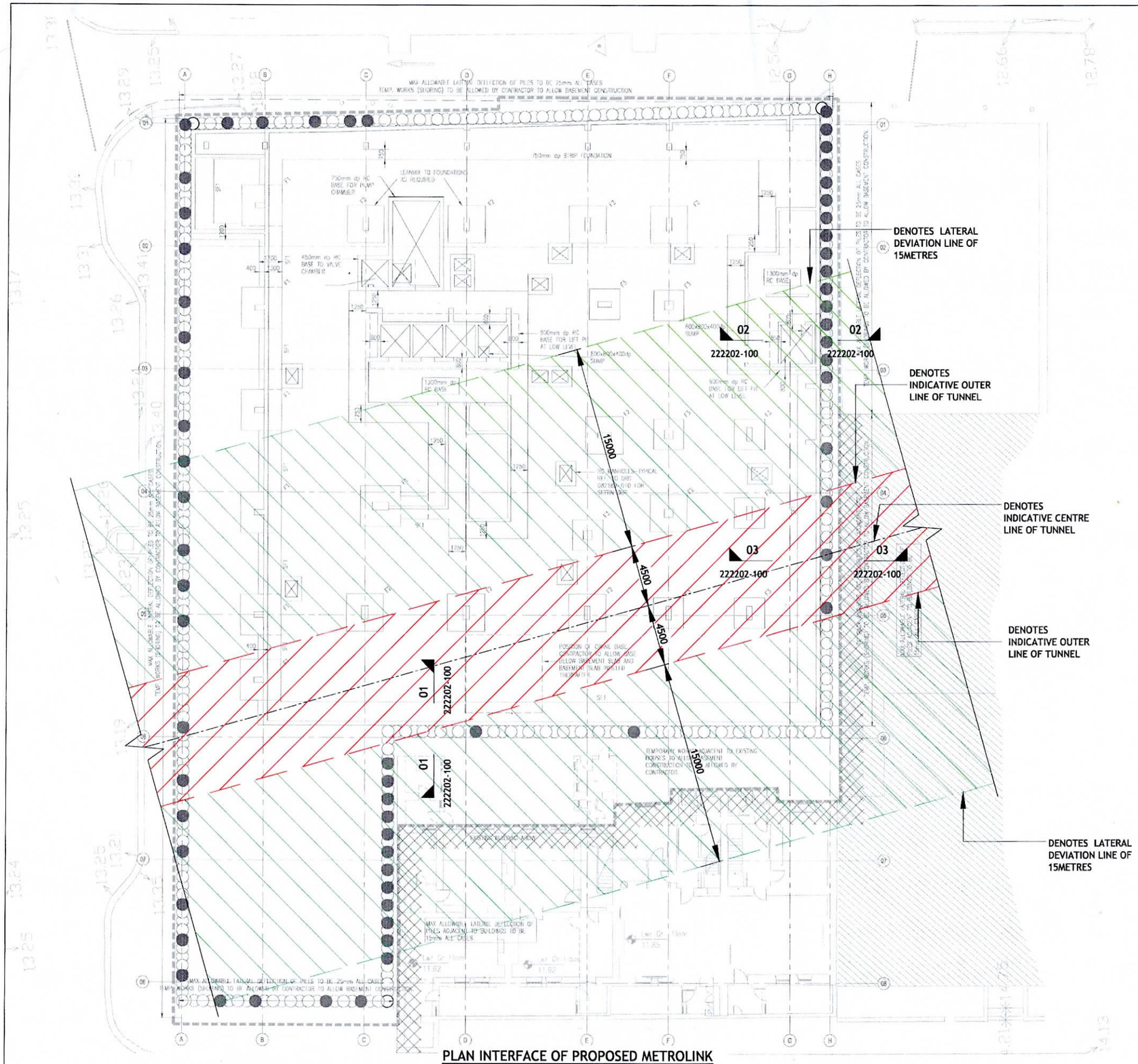
Ordnance Survey Ireland 2018

©Ordnance Survey Ireland 2022/ OSi_NMA_273. All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control. All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Appendix E – Noise Thresholds for Metrolink Documentation

Address (Section AZ4)	Construction - TBM				Construction - Mechanical Excavation				Blasting		Operation			
	L_{ASmax} dB(A)	VC	VDV day	VDV night	L_{ASmax} dB(A)	VC	VDV day	VDV night	Ppv	AOp dB	L_{ASmax} dB(A)	VC	VDV day	VDV night
EARLSFORT COURT 16 HATCH STREET LOWER DUBLIN 2	44	>VC-A	0.195	0.164							21	>VC-A	0.002	0.001
DELOITTE HOUSE 29 EARLSFORT TERRACE DUBLIN 2	44	>VC-A	0.194	0.163							23	>VC-A	0.003	0.002
20 ON HATCH HATCH STREET LOWER DUBLIN 2	44	>VC-A	0.195	0.164							22	>VC-A	0.003	0.002
10 EARLSFORT TERRACE DUBLIN 2	50	>VC-A	0.269	0.226							36	>VC-A	0.01	0.005
15 EARLSFORT TERRACE DUBLIN 2	50	>VC-A	0.269	0.226							36	>VC-A	0.01	0.005
16 EARLSFORT TERRACE DUBLIN 2	50	>VC-A	0.269	0.226							36	>VC-A	0.01	0.005
25/26 EARLSFORT TERRACE DUBLIN 2	44	>VC-A	0.19	0.16							22	>VC-A	0.003	0.002
17 EARLSFORT TERRACE DUBLIN 2	49	>VC-A	0.263	0.221							35	>VC-A	0.009	0.005
18 EARLSFORT TERRACE DUBLIN 2	49	>VC-A	0.261	0.219							34	>VC-A	0.009	0.005
19/20 EARLSFORT TERRACE DUBLIN 2	50	>VC-A	0.274	0.231							37	>VC-A	0.011	0.006
2 HATCH PLACE DUBLIN 2	44	>VC-A	0.189	0.159							21	>VC-A	0.002	0.001
4 HATCH PLACE DUBLIN 2	42	>VC-A	0.17	0.143							16	>VC-A	0.002	0.001
1 HATCH PLACE DUBLIN 2	45	>VC-A	0.203	0.17							24	>VC-A	0.003	0.002
3 HATCH PLACE DUBLIN 2	43	>VC-A	0.177	0.149							18	>VC-A	0.002	0.001
23 EARLSFORT TERRACE DUBLIN 2	42	>VC-A	0.175	0.147							18	>VC-A	0.002	0.001
ANCONA HOUSE 61 ADELAIDE ROAD DUBLIN 2	42	>VC-A	0.174	0.146							16	>VC-A	0.002	0.001
HYDE HOUSE 65 ADELAIDE ROAD DUBLIN 2	46	>VC-A	0.22	0.185							27	>VC-A	0.004	0.003
65A ADELAIDE ROAD DUBLIN 2	50	>VC-A	0.275	0.231							36	>VC-A	0.01	0.006

Appendix F - Drawings Illustrating The Close Proximity Of The Tunnel To The Existing Basement Structure.



PLAN INTERFACE OF PROPOSED METROLINK AND EXISTING BASEMENT STRUCTURE

SCALE 1:50

NOTES:

1. DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.

LEGEND:-

- DENOTES 225 THICK RC WALLS U.N.O.
- C10 — DENOTES RC COLUMN AND REFERENCE TAG
- DENOTES 900# SECANT PILE WALL
- DENOTES AREA WITH 100mm NON-STRUCTURAL SCREED ON 125 INSULATION
- DENOTES 215 THICK SOLID 20N BLOCKWALL U.N.O.
- DENOTES STRUCTURAL WALL OR BEAM UNDER U.N.O.
- DENOTES PARTITION U.N.O.
- DENOTES STRUCTURAL VOID
- 325 — DENOTES TWO-WAY SPAN RC SLAB & DEPTH
- 200 — DENOTES ONE-WAY SPAN RC SLAB & DEPTH
- 75 / 150 — DENOTES 75mm SCREED ON 150mm HOLLOWCORE SLAB
- DENOTES MULTIDECK MD60 V-2 1.2
- F11 — DENOTES FOUNDATION REFERENCE
- +0.000 — DENOTES STRUCTURAL SLAB LEVEL
- TOCB — DENOTES TOP OF CAPPING BEAM
- KOP — DENOTES KNOCK OUT PANEL FOR FUTURE EXPANSION
- 300 — DENOTES STEP IN SLAB LEVEL
- DENOTES VERTICAL LOAD BEARING PILES. VERTICAL LOAD ON LOAD BEARING PILE = 2200kN (SLS)
- ALL OTHER MALE PILES TO HAVE MINIMUM AXIAL CAPACITY OF 700kN (SLS)

BUILDING INFORMATION MODELLING (BIM) I.S. EN ISO 19650-2:2018 NSAI Certified

Rev	Amendment	By	Date
P01	ISSUED FOR INFORMATION	BM	21/10/2022

Client: EARLDEV PROPERTIES LTD

PUNCH consulting engineers
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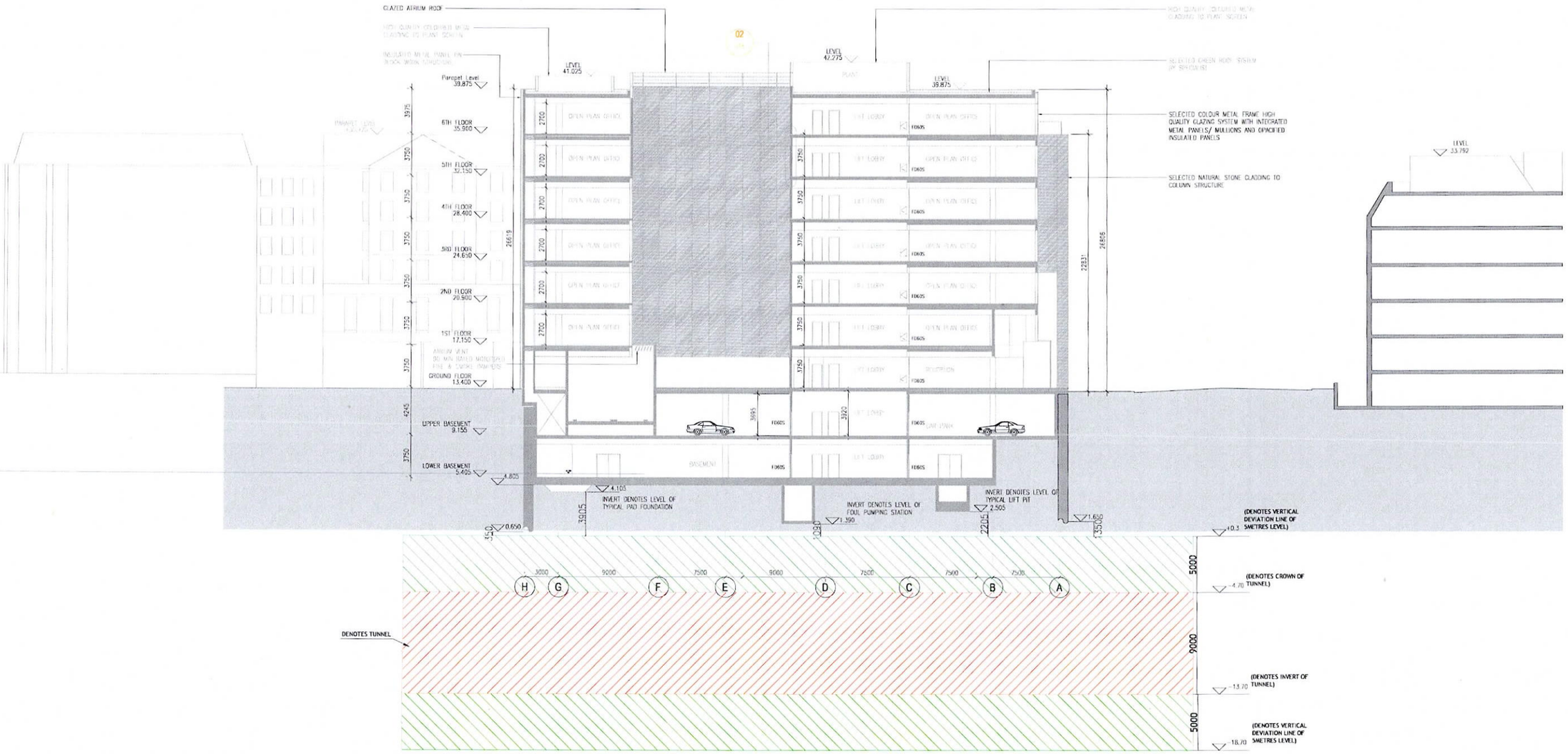
Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET				
Title: INTERFACE OF PROPOSED METROLINK & EXISTING BASEMENT STUCTURE				
Drawn: B. Mavudri	Date drawn: October 2022	Technician Check: B. Mavudri	Engineer Check: R. Coughlan	Approved: R. Coughlan
Project No.: 222202	Model File: 222202-PUNCH-XX-FN-M2-S-100		Drawing Status: S3	
Scale @ A1: 1:125	Document No.: 222202-PUNCH-XX-FN-DR-S-100			Revision: P01



Rev	Amendment	By	Date
P01	ISSUED FOR INFORMATION	MC	24/11/2022

Client: EARLDEV PROPERTIES LTD

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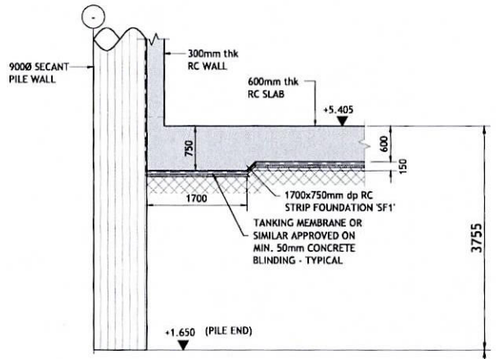
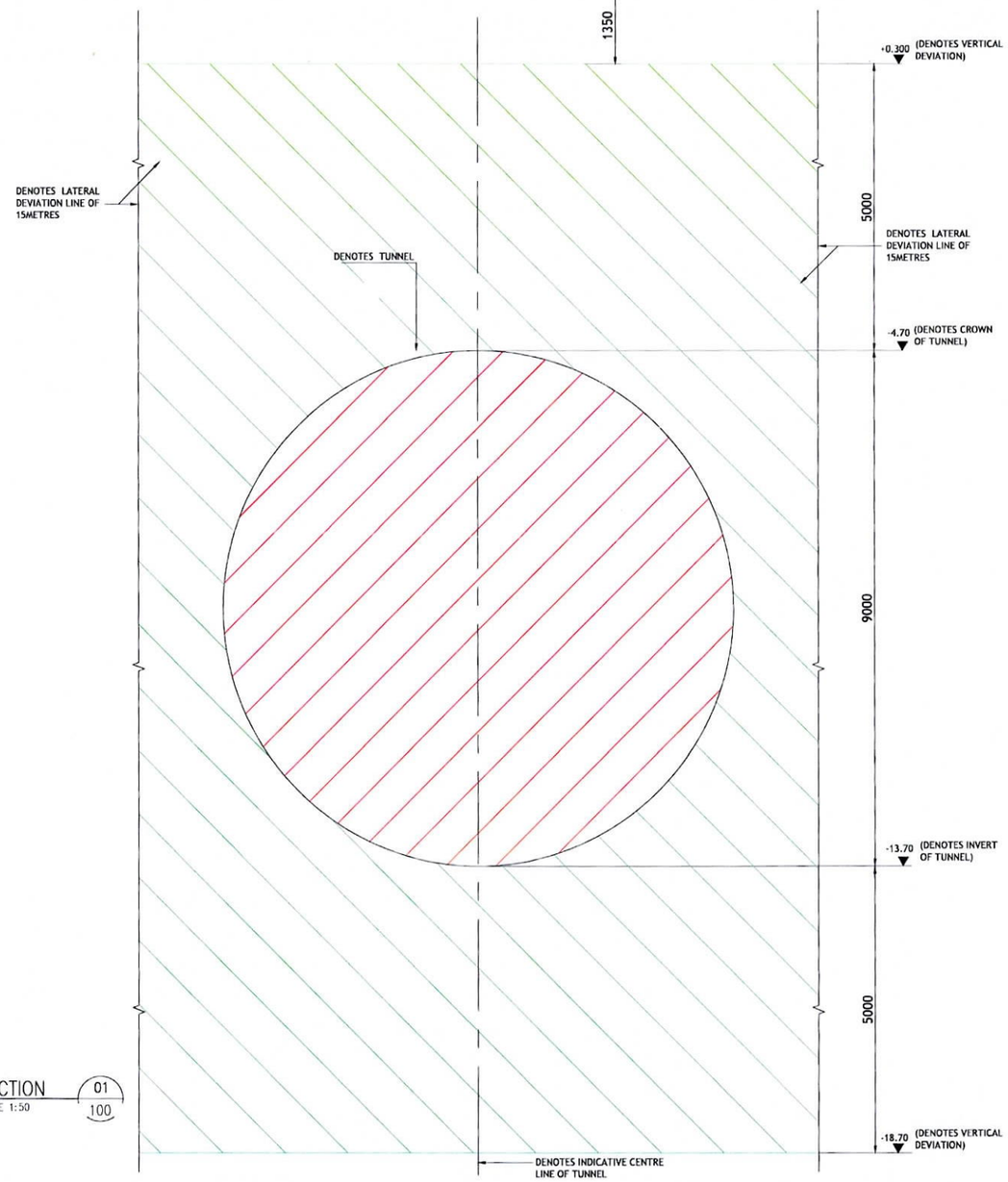
Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET
Title: FULL BUILDING SECTION WITH PROPOSED METROLINK TUNNEL

Drawn:	Date Drawn:	Technician Check:	Engineer Check:	Approved:
B. Mavudzi	May 2014	B. Mavudzi	R. Coughlan	R. Coughlan

Project No:	Model:	Drawing Status:
222202	222202-PUNCH-XX-FN-M2-S-101	S3

Scale @ A1:	Document No:	Rev:
1:125	222202-PUNCH-XX-FN-DR-S-103	P01





SECTION 01
SCALE 1:50
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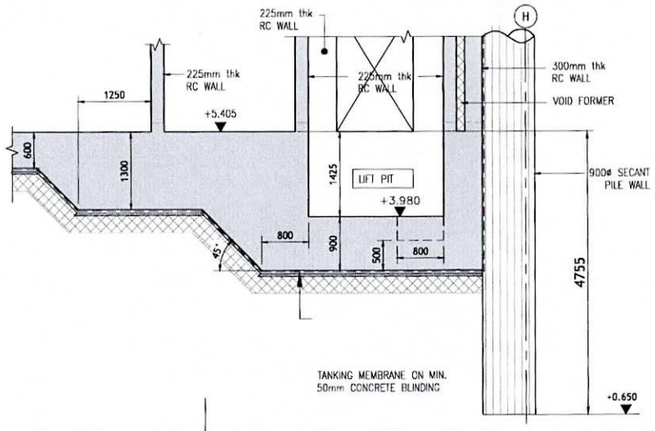
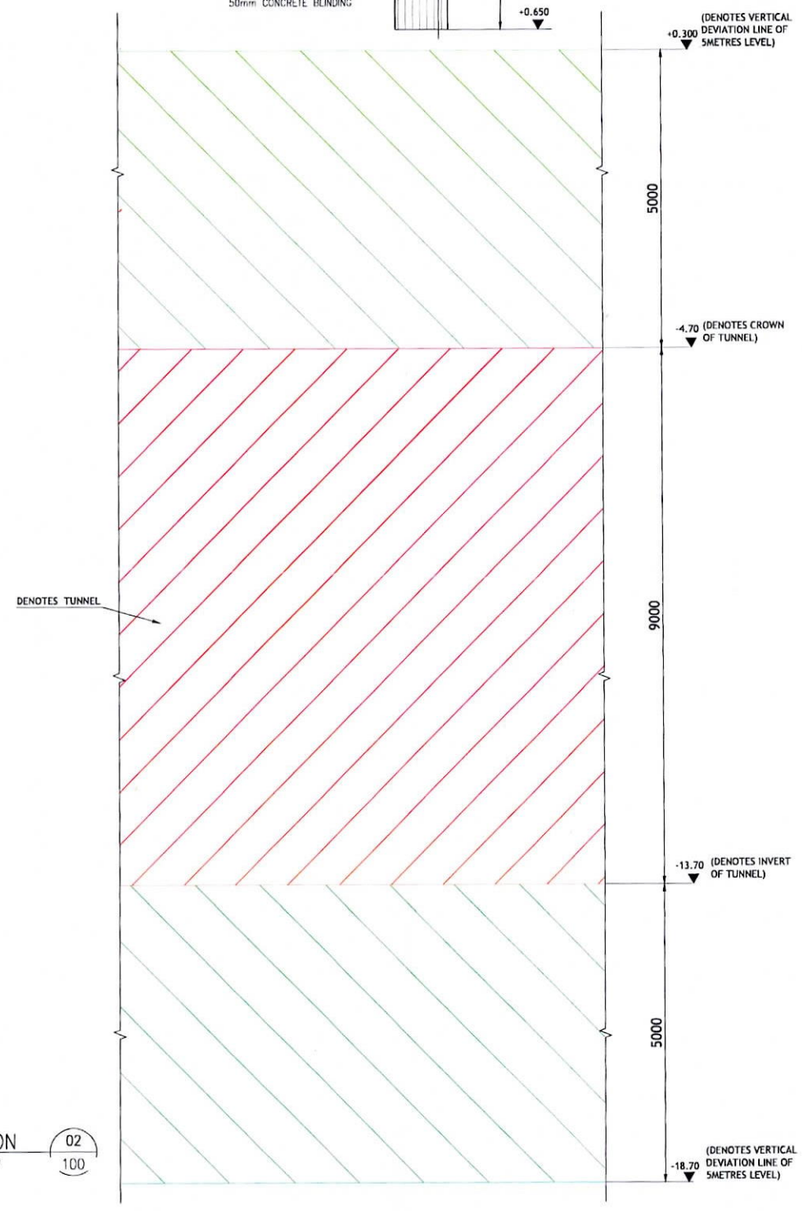


NOTES:

1. DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.



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BUILDING INFORMATION MODELLING (BIM) I.S. EN ISO 19650-2:2018
NSAI Certified

Rev	Amendment	By	Date
P01	ISSUED FOR INFORMATION	BM	21/10/2022

Client: EARLDEV PROPERTIES LTD

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Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET				
Title: INTERFACE OF PROPOSED METROLINK & EXISTING BASEMENT STUCTURE - SECTIONS (SHEET 1 OF 2)				
Drawn: B. Mavuzri	Date Drawn: May 2014	Tech/Man Check: B. Mavuzri	Engineer Check: R. Coughlan	Approved: R. Coughlan
Project No.: 222202	Model: 222202-PUNCH-XX-FN-MZ-S-101		Drawing Status: S3	
Scale @ A1: 1:125	Document No.: 222202-PUNCH-XX-FN-DR-S-101			Revision: P01

Appendix G - Rascor International Limited Letter on Impacts to Basement Waterproofing System

rascor®

Pioneers in waterproofing

Robert Coughlan
Technical Director
Punch Consulting Engineers
Carnegie House
Library Road
Dun Laoghaire
Co Dublin

13.01.2023

Ref: Project Metrolink

Hi Robert,

In line with your message regarding the proposed Metrolink project, RASCOR shares your concerns and agrees with the conclusions in your submission.

RASCOR White Tank system implemented in the Arthur Cox Building basement is a Type B structural waterproofing system which is created using the reinforced concrete elements of the structure to prevent water ingress.

The basement of the Arthur Cox building is designed for 0.2mm crack width as required for waterproof concrete structures utilizing the structurally designed reinforcement in the elements and strategically positioned crack-inducing injecting units. If cracking of 1-5mm occurs due to the new conditions arising from the tunnel construction, it would permanently damage the waterproofing system and the basement structure.

Any damage to the basement structure which can occur from ground movement, settlement, vibrations etc. would certainly cause detrimental damage to the white tank system and would cause significant issues with water ingress and further integrity of the system overall.

Kind regards.

Aleksandar Kiprijanovski BSc MIEI

Senior Design Engineer

Appendix H - Extract From Wider Effects Report Limit of Deviation Environmental Impact Assessment Report Volume 5

1. Introduction

1.1 Overview

This report assesses whether the power to deviate within the proposed limits of deviation (LOD) for the MetroLink project as identified on the property drawings that accompany this Railway Order (RO) application would alter the predicted significant impacts reported in the Environmental Impact Assessment Report (EIAR) by creating new or different (usually increased) significant impacts.

The statutory powers contained within the Railway Order allow for changes within the LOD to occur where it is found that the spatial position of the MetroLink (hereafter referred to as the proposed Project) may need to be adjusted, mainly for reasons of engineering practicability. The LOD will allow permanent project elements to be constructed within a defined envelope that would accommodate alterations in designs and layouts. These limits allow those who are appointed to implement the powers to deviate within stipulated tolerances/parameters from the project design and alignment when constructing the proposed Project should it be required.

The LOD applied for as part of this RO application defines the scope of the construction of the proposed Project beyond the geographical extent of the project works as described in Schedule 1 of the Railway Order application, should it be required.

All of these elements of the proposed Project consent can allow for flexibility in the finalisation of the detailed design and construction, subject to the constraints outlined in this report. This report provides an assessment of the maximum adverse environmental impacts of the LOD in both the construction and operational phases and outlines mitigation measures which will be applied where required or constraints to the proposed LOD where the effects of the predicted impacts cannot be mitigated in order to avoid any impacts or increase in impacts beyond what has been evaluated in the EIAR.

1.2 Limits of Deviation

The LOD is the maximum distance that a railway undertaking is authorised to deviate from the lines of the plans and drawings lodged with a successful application for a RO. The requirement for LOD is outlined in the Transport (Railway Infrastructure) Act 2001 (the 2001 Act).

The LOD is detailed in Chapter 4 (Description of the MetroLink Project) of the EIAR. To summarise, the LOD are detailed in Table 1.1.

Table 1.1: Limits of Deviations

Project Element	Vertically (upwards) (m)	Vertically (downwards) (m)	Horizontally (in all directions from centre line) (m)
Surface works (not impacting on public roadways)	2	2	5
Surface works (impacting on public roadways)	1	1	2.5
Tunnel Alignment	5	10	15

Project Element	Vertically (upwards) (m)	Vertically (downwards) (m)	Horizontally (in all directions from centre line) (m)
Retained Cut and Cut and Cover Alignment	1	2	2.5
Station Box Locations	5	10	2

It should be noted that any amendments to the alignment are expected to generally occur within construction tolerances, which are much lower than the potential variance indicated in Table 1.1. The maximum construction tolerance is of the order of 200mm in any direction.

However, the LODs set for the proposed Project are to accommodate any unknowns that might be encountered at the construction phase of the proposed Project. The assessment presented in this report is an overview of the potential environmental impacts that could be realised should the proposed project deviate within the extents of these limits.

1.3 Environmental Analysis and Assessment

An environmental sensitivity analysis has been undertaken to identify:

- If the environmental impacts of changes to the project alignment within the LOD are feasible; and
- Whether such changes are more significant and/or different from those assessed in the Environmental Impact Assessment Report, such that the assessment presented in the EIAR would not address all impacts and required mitigation measures. The analysis has regard to all of the environmental assessments undertaken in the EIAR.

The assessment was undertaken in three distinct stages which are as follows:

- ***Stage 1 Identification of Constraints to the application of LODs:*** A review of the proposed project alignment to identify locations where there is no scope for LODs to be applied due to constraints.
- ***Stage 2 Scoping Analysis:*** An analysis of the potential for environmental impacts not identified within the environmental assessment presented in the EIAR to arise due to alterations to the project alignment within the LOD. Where there is no potential for significant additional environmental impacts for specific disciplines for the different LODs, these are not considered further. However, where the analysis identified any potential for different/additional or increased impacts (than those identified in the EIAR), further analysis is undertaken in the Stage 3 Detailed Analysis.
- ***Stage 3 Detailed Analysis:*** Where Stage 2 identified the scope for potential environmental impacts beyond those identified in the EIAR, a more detailed assessment was undertaken in Stage 3. This analysis was undertaken to identify the potential additional receptors that could be impacted should the alignment be changed within the LOD and to identify the requirement for mitigation measures that can be adopted to ensure residual impacts arising are insignificant. This detailed analysis was undertaken having regard to the analysis presented in the EIAR and was based on a spatial analysis of additional receptors potentially impacted by changes to the alignment within the LOD.

1.4 Stage 1 Identification of Constraints to the Application of LODs

The assessment undertaken has identified a number of locations where it is not possible to apply LODs due to constraints in the immediate vicinity of the proposed alignment. These locations are listed below progressing from North to South along the alignment

- Cut and Cover adjacent to Estuary Court – no scope for lateral deviation given the proximity to residential properties and access road;
- Retained cut alignment section adjacent to Woodie's Seatown – no scope for lateral deviation given the proximity of the alignment to the building structure and R132 Swords Bypass;
- Seatown Station adjacent to Hertz Europe Head Office – no scope for lateral deviation given the proximity of the alignment to the building structure and R132 Swords Bypass;
- Retained cut alignment adjacent to Ashley Avenue – no scope for lateral deviation given the proximity to residential properties and access road;
- Retained cut alignment section adjacent to Fujitsu Ireland Limited – no scope for lateral deviation given the proximity of the alignment to the building structure and R132 Swords Bypass;
- Retained cut alignment section adjacent to Swords Veterinary Hospital – no scope for lateral deviation;
- No scope for the application of LODs at underground station locations including the following:
  - Glasnevin Station and interchange – no scope for lateral deviation due to the existing infrastructure at this location including Iarnród Eireann, the Royal Canal, adjacent residential buildings and roadway;
  - O'Connell Street Station – no scope for lateral deviation do to level of existing infrastructure here and the possibility of interfaces with oversight development;
  - St Stephen's Green Station – no scope for vertical deviation upwards due to restrictions on tree roots in St Stephen's Green; and
  - Charlemont Station – no scope for lateral deviation due to interfaces with oversite development and adjacent residential properties located on Dartmouth Square.
- Underground tunnel section under Trinity College Dublin – no scope for vertical deviation upwards beyond construction tolerances due to sensitive receptors to vibration and electromagnetic interference, furthermore no scope for lateral deviation to the east due to proximity to sensitive receptors.
- Underground tunnel section Grand Canal/Charlemont Station – no scope for vertical deviation upwards due to sensitive receptors to proximity of the Grand Canal drainage Sewer.

1.5 Stage 2 Scoping Analysis

The outputs of the Stage 2 Scoping analysis are summarised in Table 1.2. The results are presented for each environmental discipline having regard to the LODs outlined for Surface Works, Retained Cut areas and Tunnelled sections as outlined in Table 1.1 above. The summary presented takes account of an analysis undertaken within Geographical Information Systems (GIS) of additional receptor types within the LOD distances which could be affected by change of the alignment within the LOD. The specialists who authored each of the EIAR chapters were engaged in the analysis. This analysis entailed workshopping these areas with the appropriately qualified specialists in terms of identifying potential for additional environmental effects having regard to the assessment undertaken in the relevant EIAR chapter This analysis involved overlaying the LODs with GIS data on sensitive

Appendix I - Letter From ARUP Facades

ARUP

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arup.com

By email
21 November 2022

Mr Ken Hughes
Clancourt Mamagement UC
2 Park Place,
Upper Hatch Street
Dublin 2, D02 NP94

Our ref 280177-00

Dear Ken,

Re: Project Metrolink – Arthur Cox-ETHS Building

We have reviewed the Jacobs IDOM document Appendix D and note the following from the report:

- "*The magnitude of the ground movement will vary across the footprint of the buildings resulting in differential ground movement which has the potential to damage buildings...*"
- The Arthur Cox-ETHS building has been identified as risk Category 2 (Slight)
- Risk Category 2 will result in crack widths from 1 to 5mm with the "*Description of Typical Damage and Likely Form of Repair for Typical Masonry Building*" to be "*some repointing may be required for weathertightness*" & "*Doors and windows may stick slightly*"
- The risk categorisation and anticipated damage outlined in Table 1 is confirmed in the notes as being determined from "*the works of Burland et all (1977)*".

It would appear from the report that the baseline for anticipated damage has been established as a masonry clad building from 1977. There does not appear to be any consideration for how a modern glass clad building will react to the proposed differential settlements.

The façade to the Arthur Cox-ETHS building is not a masonry façade, it is comprised of large stone cladding and floor to ceiling glazing elements. These large cladding elements are more sensitive to differential movements. For example, a small differential movement across the base of one of the floor-to-ceiling glass panes results in a significantly larger movement at the top of the frame due to the aspect ratio of the glass.

ARUP

Our ref	280177-00 / AMcC
Date	21 November 2022

Modern façades such as those installed on the Arthur Cox-ETHS Building are carefully designed to accommodate project specific building movements. The anticipated structural movements & tolerances for the primary structural frame are defined by the structural engineer. The environmental loading associated with the anticipated wind loading and thermal expansion are defined for the proposed cladding systems.

The cladding systems are bespoke to the building and designed to accommodate a defined set of movement criteria. The façade systems and associated bracketry are then detailed to accommodate those defined movements such that the cladding can perform over its design life as these loads are applied. The accommodation of the floor slab movements resulting from changing occupancies for example.

The anticipated additional differential settlement, resulting from the installation of Metrolink has, as detailed in the report the potential to work loose pointing and cause racking of doors and windows within their frames such that they may stick, when considered for a masonry clad building. We would have a concern that when this level of potential damage is extrapolated to suit a modern office development that there are additional areas of potential damage to consider such as:

- Short term (During the construction of Metrolink) – Damage to glass; damage to stone cladding – Caused from unanticipated differential settlement exceeding current allowances
- Long term (Design life of cladding) – Damage to glass; damage to stone cladding – Caused by the differential settlement cause from the construction of Metrolink reducing the existing movement accommodation of the installed systems.

The differential settlement of this building will have to be carefully monitored and the risk of damage in both the short and long term assessed based on the movements recorded to determine the full impact and risk of damage over the design life of the cladding.

Yours sincerely

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