

Civil Engineering Dynamics Ltd.

11 Oak Walk,  
BedZED Centre,  
Hackbridge,  
Surrey, SM6 7DE



Incorporating Crockett & Associate  
Established 1948

Tel: 020 8647 1908  
Fax: 020 8405 2076  
ced@environmental.co.uk  
www.environmental.co.uk

### **Air Studios**

Lyndhurst Hall,  
Lyndhurst Road,  
Hampstead,  
London NW3 5NG

### **Structural and Ground Dynamics**

Revised Planning Submission – CED Response Note

**Ref:** AKS/3400/Revised Planning Submission– CED Response Note (18/07/16)

**Engineer:**  
PhD DIC CEng MSEE MIOA

Dr. Ather Sharif

## **1. INTRODUCTION**

- 1.1. Air Studios operate world class recording facilities at their site known as Lyndhurst Hall, in Hampstead, London NW3.
- 1.2. A proposed development comprising basements at an adjoining site known as 11 Rosslyn Hill, has been recently revised, with the omission of a TV basement room, although deep basement associated with a swimming pool and plant room continue to be proposed.
- 1.3. This note highlights some issues and the risks that remain with the proposed revised scheme, referring to drawings posted on the Camden Portal on 7<sup>th</sup> June 2016.
- 1.4. This note should be read in conjunction with CED reports listed as follows: -
  - 1.4.1. CED Report Structural and Ground Dynamics, ref . AKS/3400/R1/i1 dated (01/02/16)
  - 1.4.2. CED Addendum Report Responding to comments by :- Alan Baxter Associates (ABA) and Cole Jarman (CJ), ref AKS/3400/R1/i1/Addendum Report, dated 22/04/16

## 2. RECORDING STUDIO ACOUSTIC DESIGN AND PERFORMANCE CRITERIA

- 2.1. A high standard for the acoustic environment within the recording studios is what Air Studios set out to achieve, and commissioned experts, spending time and funds to create the facility.
- 2.2. The acoustic requirements for the studios were designed by Sandy Brown Associates (SBA) during 1991 when the listed building, originally a chapel, was altered to accommodate studios.
- 2.3. Air Studios can demonstrate that from 1991 they set out with relevant expert advice to achieve at great expense the high standards that their discerning clients demand. It is difficult to argue that when recording is under way, that they should be burdened with less.

## 3. MODIFIED IMPACT FROM UNDERGROUND RAILWAY DUE TO BASEMENT

- 3.1. The CED report dated (01/02/16) has shown that vibration and groundborne noise arises from underground trains within the Main Hall. The constraints on mitigation within a Listed building, have left the Main Hall unprotected from the effect of underground trains.
- 3.2. Whilst the vibration levels from underground trains is low, the magnified response of structural elements and other surfaces, which can act as ‘loudspeakers’, contribute to the groundborne noise being more evident.
- 3.3. The Main Hall due to its size, which can accommodate a full symphony orchestra represents a valuable studio space. When the intrusion from a train rumble or siren coincides with a quiet part of a cue or its tails, it must on such occasions be re-recorded.
- 3.4. There are factors that alter groundborne noise from rail systems, of which a major factor is the characteristics of the transmission path.
- 3.5. The remaining proposed deep basement in the revised scheme and the associated piling, can introduce more efficient ground transmission paths. The proposed basement structure, in closer proximity to the tunnel source, and also penetrating deeper into soil layers, can provide for stronger transmission.
- 3.6. A report by Dr DeFreitas of First Steps Ltd referred to in the CED report provided geotechnical sections surmised from all the information presently available and concludes “*stiffness of the London Clay will increase with depth but have a marked change at the junction of the grey with the brown clay.*”. It also states that “*Calcareous nodules are present and form distinct horizons within the London Clay; they are an obstacle to piling.*”
- 3.7. The proposed deep basement structure and piles (of which there are many), would bridge through to deeper stiffer grey (unweathered clay), and also make contact with stiffer horizons within. This may all provide more efficient transmission of groundborne noise and vibration from the tunnel structures to more strongly reach surface layers.

- 3.8. The proposed basement structure introduces new dynamics, where the pile axial dynamics and soil structure interaction of basement box, although heavily damped in their coupling to the soil may still bring more energy to the surface layers.
- 3.9. The groundborne noise intrusion from the underground trains is already evident within the Main Hall at a level that presents a problem and an increase in this intrusion will likely render this studio unusable.
- 3.10. There is a possibility that the transmission path may alter not just the magnitude, but spectral distribution in a way that certain frequencies become more troublesome than hitherto. Under this condition the change at specific frequencies can be more dramatic, as a resonant response can be very significant, compared to a situation where there is a frequency mismatch. This could give rise to spectral components suffering a large multiple increase rather than just a fractional change.
- 3.11. The Applicant's technical advisers have not provided any information to address these potential impacts, which have very serious consequences to the performance and therefore viability of the studios.
- 3.12. Structural and ground dynamics are highly complex for the system comprising the underground rail sources, the transmission paths and the receivers, and there is significant uncertainty in modelling outcomes. It is not suggested that all of the possible mechanisms will conspire to make the situation worse, there will be competing factors, which would need to be thoroughly modelled and calculated. The problem is that even after the most sophisticated analysis is undertaken, supplemented with an array of relevant site tests, which will help to reduce uncertainty, the net uncertainty that will remain will itself present a problem. So the question should arise, as to who or what entity should bear the burden of the net risk, and what if any are the remedies available.
- 3.13. The situation is in fact compounded because there is no plausible mitigation that could be implemented after the event.
- 3.14. Changes can also arise due to maintenance issues at the source, or due to operational changes by LUL. There are many factors that can alter groundborne noise and vibration from underground railways, but in all such cases, changes in the transmission path could increase the consequences. Such consequences need to be considered throughout the lifetime of a development.
- 3.15. The problem follows from what is already a difficult situation, borne out by the original designers having to make a listed building a functional facility, having been compromised in their design for the Main Hall by the listed building constraints. That means that any further additional intrusions during recording time, would make the opportunity to re-record all the harder to achieve. This relates to construction impacts, as well as the risk that the already difficult groundborne noise issue in the Main Hall could worsen, and tip the balance on viability of that recording space.

- 3.16. The underground trains are an extended line source, with correlated and uncorrelated inputs which affect all points of the building in varying degrees, and specifically it is the varying local dynamics response of radiating surfaces, that ensure that the building as a whole must be considered. It has also been stated that the source of groundborne vibration is dependent upon track condition as well as the rolling stock, and it is the track condition that varies along the alignment, which might not just be at its worst at the point of closest tunnel alignment and the condition of the track can vary over time. Therefore, there is a zone of ground, that encompasses multiple paths that are affected by the proposed deep basement and associated piling. The mechanisms of change associated with piling deeper into the ground, changing transmission characteristics has not been addressed.
- 3.17. There are also risks that the ground vibration spectrum may change in magnitude and spectral shape, which could alter the situation within the presently isolated studios. Their performance under groundborne noise from the rail source is one issue and their ability to cope with groundworks related vibration sources another, noting the building isolation system is not a very low frequency isolation system but relatively higher and so make the isolated studios potentially vulnerable.
- 3.18. It is our opinion that Air Studios with the need for continued excellence in acoustics, central to their business viability, will suffer harm to this amenity, contrary to Camden Development Policy DP26 and DP27, if changes in transmission characteristics make the impact of underground trains more evident. The information submitted by the Applicant to the Council to date is not sufficient to enable CED to advise Air Studios that the Applicants' proposals will be policy compliant, in so far as avoiding harm to their amenity, and for this to continue to be the case throughout the lifetime of the development.
- 3.19. It is our opinion that Air Studios with the need for continued excellence in acoustics, central to their business viability, will inevitably suffer harm during the construction phase of this basement, demonstrated by the harm to their amenity arising from the minor Trial Pit Archaeological investigation. The information submitted to the Council by the Applicant to date is not sufficient to enable CED to advise Air Studios that the Applicants' proposals will be policy compliant, in so far as avoiding harm to their amenity during the construction phase.
- 3.20. There are consequences of reputational damage and loss of business to Air Studios which are very serious and irreversible.
- 3.21. There is a possibility that not only will Air Studios suffer harm to their amenity, but the residential terrace Block 9 Rosslyn Hill which is closer to the tunnel may already be experiencing or complaining about groundborne noise from the Northern Line, and or road traffic vibration. It is assumed the Council would as part of this disclosure, consider harm to amenity of other neighbours due to additional impacts that may arise to the various receptors there.
- 3.22. It should also be a matter of concern to the Applicants, that such changes could also increase the impact of groundborne noise from the tunnels to their own property, which may blight the environment they currently enjoy, and so require the Council to ensure the impact assessments are broader to cater for the issues to all parties that can be adversely affected, whether they realise it or not.

- 3.23. Given that LUL clearly state that the depth and alignment of the tunnel is indicative and not to be used for design purposes it would be prudent to accept their advice that a survey is commissioned to establish that accurately, as it is so relevant to the issues raised.

#### **4. ACOUSTIC INTEGRITY OF BUILDING FABRIC**

- 4.1. Whilst hairline cracks might be regarded as negligible in a typical building damage classification, they are however potentially very severe in terms of impairing acoustic integrity for a fabric required to contain very high sound pressure levels. The Camden Development Policy in DP 26.9 recognises the importance of an air tight building.
- 4.2. Due to these reasons the burden on structural monitoring, adequate baselines from extended monitoring prior to any proposed works and the implementation of more conservative building movement limits are needed to safeguard acoustic integrity, which triggers a concern at a lower threshold compared to structural integrity.
- 4.3. The listed building of Air Studios, based upon various vulnerabilities including the large arched openings in its façade, and differential foundation arrangements still undetermined, and hard brittle pointing is likely to score high in the Sensitivity Assessment of Listed Buildings. The forgoing issues require special care at this site, to avoid cumulative impact DP 27 (c) from movements arising from a new basement which can add to movements which this building is already vulnerable to.

#### **5. BASE ISOLATED STUDIOS**

- 5.1. The current base isolation of some of the studios is not optimum due to the constraints of the Listed Building. Tico bearings are relatively stiff and give rise to high natural frequency systems, whereas the highest specification solutions adopt much softer isolators, and even steel coil systems. This implies that although the studios are floated, they have been done so using relatively stiff isolators, and whilst they appear to meet their present requirements, they are not necessarily capable of isolating all sources. They will be limited in their ability to cope with an increase in groundborne noise and vibration from rail systems or from certain construction processes.

## 6. ARCHAEOLOGICAL TRIAL PITS

6.1. Fig 6.1 highlights the Archaeological Trench (1) that was previously dug during December 2015, superimposed on the planned revised basement scheme. At closest proximity, the archaeological trench (Tr1) and the proposed deep basement are within about 7m of the Air Studios building.

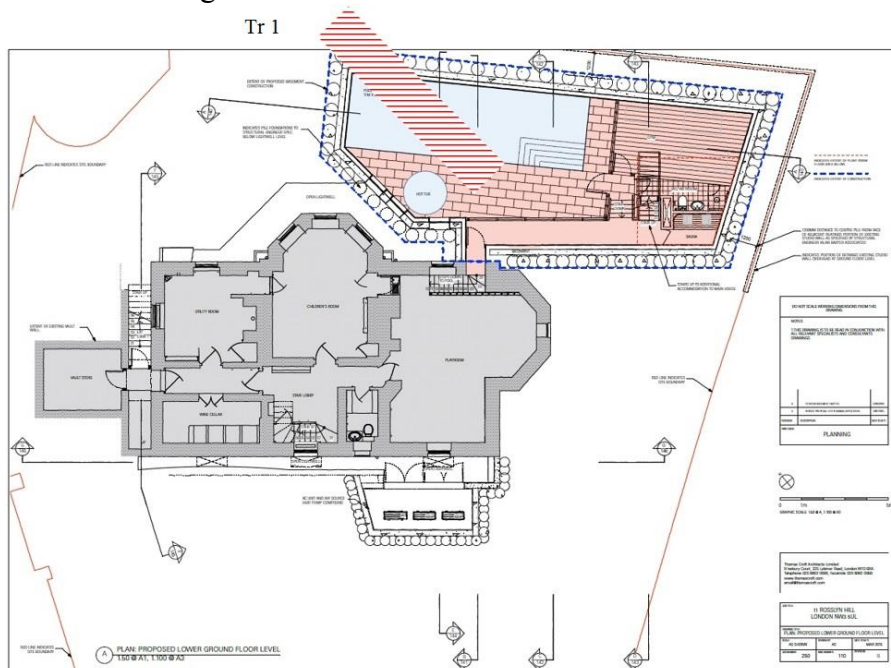


Fig 6.1

6.2. It is significant to note that the Applicants’ representative in planning the works for the Archaeological Trial Pits (Trench 2 not shown) confirmed to seek to undertake the noisiest works between the hours of 8am and 10am on the days the studios were in use, having been informed that recording that particular week on the days of studio use would begin after 11am. It was therefore surprising to see the pecker, an obvious noisy activity, being used without regard to that arrangement, and persisting in use through the middle of that day during which studios were timetabled for use. Such breaches of a voluntary arrangement would understandably undermine confidence in any future arrangements. Such experience shows that harm to amenity is almost guaranteed to take place, despite any prior arrangements given with the best of intentions or for expediency. There is therefore a net impact, which will not be eliminated and the evidence of arrangements failing on the small minor works here are a reasonable indicator to the future. Furthermore, CED reported measurement samples which show that even minor works (trench 1 within 7m of Air Studios) are very intrusive and incompatible for recording studio use, causing harm to amenity.

**7. SUMMARY**

- 7.1. The information submitted to the Council to date is not sufficient to enable CED to advise Air Studios that the Applicants' proposals will be policy compliant, in so far as avoiding harm to their amenity, and for this to continue to be the case throughout the lifetime of the development with regard to impact of the underground railway and how this can be modified by the new deep basement.
- 7.2. The information submitted to the Council to date is not sufficient to enable CED to advise Air Studios that the Applicants' proposals will be policy compliant, in so far as avoiding harm to their amenity during the construction phase of the new deep basement. The arrangements that were promised in relation to the minor works of the Archaeological trial pits were not observed by the Applicants' contractor, and shows that whatever conditions might be sought, there will inevitably be harm to the amenity of Air Studios facility.