Project Metrolink Railway Order
Estuary to Charlemont via Dublin Airport
(ABP-314724-22)

Oral Hearing

Statement of Evidence

on

Tunnelling Induced Ground Movements & Building Damage Assessment for the

Cadenza Building, Earlsfort Terrace, Dublin 2

Lowered Tunnel Level

by

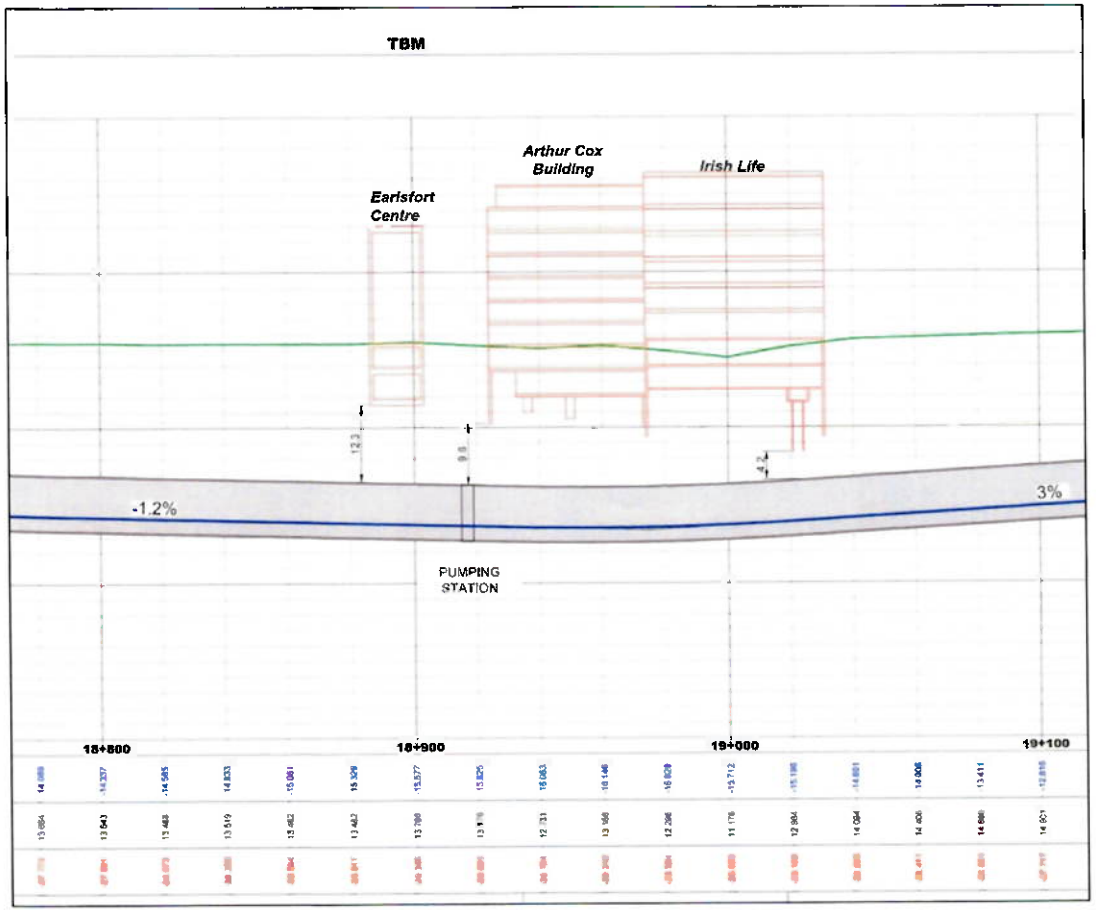
Mr. Conor O'Donnell, *BA, BAI, MS, FGS, CEng, MIEI, FConsEI*

21st March, 2024

(see submission of 4th March, 2024 for Statement of Expertise)

Phase 2a Building Damage Assessment (BDA) – Cadenza Building, Earlsfort Terrace

- Drawing No. ML1-JAI-RTA-ROUT_XX-DR-Y-01027 (Rev.P02)
- Lowered tunnel alignment below Arthur Cox & Cadenza Buildings
- Avoids Anti-Flotation Anchors
- Increased Clearance below secant pile wall and foundations (10-15m)
- EIAR Addendum does not state that proposed LoD apply at this level and that upward LoD of +1.0m from this level will not be implemented.
- Stated at Oral Hearing (4/3/2024)



Phase 2a Building Damage Assessment (BDA) – Cadenza Building, Earlsfort Terrace

A.1 Updated Tables for Appendix A5.17 Building Damage Assessment

Table 5-2: Result of Phase 2a building damage assessment – Representative Buildings

Ref	Chainage	Description	Height (m)	Number of Floors	Length (m)	Depth of basement (m)	Refined Phase 2a Assessment Damage Category	Updated Damage Category	RPS, NIAH, RMP or other heritage (Y/N/unknown)	Continue to next assessment phase? (Y/N)	Comments
B-53	18920	Earlsfort Centre	14	4	51	8 6	1 (Very Slight)	0 (Negligible)	N	Y	Case B (refer to section 4 1)
B-147	19020	Cadenza (Former Davitt House)	26 6	7	63	9 0	N/A	0 (Negligible)	N	Y	Case B (refer to section 4 1)
B-238	18980	Arthur Cox Building	40	7	17 8	8 6	2 (Slight)	0 (Negligible)	N	Y	Case B (refer to section 4 1)

- Updated assessment for Cadenza Building (Building B-147). Previously for Davitt House in EIAR (demolished in 2019).
- Assessment carried out for voume ground loss, V_l= 0.5%, although not stated in EIAR Addendum & different to original assessment for buildings that fall into Damage Risk Category 0-2 in EIAR (V_l = 0.75%).
- Concluded that Damage Risk Category = 0 (Negligible) & no further assessment required.

Phase 2a Building Damage Assessment (BDA) – Cadenza Building, Earlsfort Terrace

Damage Assessment for Irish Life Cadenza Building - Lowred Tunnel Alignment

Analysis	Details	Depth to Tunnel Axis (z_o)/ Cover to Foundation Subgrade (m)		Upper Bound (V_l = 0.50%) Lim.(Max) Tensile Strain ε_{tmax} (%)	Max Ground Slope m_{max} (%)	Max Settlement S_{max} (mm)	Risk Category	Degree of Damage
Case 1A (Rev.)	Ch. 18+975 (North Side) Basement Floor Slab Revised Tunnel Level	z_o = 20.0m Cover= 15.2m	AGL Consulting Calculations	-0.03%	0.13% (1:770)	18	1/2	Very Slight to Slight
Case 2A (Rev.)	Ch. 19+000 (Centre) Internal Building RC Frame Revised Tunnel Level	z_o = 18.4m Cover= 13.7m		-0.04%	0.16% (1:625)	19	1/2	Very Slight to Slight
Case 3A (Rev)	Ch. 19+025 (South Side) Secant Pile Wall/Bldg. Façade Revised Tunnel Level	z_o = 15.5m Cover= 10.7m		-0.06%	0.23% (1:435)	23	1/2	Very Slight to Slight
JACOBS/IDOM: Revised EIAR Assessment 0.5% Ground Vol. Loss @ Building Foundation Level [Compare to Case 2A (Rev.)]				-0.045%	0.16% (1:625)	19.5	0?	Negligible? ??

Building and Structure Damage Classification (after Burland et al (1977) and Boscarding and Cording (1989))					Approximately Equivalent Ground Settlements and Slopes (after Rankin 1988)	
Risk Category	Degree of Damage	Description of Typical Damage and Likely Forms of Repair for Typical Masonry Buildings	Approx. Crack Width (mm)	Limiting Max Tensile Strain (%)	Max Slope of Ground	Maximum Settlement of Building (mm)
0	Negligible	Hairline cracks	<0.1	Less than 0.05		
1	Very Slight	Fine cracks easily treated during normal redecoration. Perhaps isolated slight fracture in building Cracks in exterior brickwork visible upon close inspection	0.1 to 1	0.05 to 0.075	Less than 1:500	Less than 10
2	Slight	Cracks easily filled. Redecoration probably required. Several slight fractures inside building. Exterior cracks visible some re-pointing may be required for weather tightness. Doors and windows may stick slightly	1 to 5	0.075 to 0.15	1:500 to 1:200	10 to 50

RC-0	<0.05%	<0.20%	<10mm
RC-1	0.05%-0.075%		
RC-2	0.075%-0.15%	0.20%-0.50%	10-50mm
RC-3	0.15%-0.30%	0.5%-2.0%	50-75mm

- Overall Damage Risk Category = 1/2 (Very Slight to Slight) => **Damage Level understated in EIAR Addendum**
- No Assessment of perimeter secant pile wall at lower foundation level – slightly higher settlement & distortion

Phase 2a Building Damage Assessment (BDA) – Cadenza Building, Earlsfort Terrace

- Overall Damage Risk Category = 1/2 (Very Slight to Slight) => **Damage Level understated in EIAR Addendum – undermines credibility of assessment.**
- No Assessment of perimeter secant pile wall at lower foundation level – higher settlement & distortion.
- Damage criteria for masonry structures in EIAR not fit for purpose for Cadenza Building.
- Estimated levels of settlement (19-23mm) and building distortion (1:435 to 1:770) significantly outside tolerances for building façade and basement waterproofing system.
- Likely damage to building due to ground movements not identified as a **Likely Significant Effect** in the EIAR – Significant error and omission in assessment procedure.
- Effects of ground movements on building not properly assessed in the EIAR & Addendum.
- No mitigation measures specified in EIAR to mitigate effect of ground movements on damage to Cadenza Building (e.g. Ch.31 – Land Take: POPS only, does not apply to commercial property).
- Phase 3 building damage assessment should be carried out as part of EIA process to properly assess and mitigate effects.

Phase 2a Building Damage Assessment (BDA) – Cadenza Building, Earlsfort Terrace

JACOBS
IDOM
MetroLink

Technical Note:

Assessment of Borehole data at Arthur Cox Building and Cadenza Building

TBC | P01

06/03/2024

The applicant has reviewed the boreholes logs provided by AGL Consulting (acting on behalf of the owners of both buildings) on 1 March 2024 and concludes the following.

- The boreholes show a similar but higher profile for the competent rock level compared to MetroLink Geotechnical Profile.

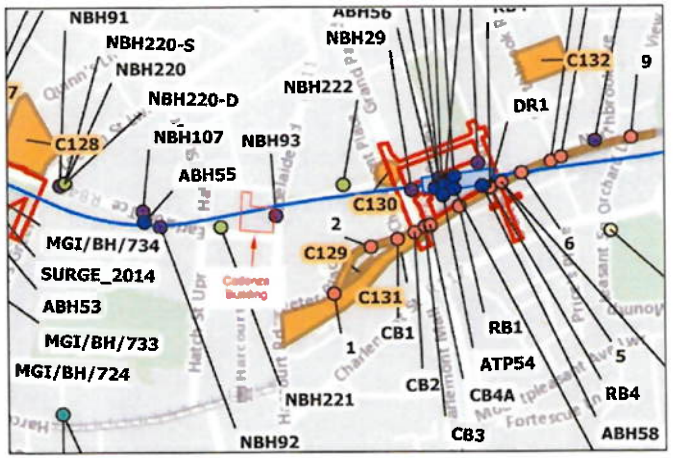


Figure 4-1 Site Investigation Location Plan [from Figure 20.6 (Sheet 7 of 8) in Chapter 20 of the EIAR]

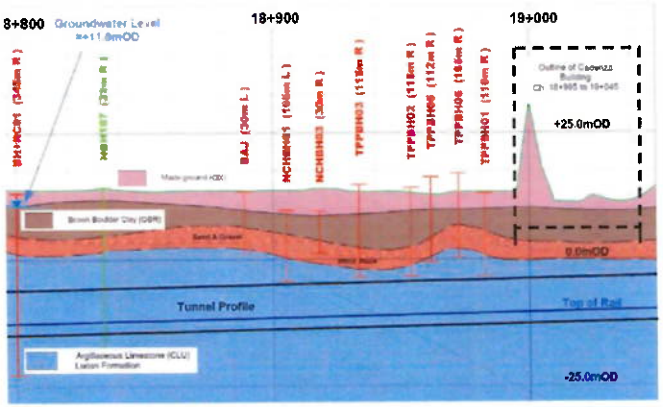


Figure 4-2 Geological Cross-Section [Sheet 26 of 28 from Appendix A20.9 to Chapter 20 of the EIAR]

Phase 2a Building Damage Assessment (BDA) – Cadenza Building, Earlsfort Terrace

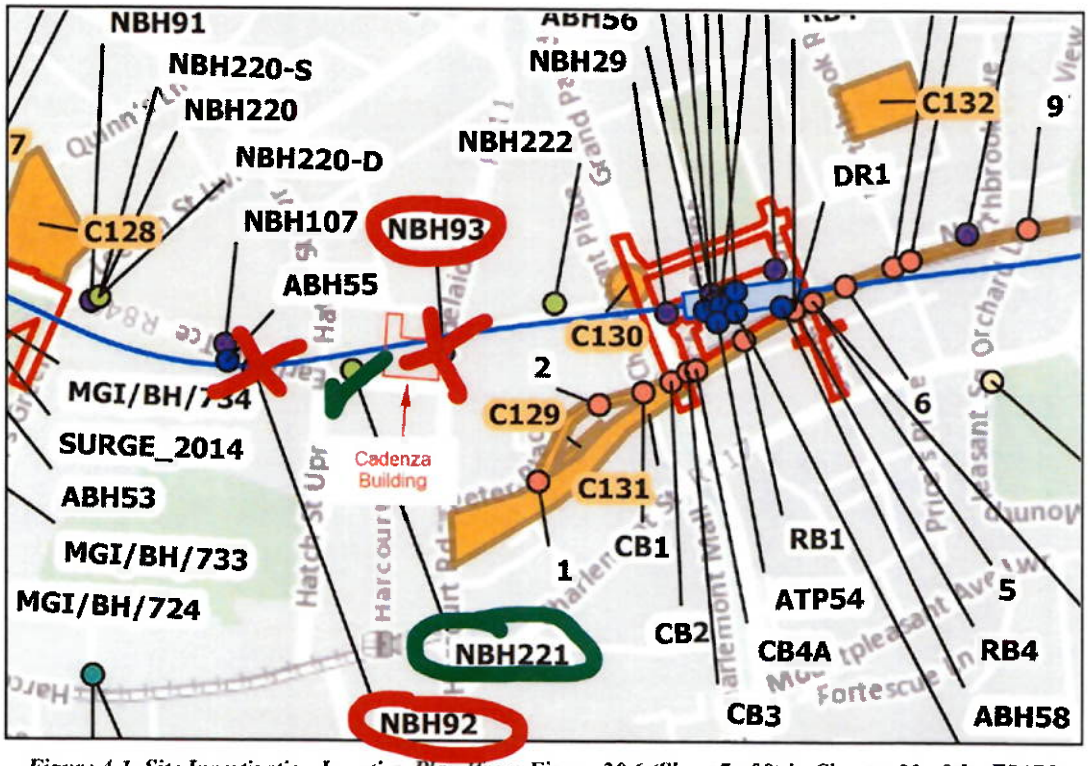
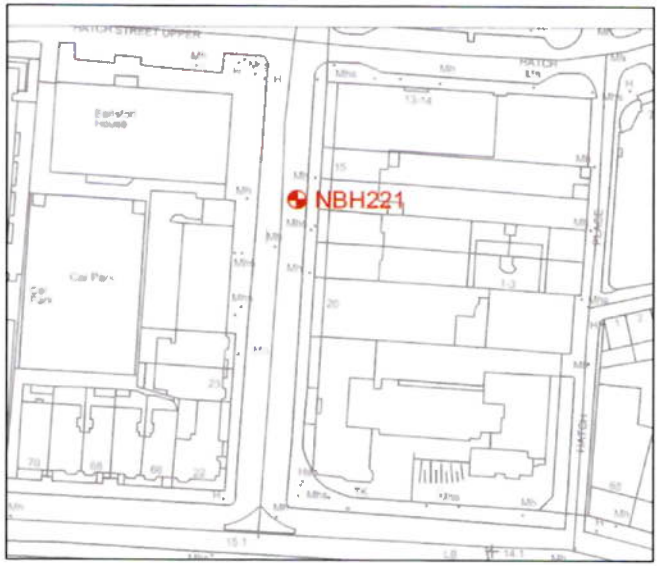
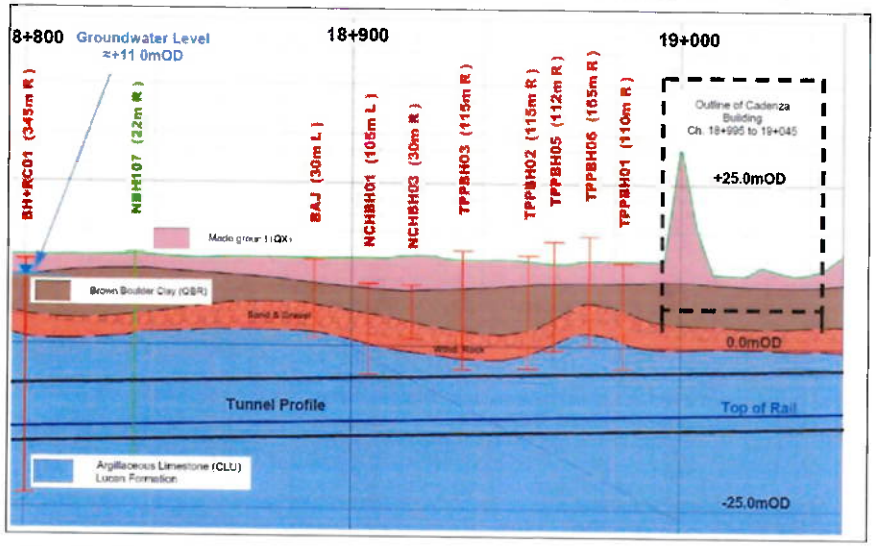


Figure 4-1 Site Investigation Location Plan [from Figure 20.6 (Sheet 7 of 8) in Chapter 20 of the EIAR]

- NBH92 & NBH93 do not exist
- Borehole NBH-221 only Metrolink SI data relevant to Cadenza Building.
- SI Location plan in the EIAR should be updated (Ch. 20)



Phase 2a Building Damage Assessment (BDA) – Cadenza Building, Earlsfort Terrace



- Geological Profile in Appendix A20.9 of the EIAR shows rock at **+0.0mOD** under Cadenza Building & between **– 2.5mOD and +2.0mOD** under Arthur Cox Building.
- Top of competent rock at **+6.25mOD** in Borehole NBH-221
- Geological profile in EIAR is incorrect and should be updated to reflect actual rock levels - Relevant to further Phase 3 assessment and construction monitoring