METROLINK Railway Order
An Bord Pleanála Oral Hearing

ABP-314724-22

Submission
Prepared by

Mr Blaine Cregan

On behalf of

Wynn's Hotel, 35-39 Abbey Street Lower, Dublin 1, D01 C9F8.

February 2024

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1.0 INTRODUCTION

Qualifications and Professional Experience

1.1 My name is Blaine Cregan. I am an Executive Director of John Spain Associates, a leading firm of planning consultants. I have 10 year's planning and development consultancy experience in Ireland. I am a Licentiate Member of the Royal Town Planning Institute (RTPI) and member of the RTPI Executive Committee for Ireland.

1.2 My qualifications include:

- BENG Civil Engineering – Munster Technological University
- BSC (Hons.) Construction Management – Munster Technological University
- MSC Environmental Planning – Queen's University Belfast

1.3 John Spain Associates are planning consultants for Wynn's Hotel, 35-39 Abbey Street Lower, Dublin 1, D01 C9F8.

1.4 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. JSA will however address the TII's Response to Submissions.

1.5 Please also see enclosed document prepared by PUNCH Consulting Engineers setting out technical response to the submission and Noise Impact Assessment prepared by ARUP Consulting Engineers.

1.6 In order to support this submission please see enclosed:

- Appendix 1: Assessment of groundborne noise and vibration impacts from Transport Ireland's proposed Metrolink
- Appendix 2: PUNCH Civil/Structural Engineering Report

Background

1.7 Wynn's Hotel is located on Lower Abbey Street and comprises a 6-storey building located within Dublin City Centre. Metrolink is proposed to run beneath Abbey Street and directly under Wynn's Hotel. It is acknowledged that the construction of the proposed Metrolink will have a certain amount of impact on the subject site. However, our client has serious concerns in relation to the identified noise and associated disruption contained with the Railway Order documentation.

1.8 The hotel is over 170 years old and is a Protected Structure (DCC RPS No. 8; NIAH Reg. Ref. 50010276), it is an iconic hotel in Dublin city with a long history.

1.9 A fundamental aspect of Wynn's Hotel's offering is to provide guests with a restful stay away from city centre traffic and noise. This is a core element of Wynn's Hotel success throughout its long history.

1.10 Ultimately it will be impossible for the hotel to take bookings during the time in which the tunnel boring machine is in proximity to the hotel, which is stated to last approximately 2 weeks, due to the 'significant, adverse' noise and disturbance these construction works will result in during this period. This will have a significant financial impact on the hotel.

1.11 Wynn's Hotel has had prior experience with large scale infrastructure construction projects in the area, notably the Luas Red Line extension which was completed in 2004

and caused extensive disruption during construction, exacerbated by poor communication by the developer.

1.12 Since the Luas became operational Wynn's Hotel has been forced to install windows with triple glazing in order to mitigate the impacts of noise from the passing trams which can begin close to 6 am each morning and continue until after midnight. Wynn's Hotel participated in the Oral Hearing when the Railway Order was submitted where similar reassurances on the management of construction activities were made to our client.

1.13 A hotel is a highly sensitive receptor to noise impacts. It is of fundamental importance that guests of Wynn's Hotel are able to sleep at night as without this, the central aspect of Wynn's Hotel offering is undermined, therefore threatening the hotel's success and reputation. We acknowledge that the Metrolink project will be of significant benefit to Dublin City Centre, however its impact should be mitigated

Figure 1: Site Location with approximately boundary outlined in red (Source: Google)

2.0 NOISE IMPACT ASSESSMENT

2.1 In relation to noise impacts, we note TII's response to the submission made on behalf of Wynn's Hotel as follows:

*"TII confirm that there will be a **temporary but very high adverse (significant) impact for groundborne noise at 35-39 Abbey Street during TBM works**. 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 impact on your commercial activity due to Groundborne Noise and Vibration as a result of tunnelling activities following mitigation will be negative, slight and short term to medium term (Table 11.70, Chapter 11 Population and Land Use). Currently, a detailed timeline for TBM passage is not available as the appointed contractor(s) will prepare the programme for the TBM once they have been appointed. TII will continue to communicate with landowners as the project progresses. Plans for communications regarding tunnel boring are detailed in section 3.3.1 of Appendix A5.1 Outline CEMP.

The EIAR fully details all impacts on the hotel and its operation 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. For timelines of impacts please refer to response item number (18) above."

2.2 Further TII states:

"Unfortunately, there are no effective methods available to reduce groundborne noise or vibration from TBMs at source, but noting that the duration of this impact will be in the order of up to two weeks as the TBM passes. TII will liaise with Wynn's Hotel to ensure the timing of these impacts are known."

2.3 As set out in the above TII considers the residual construction impact on Wynn's Hotel as *'temporary but very high adverse (significant) impact for groundborne noise'*, yet the impact on our client's 'commercial activity' is only noted as being *'negative, slight and short term to medium term'*. It is submitted that the level of impact on the commercial activity should correlate with the residual groundborne noise impact due to the hotel use and the effects of the noise on the hotel patrons.

2.4 As part of this submission ARUP Consulting Engineers have provided a report in response. The report states:

"The predicted maximum level of groundborne noise at ground floor level is around 55dBLAmax,S. This would be expected to attenuate by around 2-3dB per floor, moving up through the building and so may exceed the assessment criterion of 45dBLAmax,S on all floors when tunnelling directly below the hotel. The predicted level is consistent with EIAR Figure 14.2.

Groundborne noise will exceed the criterion as the TBM approaches and moves away from the hotel, as well as when directly beneath it, for a total drive length of approximately 90-100m. Based on information in the EIAR, this could be for a period of around two weeks.

The tunnelling will be a continuous process and not stop other than in exceptional circumstances. The cutting/excavation activity, which is the part of the cycle that causes the highest levels of groundborne noise, is expected to occur for 25 to 30% of the time and at any time of day or night. Disturbance to hotel guests at night through preventing or delaying their sleep and causing awakenings is therefore very likely, particularly during the periods when the TBM is directly below the hotel. Closure of the hotel is the only practicable way to mitigate this risk."

2.5 It is clear that Wynn's Hotel will be required to close while the TBM is close to the building. If the hotel were not closed, dissatisfied guests may not stay at the hotel and/or demand refunds having had a poor night's sleep resulting in reputational damage to our client in the long term in such instances. It is submitted that the impact on our client's commercial activity is beyond 'slight' as set out in the above response by TII, given the likely temporary closure of the hotel.

2.6 Therefore it is submitted that TII have not fully acknowledged the impact on Wynn's Hotel as the impact on the operations whilst the TBM passes the hotel are greater than 'negative slight'.

2.7 Whilst the matter of compensation may be dealt with at a later date, it is very important to our client that the commercial impacts be fully acknowledged. TII stated the following in relation to the submission from Wynn's:

"While there will be some disruption to business premises during the construction of MetroLink, TII do not have a compensation policy in place to compensate businesses for such disruption. It is envisioned that all businesses in the locality of MetroLink will benefit significantly once MetroLink is operational"

2.8 This provides little assurance for businesses along the Metrolink route. Surveys before and after will not capture noise disruption that Wynn's Hotel will experience and the consequent operational and financial impact.

2.9 Whilst we note TII have referred to communication with Wynn's in relation to the timing of the tunnel activities proximate the hotel, our client requires early communication of this timing, to ensure bookings are not taken during this time.

3.0 STRUCTURAL ENGINEERING CONSIDERATIONS

3.1 We note the following TII comments in response to our client's submission:

"The EIAR Chapter 5 Appendix 5.17 describes the industry standard three-phased ground movement impact assessment process that is undertaken on tunnelling and underground projects around the world, that includes Channel Tunnel Rail Link (CTRL), Dublin Port Tunnel, Crossrail and High Speed 2, and how it has been applied to the MetroLink project. Section 1.3 of this document clearly describes the ground movement assessment methodology. TII do recognise that this building is a Protected Structure and have therefore designated it as a "Special" structure. This designation requires TII (through its contractor) to undertake a further Phase 3 assessment to assure that the predicted impacts are correct. The results of this refined assessment typically show that earlier assessments are conservative and overestimate the likely impact of construction generated ground movements."

3.2 Elsewhere in their response, TII state:

"Response to point i): Slight damage is predicted at the Wynn's Hotel building (B-241) following the Refined Phase 2a Damage Assessment.

This category of damage is not considered structural damage and an explanation for typical damage and likely forms of repair can be found in Table 4-4 of the Building Damage Report (EIAR Appendix A 5.17). In this case, typical damage and likely forms of repair would be limited to "Cracks easily filled. Redecoration probably required. Several slight fractures inside building. Exterior cracks visible some repointing may be required for weather tightness. Doors and windows may stick slightly".

3.3 As set out in Punch's enclosed report: "*The refined Stage 2a Assessment carried out as part of the EIAR placed the Building in Risk Category 2 where the description of Degree of Damage is classed as "Slight" with Maximum Tensile Strain % of more than 0.075 and not exceeding 0.15 and Approximate Crack Widths of between 1 and 5mm. This level of damage cannot be accepted by the Hotel. Please see Appendix A for the Damage Building Classification Table."*

Building damage considerations are addressed in further detail in the enclosed document prepared by PUNCH.

4.0 CONCLUSIONS

4.1 Our client acknowledges that a scheme of this scale will result in impacts, however, these should be carefully managed to minimise the effects on the surrounding landholdings.

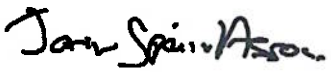
4.2 Given that TII has stated that there are no effective methods available to reduce ground borne noise or vibration from TBMs at source and the construction stage impact is identified by TII's consultants as "very high adverse", we wish to emphasise that the resulting impact in reality on Wynn's Hotel will be more then 'slight', as it will result in the closure of the Hotel while the TBM is proximate to the hotel, resulting in a significant adverse commercial impact.

4.3 Building damage considerations are addressed in further detail in the enclosed document prepared by PUNCH.

4.4 Our client reserves the right to elaborate further on these issues as necessary and we trust this submission will be taken into consideration in assessing the proposals.

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

Yours sincerely,



John Spain Associates

APPENDIX 1: ASSESSMENT OF GROUNDBORNE NOISE AND VIBRATION IMPACTS FROM TRANSPORT IRELAND'S PROPOSED METROLINK PREPARED BY ARUP

ARUP

Wynn's Hotel Limited

Wynn's Hotel

Assessment of groundborne noise and vibration impacts from Transport Ireland's proposed Metrolink

Reference: R01

27 February 2024

Job number 603371-14

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ARUP

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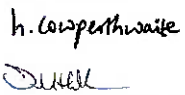
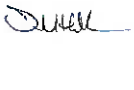
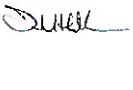
		Signature			
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Executive Summary

Wynn's Hotel Limited has appointed Arup to provide an assessment of groundborne noise and vibration impacts at Wynn's Hotel, 35-39 Abbey Street Lower, North City, Dublin 1, D01 C9F8, during construction and operation of Transport Infrastructure Ireland's proposed MetroLink scheme.

Groundborne noise and vibration have been predicted using empirical methods that have been developed and applied to many rail schemes globally. Predicted levels are compared with the assessment criteria presented in TII's Environmental Impact Assessment Report (EIAR) and with criteria from other appropriate sources.

With a track system with the vibration isolation performance proposed in the EIAR where the metro system would run beneath the hotel, the operational groundborne noise and vibration levels are well below the criteria for hotels.

Groundborne noise from construction is expected to exceed the criteria during the excavation period of the tunnelling cycle for a period of up to around two weeks.

1. Introduction

Arup has been appointed to provide an assessment of groundborne noise and vibration impacts at Wynn's Hotel during construction and operation of Transport Infrastructure Ireland's proposed MetroLink scheme. As currently proposed, MetroLink would pass directly beneath the building.

Vibration would be generated by the tunnelling works during construction of the scheme and by passing trains once the scheme is operational. Vibration can also generate groundborne noise, which is audible sound that is re-radiated from elements of building (wall, floors, ceilings) when they are caused to vibrate, both during construction and due to train movements. Groundborne noise can be audible at levels of vibration which may not be otherwise perceptible i.e. as feelable vibration.

The proposed floating slab track system has been assessed, which is the track type relevant to this location as set out in Appendix 14.1 of the Chapter 14 of the Environmental Impact Assessment Report (EIAR). The impacts on the building, which lies directly above the tunnel, have been assessed against the EIAR and other relevant criteria.

1.1 Building description

The building is a multi-storey hotel with a basement floor and six floors above ground level. The basement contains ancillary spaces not sensitive to noise and vibration. The ground floor contains a bar, restaurant and hotel reception area. The hotel rooms are all located on the first to fifth floors.

FRONT ELEVATION

Figure 1: Hotel front elevation

1.2 Hotel location

The hotel is located above a 200m portion of track which will incorporate an improved floating slab track system, due to its proximity to the Abbey Theatre, circled in Figure 2.

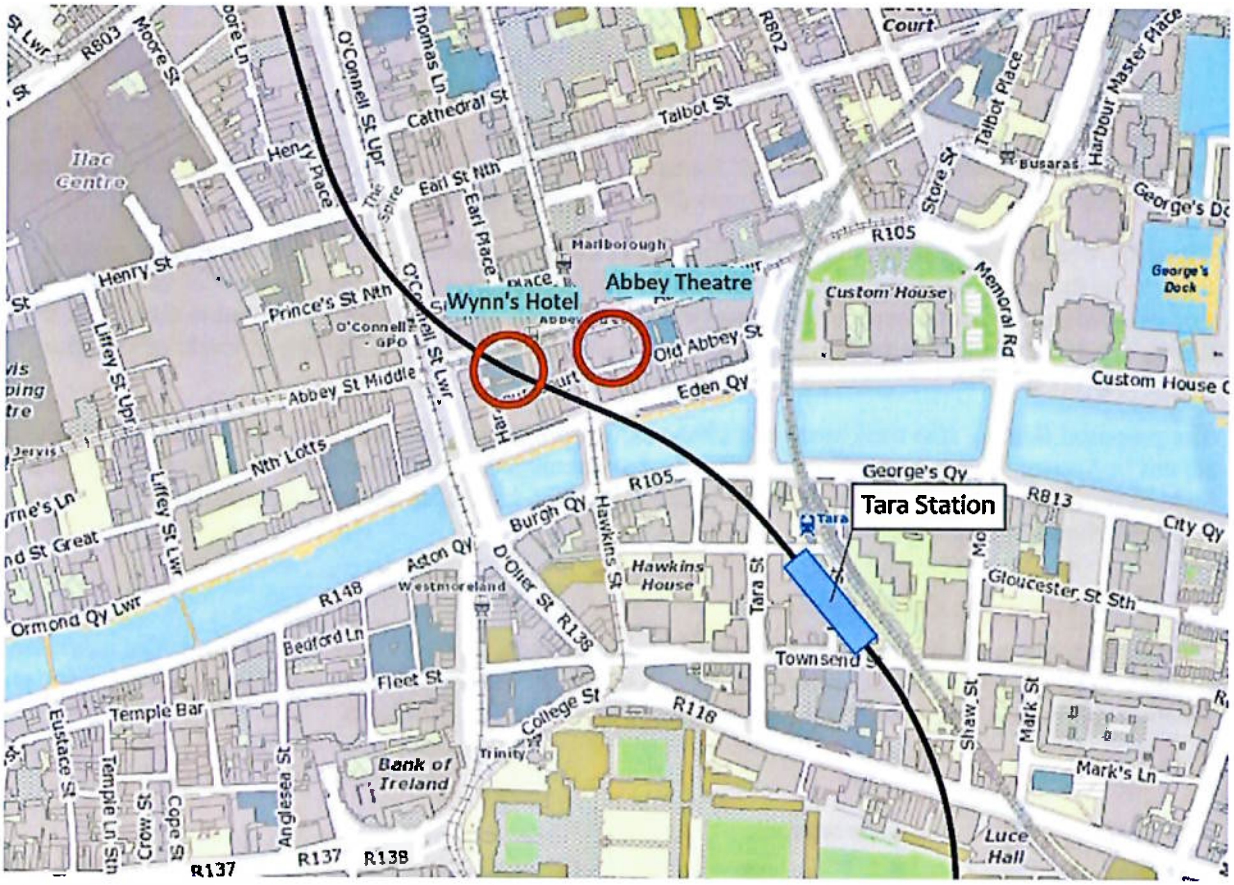

Figure 2: Hotel location and track alignment

2. Assessment criteria

Assessment criteria below consider the risks from groundborne noise, feelable vibration and risk of building damage.

2.1 Groundborne noise

Groundborne noise has been assessed against the criteria given in Table 1 taken from the EIAR. These criteria are consistent with those applied to groundborne noise from other rail projects in Ireland and the UK[1].

Activity	Groundborne noise criteria $dBL_{Amax,s}$
Operation (i.e. from trains)	40
Tunnel boring machine (TBM) passage	45
Mechanical excavation (other than TBM)	40

Table 1: Criteria for groundborne noise from EIAR chapter 14 Table 14.18

[1] ANC Guidelines. Measurement & Assessment of Groundborne Noise & Vibration. Third Edition. The Association of Noise Consultants, 2020.

2.2 Vibration

Vibration that may be directly perceptible is assessed using the vibration dose value (VDV) which provides a summation of the total vibration exposure, taking account of the magnitude and number of events over the duration of the day (or night). VDV criteria are given for day (07:00 – 23:00) and night-time (23:00 – 07:00) and are presented below in Table 2.

Activity	VDV Day ($ms^{-1.75}$)	VDV Night ($ms^{-1.75}$)
Operation	0.2	0.4
Construction	0.8 to 1.0	0.4 to 0.5

Table 2: Vibration dose value criteria from EIAR chapter 14 Table 14.18

People are very much more sensitive to vibration than are buildings. Any risk of damage to buildings due to vibration from tunnelling or train movements is negligible at the levels of vibration that will arise and therefore is not considered further in this report.

3. Assessment assumptions from EIAR

3.1 General

This section summarises the information from the EIAR upon which Arup's assessment of the vibration risks has been based.

3.2 Position and depth of the proposed tunnel

The proposed MetroLink route would run directly beneath the building, at a vertical depth of approximately 14m from the basement to the crown of the tunnel. The predicted depth is an assumed worst-case scenario, drawn from the depths of the two stations closest to the building. Tara station has a depth of 18.5m – 19m and O'Connell station has a depth of 17 – 17.5m, as shown in Figure 3 and Figure 4 respectively, taken from EIAR Appendix A20.4.

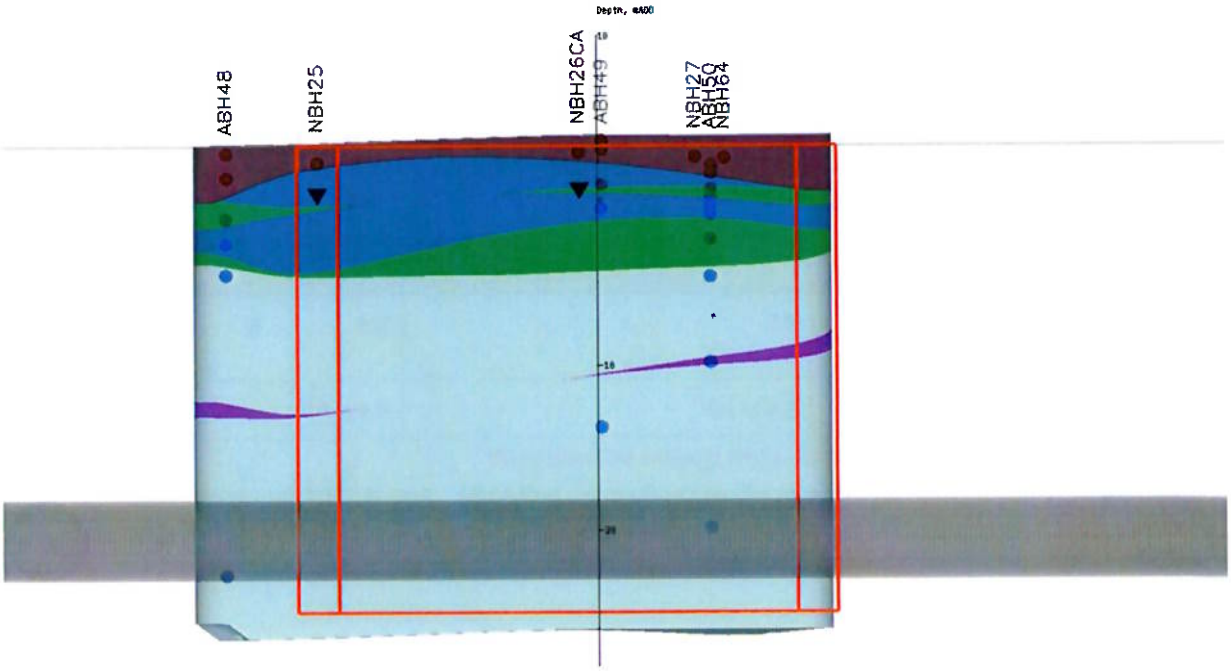

Figure 3: Tara Station depth and tunnel alignment

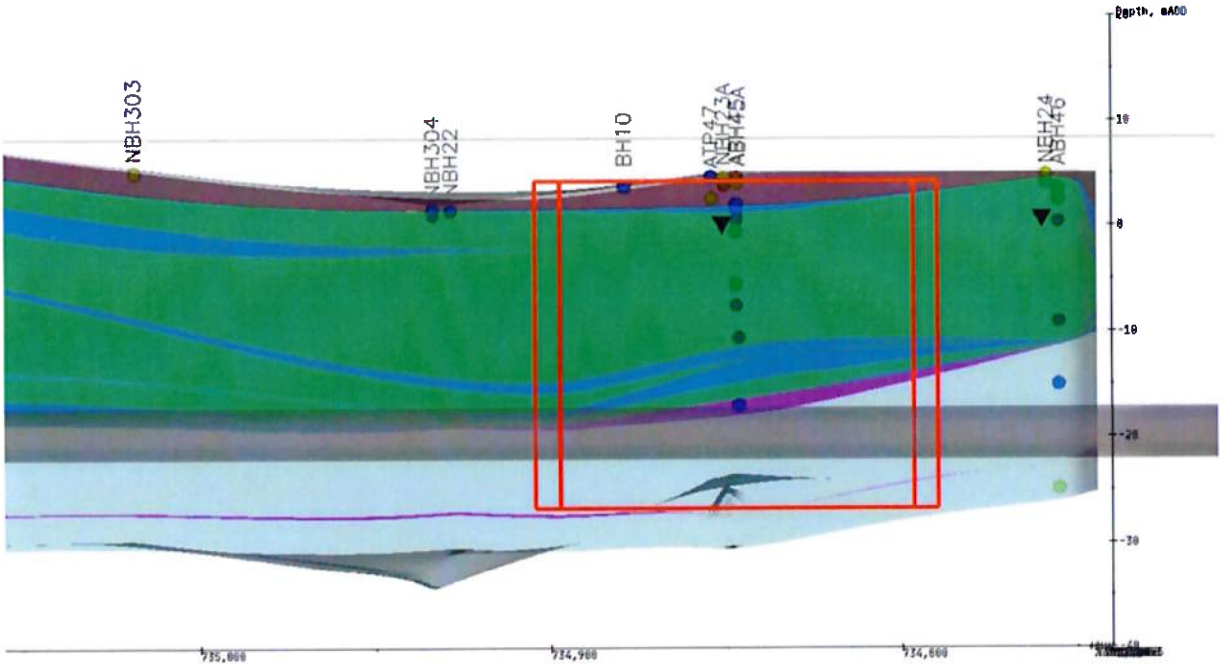

Figure 4: O'Connell Station and tunnel alignment

3.3 Proposed design

3.3.1 Track design

There are two main track options for the proposed tunnel route: standard track (booted blocks); and floating slab track, proposed under highly sensitive areas, such as laboratory facilities with highly sensitive equipment and theatres, which includes the Abbey Theatre. Wynn's Hotel would therefore benefit from the higher performing track system. The extent of the improved slab track system (Ch.17+000 to 17+200) is shown below in Figure 5.

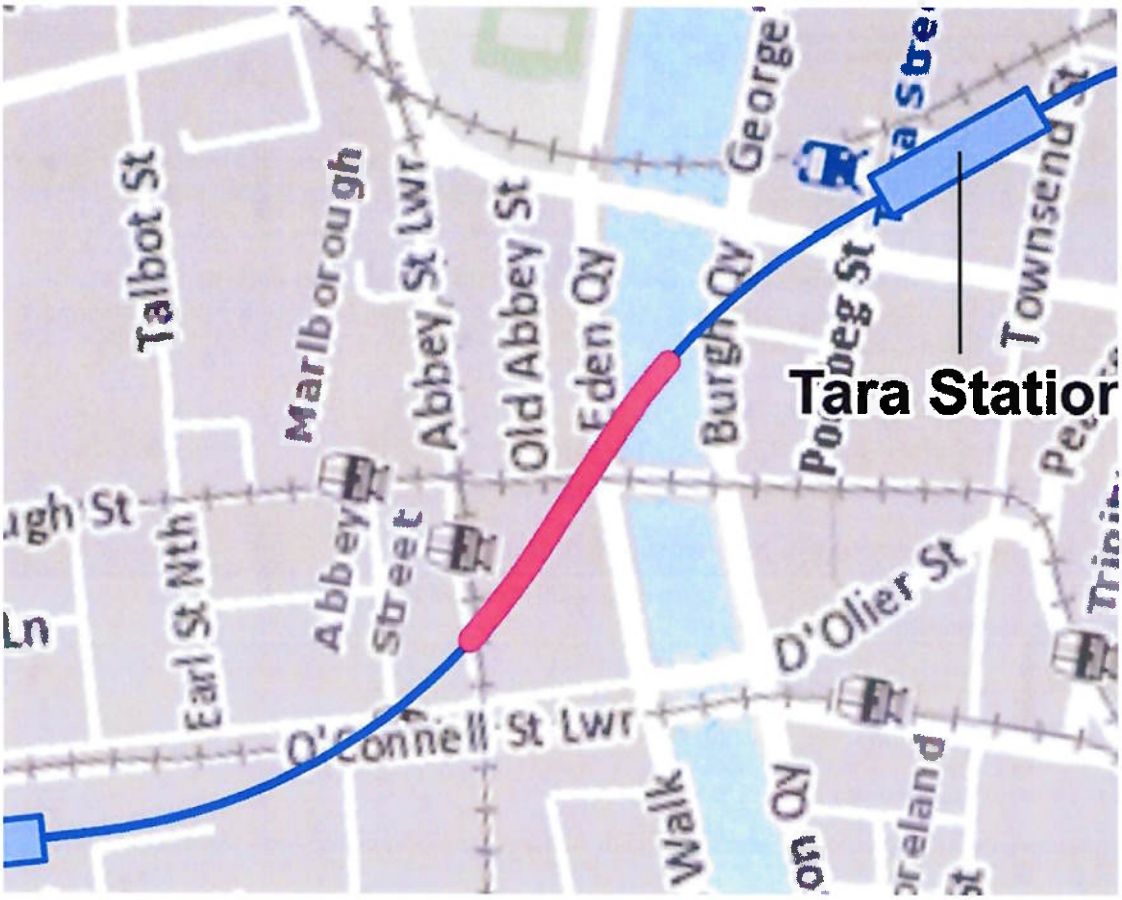

Figure 5: Extents of slab track system Ch17+000 to 17+200

The EIAR Table 14.47 shows floating slab track in the tunnel below the hotel due to the proximity to Abbey Theatre. Track support properties and assumptions are given in Table 3 below.

Item	Value and units
Rail	CEN60
Support spacing	650mm
Rail baseplate dynamic stiffness	150MN/m
Rail baseplate loss factor	0.2
Block mass	125kg
Boot dynamic stiffness	17MN/m
Boot loss factor	0.2

Item	Value and units
Slab length	1,950 mm
Slab mass	2,396 kg
Nu of bearings per slab	4
Dynamic stiffness of each bearing	1.034 MN/m
Bearing damper loss factor	0.5

Table 3: Properties of standard track in tunnels (See EIAR Appendix 14.3, Table 14.2)

3.3.2 Rolling stock

The trains assumed by TII for the MetroLink are based on those used for the Metro in Madrid, the CAF 6000 units. Assumptions for the rolling stock parameters are given in Appendix 14.2 in Tables 14.1 and 14.2 of the EIAR.

EIAR Volume 1 Non-Technical Summary Section 8.1 suggests that the maximum possible frequency of trains is one train every 100 seconds. Across a 16-hr day this is estimated to be a number of 576 train pass-bys. The operational design speed is 80km/h.

4. Predicted groundborne noise levels

4.1 Building information and foundation type

As mentioned in Section 1.1, the building is a hotel building with five floors above ground level and a basement. Floor uses are currently as follows.

- Basement: not in sensitive use
- Ground level: reception, bar, restaurant
- Levels 1 – 5: guest rooms

No information on the foundations has been identified. A worst-case assumption has therefore been made in calculating the impacts.

4.2 Prediction method and assumptions

Construction groundborne noise and vibration assessment has been based on TRL Report 429[2] and information from tunnelling in Dublin reported by Orr[3]

For impacts from operation of MetroLink, the assessment has been undertaken using Arup's empirical prediction method which is consistent with ISO 14837-1[4] and has been applied to many rail schemes worldwide (Singapore MRT; MetroLink, UK; Sydney's Tangara Australia; Crossrail (now Elizabeth Line) UK; High Speed 2, UK).

The predicted vibration performance of the relevant trackform (see section 3.3.1) has been calculated based on the physical properties of their constituent components set out in Table 3 above.

[2] Groundborne vibration caused by mechanical construction works. Hiller DM and Crabb GI, Transport Research Laboratory Report 429, 2000

[3] Trevor L L Orr. Ground vibrations and the Dublin Port Tunnel, 2004

[4] ISO 14837-1:2005 Mechanical vibration – Ground-borne noise and vibration arising from rail systems - Part 1: General guidance

4.3 Groundborne noise results

4.3.1 Construction groundborne noise

The predicted maximum level of groundborne noise at ground floor level is around 55dB$L_{Amax,S}$. This would be expected to attenuate by around 2-3dB per floor, moving up through the building and so may exceed the assessment criterion of 45dB$L_{Amax,S}$ on all floors when tunnelling directly below the hotel. The predicted level is consistent with EIAR Figure 14.2.

Groundborne noise will exceed the criterion as the TBM approaches and moves away from the hotel, as well as when directly beneath it, for a total drive length of approximately 90-100m. Based on information in the EIAR, this could be for a period of around two weeks.

The tunnelling will be a continuous process and not stop other than in exceptional circumstances. The cutting/excavation activity, which is the part of the cycle that causes the highest levels of groundborne noise, is expected to occur for 25 to 30% of the time and at any time of day or night. Disturbance to hotel guests at night through preventing or delaying their sleep and causing awakenings is therefore very likely, particularly during the periods when the TBM is directly below the hotel. Closure of the hotel is the only practicable way to mitigate this risk.

Vibration may also be perceptible intermittently during this period but at a level that should not be disturbing provided that guests and staff are warned in advance that they may occasionally feel vibration through the floor.

4.3.2 Operational groundborne noise and vibration

Figure 14.6 of the EIAR shows the groundborne noise level to be 30 to 35dB$L_{Amax,S}$ at the hotel (groundfloor level). It is assumed that this is the situation without the floating slab track.

A-weighted groundborne noise levels within the hotel have been predicted to be lower than this. At groundfloor level, the predictions are less than 20dB$L_{Amax,S}$. Levels will reduce up the building to be lower on higher floor levels and therefore all well below the assessment criteria and unlikely to be audible.

Similarly, perceptible vibration (Table 4) is well below the assessment criteria and so unlikely to give cause for comment.

Building level	Predicted vibration level (eVDV $ms^{-1.75}$)	
	16hr day	8hr night
Ground	0.13	0.10
First	0.09	0.07
Second	0.07	0.05
Third	0.05	0.04
Fourth	0.03	0.03
Fifth	0.01	0.02

Table 4: Predicted vibration levels

5. Conclusion

This study has shown that the groundborne noise and vibration impacts during operation of MetroLink are predicted to be lower than the assessment criteria and therefore unlikely to cause any disturbance to hotel guests or staff.

During construction groundborne noise is likely to be audible and potentially disturbing at times over a period of up to two weeks as the TBM passes beneath the hotel.

APPENDIX 2: PUNCH STRUCTURAL ENGINEERING RESPONSE

PUNCH
consulting engineers

Project MetroLink - Wynn's Hotel,Dublin 1

ABP-314724-22

PUNCH Civil/Structural Engineering Report - Module 1

222266-PUNCH-XX-XX-RP-S-0001

February 2024

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1 Report Authors

This report has been jointly authored by Robert Coughlan *BE CEng FIEI MIStructE* and Tim Murnane *BEng CEng FIEI FICE FConsEI*

Robert Coughlan is a Consultant for PUNCH Consulting Engineers and was previously a Technical Director for the company for 6 years and has over 18 years' experience in Structural and Civil Consulting Engineering. He is a Fellow of Engineers Ireland (CEng FIEI) and a Chartered Engineer with the Institution of Structural Engineers (IStructE).

Tim Murnane is Managing Director of PUNCH Consulting Engineers and has almost 30 years' experience in Consulting Engineering. He is a Fellow of Engineers Ireland (CEng FIEI) and a Fellow of The Institution of Civil Engineers UK (CEng FICE). He is also Fellow of the Association of Consulting Engineers of Ireland (FConsEI) where he serves on the Executive Board as 2nd Vice President.

2 Introduction

This report has been prepared as part of a submission by Wynn's Hotel, Dublin 1 for the An Bord Pleanala Oral hearing relating to the Dublin MetroLink project - Ref ABP-314724-22 Submission Number 317. The report covers Structural Civil Engineering matters specific to the site.

Wynn's hotel is over 170 years old and is a Protected Structure (NIAH 50010276) and is an iconic hotel in Dublin City Centre. This landmark hotel welcomes the idea of Project Metrolink, however it is vital to Wynn's Hotel, that the building remains fully operational during the construction works and operational phase and cannot accept any interruption or damage to its business.

On Friday 23rd of February 2024, there was a meeting between TII representatives and the Technical Team of Wynn's Hotel. The meeting was requested by TII and was welcomed by the Technical Team of Wynn's Hotel. TII explained their approach to Noise for the proposed works under Wynn's Hotel in both the construction and operational phases. ARUP Acoustics Team have undertaken an independent assessment of Noise in relation to Wynn's Hotel and will be outlined in greater detail by Mr. David Hillier of ARUP.

The refined Stage 2a Assessment carried out as part of the EIAR placed the Building in Risk Category 2 where the description of Degree of Damage is classed as "Slight" with Maximum Tensile Strain % of more than 0.075 and not exceeding 0.15 and Approximate Crack Widths of between 1 and 5mm. This level of damage cannot be accepted by the Hotel. Please see Appendix A for the Damage Building Classification Table.

It has been confirmed by TII that a Phase 3 Assessment will be undertaken on the building, and this is welcomed by Wynn's Hotel.

3 Phase 3 Assessment

It is the understanding of PUNCH Consulting Engineers that a Phase 3 assessment consists of several sub-steps (referred to as "Iterations"), each refining the building and tunnel model to a higher degree. In this phase, both the magnitude of strain developing in the building and the validity of the standard risk categories (which are originally based on masonry structures) are reappraised. In the first Iteration, a similar model that was used for the Phase 2 assessment will be adopted. The model is then successively refined in the subsequent iterations. If required, the tunnel- excavation-ground-building interaction is modelled using Finite Element / Finite Difference techniques with appropriate level of sophistication to verify whether a reduction in the category of damage to an acceptable level is feasible.

TII have stated that the Refined Stage 2a Assessment is likely conservative as the assessment allowed a 1% ground loss in its calculations, based on position of rock and gravel profiles. It is likely in the Phase 3 Assessment that the ground loss % can be reduced and the Risk Category therefore reduced. As a result of it Protected Structure nature and the sensitivity and profile of this hotel, Wynn's Hotel can only accept a Risk Category of 1 or lower in Damage Building Classification Table and would request that any Phase 3 Assessment achieves this.

It is also noted that the building has been designed for a number of extra floors and the client intends to extend the height of the building in the future accordingly. Planning Permission for these works was granted under Dublin City Council Planning Reference 3131/18 in 2018. Any Phase 3 assessment should satisfy a Category of 1 or lower in Damage Building Classification Table for both the existing and proposed structures.

4 Condition Surveys and Monitoring of the Building

TII confirmed in its responses to the Technical Submission by PUNCH Consulting Engineers in January 2023 that a pre-condition survey would be undertaken 3 months in advance of the TBM approaching the hotel. This is welcomed. The response from TII to Item No. 23 in relation to surveys and monitoring is welcomed by Wynn's Hotel request that is strictly adhered to ensure negligible building damage. A copy of this response can be found in Appendix B.

5 Conclusions/Recommendations

We make the following recommendations to the Board:

3.1 In the event that the MetroLink proposals are granted, An Bord Pleanála should ensure conditions are imposed that require TII to carry out a Phase 3 assessment where Category of 1 or lower in Damage Building Classification Table is achieved.

3.2 The additional floors permitted under Dublin City Council Grant of Permission 3131/18 and catered for the Phase 3 assessment.

3.3 The surveying and monitoring proposals as per TII response to Item 23 of PUNCH Consulting Engineers submission in January 2023 are strictly adhered to.

6 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 - Building Damage Classification Table

Mair, R.J., Taylor, R.N. and Burland, J.B. (1996). Prediction of ground movements and assessment of risk of building damage due to bored tunnelling. In: Proc. Of the Int. Symp. On Geotech. Aspects of Underground Construction in Soft Ground, 713-718, Balkema, Rotterdam.

Mair, R.J. (2001). Theme Lecture, Research on tunnelling-induced ground movements and their effects on buildings – Lessons from the Jubilee Line Extension. Proceedings of the international conference held at Imperial College, London, UK, on 17–18 July 2001

TABLE 1

Building Damage Classification[1]				
1 Risk Category	2 Max Tensile Strain %	3 Description of Degree of Damage	4 Description of Typical Damage and Likely Form of Repair for Typical Masonry buildings	5 Approx[2] Crack Width (mm)
0	0.05 or less	Negligible	Hairline cracks.	
1	More than 0.05 and not exceeding 0.075	Very Slight	Fine cracks easily treated during normal redecorations. Perhaps isolated slight fracture in building. Cracks in exterior brickwork visible upon close inspection.	0.1 to 1
2	More than 0.075 and not exceeding 0.15	Slight	Cracks easily filled. Redecoration probably required. Several slight fractures inside building. Exterior cracks visible; some repointing may be required for weather-tightness. Doors and windows may stick slightly.	1 to 5
3	More than 0.15 and not exceeding 0.3	Moderate	Cracks may require cutting out and patching. Recurrent cracks can be masked by suitable linings. Repointing and possibly replacement of a small amount of exterior brickwork may be required. Doors and windows sticking. Utility services may be interrupted. Weather tightness often impaired.	5 to 15 or a number of cracks greater than 3
4	More than 0.3	Severe	Extensive repair involving removal and replacement of sections of walls, especially over doors and windows required. Windows and door frames distorted. Floor slopes noticeably. Walls lean or bulge noticeably, some loss of bearing in beams. Utility services disrupted.	15 to 25 but also depends on number of cracks
5		Very Severe	Major repair required involving partial or complete reconstruction. Beams lose bearing, walls lean badly and require shoring. Windows broken by distortion. Danger of instability.	Usually greater than 25 but depends on number of cracks

Notes

The table is based on the work of Burland et al (1977) and includes typical maximum tensile strains for the various damage categories (column 2) used in phase 2 settlement analysis.

Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

Appendix B - TII Response to Technical Submission to Surveying and Monitoring of the Building

Submission No.	317
Organisation Name or Name of Submitter	Wynn's Hotel

Item No.	Section Ref.	Page No.	Observation Statement	TII Response
RE: SUBMISSION ON THE METROLINK ON BEHALF OF WYNN'S HOTEL, 35-39 ABBEY STREET LOWER, DUBLIN 1, D01 C9F8				
22	APPENDIX 2: Technical Observations (Query E)	11	e) Confirmation of the Technical Design Checking Process for the Metrolink tunnel beneath Wynn's Hotel Dublin In responding to this item, we ask that TII to consider the following along with any other items they consider relevant: i) Category 3 independent checking is expected as a minimum checking process. We ask TII to confirm checking process and we request An Bord Pleanála 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, in line with best practice.
23	APPENDIX 2: Technical Observations (Query F)	12	f. Details and frequency of proposed condition surveys for Wynn's Hotel Dublin by TII, both in advance of and during the construction works as well as during the tunnel operational phase. In responding to this item , we ask that TII to consider the following along with any other items they consider relevant: i) In the Damage Assessment Report of Building document on https://www.metrolinkro.ie/, it places WHD (B-241) in Damage Category B (Refer to Appendix A) . This cannot be accepted by WHD and will likely negatively impact the building's basement, frame and facades which in turn affects the operations of the business. ii) 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 by TII/Main Contractor to ensure any potential damage to the building is accurately recorded iii) It is expected that the condition surveys continue post construction and through the tunnel operational stages and request frequency of these surveys to be confirmed by TII iv) We request this information from TII as soon as possible to ensure the integrity of the building is maintained during all phases 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.	Condition surveys are best undertaken just prior to works that could give rise to damage. Normally this would mean that the pre-construction condition survey would be undertaken circa three months prior to the TBM approaching the hotel. Impacts of the tunnel works would be noticed very soon after TBM passage and it would normally be the case that any residual movements would terminate with a few months of the TBM passing. TII's monitoring will be used to verify that movement has ceased and hence trigger the close out construction condition survey The operation of the MetroLink would not impact on the structure and no further condition surveys are deemed necessary. TII would respond to the points raised as follows: Response to point i): Slight damage is predicted at the Wynn's Hotel building (B-241) following the Refined Phase 2a Damage Assessment. This category of damage is not considered structural damage and an explanation for typical damage and likely forms of repair can be found in Table 4-4 of the Building Damage Report (EIAR Appendix A 5.17). In this case, typical damage and likely forms of repair would be limited to "Cracks easily filled. Redecoration probably required. Several slight fractures inside building. Exterior cracks visible some repointing may be required for weather tightness. Doors and windows may stick slightly". Response to point ii): "TII note and agree, and further comment below. As detailed in section 6.2. of Appendix A5.1 Outline CEMP, photographic records will form part of the pre and post-construction condition surveys. Ground Movement Impact Assessment Please refer to response item number (19) above. Monitoring Plans TII will procure its contractors to develop Instrumentation and Monitoring Plans in tandem with Monitoring Action Plans, As indicated in section 1.1. of Appendix A5.1 Outline CEMP. These plans will help assure that the risks associated with tunnelling are appropriately managed and controlled for this property. TII will provide details of any monitoring proposed by the contractor at detailed design stage and agree the methodology of installation to the Wynn Hotel. TII will provide advance notice of any attendance that the monitoring contractor may require. With regard to the timing of monitoring specific to ground movement TII will ensure that it is commenced 3 months prior to the construction activities that would give rise to the settlement. However, as these construction activities may complete years prior to the MetroLink operational phase the termination of monitoring will be linked to a determination that settlement has effectively ceased, allowing a removal of the instrumentation Response to point iii): Condition surveys will continue until the effect of the construction has ceased, long term impacts during the operational phase are not anticipated. (EIAR Ch5, Section 5.4.11.4, Section 5.4.11.1 & 5.4.11.2- Ch26, Section 26.3.4). Response to point v): 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. (EIAR Ch5, Section 5.4.11.4, Section 5.4.11.1 & 5.4.11.2- Ch26, Section 26.3.4). Response to point v): Regarding remediation please note that TII do not intend to put in place a Property Owners Protection Scheme for Commercial Properties along the MetroLink route. 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.