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Project MetroLink - 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) - PUNCH Civil/Structural Engineering Report - Module 1

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1 Report Authors

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2 Introduction

This report has been prepared as part of a submission by Earldev Properties Unlimited Company (Earldev) for the An Bord Pleanála Oral hearing relating to the Dublin MetroLink project - Ref ABP-314724-22 Submission Number 079. The report covers Structural Civil Engineering matters specific to the site. It is noted from the outset that Earldev are fully supportive of the Dublin MetroLink Project. There are however a number of areas of concern of Earldev and their Technical Team, which we request are fully addressed to ensure the building is not damaged beyond its design limits during any tunnel works.

PUNCH Consulting Engineers prepared a Technical Submission on the proposed MetroLink in January 2023 and responses to this submission were issued by Transport Infrastructure Ireland (TII) on https://www.metrolinkro.ie/ in late 2023.

This evidence does not reiterate the detailed points addressed within the original submission on the Railway Order which are considered as read by all parties. Earldev's Technical Team will however address the TII's Response to Submissions.

Earldev appointed AGL Consulting Engineers as part of the Technical Team to prepare the original Technical Submission. As part of the follow-on work from the Technical Submission, Earldev instructed AGL to carry out an independent Refined Phase 2a Assessment on the proposed tunnel. It is noted the methodology used by AGL in this assessment was the same methodology used by TII in the EIAR. The findings of this assessment will be discussed in greater detail by my colleague Mr. Conor O'Donnell.

There were communications in February 2024 between the Technical Teams of Earldev and TII to work through the TII responses of the Technical Submission. Earldev have added responses to the TII responses following these communications. A copy of these responses to TII can be found in Appendix A.

In addition, there was further communication in February 2024 from TII in relation to their design approach in their Stage 2a assessment and subsequent work of a high-level preliminary Phase 3 assessment, carried out since the issue of the Railway Order. Earlvev's Technical Team reviewed the content of the communication, and a formal response of these points was submitted TII on Friday 23rd February 2024. A copy of this document can be found in Appendix B.

3 Building Structure

The building is a Reinforced Concrete Framed Structure of 7 storey structure over double basement structure. The superstructure consists of a reinforced concrete frame with reinforced concrete columns supporting flat slab construction at each level. Part of the top floor on the north is constructed in lightweight steel frame to allow for the future addition extra floors, which the buildings structure and foundations were designed for. This part of the floor has been designed so that the set back at this level can be brought out onto the main building line and additional floors constructed around the full floor plate. Lateral stability in the structural frame is achieved by diaphragm action through the floor plates into three separate structural cores around the building.

The perimeter columns of the building are supported on a perimeter capping beam and these loads are transferred directly into the secant piled wall and into the limestone rock. The internal columns are transferred onto pad foundations which are integrated in the basement ground bearing slab. The basement slab is designed as an inverted suspended slab in the water table uplift condition as the building is constantly under the water table.

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.It is our opinion that the refined Phase 2a assessment in the EIAR by TII did not consider the basement waterproofing system of this building. This will be discussed in greater detail by Mr. Conor O'Donnell. A report from Rascor accompanied PUNCH's Technical Submission in January 2023 where it confirmed the basement waterproofing system could not cater for the predicted damage stated in the EIAR. Rascor were asked to comment on the findings of the Independent Phase 2a assessment carried out by AGL and produced a further report in February 2024 which can be found in Appendix C. Rascor confirmed again in this report, the basement waterproofing system could not cater for the predicted damage stated in the independent Phase 2a Assessment.

As part of the development, we were required to divert the culverted River Stein, which ran through the site and proposed basement. The culvert was diverted by dropping the flow down the back of the piled wall on the south and through a land drain underneath the basement slab and returns up the piled wall on the north as the basement is constantly under the water table. With the sensitive nature of the basement as outlined, this culverted detail would also be a concern for the predicted damage stated in the independent Phase 2a Assessment.

The building facades are a combination of selected stone and glazing. ARUP facades who were Façade Consultant on the project, produced a report for PUNCH's Technical Submission in January 2023 where it confirmed the building facades design parameters would be exceeded for the predicted damage stated in the EIAR. ARUP were asked to comment on the findings of the AGL Independent Phase 2a assessment and produced a further report in February 2024, which can be found in Appendix D. ARUP Facades confirmed again in this report, the basement façade system could not cater for the predicted damage stated in the independent Phase 2a Assessment.

The EIAR bases the Phase 2a assessment on "Typical Masonry Buildings" from "the works of Burland et all (1977)". It is recognised that this approach may have been industry standard previously for tunnel design at initial concept stage. However, we are of the opinion that this approach is simply not suitable for this type of building owned by Earldev. The building is not a masonry building, there is no loadbearing masonry on the primary structural frame of this building. Furthermore, this approach does not consider the sensitive nature of the basement structure or the sensitive nature of the building facades. This approach does not cater for the concentrated loads on the tunnel from internal pad foundations nor the concentrated loads form the axially loaded piles, which both directly load the crown of the tunnel. It is our opinion that while the Phase 2a Assessment in the EIAR may relate and accurately represent other buildings along the proposed line, it does not represent this building and this type of assessment on this particular building is not fit for purpose.

4 Proposed Tunnel Alignment and Proposed Vertical Deviations of the Tunnel in the EIAR

The proposed tunnel under the building at 10 Earlsfort Terrace rises from north to south approximately 0.9m over the length of the building. The crown of the proposed tunnel ranges from -4.38mod to - 3.48mod from north to south. The toe of the piles of the building are at 0.65mod. The distance from the higher crown level of the tunnel to the piles is 4.13m. Please refer to sections and 3d images in Appendix D.

It was originally proposed in the EIAR that the upwards vertical deviation was +5m. This would increase the proposed tunnel crown levels to 0.62mod to 1.52mod from north to south. The toe of the piles of the building are at 0.65mod, therefore this upward deviation would result in a clash with the piles. Please refer to sections and 3d images in Appendix D.

On the 19th of February 2024 it was proposed by TII that the upward vertical deviation was to be limited at +1m. As a result of this deviation, this would increase the proposed tunnel crown levels to -3.48mod to -2.48mod from north to south. The toe of the piles of the building are at 0.65mod, therefore this upward deviation would give a clearance of 3.13m from the crown of the tunnel to the piles. Please refer to sections and 3d images in Appendix D.

It was proposed in the EIAR that the downward deviation is -10m. This would decrease the proposed tunnel crown levels to -14.38mod to -13.48mod from north to south. AGL analysis which will be discussed in greater detail by Mr. Conor O'Donnell , reviewed the level of a -5m deviation. The toe of the piles of the building are at 0.65mod, therefore this downward deviation would give a minimum clearance of 9.13m from the piles. Please refer to sections and 3d images in Appendix D.

5 Conditions of Engagement

This survey and report was undertaken under the conditions of engagement Agreement RA9101 for the Appointment of Consulting Engineers for Report and Advisory Work Published in agreement with The Association of Consulting Engineers of Ireland.

Appendix A - TII Responses to Earldev Technical Submission in January 2023

Submission No.	079
Organisation Name or Name of Submitter	Earldev Properties Unlimited Company (represented by John Spain Associates)

Item No.	Section Ref.	Page No.	Observation Statement	TII Response	Earldev Team Response 27.02.2024
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)					
1	Introduction (page 1 and 2 of John Spain Associates submission)	2&3	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. 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. 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.	Thank you for the submission and request for Oral Hearing. We have reviewed the submission and provided response for the observations/ concerns raised in detail below. An overview of the Oral Hearing process is provided in the EIAR Chapter 8.9.2. The Board has confirmed that it intends to hold an Oral Hearing for this project. The purpose of the oral hearing will be to allow issues relevant to an application for approval be examined. The oral hearing can be attended by anyone, but only those that have made a written application may make an oral submission at the oral hearing. The oral hearing is managed by the An Bord Pleanála inspector.	Noted
2	Site and Impacts on Metrolink (page 3 of John Spain Associates submission)	3	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.	TII note your concerns in relation to the noise and vibration related potential impacts on your property. EIAR Appendix 14.5 Groundborne Noise and Vibration Blasting Modelling Results presents predicted groundborne noise and vibration levels during the construction phase of the project, with the results for 10 Earlsfort Terrace summarised below: • The predicted level of groundborne noise during TBM passage at surface level is 50 dB LASmax, which is above the 45 dB LASmax threshold, resulting in a significant impact on the buildings occupants for the short duration of the TBMs passage which is estimated to be 2- weeks. This means that the noise will be audible within the building during the short period that the TBM progresses. However, there is no potential for any permenant damage to the building resulting from this activity. • The predicted level of groundborne vibration during TBM passage is 0.269 ms-1.75, which is lower than the VDV (Vibration Dose Value is a parameter that combines the magnitude of vibration and the time for which it occurs) Threshold Level of 1.6 ms-1.75, resulting in a not significant impact on the building. Unfortunately, there are no effective methods available to reduce groundborne noise from TBMs at source. TII will liaise with Earldev Properties Unlimited Company to ensure the timing of these impacts are known. The principal mitigation measures aimed at minimising impacts are as follows: • Advance public consultation and stakeholder engagement can greatly reduce the significance of groundborne noise effects during construction, as building occupants would be prepared for the passage of the TBM and resultant elevated noise and vibration levels. • TII will accept and consider applications for additional measures on a case-by case basis, in accordance with its Noise and Vibration Mitigation Policy (see EIAR Appendix A14.6).	Noted
3	Engineering Considerations (page 4 and 5 of John Spain Associates submission)	5&6	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 buildingfrom 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 facades 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 facade 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.	This response here also relates to Item 46 and others below. TII are satisfied that the approach adopted to date for assessment of building damage follows an industry standard approach undertaken on tunnelling and underground projects around the world including on the Channel Tunnel Rail Link and Crossrail in London, the Dublin Port Tunnel and currently on HS 2 in England, and therefore that further assessment does not need to be delivered prior to the proposed Project being consented. The purpose of the Stage 1 and Stage 2a assessments has been to provide/ensure confidence that the Works will not induce unacceptable damage to buildings/structures along the Route. The primary objective has been to confirm that the structural integrity of each building/structure will not be compromised by the Works. Ancillary features in each building/structure, which themselves do not contribute to the structural integrity of the building/structure, are considered in the subsequent Phase 3 assessment. The D&B Contractor is responsible to further investigate the sensitivities of each building/structure to identify those elements within the building/structure curtilage that may not contribute to the structural integrity of the building/structure itself, but will most likely in themselves be sensitive to the excavation and construction processes. In each instance, engaging with the building/structure owner (or their delegated representative) the D&B Contractor will be responsible for identifying further mitigations that will further reduce the potential for damage if needed. These mitigations might relate directly to the excavation and construction processes (at source measures), or they might relate to a direct protection of the non-structural elements for which damage related concern remain.	This is not accepted.
			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."	TII are however confident that mitigation to the building itself will not be required. It should be noted that Phase-2a assessment has been carried out with very conservative assumptions with regard to the tunnelling volume loss value (1%) ignoring the beneficial effect that the tunnel face is entirely within the rock strata. This building has been identified as a 'special' building and will be subject to a detailed assessment (Phase-3 assessment) and appropriate control measures will be implemented to protect the building. The Phase-3 assessment will utilize the site specific ground model, particularly considering that the tunnel face is fully in the rock strata in this area. If, based on the detailed Phase-3 assessment, the impacts are still deemed to be unacceptable to items such as building cladding or basement waterproofing (or any other ancillary features) further mitigation measures would then be assessed and implemented. For example enhanced control the TBM slurry pressure in this zone would further reduce face loss and hence impacts. This process has been used successfully across major projects elsewhere with buildings of similar cladding and basement detailing.	

4	Engineering Considerations (page 5 and 6 of John Spain Associates submission)	6&7	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. "	TII confirm that the Phase-2a assessment does consider the greenfield settlements and the lateral ground movements at the formation level of the basement (underside of the basement slab) in the Damage Category Assessment and not at ground level. Please also see response to Item 3. The design includes for a limit of deviation which is required to allow for unforeseen obstructions and construction tolerances which may necessitate a change to the alignment. In the highly unlikely event that this were to occur, any resulting environmental impacts will comply with the limits set by the enforceable Railway Order. TII has carried out a comprehensive set of ground investigations in accordance with relevant guidelines and best practice. It has a high confidence that MetroLink can be constructed along the proposed alignment without requiring vertical or horizontal adjustment. However, in order to guard against rare and undetectable subterranean conditions that might interfere with construction, the Railway Order provides for limits of deviation (as have other railway authorisation since at least the 1840s). The impacts of potential changes within the Limits of Deviation are considered in the Wider Effects Report (Appendix A5.19). There are no omissions to the EIAR assessment approach, the approach adopted is industry standard and designed to ensure that impacts are managed to protect 3rd parties.	Thiis is not accepted .
5	Engineering Considerations (page 6 of John Spain Associates submission)	7	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.	Please refer to Item 3. In EIAR Appendix A 5.17 Building Damage Report Table 5.2 the Arthur Cox Building assessments to date indicate that the building falls into the Slight damage category and hence further assessment is not required at this stage. However, the building has been classified as 'special' building, and hence a further assessment (Phase 3) will be undertaken at detailed design phase. This further assessment will pick up on the building's condition close to the time when the building will be impacted, and this additional assessment will refine the impacts of the Metrolink and explore options to mitigate and/or reduce the residual impacts. Residual impacts will not be significant as noted here.	This is not accepted.
6	Settlement and Building Damage (page 6 of John Spain Associates submission)	7	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.	The building damage assessment has estimated "Slight" damage currently. Table 4-3 Classifies building damage *"Slight"* as *"Cracks easily filled"*. Slight damage does not constitute structural impact and hence the statement is correct. Please refer to Item 3 with regard to further refined assessment of impacts.	This is not accepted.
7	Settlement and Building Damage (page 6 and 7 of John Spain Associates submission)	7&8	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,"*	With regard to the specific points noted requiring additional information: 1. Refer to Items 3 and 4. 2. Refer to Items 3 and 4. 3. The Arthur Cox Building is identified in Appendix 5.17 as a Special Structure and hence further assessment will be undertaken. 4. The building together with its basement has been assessed at Phase 2a. Phase 3 assessment will further assess all aspects of the structure together with ancillary items and incorporate the existing condition to verify sensitivity. 5. Refer to Items 3 and 4. However please note that TII can commit not to raise the alignment of the tunnel at this location. 6. Refer to Items 3 and 4.	This is not accepted.
8	Settlement and Building Damage (page 7 of John Spain Associates submission)	8	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."*	TII would respond to the points raised as follows: • TII Engineers have interpreted the geological cross sections from the site investigations performed on behalf of MetroLink project. This volumnous technical data derived from the various ground condition site investigations is not included nor required in the EIAR. • The collation of ground information will continue to progress post the grant of the Railway Order. The geological cross section in Appendix 20.9 were prepared prior to completion of the latest stages of Ground Investigation (GI) and will be updated incorporating any subsequent investigations commissioned by the contractor. • The location of Arthur Cox building can be identified on the following RO drawings: drawing no. ML-LN O-O18: MetroLink - Alignment, Long Section 18, drawing no. ML-RO 306 D-E: MetroLink - General Arrangement, St. Stephen's Green to Hatch St. Lower and drawing no. ML-RO 306 E-O: MetroLink - General Arrangement, Hatch Street Lower to Grande Parade. • The assessments undertaken relate to the new building and the detailed information provided to TII in 2019. This included the bkd planning drawings and an inspection undertaken by ORS of the property (including the basements). This will be refreshed for the Phase 3 assessment.	This is not accepted.
9	Settlement and Building Damage (page 7 of John Spain Associates submission)	8	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."	Please refer to Item 3, 4 and 7. An alteration of the horizontal alignment is not considered necessary and would introduce significant track alignment and operational constraints due to the proximity to the Charlemont station. A lowering of the tunnel alignment in this area within the bounds permissable by the limits of deviation may be feasible subject to more detailed engineering analysis.	Noted
10	Construction and Operational Impacts on Building (page 7 of John Spain Associates submission)	8	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"*	All surveys, monitoring and mitigation proposals for your property will be discussed and agreed with you. TII will employ Professionally Qualified Engineers / Surveyors with the appropriate expertise to undertake the pre and post condition surveys and you are welcome to observe the surveys being undertaken of their property. Initials surveys will be undertaken to educate the Phase 3 assessments discussed under Item 3 and 4. Close out surveys will be undertaken once TII can demonstrate that ground movements have ceased.	Noted
11	Construction and Operational Impacts on Building Occupants (page 8 of John Spain Associates submission)	9	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.	The assessment presented in Chapter 14 Groundborne Noise and Vibration includes threshold levels for vibration in terms of human response in buildings. These are much more sensitive than levels of vibration that would results in any building damage. As the predicted level of vibration at the building is below the assessment threshold for human response there is a very low risk of building damage as a result of noise or vibration from construction works at this location.	Noted

12	Asset Protection Policy (page 8 of John Spain Associates submission)	9	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.	The tunnels are designed and constructed to support future imposed loads. TII is working on an MetroLink Guidance Note for Developers that will be the subject of bye-laws following the grant of Railway Order. It has not published that in advance because it would have to be in broad terms that deal with the current RO proposal and any contingencies that might arise from the Board seeking revised designs or new conditionality. Instead, TII's approach to date has to provide comments on design proposals brought forward by developers in advance of them being submitted for planning permission. TII has successfully engaged with a number of developers over the last two years to accommodate development over and in proximity to the alignment and there have been no material restrictions on development subject to the implementation of agreed design and mitigation measures. It is not anticipated that MetroLink will have a material impact on the development potential of sites above and in proximity to the alignment. For information, TII note the following observations: The site is zoned Z9 - Employment / Enterprise in the Dublin City Development Plan 2022-2028. This zoning permits intensive employment generating development in principle, subject to consideration of the surrounding context and compliance with a range of statutory development management standards set out in the plan. The site has been developed on foot of planning permissions lodged in 2008 and 2014. The maximum height of the building was set as 7 storeys by way of condition (by An Bord Pleanála). The development carried out would appear to be in the range of the maximum development potential on current development standards, although it may be possible to attain a higher insitu development should standards change or the scale of surrounding development also increase.	This is not accepted.
13	Specific Assessment and Limitations in relation to 13 & 14 Earlsfort Terrace, Punch Consulting Engineers Report (page 8 of John Spain Associates submission)	8&9	As set out in the Punch Consulting Engineers Report: *1. 13 and 14 Earlsfort Terrace requires individual attention from TII as a standalone unique structure in the design of the proposed Metrolink Tunnel.* *2. An assessment of the proposed Metrolink in relation to the close proximity of the basements structure and secant piled wall.* *3. 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.* *4. 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.* *5. 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.* *6.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.* *7. 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.*	With regard to the Punch Consulting Engineers Report: 1. Please refer to Items 3, 4 and 7. 2. Refer to Items 3, 4 and 7. 3. It is agreed that Cat 3 checking will be undertaken. 3. The EIAR as submitted has detailed the impacts on the building and its tenants both during construction and operation of the MetroLink. 4. **Construction Phase Impacts** Appendix 14.5 Groundborne Noise and Vibration Blasting Modelling Results presents predicted groundborne noise and vibration levels during the construction phase of the project, with the results for 10 Earlsfort Terrace summarised below: - The predicted level of groundborne noise during TBM passage is 50 dB LASmax, which is above the 45 dB LASmax threshold, resulting in a significant impact on the buildings occupants for the short duration of the TBMs passage which is estimated to be 2-weeks. - The predicted level of groundborne vibration during TBM passage is 0.269 ms-1.75, which is lower than the VDV Threshold Level of 1.6 ms- 1.75, resulting in a not significant impact on the building. - Predicted ground movement and building damage impacts are included with EIAR Appendix 5.17 and discussed in Item 4 above. **5. Operational Phase Impacts** - The predicted level of groundborne noise railway operation is 36 dB LASmax, which is below the 40 dB LASmax threshold, resulting in a not significant impact on the buildings occupants. - The predicted level of groundborne vibration during operation is 0.001 ms-1.75, which is much lower than the VDV Threshold Level of 0.8 ms-1.75, resulting in a not significant impact on the building. 6. Appropriate ground investigation will be undertaken by the Contractor to verify design assumptions with regard to the tunnelling operation and in respect of its impact on the surrounding environment. 7. Please refer to Items 3 and 4.	Noted
14	Specific Assessment and Limitations in relation to 13 & 14 Earlsfort Terrace, AGL Report recommendations (page 8 and 9 of John Spain Associates submission)	9&10	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.*	Please refer to Items 3 and 4.	This is not accepted.
15	Structural and Condition Surveys (page 9 of John Spain Associates submission)	10	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."*	Please refer to Items 3, 4, 6, 7, 8, 9, 10 and 12 above. TII note the party's request for remedial measure however please note the following in relation to potential damage to commerical buildings. TII do not intend to put in place a Property Owners Protection Scheme for Commercial Properties along the MetroLink route. However to protect commercial properties, TII contractors appointed to carry out the works will, with the agreement of the owners of such properties, commission chartered building surveyors to carry out a precondition survey of commercial properties. In the event that it is determined that damage has occurred. TII's contractor will be required to commission a follow up survey to confirm the extent of the damage and confirm if the damage has been caused by MetroLink works. Where property damage is confirmed to have been caused by MetroLink works the property concerned will have recourse to MetroLink project insurances.	This is not accepted.
16	Provision for Future Building Loading (page 9 of John Spain Associates submission)	10	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*	The provision of additional floors to the Arthur Cox building is not compromised by MetroLink as the tunnels design will allow oversite development subject to some requirements, including full engagement with TII by the future designers of the proposed building alterations	Noted
17	Land use zoning (page 10 of John Spain Associates submission)	11	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. "*	TII proposals do not impact on the architectural and civic character and will be constructed so as to minimise impacts so far as is reasonably practicable. All impacts have been assessed in the EIAR.	This is not accepted.
18	Shape and Structure of the City (page 10 of John Spain Associates submission)	11	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.	The EIAR presents any potential imapcts arising at this site. TII will seek to minimise impacts so far as is reasonably practicle in line with the proposed mitigation strategies outlined in the EIAR .	Noted
19	Sustainable Movement and Transport (page 11 of John Spain Associates submission)	12	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.	Refer to Item 2 above	Noted

20	Development Potential (page 11 of John Spain Associates submission)	12	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.	Refer to Item 12 above.	This is not accepted.
21	Development Potential (page 11 of John Spain Associates submission)	12	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.	Refer to Item 12 above	This is not accepted.
22	Concluding Comments (page 11 of John Spain Associates submission)	12	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.	See response to item 2 and 3.	Noted
23	Concluding Comments (page 11 and 12 of John Spain Associates submission)	12&13	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.	TII note these comments, reiterate that all impacts have been assessed and presented in the EIAR. TII are happy to engage further with EPUC regarding any residual concerns.	Noted
24	Concluding Comments (page 12 of John Spain Associates submission)	13	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 request to withhold approval subject to funding is not within ABP's remit.	This is not accepted.
25	Concluding Comments (page 12 of John Spain Associates submission)	13	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.	Under the Transport (Railways Infrastructure) Act 2001 (as amended) upon commencement of the Railway Order, TII will be authorised to acquire compulsorily any land or rights in, under or over land or any substratum of land specified in the Railway Order. Compulsory purchase powers will therefore only take effect following an enforceable Railway Order.	This is not accepted.
26	Concluding Comments (page 12 of John Spain Associates submission)	13	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 II 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. The assessment of compensation would not be limited to the content of this submission.	Plese refer to Items 2, 3 and 4. TII do not consider the request for a condition imposed from An Bord Pleanála to be appropriate. The detailed design and detailed method statement will be developed post an Enforceable Railwau Order being in place.	This is not accepted.
27	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 2 of memorandum)	16	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 Pleanala condition same in any grant of the Railway Order. We request that An Bord Pleanala 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.	Plese refer to Items 3 and 4. TII do not consider the request for a condition imposed by An Bord Pleanála to be appropriate.	This is not accepted.
28	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 3 of memorandum)	17	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 facade 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.	The assessments undertaken relate to the new building and the detailed information provided to TII in 2019. This included the bkd planning drawings and an inspection undertaken by ORS of the property (including the basements). This will be refreshed for the Phase 3 assessment.	Noted
29	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 3 of memorandum)	17	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.	Thank you for the request for Oral Hearing. The oral hearing process is managed by the An Bord Pleanála. Please refer to Item 1 above.	Noted
30	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 5 of memorandum)	19	**a. Tunnel detail design procurement approach i.e. client design or contractor design. When is the contractor expected to be appointed?** *TII Response 11 th November 2022 - Transport Infrastructure Ireland (TII) applied for a Railway Order for the project on 30 September 2022. The planning process with An Bord Pleanala 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.	The detailed design and construction programme (in so far as it relates to the Arthur Cox Building) will be provided once developed by the TII Contractor.	Noted
31	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 5 of memorandum)	19	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?	It is anticipated that the Contractor will be procured within 18 months of the grant of the RO. It should be noted it may be a further 60 months prior to the TBM being within the zone of influence of your building.	Noted

32	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 5 of memorandum)	19	iii) TII to confirm when EPUC will receive a full design package for the works?	This will be confirmed once the main contract is let but likely to be approximately 24 -30 months after the grant of the RO. TII will continued to consult with the submitter but will not furnise the submittter with the detailed design.	Noted
33	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 5 of memorandum)	19	iv) TII to confirm what information EPUC will receive prior to the Oral Hearing?	There are no plans to issue any further information prior to the Oral Hearing apart from any clarifications issued herewith.	Noted
34	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 5 of memorandum)	19	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?	The main contractor will be responsible for all design and construction. However, all designated designs will be independently checked and TII will accept the design. TII will provide the assurance to EPUC that the design and modelling, together with proposed instrumentation and monitoring is fit for purpose and will not result in impacts greater than that assessed in the EIAR. If monitoring is to be installed on or in your properties, then the methodology and timing of the installations will be agreed with EPUC together with any ongoing maintenance of the monitoring. The Contractor and TII will provide updates as required during the construction process. Additionally, condition surveys will be coordinated with EPUC including any close out condition surveys and the identification of any remedial measures needed. If required by EPUC TII will issue the Phase 3 Assessment details. Please refer also to Items 3 and 4 above.	Noted
35	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 5 of memorandum)	19	vi) We request that An Bord Pleanala 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.	TII intend to include all necessary constraints and planning conditions in the tender documents together with all available building information to ensure that full cognisance is taken of all 3rd party buildings and infrastructure.	This is not accepted.
36	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 5 and 6 of memorandum)	19&20	**b. Confirmation of Civil and Structural Design Firm for the Metrolink tunnel under 13 and 14 Earlsfort Terrace, Dublin 2.** *TII Response 11 th 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	No response required.	Noted
37	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Confirmation of Geotechnical Design Firm (page 6 of memorandum)	20	**c. Confirmation of Geotechnical Design Firm for the Metrolink tunnel under 13 and 14 Earlsfort Terrace, Dublin 2.** *TII Response 11 th 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.	TII is satisfied that the level of detail provided is sufficient for the purposes of An Bord Pleanála making a decision on the Railway Order in accordance with the relevant statutory provisions and policy.	This is not accepted.
38	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Confirmation of Geotechnical Design Firm (page 6 of memorandum)	20	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.	Please refer to Items 3, 4, 30, 31 and 32 above.	This is not accepted.
39	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Confirmation of Geotechnical Design Firm (page 6 of memorandum)	20	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.	TII do not believe there is a lack of clarity as all impacts are assessed in the EIAR. If further clarification is required over and above that stated herein, TII are happy to facilitate such dialogue.	This is not accepted.
40	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 6 and 7 of memorandum)	20&21	**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 11 th 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 Pleanala to condition same in any grant of the Railway Order.	The design checking process is to be developed by TII and will incorporate a CAT 3 checking process.	Noted
41	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 7 ato 9 of memorandum)	21 to 23	**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 11 th 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 Pleanala 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. 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) vi) The construction of the secant piled wall required the culvert to be diverted under the new basement (refer to Figure 1) .	TII would welcome a meeting with EPUC to further explore the details presented here and to collate the relevant information to educate the further assessment. Specifically with regard to the points noted, TII comment: 1. With regard to ii) TII will issue EPUC with the Phase 3 settlement assessment if required. With regard to timings please refer to Item 32. 2. With regard to iii) Phase 3 assessments will be building specific. 3. With regard to iv) This point is noted and will be taken into the further assessment. To facilitate this further assessment the original design details would assist if they can be made available. 4. With regard to v) we note the comment with regard to the River Stein and TII would like to record that detailed geotechnical and hysrogeological information including the location of underground rivers have informed the development of the MetroLink design. 5. With regard to vi) The culverted river under the basement will be taken into account and TII would like to record that detailed geotechnical and hysrogeological information including the location of underground rivers have informed the development of the MetroLink design..	This is not accepted.

42	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 9 and 10 of memorandum)	23&24	**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 21 st 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 Pleanala. 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 Pleanala to recognise same	TII would respond to the points raised as follows: 1. with regard to ii) there is no contradiction here. "Slight" damage (in EIA terminology) is predicted, this is not structural damage. 2. with regard to point iii) TII note and agree, this is as planned. 3. with regard to iv) TII agree that the surveys and assessment are to be undertaken in time such that the integrity of the building is maintained. This is TII's stated position. With regard to point v), please refer to item 15 above.	This is not accepted.
43	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 10 and 11 of memorandum)	24&25	**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.	1. with regard to point i) please refer to Items 10, 34 and 42. 2. with regard to point ii) condition surveys will continue until the effect of the construction has ceased, long term impacts during the operational phase are not anticipated. 3. with regard to point iii) please refer to Items 10, 34 and 42. 4. with regard to point iv) please refer to Items 10, 34 and 42.	Noted
44	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 11 and 12 of memorandum)	25&26	**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 24 th 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 Pleanala 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.	Please refer to Items 3 and 4. The settlement contours shown on Figure 20.16 of Appendix B is based on Phase-1 assessment with very conservative (absolute worst case) tunnelling volume loss parameters and its purpose is to define the boundaries for the buildings for subsequent assessments. However, Phase 2a has been carried with refined (but still conservative) tunnelling volume loss parameters with the consequent reduction in the greenfield settlements (to less than 30mm). Further, the Phase 2a assessment is based on the ground movements at the formation level of the basement (underside of the basement slab) - for the Damage Categorisation. Phase-3 assessment will utilize the site specific ground model, particularly that the tunnel face is in rock strata in this area, which will result in significant reduction in the volume loss compared to that adopted for the Phase-2a assessment for tunnelling works - this will lead to lower damage category. Any additional ground probing works etc required to validate the basis of assessment will be prescribed as part of the recommendations from the Phase-3 assessment works.	This is not accepted.
				i) TII acknowledge your concern and as per the EIAR, will put measures in place to reduce impacts to your property as much a reasonably practicable. It is correct that there is potential for significant effects from TBM along the route of the tunnel without mitigation (Section 14.5.1, Chapter 14 Groundborne Noise and Vibration). However, for 10 Earlsfort Terrace, the potential impact on commercial activity due to Groundborne Noise following mitigation will be negative, slight and short term to medium term (Table 11.70, Chapter 11 Population and Land Use). As mentioned at Item 2 above, unfortunately, there are no effective methods are available to reduce groundborne noise or vibration from TBMs at source, but mitigation measures can be implemented to minimise impacts. These are as follows: - Advance public consultation and stakeholder engagement will take place. This can greatly reduce the significance of groundborne noise effects, as building occupants would be prepared for the passage of the TBM and resultant elevated noise and vibration levels; and - TII will accept and consider applications for additional measures on a case-by case basis, in accordance with its Noise and Vibration Mitigation Policy (see Appendix A14.6).	Noted

45	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 13 and 14 of memorandum)	27&28	**i. Confirmation of predicted vibration and noise under the existing structure at 13 and 14 Earlsfort Terrace from the proposed works.** *TII Response 11 th 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 Pleanala 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.	ii) The duration of impacts from groundborne noise due to TBM passage is short term which means a few days and is expected to be of up to 2-weeks. Currently a detailed timeline is not available as the contractor(s) will prepare the programme for the TBM once they are appointed. Once the programme has been prepared, an advance public consultation and stakeholder engagement will take place (Appendix A5.1, Table 6.1 Tunnel Boring GNV1). iii) The Figure 13.2 Construction Noise assessment locations presents the receptor locations considered in the assessment of Airborne noise and vibration around those construction works that will take place above ground, at stations and site compounds. The property is between two of these locations, in excess of 250m from any works, and as such has not been considered in the assessment of airborne noise. The Figures associated with Chapter 14 of the EIAR indicated groundborne noise contours for the passage of the TBM and the operational railway which include coverage of the named property. iv) The assessment results presented in Appendix 14.5 Groundborne Noise and Vibration and Blasting modelling results present predicted levels of groundborne noise and vibration during construction and operation of the named building. No additional assessment is considered necessary. v) At Arthur Cox's offices the level of TBM noise at surface level is shown as 50 LAmaxS in the EIAR contours, and operational noise is shown as 35 LAmaxS. The effect of two basements and piles down to the rockhead is an increase of 5 LAmaxS for TBM noise to 55 LAmaxS and 4dB for operational noise to 39 LAmaxS. For TBM noise the threshold of significant effects for offices is 45 LAmaxS. More relevant is that the duration of significant effect will approximately 2-weeks depending on the rate of advance in this area. For operational noise the impact remains in the "not significant" category. For TBM the VDV is 0.269 ms-1.75 day at ground level increasing to 0.398 ms-1.75 with the two basements and piles. The threshold of significant effect is 1.6 ms-1.75. No further mitigation is necessary for operational effects. No mitigation is available for the TBM groundborne noise impact anticipated at ground level and within the basements as detailed above except through consultation with the owner/occupier of the timings of the TBM arrival, anticipated duration of the TBM progress and programming. vi) & vii) Appendix 5.1 of the EIAR contains an outline Construction Environmental Management Plan (CEMP) which outlines the proposed approach to noise and vibration monitoring during the construction phase in Table 6.2. A full monitoring and auditing programme will form part of the Construction Noise and Vibration Management Plan (CNVMP) which will be agreed with the Local Authorities prior to the commencement of the Construction Phase.	
46	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 14 and 15 of memorandum)	28&29	**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 l-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 l-5mm occurs due to the new conditions arising from the tunnel construction, it would permanently damage the waterproofing system and the basement structure.* 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 Pleanala condition a site specific assessment of the proposed tunnel depth.	Refer to Items 3 and 4 above. A specific condition is not required as site specific assessment is TIIs stated position. Refer to Items 3 and 4 above.	This is not accepted.
47	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 15 to 17 of memorandum)	29 to 31	**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 lm 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 Pleanala 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 l-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 facade 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 Facade concerns. (a) The facade to the Arthur Cox-ETHS building is not a masonry facade, 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 Pleanala to consider same.	1. with regard to point i) please refer to Items 3, 4 and 7 above. 2. with regard to point ii) please refer to Items 3, 4 and 7 above. 3. with regard to point iii) please refer to Items 3, 4 and 7 above. 4. with regard to point iv) TII will remediate any issues arisings from the construction of the works such that there are no residual issues. 5. with regard to point v), (a) and (b) please refer to Items 3 and 4 above. 6. with regard to point vi) please refer to Items 3, 4 and 7 above. 7. with regard to point vii) please refer to Item 9 above.	This is not accepted.

48	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 17 and 18 of memorandum)	31&32	**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 21 s' 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 Til 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 Pleanala impose specific conditions in relation to this unique site and structure.	1. With regard to point i) TII confirm that the tunnel is to be designed to cater for all existing buildings above the tunnel. 2. With regard to point ii) TII have confirmed previously that the building in question will have detailed specific Phase 3 assessments. This is contained within the EIAR Appendix 5.17. Refer to table 5-2 building B-238. 3. With regard to point iii) TII do not believe that additional conditions are required as the requested action in i) and ii) are planned to be undertaken. That said if these are to be conditioned TII have no objection subject to confirmation of the wording of said condition.	This is not accepted.
49	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 18 of memorandum)	32	**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 21 st November 2022 - TII confirm the loadings for the additional floors will be included in the design of the tunnel (also see response to (I) 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.	Refer to Item 12 and 16 above.	Noted
50	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 18&19 of memorandum)	32&33	**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?	Please refer to Item 12. MetroLink will be a catalyst for and provide opportunity for future development and regeneration. While the MetroLink Railway Order does not include for future neighbouring or overhead development, the tunnels and stations are designed to support appropriate future imposed loads. TII will be required to make submissions in relation to planning applications for proposed future developments on or adjacent to MetroLink and there will necessarily be some engineering constraints (such as permissible loadings) required. However MetroLink is committed to engaging with known development proposals and new development proposals as they emerge with the intent of facilitating such developments as they emerge to the maximum extent consistent with the safe operation of the proposed Project. Again in common with other existing rail and tunnel projects, following grant of the Railway Order and development of detailed design, TII will produce "Guidance Note for Developers" that will be the subject of bye-laws following the grant of Railway Order and which is designed to facilitate future adjacent or over-site development while protecting the integrity and safety of the MetroLink works and operations. Therefore at this stage TII is dealing with known development proposals on a case by case basis, TII will work with parties in the future to assist with the wider development of sites over and above stations and tunnels. In this context TII has successfully engaged with a number of developers over the last two years to accommodate development over and in proximity to the alignment and there have been no material restrictions on development subject to the implementation of agreed design and mitigation measures and it is not anticipated that MetroLink will have a material impact on the development potential of sites above and in proximity to the alignment in future.	This is not accepted.
51	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 19 and 20 of memorandum)	33&34	**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 Pleanala condition same.	During construction phase the possible impacts on Arthur Cox building could arise due to settlement and groundborne noise and vibration. Please refer to Items 3, 4, 5, 6 for details on building damage and settlement assessment results at Arthur Cox building. TII confirm that there will be a temporary (up to 2 weeks) but very high adverse (significant) impact for groundborne noise at your building during TBM works, as referred to in Chapter 14: Groundborne Noise and Vibration, section 14.6.1.1 Tunnel Boring. This means that noise will be noticeable within the building, but there is no potential for damage to the building from the noise & vibration. Please refer to Items 2 and 45 above for further details on noise and vibration assessment at your building. Where eligibility is established, there will be an opportunity to apply the TII Airborne Noise and Groundborne Noise Mitigation Policy (EIAR Appendix A14.6). Additionally, advance public consultation and stakeholder engagement will be carried out and TII will continue to communicate timelines and construction details as the project progresses. TII are happy to discuss the application of the TII Airborne Noise and Groundborne Noise Mitigation Policy further. The EIAR fully details all impacts during construction phase of the MetroLink. Please refer to, inter alia, EIAR Appendix 5.17 for Ground movement impacts, EIAR Chapter 11 Population and Land Use, EIAR Chapter 13 Airbourne Noise and Vibration and Chapter 14 for Groundborne Noise and Vibration. TII do not believe it appropriate for An Bord Pleanala to issue such as condition.	Noted
52	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 20 of memorandum)	34	**p. Written confirmation of any anticipated impacts on the building and its tenants at 1 3 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 ifor 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 Pleanala condition same.	During operation phase the possible impacts on Arthur Cox building could arise due to ground-borne noise and vibration. Appendix 14.5 Groundborne Noise and Vibration Blasting Modelling Results presents predicted groundborne noise and vibration levels during the operation of the project, with the results for 10 Earlsfort Terrace summarised below: - The predicted level of groundborne noise during railway operation is 36 dB LASmax, which is below the 40 dB LASmax threshold, resulting in a not significant impact on the buildings occupants. - The predicted level of groundborne vibration during railway operation is 0.01 ms-1.75, which is much lower than the VDV Threshold Level of 0.8 ms-1.75, resulting in a not significant impact on the building. Business operations of EPUC will not be negatively impacted during the operational phase (Section 11.7.2, Chapter 11 Population and Land Use). The EIAR fully details all impacts during operational phase of the MetroLink. Please refer to, inter alia, EIAR Chapter 11 Population and Land Use, EIAR Chapter 13 Airbourne Noise and Vibration and Chapter 14 for Groundborne Noise and Vibration. With regard to timelines, the operational impacts will commence once operations commence in 2035. Once operational, demand will vary through the day and week, with different service levels provided to meet varying demand. Services will operate between 05:30 and 00:30 every day. Service frequency is reduced on weekends and public holidays to reflect lower demand during these periods. TII do not believe it appropriate for An Bord Pleanala to issue such as condition.	Noted
			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.		

53	Appendix 1, Memorandum prepared by Punch Consulting Engineers (page 20 and 21 of memorandum)	34&35	*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.	1. With regard to point i) please refer to Item 6. 2. With regard to point ii) please refer to Items 3 and 32. 3. With regard to point iii) The damage predicted is outlined in Items 3 and 4. TII commit to undertaking the condition surveys pre and post construction and will remediate damage caused such that the basement functionality is not compromised. Please also refer to item 15 above.	This is not accepted.
54	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Conclusion (page 21 of memorandum)	35	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.	Thank you for the request for Oral Hearing. The oral hearing process is managed by the An Bord Pleanála. Please refer to Item 1 above.	Noted
55	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Conclusion (page 21 of memorandum)	35	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.	TII would welcome further engagement with EPUC to further explore any residual concerns presented in this submission.	Noted
56	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Conclusion (page 21 of memorandum)	35	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 Pleanala condition this.	Please refer to Items 3 and 4. The building damage assessment process proposed caters for the elements that are noted as of concern to EPUC. This building has been identified as a 'special' building and therefore will be subjected to a detailed assessment (Phase-3 assessment) which will utilize the site specific ground model and the structural details/features of the building to determine any mitigation measures required to protect the building and these measures will be agreed with the buildings owners and their advisers prior to commencement of tunnelling in the area.	This is not accepted.
57	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Conclusion (page 21 of memorandum)	35	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 Pleanala condition this.	refer to Items 31 and 32.	Noted
58	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Conclusion (page 21 of memorandum)	35	v) We request An Bord Pleanala 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)	The further assessments noted are planned as detailed in the EIAR post grant of the RO and undertaken by the Contractor.	Noted
59	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Conclusion (page 22 of memorandum)	36	vi) We also request An Bond Pleanala 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.	The further assessments noted are planned as detailed in the EIAR post grant of the RO and undertaken by the Contractor.	Noted
60	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Conclusion (page 22 of memorandum)	36	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	Refer to Items 31 and 32 for scheduling details. The tender documents will include all requisite information available to allow the contractor to effectively mitigate impacts so far as is reasonably practicable. EPUC assistance in collating the latest building information will be appreciated.	Noted
61	Appendix 1, Memorandum prepared by Punch Consulting Engineers, Conclusion (page 22 of memorandum)	36	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.	refer to Items 3 and 4 above.	Noted

Appendix B - Earldev Responses to TII on 23rd February 2024

Submission No.	**079**
Organisation Name or Name of Submitter	**Earldev Properties Unlimited Company (represented by John Spain Associates)**

Item No.	Section Ref.	Page No.	Observation Statement	TII Response 15/02/2024	PUNCH/AGL Response Without Prejudice
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)					
				As discussed during the meeting, the phase 2 assessment that has been completed within the EIAR indicates that the Arthur Cox building damage category is slight . This phase is considered conservative since it neglects any interaction between the stiffness of the buildings and the ground. However, with the information provided about the structure we can comment that, the basement slab is very effective in restraining the lateral ground movements applied to the building. Furthermore, the raft slab is also effective in smoothing out the greenfield differential settlement imposed on the building.	We respectfully disagree with this assessment. Firstly TII appear to have made an incorrect assumption that the Arthur Cox building has a raft foundation. It does not. It has pad foundations with a ground bearing concrete slab. Hence, the non-existent raft is not "effective in smoothing out the greenfield settlement imposed on the building" as a raft does not exist. Furthermore, the slight damage level for Risk Category 2 in the EIAR has crack widths and building distortion levels that exceed the design tolerances for the basement waterproofing system and building facade and therefore, is not appropriate as an "acceptable" threshold of damage for the Arthur Cox Building. Secondly, our expert team have carried out an assessment of the impact of raising the tunnel alignment by up to 5.0m, which is within the proposed upward Limits of Deviation and have demonstrated that this has a significant impact on the damage that could be caused to the building, potentially raising the category of damage to "moderate" or "severe" using the same methodology as the refined Phase 2a assessment presented in the Building Damage Report in the EIAR for ground loss ranging from 0.5% to 1.0%. It was a fundamental omission that this was not considered in the Wider Effects Report as the EIAR should consider all likely significant effects. On the first day of the Oral Hearing on the 19th February 2024, it was confirmed that TII propose to modify any potential deviation upwards to 1m. Jacobs/IDOM also submitted a technical note with a high level assessment of the potential impact of implementing the LoD on building damage. However, the 2 page document is very generic and is considered insufficient to adequately assess the likely significant effects of raising the level of the tunnel on th Arthur Cox Building, or the likely mitigating effects of lowering the alignment. Our team are working through an assessment of the impact of raising the tunnel 1m and will revert however our concerns as outlined above remain. Furthermore, our analyses also indicated that lowering the tunnel alignment by 5m has a substantial mitigating impact on possible building damage, possible reducing the damage to Risk Category 1 ("very slight") which has lower bound parameters of crack widths and building strain that could potentially fall within acceptable limits for the building, although this would have to be verified by more detailed Phase 3 analysis. It is our belief that lowering the tunnel is the only effective mitigating measure to ensure our building is not damaged. We would also like to point out that all of the effects that you refer to with regard to the structural characteristics of the building have not been considered or assessed in the EIAR.
				The presence of load bearing secant pile walls along the lines of the glazing facades further dampens the greenfield differential settlement applied to the facades	We do not accept the TII position on this. The modelling completed by our experts shows that with the tunnel at its proposed design level, has a degree of damage at the line of the secant piles could potentially rise to "moderate to severe" on the +5m deviation and +1m deviation when the lower toe level of the piles and the concentrated axial loads on the pile are considered. Furthermore, the potential impact of concentrated foundation loads from the integral pads for the interior columns, which could have bearing pressures of up to 1,000kPa directly over the crown of the tunnel, has not been taken into account in the Phase 2 building damage assessment in the EIAR. This is not acceptable and we request that the tunnel level is dropped by 5m to mitigate against this damage occurring. As above, it is our belief that lowering the tunnel is the only effective mitigating measure to ensure our building is not damaged.
				We have also investigated an example phase 3 in the area using PLAXIS modelling, and a location specific ground model and the results show that the equivalent volume loss of 0.2%, this compares well with the values experienced from the rock tunnel sections of the Port Tunnel. Therefore, we are confident that the anticipated settlement and slope impacts on the building will not be significant. It is important to note that the damage classification is based on the ease of repair of a masonry structure and not a prediction of cracks within a reinforced concrete structure.	Firstly, we have not been provided with the result of any further analysis other than the Phase 2a assessment that was carried out for the design tunnel alignment in the Building Damage Report in Appendix A5.17 of the EIAR. Therefore, we cannot comment on the potential outcome of these analyses but would re-iterate our concerns that it is a significant omission in the EIAR and related documents that: 1. there is no restriction on raising or lowering the alignment of the tunnel within the proposed Limits of Deviation under the Arthur Cox Building 2. the likely significant adverse effects of raising the tunnel alignment by up to 5.0m within the proposed original Limits of Deviation was not assessed in the EIAR. 3. the likely significant adverse effects of raising the tunnel alignment by up to 1.0m within the new proposed Limits of Deviation as on 19th February 2024 has not been assessed in the EIAR and the technical note that was issued by Jacobs/IDOM is very generic and is considered insufficient to adequately assess the likely significant effects of raising the level of the tunnel on th Arthur Cox Building, or the likely mitigating effects of lowering the alignment; 4. the likely mitigating impacts of lowering the tunnel alignment by up to 5.0-10.0 within the proposed Limits of Deviation has not been assessed in the EIAR; and 5. the "acceptable" building damage risk category of 2 (Slight) in the EIAR does not take into account the specific structural characteristics of the Arthur Cox building and the corresponding building damage and distortion levels would exceed the design tolerances for the basement waterproofing and building facade. Secondly, we have a fundamental concern about the reliability of using 0.2% volume loss for assessing the building damage, which appears to be a new core principle of the revised TII design and building damage assessment. We would note that: - the building damage assessment for the Arthur Cox Building that is currently in the EIAR is based on a ground loss of 0.75%. - the refined Phase 2A assessment that was carried out int he Building Damage Report (BDR) in the EIAR for a small number of buildings that fell into Risk Category 3 were based on a ground loss of 0.5%for tunnelling in rock with >0.5D rock cover, and the report by Jacbos/IDOM states that this is compatible with values experienced using the modering tunnelling equipment and control systems that are expected to be used on the Metrolink Project - not 0.2% - published case studies of ground movements and building damage related to the Dublin Port tunnel show that ground loss values of 0.5% were recorded due to tunnelling in the Limestone rock along some sections of the route. - the case studies of ground movement that are presented in the BDR in the EIAR, which are largely for Earth Pressure Balancing TBM, do not support the claim that 0.2% ground loss would be representative of the conditions that would be reliably expected for the TBM that will be used for tunnelling in rock through Dublin city centre on the Metrolink Project. Most of the case studies show ground loss values on the order of 0.3-1.0%, although it would appear that very few of the case studies relate to tunnelling in rock. No clearly representative case studies have been presented in the EIAR or related documents to support 0.2% ground loss while tunnelling in similar rock conditions with the type of TBM that could be used on this project. Furthermore, while it may be possible to achieve a ground loss on the order of 0.2% with the variable density slurry TBM in rock: - although this is the "preferred option" for the TBM, the type of TBM will not be mandated through the contract and will be selected by the tunnelling contractor - the EIAR does not commit to any limiting value of ground loss that will be specified through the contract as a mitigating so the assessment is currently based on the values used in the Building Damage Report. - the actual % of ground loss will also depend on other factors including the quality of the rock and workmanship, which can be variable. - the rotary coreholes that were carried out for the Arthur Cox Building do not reach the level of the tunnel and the geological profile at the building that is included in the EIAR shows the incorrect rock level and is only based on one corehole. Therefore, it cannot be confirmed that there are not variable or poor rock conditions under the building. In summary, our Expert advises that, while it may be possible to achieve a ground loss on the order of 0.2% with the appropriate type of TBM in good quality rock, this is not supported in the EIAR and can only be considered a "best case scenario". The % ground loss is a key parameter for the building damage assessment. Therefore, the EIAR should consider all potential outcomes for a range of upper and lower bound values as an appropriate risk assessment to identify potential significant impacts on the building. We would consider that a minimum ground loss of 0.5% should be considered, as in the refined Phase 2A assessment in the EIAR. A detailed analytical assessment should also take into account concentrated loads from the building foundations, which could have a more significant impact for the design tunnel profile, or for the raised tunnel profile within the proposed LoD, which will support our request to lower the tunnel profile by at least 5m.
				Although as outlined in EIAR Appendix A 5.17 Building Damage Report Table 5.2 the Arthur Cox Building assessments to date indicate that the building falls into the Slight damage category and hence further assessment is not required at this stage, we are prepared to undertake Stage 3 assessment as soon as possible rather than waiting to be undertaken at detailed design phase. We will update you in due course regarding the timelines of this assessment	As per our point above, we do not accept the building falls into the "slight" damage category. There are currently no limits on raising the level of the tunnel within the LoD under the Arthur Cox Building in the EIAR. Therefore, our analyses have shown that the level of building damage could raise to "Moderate" (Risk Category 3) if the concentrated loads from the foundations are taken into account, or possibly to Severe or Very Severe if the level of the tunnel is raised by up to 5.0m. On the first day of the Oral Hearing on the 19th February 2024, it was confirmed that TII propose to modify any potential deviation upwards to 1m. The 2 page document by Jacobs IDOM is considered insufficient. Our team are working through an assessment of the impact of raising the tunnel 1m and will revert however our concerns as outlined above remain. Furthermore, the "acceptable" building damage risk category of 2 (Slight) in the EIAR does not take into account the specific structural characteristics of the Arthur Cox building and the corresponding building damage and distortion levels would exceed the design tolerances for the basement waterproofing and building facade. We require the stage 3 assessment to be carried out now as part of the Oral Hearing process (including upper and lower bound volume loss ranges). When this is done we believe it will demonstrate the only way to get the damage category for the Arthur Cox building to the required level of "very slight" with crack widths and building distortion levels within acceptable tolerances is to lower the level of the tunnel by 5m. Is it also our belief that TII should provide information on the positive effects to the Arthur Cox Building and its occupants of lowering the tunnel by 5m in accordance with the LoD, in relation to mitigation of building damage and other potentially beneficial impacts including assisting with the future loading tolerances and other development t restrictions above and adjacent to the tunnel proposed in the recently published draft "Guidance for Developers". The Metrolink Guidance Note for Developers Draft Document was uploaded to the Metrolink Website on the 19th February 2024. Based on this document the current Arthur Cox building structure could not be built on the site if the Metrolink preceded this development. Lowering the tunnel by a minimum of 5m would assist by potentially benefiting future developments on site.
				As stated at the meeting, it is unlikely that tunnel alignment under your property will be raised but we can not commit to lower the alignment at this stage.	As per our point above, there are currently no limits on raising the level of the tunnel within the LoD under the Arthur Cox Building in the EIAR and related documents such as the Wider Effects Report. Therefore, your assurances have no merit in terms of the current Railway Order application and Oral Hearing Process. It is essential that raising the level of the tunnel under the Arthur Cox Building is not permitted under this planning permission as the damage to the building will be unacceptable. The detail design of the tunnel will be carried out by a contractors team, who will be heavily influenced by commercials, and hence it is imperative that they are constrained from raising the level of the tunnel by the reference design and the planning permission granted. Additionally, our modelling has demonstrated beyond doubt that lowering the level of the tunnel is essential to mitigate damage.

Appendix C - Rascor Report to Independent Phase 2a Assessment

Robert Coughlan
Carnegie House,
Library Road,
Dun Laoghaire,
Co Dublin

Reference: Arthur Cox Building

Dear Robert,

In relation to the upcoming Oral Hearing with TII on Project Metrolink and review of the independent refined Stage 2 report by AGL Consulting Engineers issued on 7th February 2024, Rascor would note the following:

1) This letter should be read in conjunction with the Rascor Letter issued to PUNCH Consulting Engineers on the 13th of January 2023.

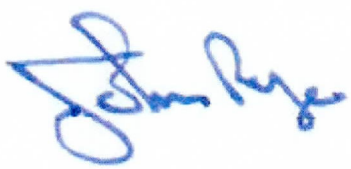
2) As discussed in this letter, the basement of the Arthur Cox Building is designed for 0.2mm crack width as required for waterproof concrete structures utilizing the structurally designed reinforcement in the elements and strategically positioned crack-inducing injecting units. With the current position of the tunnel, cracking between 1-5mm is predicted. 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.

3) AGL's reports looks at the consequences of raising the tunnel 5m. There appears to be a collision with piles should this be undertaken. In relation to the basement, possible cracking of up to 25mm is predicted. The basement structure cannot cater for this level of damage and the possibility of the tunnel rising needs to be removed as a design possibility.

4) AGL's report looks at what will happen should the tunnel be lowered at least 5m. In this position, cracking of between 0.1mm-1mm is predicted and is getting to a level where the cracking could be tolerable in relkatuion to the tanked basement.

5) Rascor understand a Phase 3 assessment of the building will be undertaken. It is recommended that this is done immediately to confirm theoretically what level the tunnel needs to be to ensure cracks withs are 0.2mm or lower.

Signature



Appendix D - ARUP Façades Report to Independent Phase 2a Assessment

ARUP

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arup.com

By email
9 February 2024

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

Our ref 299520-00
Our ref 299520-00

Dear Ken,

Re: Project Metrolink – Arthur Cox-ETHS Building

We have reviewed the MetroLink A5.17 Building Damage Report in conjunction with the findings of the Independent Assessment undertaken by AGL and note the following:

- MetroLink A5.17 Building Damage 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 risk categorisation and anticipated damage outlined in Table 4-4 is based on "*Typical Masonry Buildings*" from "*the works of Burland et all (1977)*".
    - The Arthur Cox-ETHS building has been identified in the MetroLink report 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 anticipated *"Approximately Equivalent Ground Settlement and Slopes"* for Risk Category 2 is detailed as 10 to 50mm or 1:500 to 1:200 respectively.
- TN001 Project Metrolink – Refined Phase IIa Assessment
    - The significant adverse impact of the tunnel being installed to its upper bound vertical alignment has not been considered in the issued Metrolink assessment.
    - If the tunnel is installed to its upper bound vertical alignment the risk of damage to the building could increase to Risk Category 4/5 (Severe to Very Severe) for the façade.

ARUP

Our ref	280177-00 / AMcC
Date	9 February 2024

It would appear from the Metrolink 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 large floor to ceiling glazing elements. These large cladding elements are more sensitive to differential movements than masonry. 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.

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 at the start of the project.

The cladding systems are bespoke to the building and designed to accommodate a defined set of movement criteria, prescribed at the time of design. 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 (Floor live loading; Building Creep & Settlement; Wind Loading; Thermal loading; etc) are applied. The anticipated differential ground settlement, resulting from the installation of Metrolink would not have been considered in the design of the façades.

The anticipated damage for the magnitude of movement (based on a masonry building) associated with Category 2 (as identified in the MetroLink Report for this building) is described as the potential to work loose pointing and the racking of doors and windows within their frames such that they may stick. We would have a concern that when this level of damage is extrapolated to take account of the modern cladding systems installed on the Arthur Cox-ETHS building that there will be significant additional 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 (for the design life of cladding) – Damage to glass; damage to stone cladding – Caused by the differential settlement from the construction of Metrolink reducing/fully utilising the existing movement capacity of the installed systems, resulting in damage in the future when the original prescribed loading is applied.

In our view it is not appropriate to categorise and assess the Arthur Cox – ETHS building as a masonry clad building. As detailed above the extent of potential damage is more in keeping with a damage described in the higher Risk Categories described in Table 4-4, namely: "*Weather tightness often impaired*"; "*Windows and Frames Distorted*"; "*Windows broken by distortion*".

ARUP

Our ref	280177-00 / AMcC
Date	9 February 2024

We welcome the confirmation by TII that this building is now being classified as 'Special' Building and will be included under the Phase 3 assessments.

However, as outlined in the AGL report, there is a direct correlation between the anticipated building settlements and the location of the tunnel with respect to its vertical alignment. The findings of this assessment concluded that if the tunnel were to be installed to its upper bound vertical alignment position, then the potential impact on the building will be exasperated. With the categorisation for the façade potentially increasing to Category 4/5 (Severe to Very Severe).

The potential impact of the tunnelling related ground movements needs to be as negligible as possible to mitigate any risk of damage to the stone and glass façade. As outlined in the AGL report, the position of the tunnel should be lowered to ensure the impact on the building is as low as practicable possible.

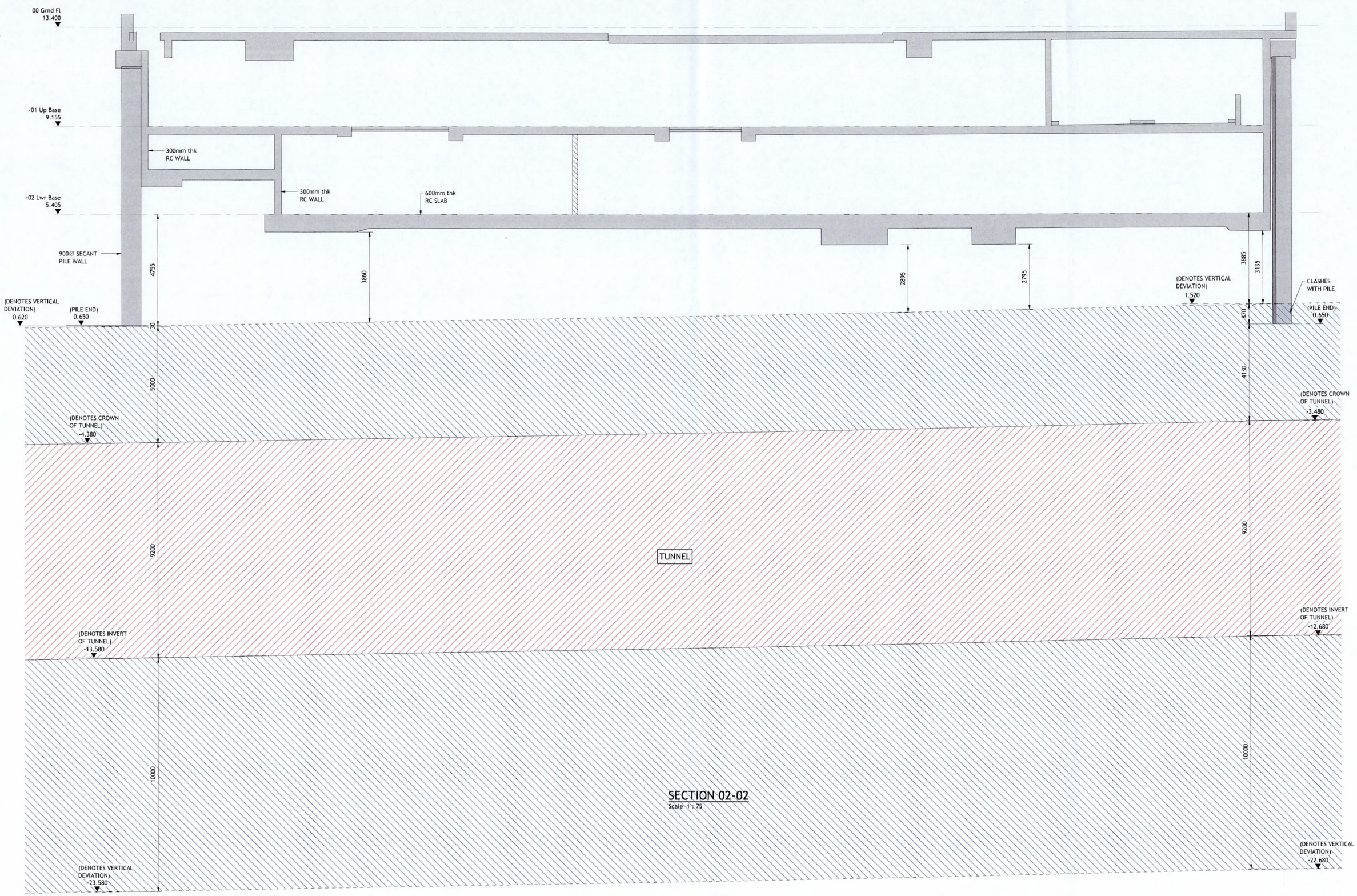
Due to the bespoke nature of the structure and cladding on this building, it would be important that when working through the Phase 3 assessment that TII and Jacobs/Idiom liaise with the structural engineers for the building to agree how it will be appropriately assessed and monitored during construction.

Yours sincerely,

Anthony McCauley

Anthony McCauley, Associate Director | Façade Lead
e anthony.mccauley@arup.com

Appendix E - Sections and Images of Propose Upward and Downward Vertical Deviation



SECTION 02-02

Scale 1 : 75

Rev	Amendment	By	Date	Rev	Amendment	By	Date

Client: EARLDEV PROPERTIES LTD

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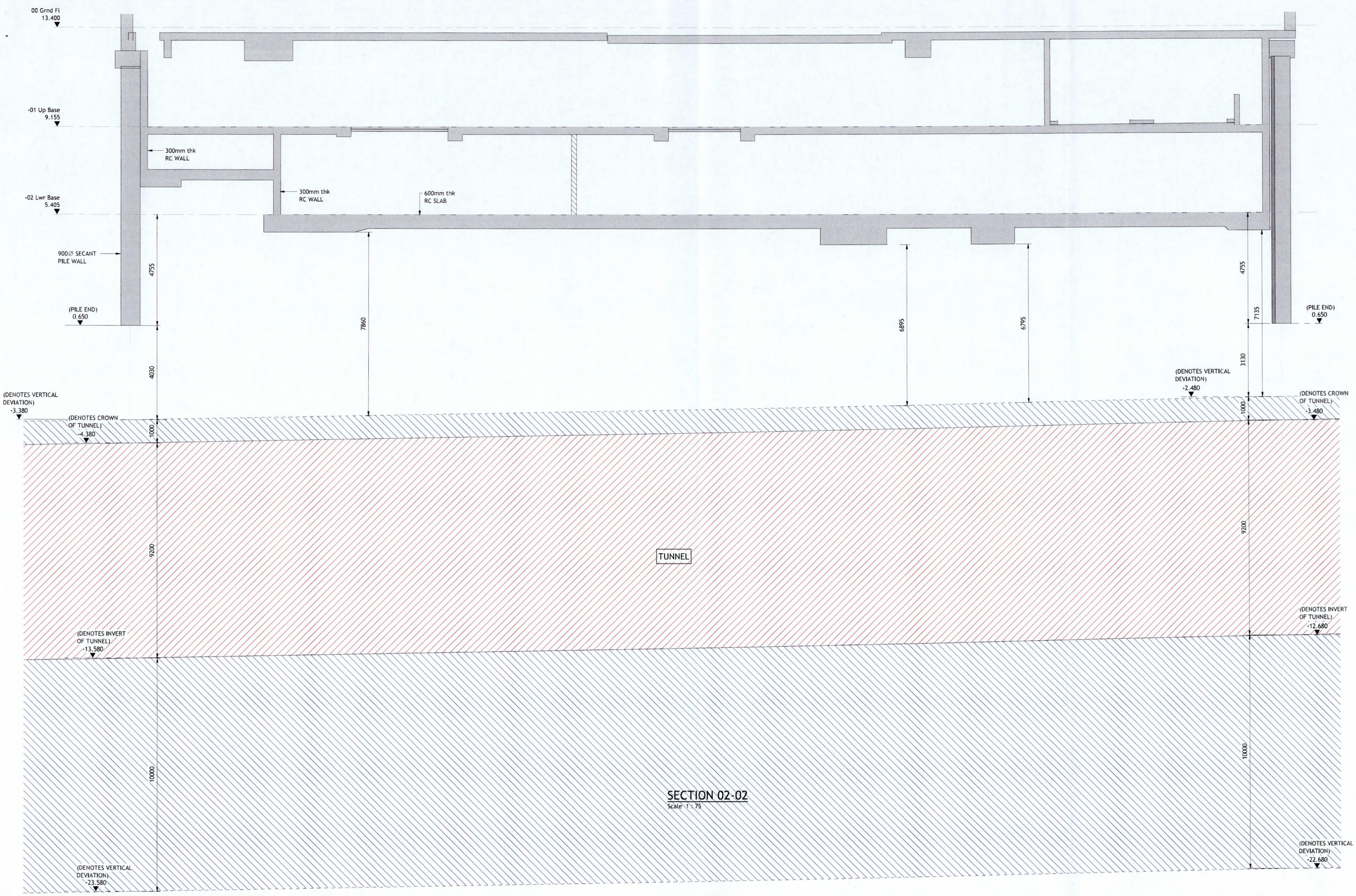
Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET				
Title: SECTIONS AND DETAILS SHT 2				
Drawn: HK	Date drawn:	Technician check: HK	Engineer check: RC	Approved: RC
Project No: 222202	Model Ref: 222202-PUNCH-XX-XX-M3-S-00001		Drawing Status: S2	
Scale: 1 : 75	Drawing No: 222202-PUNCH-XX-XX-DR-S-3001			Revision No:



SECTION 02-02

Scale 1 : 75

bmtrada SYSTEM CERTIFICATION ISO 9001 CERTIFICATION
bmtrada SYSTEM CERTIFICATION ISO 14001 CERTIFICATION
bmtrada SYSTEM CERTIFICATION ISO 45001 CERTIFICATION
BUILDING INFORMATION MODELLING (BIM) I.S. EN ISO 19650-2:2018
NSAI Certified

Rev	Amendment	By	Date	Rev	Amendment	By	Date

Client: EARLDEV PROPERTIES LTD

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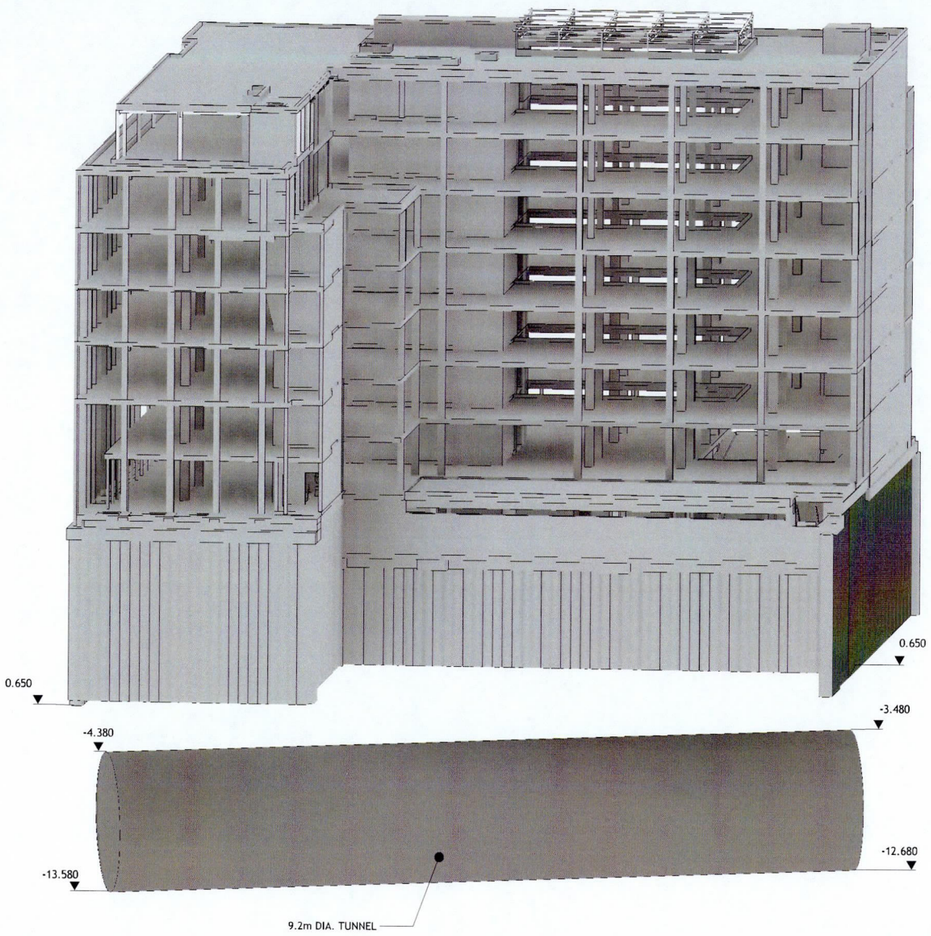
Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET				
Title: SECTIONS AND DETAILS SHT 2				
Drawn: HK	Date drawn:	Technician Check: HK	Engineer Check: RC	Approved: RC
Project No: 222202	Model File: 222202-PUNCH-XX-XX-M3-S-00001		Drawing Status: S2	
Scale @ A1: 1 : 75	Document No: 222202-PUNCH-XX-XX-DR-S-3006			Revision No:

GENERAL NOTES

1. DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS. DO NOT SCALE USE FIGURED DIMENSIONS ONLY.
2. IT IS THE CONTRACTORS RESPONSIBILITY TO VERIFY OR DETERMINE ALL DIMENSIONS AND LEVELS REQUIRED PRIOR TO COMMENCEMENT OF CONSTRUCTION OR PRODUCTION OF FABRICATION DRAWINGS
3. FOR DETAILS OF SETTING OUT OF RWP, SVP, WVP AND ALL OPENINGS SEE THE RELEVANT ARCHITECTS DRAWINGS.
4. FOR INSULATION DETAILS REFER TO ARCHITECTS DRAWINGS.



3D VIEW 1
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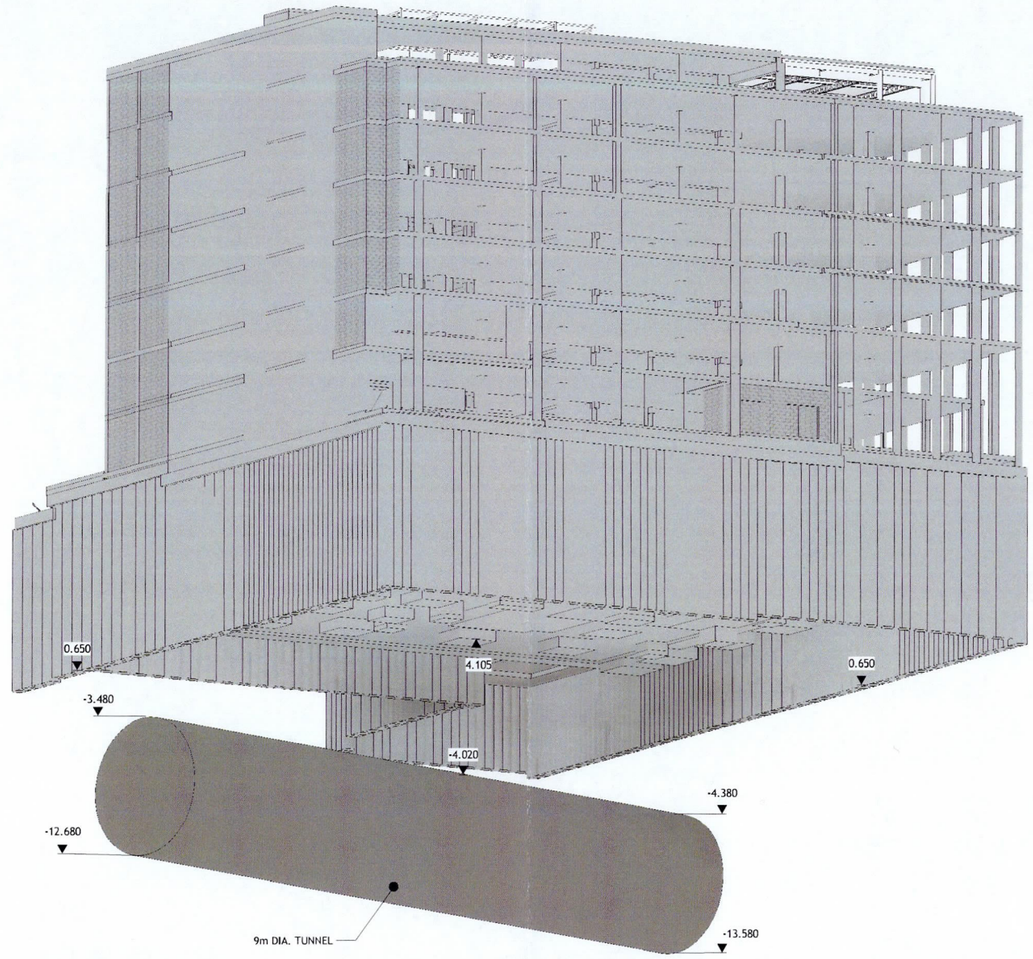

3D VIEW 2
Scale

CASE 1 PROPOSED TUNNEL ALLIGNMNET

Rev	Amendment	By	Date	Rev	Amendment	By	Date

Client: EARLDEV PROPERTIES LTD

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Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET				
Title: 3D DETAILS CASE 1				
Drawn: HK	Date drawn:	Technically checked: HK	Engineering check: RC	Approved: RC
Project No: 222202	Model Ref: 222202-PUNCH-XX-XX-M3-S-00001		Drawing Status: S2	
Scale @ A1:	Document No: 222202-PUNCH-XX-XX-DR-S-3002			Revision No:

GENERAL NOTES

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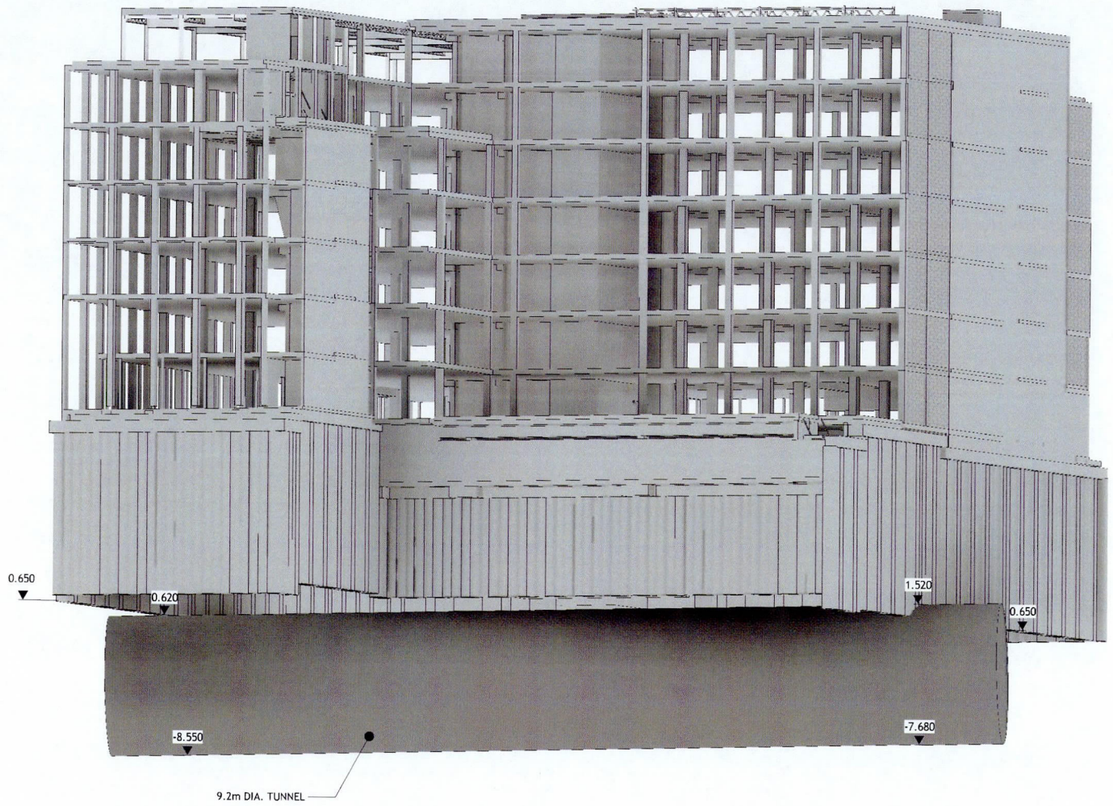
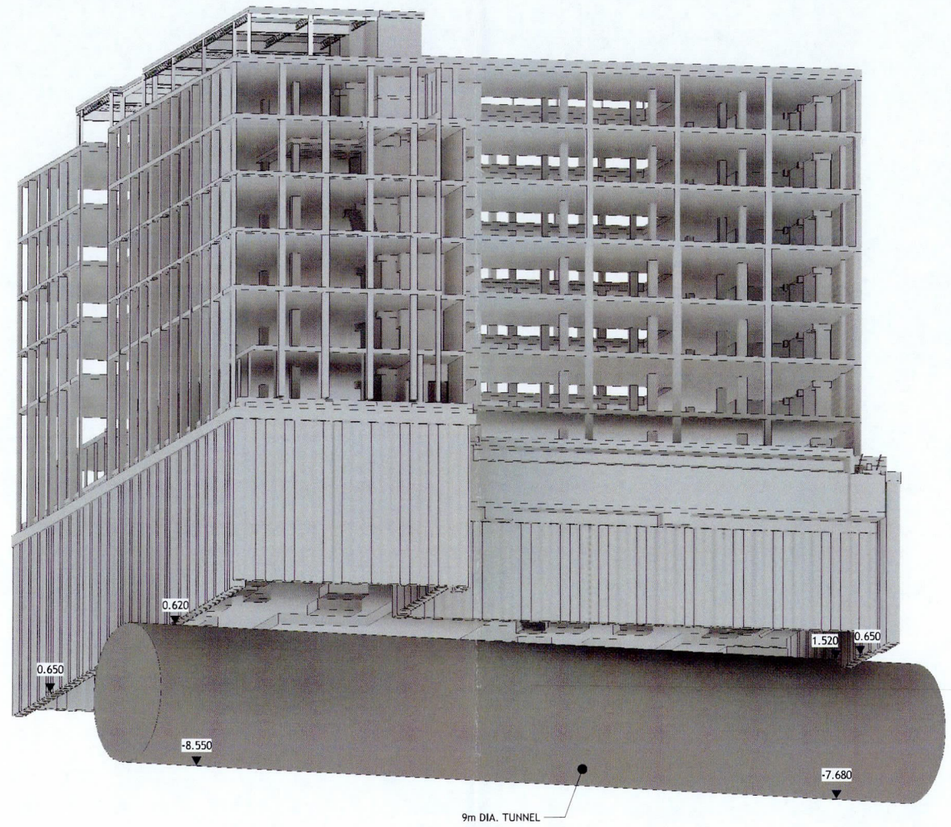


3D VIEW 1
Scale



3D VIEW 2
Scale

CASE 2 : +5m DEVIATION VERTICALLY

Rev	Amendment	By	Date	Rev	Amendment	By	Date

Client: EARLDEV PROPERTIES LTD

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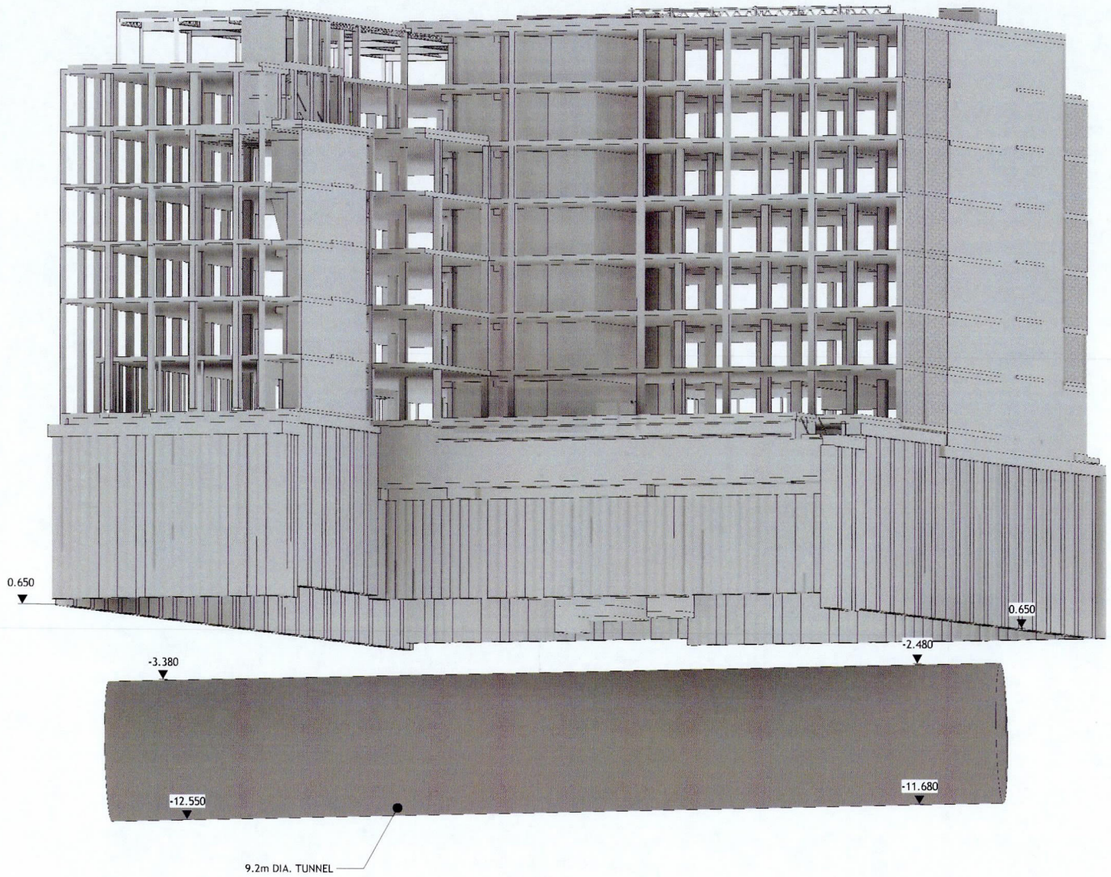
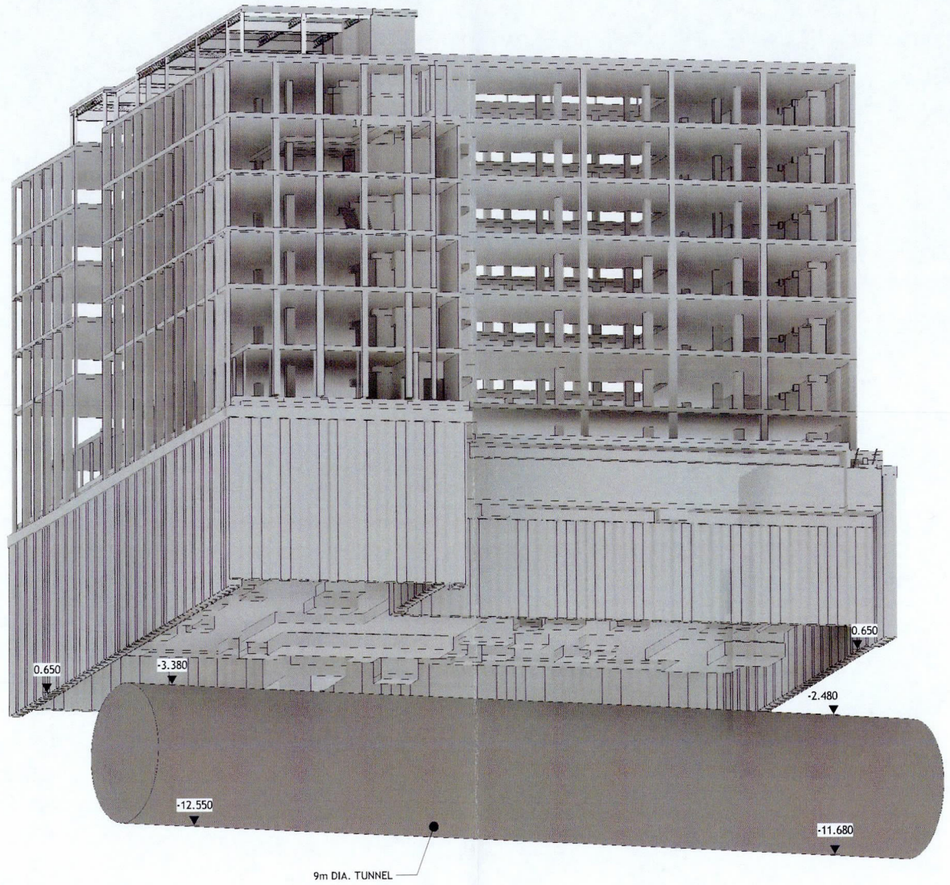
Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET				
Title: 3D DETAILS CASE 2				
Drawn: HK	Date drawn:	Technician Check: HK	Engineer Check: RC	Approved: RC
Project No: 222202	Model Type: 222202-PUNCH-XX-XX-M3-S-00001		Drawing Status: S2	
Scale in A1:	Document No: 222202-PUNCH-XX-XX-DR-S-3003			Revision No:

GENERAL NOTES

1. DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS. DO NOT SCALE USE FIGURED DIMENSIONS ONLY.
2. IT IS THE CONTRACTORS RESPONSIBILITY TO VERIFY OR DETERMINE ALL DIMENSIONS AND LEVELS REQUIRED PRIOR TO COMMENCEMENT OF CONSTRUCTION OR PRODUCTION OF FABRICATION DRAWINGS
3. FOR DETAILS OF SETTING OUT OF RWP, SVP, WVP AND ALL OPENINGS SEE THE RELEVANT ARCHITECTS DRAWINGS.
4. FOR INSULATION DETAILS REFER TO ARCHITECTS DRAWINGS.



3D VIEW 1
Scale



3D VIEW 2
Scale

CASE 3 . +1m DEVIATION VERTICALLY

Rev	Amendment	By	Date	Rev	Amendment	By	Date

Client: EARLDEV PROPERTIES LTD

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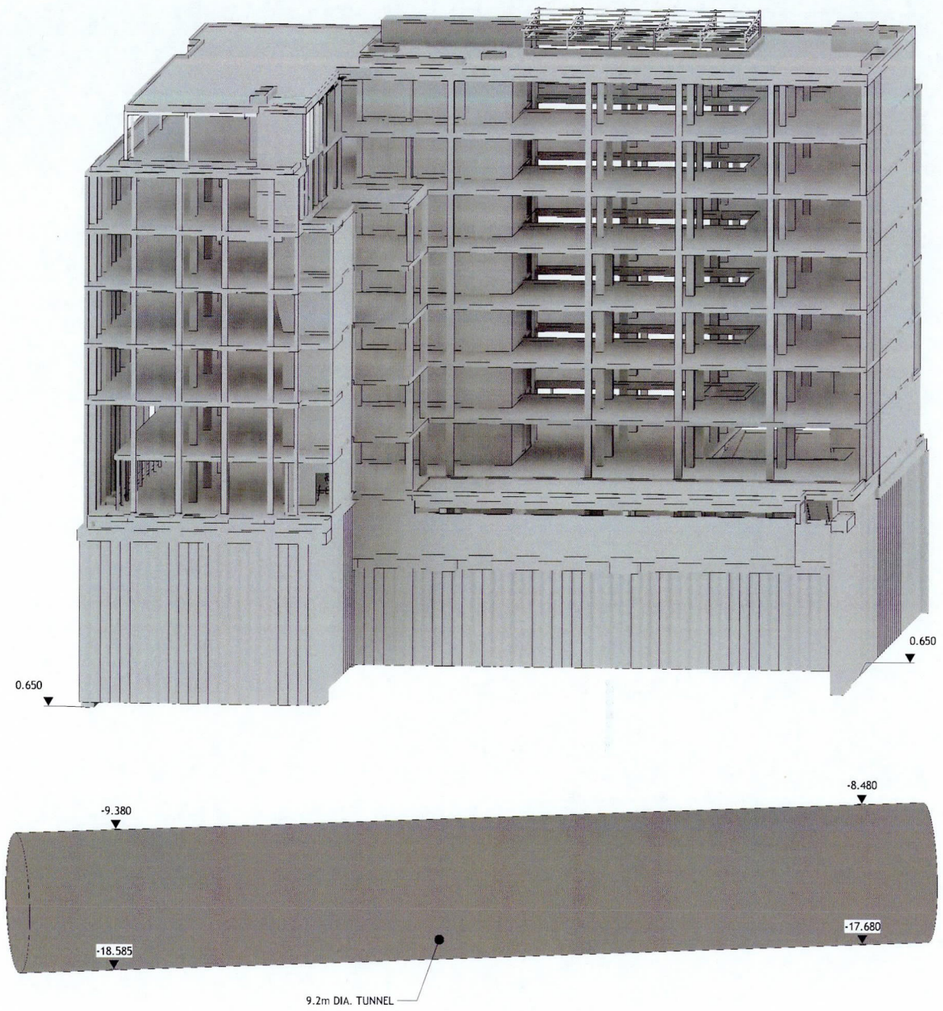
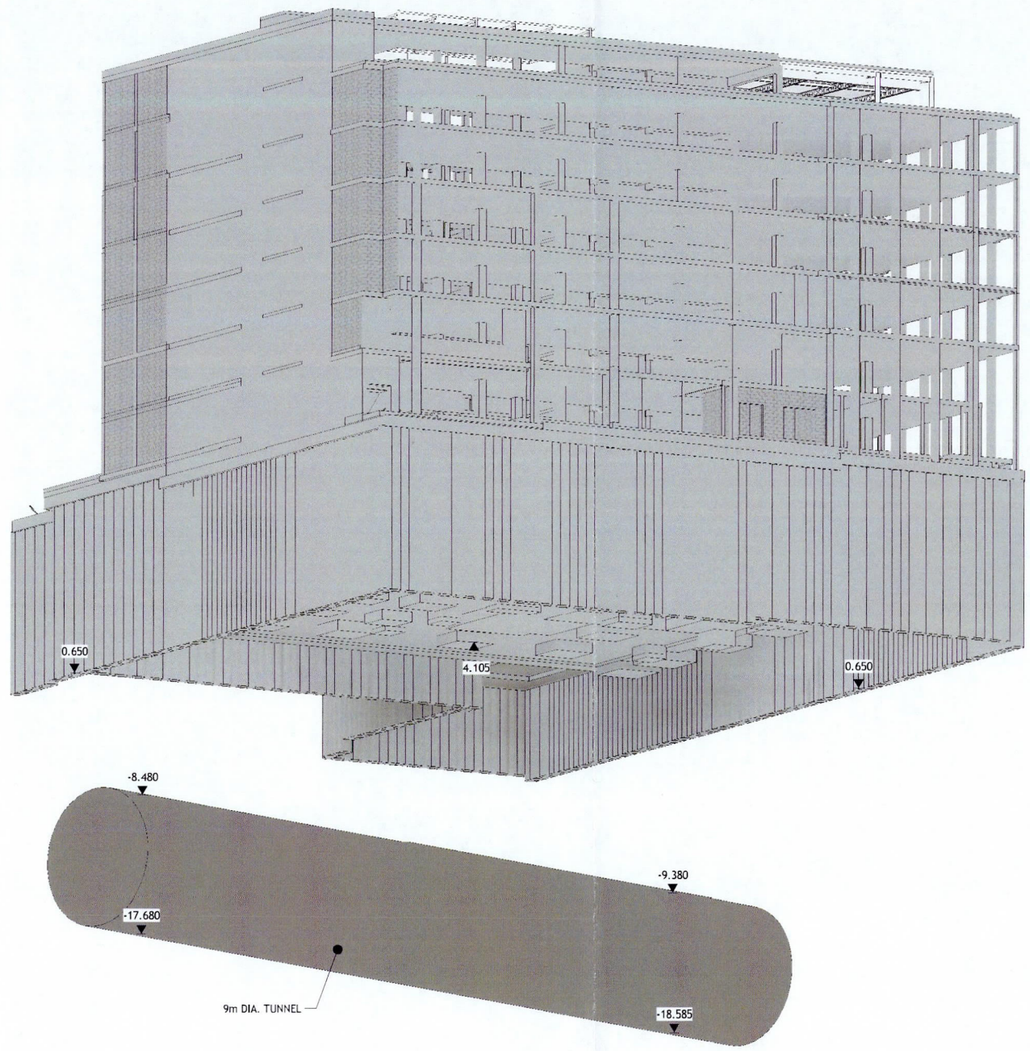
Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET				
Title: 3D DETAILS CASE 4				
Drawn: HK	Date drawn:	Technician Check: HK	Engineer Check: RC	Approved: RC
Project No: 222202	Model File: 222202-PUNCH-XX-XX-M3-S-00001		Drawing Status: S2	
Scale @ A1:	Drawing No: 222202-PUNCH-XX-XX-DR-S-3008			Revision No:

GENERAL NOTES

1. DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS. DO NOT SCALE USE FIGURED DIMENSIONS ONLY.
2. IT IS THE CONTRACTORS RESPONSIBILITY TO VERIFY OR DETERMINE ALL DIMENSIONS AND LEVELS REQUIRED PRIOR TO COMMENCEMENT OF CONSTRUCTION OR PRODUCTION OF FABRICATION DRAWINGS
3. FOR DETAILS OF SETTING OUT OF RWP, SVP, WVP AND ALL OPENINGS SEE THE RELEVANT ARCHITECTS DRAWINGS.
4. FOR INSULATION DETAILS REFER TO ARCHITECTS DRAWINGS.



3D VIEW 1
Scale



3D VIEW 2
Scale

CASE 4 : -5m DEVIATION VERTICALLY

Rev	Amendment	By	Date	Rev	Amendment	By	Date

Client: EARLDEV PROPERTIES LTD

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Project: PROJECT METROLINK AT EALRSFORT TERRACE / HATCH STREET				
Title: 3D DETAILS CASE 3				
Drawn: HK	Date drawn:	Technician Check: HK	Engineer Check: RC	Approved: RC
Project No: 222202	Model Ref: 222202-PUNCH-XX-XX-M3-S-00001		Drawing Ref No: S2	
Scale @ A1:	Drawing No: 222202-PUNCH-XX-XX-DR-S-3004			Revision No: