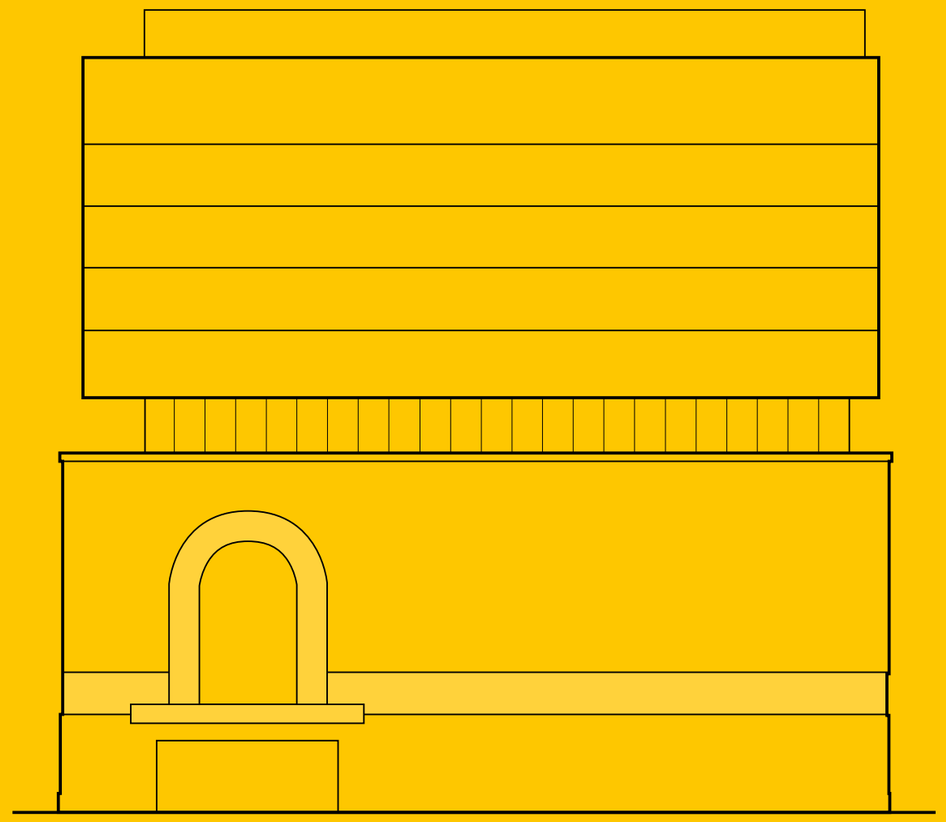

SAVILLE THEATRE

135 SHAFTESBURY AVENUE

NOISE IMPACT ASSESSMENT

HOARE LEA

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	24/01/2024	Draft for Client review	MB	BJ	BJ
01	29/01/2024	Issue for planning	MB	BJ	BJ
02	31/01/2024	Revised description of development	MB	AH	BJ
03	28/01/2025	Revised design assessments	FT/BJ	BJ	BJ

Project number: 10-13133
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Non-technical summary

A noise impact assessment has been undertaken in relation to the proposed redevelopment of the historic Saville Theatre at 135-149 Shaftesbury Avenue in London. This document has been prepared as an accompaniment to the planning application and sets out to demonstrate that the design provisions are suitable to meet planning policy requirements on noise.

This document is a revision to the report that was submitted with the original planning application. There has been one key change which has involved remodelling of plant noise emissions with the revised roof layout and updated preliminary equipment selections. The outcome of the assessment remains the same with the principles of the noise control measures unchanged.

Environmental sound surveys

Environmental sound measurements were taken to establish the baseline sound conditions experienced around the site and by neighbouring noise sensitive receptors. Results from the survey have informed the noise impact assessment, particularly in deriving noise emission limits for new building services plant in line with London Borough of Camden policy.

The site is subject to relatively high sound levels along Shaftesbury Avenue, which are attributed to road traffic vehicles and people noise. Noise sensitive receptors to the rear of the site along New Compton Street and at Phoenix Gardens experience relatively lower sound levels, although it is noted that distant sound from Shaftesbury Avenue and Charing Cross Road is audible.

Noise and vibration from demolition and construction

Consideration has been given to noise and vibration during demolition and construction.

The developer recognises that is a requirement of both London Borough of Camden (LBC) and the Control of Pollution Act 1974 that Contractors employ 'Best Practicable Means' to reduce noise to a minimum.

Noise and vibration effects during the construction and demolition phase will be managed through the implementation of best practicable means, set out within a Construction Management Plan (CMP). An outline CMP has been submitted alongside the planning application which includes preliminary noise and vibration control measures. These include a commitment to real-time monitoring of noise and vibration throughout construction.

Containing theatre sound within the venue

Production sound from the theatre will need to be contained within the venue to minimise impact upon neighbouring buildings.

The theatre will be fully located below ground level, thereby designing out direct sound-transfer paths to outside.

The theatre will be built within an acoustic box to protect the venue against noise from underground trains, as well as to limit sound transfer to other parts of the development. The main potential path for sound breakout is therefore in-direct sound escaping through the ventilation system.

This will be controlled via the use of sound attenuators installed within the ventilation ductwork, The attenuators will be specified to reduce theatre sound to an appropriately low sound level in line with LBC's policy on entertainment noise.

Noise from patrons queuing outside the theatre

Consideration has been given to noise from patrons queuing for the theatre. The current strategy is for patrons to queue along the Shaftesbury Avenue façade of the theatre, and not to use the quieter side streets (Stacey Street and St Giles Passage) for queuing. This therefore keeps queuing areas away from the nearby residential buildings and therefore aligns with the guidance within the CPG Amenity document.

Shaftesbury Avenue currently experiences high levels of environmental sound from road vehicles and pedestrians. Sound from the queue will be masked by this existing ambient noise, which will enable the new sound to blend into the existing soundscape.

Hotel guests arriving by taxi

The site benefits from excellent transport links. However, it is recognised that there may be occasional guests arriving by taxi. The hotel entrance is located away from residential receptors and is in an area already exposed to traffic noise. Considering the low anticipated number of vehicles and recognising that an increasing number of taxis in London transitioning to electric vehicles, the impact of noise from this source is considered negligible.

Noise from deliveries, servicing, and waste collection

Noise from deliveries, servicing and waste collection will also need to be managed to minimise the impact of neighbouring receptors.

The Framework Delivery, Waste and Servicing Plan submitted alongside the planning application confirms that these activities will take place during times aligning with LBCs standard requirements, and it is expected that delivery times will be enforced by a standard planning condition attached to any decision notice for the scheme.

It is noted that the existing acoustic environmental already includes noise from delivery vehicles, with multiple deliveries observed along Stacey Street, Phoenix Street and New Compton Street during the environmental sound survey. Based upon information provided by the project Transport Consultant, the number of daily vehicles associated with deliveries, servicing and waste are similar to those associated with the existing cinema use. As such, the proposed development is not expected to significantly change the acoustic character of the area.

Noise from building services plant

Finally, an assessment of noise from building services plant associated with the proposed development has been undertaken. The building will be served by several air source heat pumps (ASHPs), air handling units and ventilation fans split between the basement and roof levels.

Plant noise emission limits have been defined with reference to LBCs planning policy. Separate limits are proposed for neighbouring residential and commercial receptors, as well as at nearby public amenity spaces.

Preliminary assessments identified the need for physical noise control measures to be integrated within the design. These are relatively standard controls, including acoustic attenuation packages to the ASHPs, sound attenuators to the air inlets and outlets of all ventilation plant, and a solid acoustic screen enclosing the rooftop plant area.

Subsequent assessments, based upon typical equipment selections provided by the project mechanical engineer, have confirmed that noise from the proposed plant can be controlled to the defined noise emission limits.

Controlling external noise to the hotel

An assessment of noise break-in to the hotel bedrooms concluded that appropriate internal sound levels in line with LBC's requirements can be achieved with commercially available double glazed window systems in combination with relatively lightweight external wall constructions.

Conclusion

On the basis of this assessment, noise and vibration associated with the development can be controlled to appropriate levels through a combination of physical noise control and management policies secured by planning condition. As such, noise and vibration should not pose an obstacle to granting planning permission for the proposed development.

1. Introduction

There are proposals to redevelop the Grade II listed building located at 135-149 Shaftesbury Avenue in London, to provide a new venue within the heart of the London theatre district. The building, which has historically been known as the Saville Theatre, is currently used as an Odeon multiplex cinema.

Planning permission is sought for the following:

Part demolition, restoration and refurbishment of the existing Grade II listed building, roof extension, and excavation of basement space, to provide a theatre at lower levels, with ancillary restaurant / bar space (Sui Generis) at ground floor level; and hotel (Class C1) at upper levels; provision of ancillary cycle parking, servicing and rooftop plant, and other associated works.

This report provides a noise impact assessment undertaken in support of the planning application. An environmental sound survey has been undertaken to quantify the existing acoustic environment experienced around the Site and by neighbouring noise sensitive receptors. Results from the survey have been used to inform the design and subsequent noise impact assessment.

Key acoustic elements that have been considered are:

- Noise and vibration effects during the construction phase of the project,
- Sound breakout from the venue,
- Noise emissions from building services plant,
- Noise from ancillary activities, including deliveries.

Recognising that the report is necessarily technical in nature, a glossary of acoustic terms has been provided in Appendix A.

2. Description of site and surroundings

The site is located at 135-149 Shaftesbury Avenue within the London Borough of Camden.

Shaftesbury Avenue, which runs parallel to the south-eastern site boundary, is the predominant source of environmental sound in the area, attributable to regular road vehicles including frequent busses. Additional road traffic, including regular delivery and servicing vehicles, is present along Stacey Street, to the west of the site.

To the north of the site are New Compton Street and The Phoenix Garden, a community-run green space. As well as sounds from local flora and fauna within the garden itself, the acoustic environment here is characterised by distant road traffic and construction from further afield within London, with an underlying level of noise from existing building services plant from the surrounding buildings. Occasional vehicle movements have been observed along New Compton St, as well as noise from relatively frequent deliveries along New Compton Street, Stacey Street, and Phoenix Street.

The neighbouring buildings comprise a mix of commercial and residential buildings. To the west of the site, 125 Shaftesbury Avenue is an unoccupied office building, most recently used by WeWork, and currently due to be redeveloped to provide new modern workspaces. Shaftesbury House is also commercial office space and located to the east of the site.

The nearest residential receptors are located at 3-45 New Compton Street to the northeast, with two further residential developments (7-10 Stacey Street and 1A Phoenix Street) to the northwest. It should be recognised that there will be additional residential receptors in the surrounding areas. However, these will inherently be protected by controlling noise to the nearest noise sensitive receptors identified above.

With regard to environmental vibration, the site is located relatively close to underground tunnels for the London Underground (LU) Northern and Elizabeth lines, although it is noted that these do not run directly beneath the proposed development (the nearest tunnel is understood to be approximately 80-100 m away).

An aerial view, showing the site and surroundings, is provided in Figure 1.

Figure 1 Aerial view of site and surrounding. Image source: Google Maps

3. Environmental sound survey

An environmental sound survey was undertaken in January 2024 to establish the typical sound environment around the site and experienced by surrounding buildings.

The survey comprised long-term sound measurements at two fixed positions on the roof of the existing building, supplemented by attended measurements at select locations around the site. The measurement locations and key measurement results are shown in Figure 2, with full details of the environmental sound survey provided in Appendix B. All results are presented as free-field values.

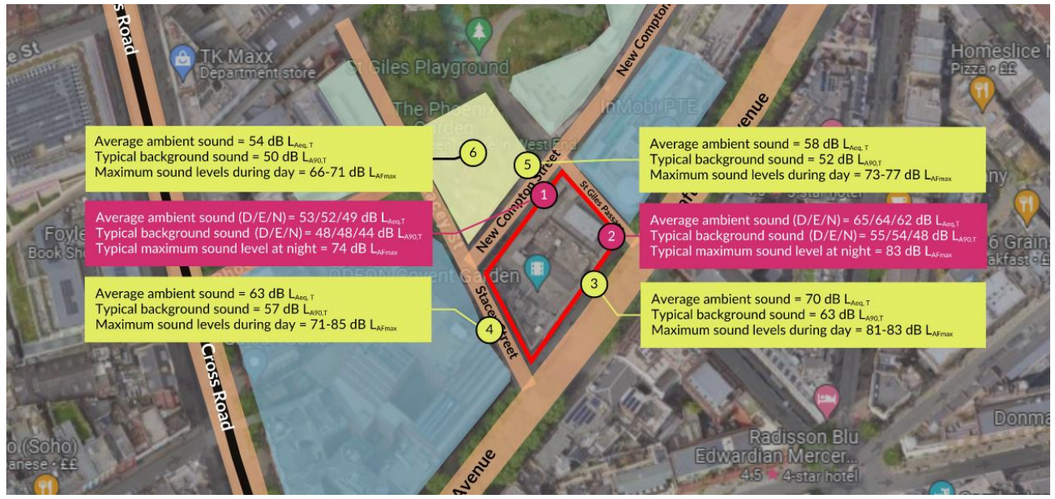


Figure 2 Environmental sound survey measurement positions and results.
D = Daytime (0700-1900), E = Evening (1900-2300), N = Night (2300-0700)

Table 1 Description of measurement positions

Position	Duration	Description
1	Long-term	Roof level of existing building overlooking 3-45 New Compton Street and The Phoenix Garden. Also used to represent residences along Stacey Street and Phoenix Street.
2	Long-term	Roof level of existing building overlooking Shaftesbury Avenue. Used to represent commercial buildings at 125 Shaftesbury Avenue and Shaftesbury House.
3	Short-term	Ground floor position along Shaftesbury Avenue
4	Short-term	Ground floor position along Stacey Street
5	Short-term	Ground floor position at corner of New Compton Street and St Giles Passage
6	Short-term	Ground floor position in centre of the Phoenix Garden

Daytime ambient sound levels along Shaftesbury Avenue are fairly typical of an inner-city location close to a major road. Sound levels to the north of the site (along New Compton Street and within Phoenix Garden) are reduced, although it was noted that residual road traffic from Shaftesbury Avenue is audible at these positions.

There is relatively little change in the ambient sound level across the day, with a 1 dB drop in sound level typically observed during the evening hours, and 3 dB at night compared to the typical day.

3.1 Background sound levels

Based upon the noise survey work undertaken, representative background sound levels have been defined following a statistical analysis of the measurement data. The stated background sound levels represent the cumulative 10th percentile of all measured L_{A90} values.

The representative background sound levels form the basis of noise emission limits for building services plant, which are defined in section 10 of this report.

Table 2 Representative background sound levels measured during environmental sound survey

Position	Representative background sound level, dB $L_{A90,15min}$		
	Day (0700-1900)	Evening (1900-2300)	Night (2300-0700)
1	48	48	44
2	55	54	48

4. Acoustic design standards

Appropriate, well established guidance on the assessment of noise and acoustic design relevant to planning for 135-149 Shaftesbury Avenue is available from a variety of sources including, but not limited to, the following:

- National Planning Policy Framework (NPPF) Department for Levelling Up, Housing & Communities (DLUHC): 2024
- Planning Practice Guidance (PPG), Noise, 2019
- London Borough of Camden (LBC) local policy, including the Local Plan 2017, and the 2021 Camden Planning Guidance (CPG) document 'Amenity'
- British Standard BS 4142, 2014 + A1 2019: *Methods for rating and assessing industrial and commercial noise*

4.1 LBC local policy relating to noise

LBC's policy relating to noise is summarised within the Local Plan 2017, principally through policy A4 *Noise and vibration* which states:

> *The council will seek to ensure that noise and vibration is controlled and managed.*
>
> *Developments should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:*
>
> *a) Development likely to generate unacceptable noise and vibration impacts, or*
> *b) Development sensitive to noise in locations which experience high levels of noise unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.*
>
> *We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.*

4.1.1 Camden's Noise and Vibration Thresholds (Local Plan Appendix 3)

LBC's Local Plan sets out the noise and vibration thresholds that are to be achieved by new development within the borough. The thresholds recognise that the significance of noise impact varies depending on a number of factors.

LBC's approach to evaluating the significance of noise uses a red/amber/green (RAG) system based upon the 'effect levels' described in NPPF and PPG. Broadly, the approach is summarised as per Table 3 below.

Table 3 LBC's basic acceptability criteria

Criteria	Effect level as defined in NPPF*	Acceptability according to LBC Local Plan Appendix 3
Green	LOAEL	Where noise is considered to be at an acceptable level
Amber	LOAEL to SOAEL	Where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development
Red	SOAEL	Where noise is observed to have a significant adverse effect

*NOEL: No observed effect level, LOAEL: Lowest observed adverse effect level, SOAEL: Significant observed adverse effect level.

Appendix 3 of the local plan sets out the thresholds for red, amber and green for several types of noise and development.

Noise from building services plant
LBC require that plant noise is controlled to limiting levels, relative to the level of background sound that is experienced at an existing noise sensitive receptor. Noise limits are expressed as 'Rating Levels' as defined within BS 4142 and therefore will include penalties for identifiable acoustic character such as tonality.

The following requirements are set out within LBC's Local Plan:

Table 4 LBC's plant noise emissions acceptability criteria

Noise sensitive receptor	Period*	Assessment location	Acceptability criteria		
			Green	Amber	Red
Dwellings	Day	Gardens used for main amenity (free field), Outside living/dining/bedroom window (façade)	Rating level 10 dB or more below background	Rating level -9 to +5 dB relative to background	Rating level more than +5 dB above background
Dwellings	Night*	Outside bedroom window (façade)	Rating levels as per daytime, and no individual events exceeding 57 dB L_{Amax}	Rating levels as per daytime, or Individual events 57-88 dB L_{Amax}	Rating levels as per daytime, or Individual events exceeding 88 dB L_{Amax}

* Day = 07:00-23:00 hrs, Night = 23:00 -07:00 hrs, as defined within the Local Plan Appendix 3.

It should be noted that criteria are only provided to control noise at dwellings, and the Local Plan specifically states that these levels are use specific and that "*different levels will apply dependent on the use of the premises".*

For the commercial properties at 125 Shaftesbury Avenue and Shaftesbury House, it is proposed that a rating level not exceeding the daytime background sound level is achieved. According to BS 4142, "*where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context"* . With regard to context, the resultant sound levels within the commercial buildings would be significantly lower than the normal design standards for office buildings recommended by the British Council for Offices (BCO) and would not be expected to be noticeable over other normally occurring sounds within the offices.

The Local Plan explicitly states that noise from emergency equipment should be designed to meet a noise criteria no more than 10 dB above the background sound level when used for short periods (i.e. periodic testing).

Entertainment noise
LBC's Local Plan also provides requirements for controlling entertainment noise, which includes consideration of amplified and unamplified music and noise from patrons. Separate limits are set out for residential gardens.

The following requirements are set out within LBC's Local Plan:

Table 5 LBC's entertainment noise acceptability criteria for gardens

Noise sensitive receptor	Period*	Assessment location	Acceptability criteria		
			Green	Amber	Red
Dwellings	Day	Gardens used for main amenity (free field)	The higher of: 55 dB $L_{Aeq,5min}$ or 10 dB below the existing $L_{Aeq,5min}$ without entertainment noise	The higher of: 56-60 dB L_{Aeq} or 9-3 dB below the existing $L_{Aeq,5min}$ without entertainment noise	The higher of: 61 dB L_{Aeq} or 2 dB below the existing $L_{Aeq,5min}$ without entertainment noise
Dwellings	Evening	Gardens used for main amenity (free field)	The higher of: 50 dB $L_{Aeq,5min}$ or 10 dB below the existing $L_{Aeq,5min}$ without entertainment noise	The higher of: 51-55 dB L_{Aeq} or 9-3 dB below the existing $L_{Aeq,5min}$ without entertainment noise	The higher of: 56 dB L_{Aeq} or 2 dB below the existing $L_{Aeq,5min}$ without entertainment noise
Dwellings	Night*	Gardens used for main amenity (free field)	The higher of: 45 dB $L_{Aeq,5min}$ or 10 dB below the existing $L_{Aeq,5min}$ without entertainment noise	The higher of: 46-50 dB L_{Aeq} or 9-3 dB below the existing $L_{Aeq,5min}$ without entertainment noise	The higher of: 51 dB L_{Aeq} or 2 dB below the existing $L_{Aeq,5min}$ without entertainment noise

* Day = 07:00-19:00 hrs, Evening = 19:00 – 23:00, Night = 23:00 -07:00 hrs, as defined within the Local Plan Appendix 3.

Additionally, the Local Plan sets out that entertainment noise should be controlled to not exceed NR 35 within habitable rooms within dwellings during the day, or NR 25 within bedrooms at night (23:00-07:00).

5. Demolition and construction noise and vibration

5.1 Noise during demolition and construction

Noise from activities during the demolition and construction phase of the development will need to be controlled to minimise the impact on neighbouring receptors. Typical activities are expected to include:

- Site set-up: Installing scaffold, set up of tower crane,
- Demolition: Soft strip of internal building elements, breaking out concrete slabs, breaking out masonry loadbearing walls
- Groundworks: Excavation and mucking away,
- Construction: Steel frame erection, concrete pumping, operating tower crane, general hand-tool use

It is reasonable to expect that, if no consideration were given to noise from construction activity, there would be a risk of higher than ideal noise levels which may lead to complaint from nearby neighbours. It is, however, a requirement of both London Borough of Camden (LBC) and the Control of Pollution Act 1974 that Contractors employ 'Best Practicable Means' to reduce noise to a minimum. LBC provide further guidance within their document *'Camden's Minimum Requirements for Building Construction'*.

An outline Construction Management Plan (CMP) has been submitted alongside the planning application, which sets out the measures that will be taken to minimise the noise impact of demolition and construction works. The CMP commits to the following measures:

- Works will only be undertaken between 0800-1800 hrs Monday to Friday and 0800-1300 hrs Saturday. No works will be carried outside of these hours unless first agreed and approved by LBC.
- A Community Liaison Group will be formed to keep members of the community informed of upcoming construction related activities and for local residents to relay concerns to the Construction team.
- The Contractor will enter into a Section 61 (S61) agreement with LBC. As part of the S61 commitments, construction noise limits will be agreed. The outline CMP proposes a limit of 75 dB $L_{Aeq,10hr}$ which is commonly agreed for construction projects within London.
- As part of the S61 agreement, the Contractor commits to the implementation of 'quiet periods', which would typically follow a 'Two hours on / Two hours off' working pattern to provide relief from construction noise throughout the day.
- A noise monitoring system will be installed to record construction noise levels in real time. The monitoring system will be set to trigger alarms if the agreed noise-threshold is exceeded. Should the pre-agreed trigger levels be exceeded, works will be stopped, and remedial actions taken to reduce noise to an acceptable level. Measurement records will be made available via a publicly available online platform.
- Construction techniques and processes will be chosen to minimise noise at source as far as possible.
- The Contractor will implement acoustic screening where necessary to shield noise sensitive receptors from construction plant (e.g. concrete pumps)
- Temporary building power supplies will be sought to reduce reliance on generators.

At this stage, the exact processes and construction techniques are to be finalised and therefore a detailed quantitative assessment cannot be undertaken. However, with the above measures in place, in particular the commitment to monitor noise throughout the building programme, it is considered that noise due to demolition and construction can be suitably controlled to neighbouring noise sensitive receptors.

On the assumption that the 'two-hours on/two hours off' working pattern is agreed (i.e. 60% 'on' time), noise levels of up to 80 dB L_{Aeq} could typically be reduced to the overall limit of 75 dB $L_{Aeq,10hr}$ proposed in the outline CMP. There are several examples of historic data listed within BS 5228-1, for the likely noise-generating activities set out above, that fall below or within this range.

Specific details of the noise control measures will need to be developed post-planning by the incoming Contractor as part of a final Construction Management Plan. The need to provide such mitigation measures can be secured by inclusion of an appropriate planning condition attached to any decision notice for the scheme.

5.2 Vibration during demolition and construction

Vibration during demolition and construction will need to be controlled to minimise the impact on neighbouring receptors.

Guidance on human perception of vibration can be found within BS 5228-2 for both human perception and the onset of building damage. It is noted that the thresholds at which cosmetic damage to buildings is likely to occur are significantly higher than human perception thresholds (i.e. buildings are more tolerant of vibration).

The outline CMP commits to the monitoring of vibration, in line with *Camden's Minimum Requirements for Building Construction'* This document also suggests vibration thresholds not to be exceeded of 1 mm/s PPV for residential buildings, and 2 mm/s at commercial buildings. The criteria for residential buildings align with guidance in BS 5228-2 and is commonly agreed as a trigger threshold.

Piling operations during the early phases of construction present the main risk of vibration effects to surrounding properties. Other activities are unlikely to generate significant levels of vibration over prolonged periods. Excavation, for example, can result in transient vibrations at the moment of impact between the grabber and solid ground, or if the grabber collides with a solid surrounding element, but typically isn't a source of continuous vibration.

The structural design has been developed based upon underpinning the existing building, rather than utilising a piling solution. Therefore, the need for site-wide piling has been largely designed out. There may be a need for a limited number of piles to support the tower crane, although specific requirements are to be confirmed.

Any piling that would be required would be undertaken using Continuous-Flight-Auger techniques. Whilst there is no ratified method for predicting vibration from this type of piling, it is commonly recognised that it generates the least noise and vibration, and there are several examples of auger-based piling within BS 5228-2 at distances less than 10 m that result in PPV values lower than the trigger levels set out above.

It is therefore considered that the impact of vibration during demolition and construction can be suitably controlled through a combination of on-site monitoring and review. The specific requirements can be set out within the final Construction Management Plan, secured via an appropriately worded planning condition attached to any decision notice for the scheme.

6. Sound breakout from the theatre to outside

Sound from within the theatre will need to be controlled to limit the noise impact to surrounding buildings.

The proposals are to locate the theatre below ground at subterranean levels. This will help with containing production sound within the venue as there are no direct sound transmission paths to outside. There will, however, be a need to carefully develop the detailed design to ensure that event sound does not escape via less obvious indirect sound transfer paths.

6.1 Containing sound within the venue

The theatre will be built within an acoustically lined box. The purpose of the box is twofold:

1. To protect the venue against re-radiated noise from underground trains,
2. To prevent sound from the venue from reaching other parts of the development through common structures (including the existing façade) to ensure that music and other production sound is not audible in the hotel bedrooms above. This will inherently limit venue sound from escaping to the outside.

The specific details of the acoustic box will be developed further as the design is progressed post-planning, but fundamentally it will comprise an acoustically isolated floor within the venue, with independent wall linings and acoustic ceilings where required. Any new structure required to support the hotel extension will be isolated using specialist acoustic bearings to separate the hotel from the theatre structure.

6.2 Reducing sound breakout through the building ventilation system

Noise from the ventilation plant itself will be controlled to meet LBC requirements through the use of silencers installed within the ductwork system. The main risk is event noise from the theatre breaking into the ventilation ductwork and being emitted through the external grilles.

To overcome this, in-duct silencers will need to be designed to account for both noise from the ventilation equipment, and the additional event noise entering the system to achieve appropriate external noise levels.

Audio systems within the theatre would also be fitted with sound limiter devices to aid with control of maximum operational sound levels. The sizing of attenuators would be subject to further detailed design at a later stage, and selections will be made with reference to both existing noise sensitive receivers, and also hotel bedrooms as part of the development.

At this early stage, it is proposed that sound from the theatre (in terms of the parameter $L_{Aeq,5min}$) will be limited to not exceed background sound levels outside the nearest residential receptors along New Compton Street. This would result in a breakout sound level of less than 35 dB (A) outside, which would enable internal sound levels of less than NR 25 to be achieved, in line with LBC's entertainment noise policy.

7. Sound from patrons queuing

Consideration has been given to the potential impact of patrons queuing to enter, and leaving, the theatre. Whilst the level of sound from patrons queuing is difficult to predict, as it will be dependent upon the number of people in the queue at any one time, it is possible to provide a qualitative assessment to place the sound into context. The CPG document "Amenity" provides guidance on measures that should be taken to manage this type of sound. Relevant extracts from this document advise that:

- *Access routes, outdoor standing/seating areas, smoking areas, pub gardens etc should be sited away from noise sensitive facades and/or effectively screened,*
- *The Council will* [...] *consider the use of management plans secured through a section 106 legal agreement, which may include elements principally seeking to manage noise off-site. Examples could include: Staff training,* [and] *positioning queues away from residential buildings.*

The theatre entrance is in the same location as the existing Odeon cinema entrance. The current strategy is for patrons to queue along the Shaftesbury Avenue façade of the theatre, and not to use the quieter side streets (Stacey Street and St Giles Passage) for queuing. This therefore keeps queuing areas away from the nearby residential buildings and therefore aligns with the guidance within the *CPG Amenity* document. The existing acoustic environment is characterised by a mixture of noise from existing road traffic and pedestrians, and so the sound of patrons queuing for the theatre will be in keeping with the existing character of the area.

Based upon measurements undertaken during the environmental sound survey, ambient sound levels at ground level are typically in the order of 70 dB L_{Aeq} during the day. This is expected to fall to by approximately 1 dB during times when patrons are likely to be queuing for evening shows, i.e. 69-70 dB during the evening.

A single person speaking at a normal vocal level is typically 60-65 dB(A) at 1 m. Even with multiple people speaking at once, sound generated within by patrons queuing will be lower than the prevailing ambient noise at neighbouring buildings along Shaftesbury Avenue. Sound from the queue will therefore be masked by existing ambient noise, which will enable new sound to blend into the existing soundscape.

8. Hotel guests arriving by taxi

The site is located within central London and is easily accessible via a number of public transport links. However, there is potential for some guests to arrive by taxi. Although there are no formal taxi drop-off areas, the hotel entrance is located along Stacey Street and is therefore located away from residential receptors.

The project Transport Consultant has advised that there may be between 30-40 taxis per day. Stacey Street is currently used by passenger cars and is also subject to residual road traffic noise from Shaftesbury Avenue. The impact of an additional 30-40 passenger cars, even if they were to all arrive within a single hour, would be negligible (This number of vehicles is so low that it falls below the scope of the Department of Transport's *Calculation of Road Traffic Noise* document; the industry standard for calculating noise from road vehicles).

Furthermore, there is an increase in taxi companies using electric vehicles within London which will limit the potential impact of noise from taxis. When travelling at 20 mph, the posted speed limit along Stacey Street and New Compton Street, electric vehicles are extremely quiet. Noise from guests arriving by taxi is therefore expected to result in negligible change in the acoustic character of the area.

9. Noise from deliveries, servicing, and waste collection

There will be a need for deliveries to the building as well as for servicing and waste collection. Noise from these activities will need to be managed to limit the noise impact on neighbouring noise sensitive receptors.

Policy A4 of the 2017 Local Plan states that LBC will seek to minimise the impact of deliveries. Both the Local Plan, and the Amenity CPG document state that the Council expects deliveries and refuse collections to be carried out between 0800 and 2000 hrs. The documents state that a noise impact assessment is required if deliveries take place outside of these times to demonstrate that there will be no adverse impact in relation to noise. The Framework Delivery, Waste & Servicing Plan (FDWSP) for the Proposed Development confirms that deliveries and waste collection will take place during the Council's standard hours of 0800-2000. It is likely that this will be secured by a standard planning condition attached to any Decision Notice for the Proposed Development.

In addition to adhering to the Council's standard delivery hours, a qualitative assessment has been undertaken considering the context in which noise from future deliveries will be occurring:

- Based upon information provided by the Transport Consultant, deliveries and servicing vehicles for the combined uses of hotel, theatre and restaurant, are expected to result in a peak of up to 22 vehicles per day (including three medium-sized vehicles and 1 heavy-goods vehicle). With the management measures proposed within the FDWSP in place, it is anticipated that most days will experience traffic flows closer to 11-12 vehicles per day, further reducing the impact of noise sensitive receptors.
- Traffic flow data provided by the Transport Consultant for the existing site indicates that the cinema has average daily traffic flows of 28 vehicles including 3 HGVs. Therefore, the number of peak day vehicles is broadly similar to the current cinema use.
- It is understood that existing vehicles, and vehicles associated with the Proposed Development, will both arrive at the site following the same route along New Compton Street.
- It is also noted that the existing acoustic environmental already includes noise from delivery vehicles from other vehicles not associated with the cinema or Proposed Development. During the environmental sound survey, regular vehicles were observed making deliveries to various recipients on Stacey Street, Phoenix Street and New Compton Street. As such, the acoustic character of the area will not be changed as a result of this noise source.

Accounting for the above context, the Proposed Development is not expected to result in significant changes in noise due to vehicles associated with delivery and servicing activities.

To further minimise the impact of noise during the delivery period itself, and during collection of waste, management measures could be integrated within the final FDWSP. Such measures could include:

- Providing training to ensure that staff are aware of the need to control noise to surrounding neighbours,
- Vehicle engines to be switched off if waiting for the delivery slot to open,
- Any radios, either within delivery vehicles or the loading area, to be switched off while doors are open,
- For keg deliveries, ensure dropping beds are used when dropping keys into and out of the vehicle. The use of sack trucks with rubber tyres is preferable for moving kegs than rolling along the ground.
- Disposal of glass bottles and cans into outdoor bins should not take place at night. The Amenity CPG (para 6.34). specifically states that this requirement can be secured by planning condition. The impact of bottle disposal can be further managed by undertaking as much of this process inside as possible, thereby minimising the duration of noise exposure externally.

10. Noise from building services plant

The control of noise from external building services plant has been a key consideration as part of the early design development. Noise will need to achieve appropriate noise limits, as discussed in section 4.1.1.

10.1 Plant noise limits

Based upon the environmental sound survey work undertaken, representative background sound levels have been defined following a statistical analysis of the measurement data, as recommended within BS 4142. The stated background sound levels represent the cumulative 10th percentile of all measured values.

The noise limits presented in Table are rating levels as defined in BS 4142 and will be inclusive of any acoustic character penalties as defined within the standard. The limits are expressed as free field values and will apply at 1 m from the façade of the neighbouring receptors identified in Figure 1.

Table 6 Proposed plant noise limits

Receptor	Period	Representative measured background sound level, dB $L_{A90,15min}$	Maximum rating noise limit for new building services plant, dB $L_{Ar,Tr}$
Residential buildings on New Compton Street and Phoenix Street	Day (0700-2300)	48	38
	Evening (1900-2300)	48	38
	Night (2300-0700)	44	34
The Phoenix Garden	Day (0700-2300)	48	38
	Evening (1900-2300)	48	38
	Night (2300-0700)	44	34
Commercial offices at 125 Shaftesbury Avenue and Shaftesbury House	Day (0700-2300)	55	55
	Evening (1900-2300)	54	54
	Night (2300-0700)	48	48

10.1.1 Emergency plant noise limits

The Local Plan confirms that noise from emergency equipment does not need to adhere to the plant noise limits set out above. It states that noise from this type of plant should be controlled to a level not more than 10 dB above the background sound level for short periods (i.e. during testing).

This results in a daytime noise limit for emergency plant of 65 dB $L_{Ar,Tr}$ at commercial receptors, and 58 dB $L_{Ar,Tr}$ at residential receptors and the Phoenix Garden respectively. Testing should be carried out for up to 1 hour per month, Monday to Friday excluding bank holidays and should be undertaken during daytime hours.

10.2 Key items of noise generating equipment

The main items of noise generating plant will be:

- 3no. air source heat pumps (ASHPs) at roof level providing the hotel with heating and cooling.
- 3no. ASHPs at roof level serving the theatre
- 9no. domestic hot water (DHW) units at roof level providing the hotel with hot water.
- 3no. DHW units at roof level serving the theatre.
- 2no. air handling units (AHUs) at roof level serving the hotel.

Emergency equipment will comprise a life safety generator and smoke extract fan at roof level.

10.3 Proposed noise control measures

Assessments have been undertaken to identify noise control measures that will need to be integrated within the design in order to achieve the plant noise limits set out in Table 1.

Initial assessments, based upon preliminary equipment selections made by the project MEP (Mechanical, Electrical and Public Health) engineer has identified the need for the noise control measures set out below.

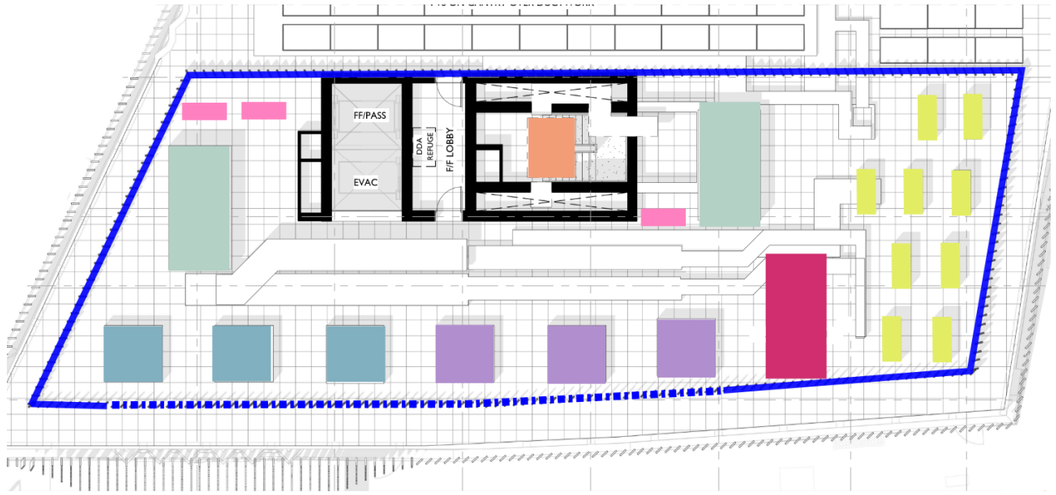


Figure 3 Preliminary roof plant layout

Table 7 Proposed noise control measures

Key	Description	Noise control measures integrated within design
	Hotel ASHPs for heating and cooling	– Sound power per unit limited to 84 dB L_{wA} – Acoustic attenuation package to all units (e.g. Allaway AA206S)
	Hotel DHWs	– Sound pressure level per unit limited to 72 dB(A) at 1 m
	Hotel AHUs	– Case-breakout sound power per unit limited to 63 dB L_{wA} – In-duct sound attenuators to the air inlets and exhausts
	Theatre AHSPs	– Sound power per unit limited to 84 dB L_{wA} – Acoustic attenuation package to all units (e.g. Allaway AA206S)
	Theatre DHWs	– Case-breakout sound power per unit limited to 75 dB L_{wA} – In-duct sound attenuators to the air inlets and exhausts
	Life safety generator	– Sound pressure level of unit limited to 80 dB(A) at 1 m – Likely to require an acoustically packaged generator set
	Smoke extract fan	– Case-breakout sound power per unit limited to 98 dB L_{wA} – In-duct sound attenuators to the air inlets and exhausts
	Solid acoustic screen	– 3.9 m height above finished roof level – Dashed sections denote a louvre to permit airflow
	General	– Anti-vibration mounts to be supplied to all fan or motor driven equipment

The above noise control measures have been integrated into the current design proposals.

10.4 Plant noise assessment

A 3D computer noise model of the proposed development has been created using CadnaA software to predict plant noise emissions at the neighbouring buildings, accounting for the noise control measures set out above. The software, which is a recognised industry standard for environmental noise predictions, implements the outdoor propagation methodology set out within ISO 9613.

It should be noted that the model does not include for noise from the air inlets and exhausts of the air handling and ventilation equipment at roof level, or for the ducted air connections from the basement AHUs. Noise from these sources will be controlled by providing in-duct sound attenuators to all ventilation plant sized to achieve the necessary limits. This is a standard approach to noise control and space allowance has been made within the ductwork design. The detailing of these attenuators will be undertaken at a later date, based upon the sound power levels of the final fan selections.

No BS 4142 character corrections have been included within the predictions. Plant is not expected to be impulsive, and is not expected to be intermittent enough to draw unwarranted attention. Whilst there is potential for ASHPs to be tonal on occasion, the inclusion of an acoustic attenuation package will typically mitigate this as it is often most effective at frequencies associated with the audible tones. There is also a level of underlying plant noise from the surrounding existing buildings and so this type of noise is already present within the existing acoustic environment.

Outputs from the noise model predictions are presented in the figures below. Note that the number in the white circle denotes the maximum predicted noise level per building. The calculations therefore demonstrate that, following the implementation of the noise control measures outlined in Table 7, plant noise can be controlled to the required plant noise limits set out in Table 6 at all receivers.

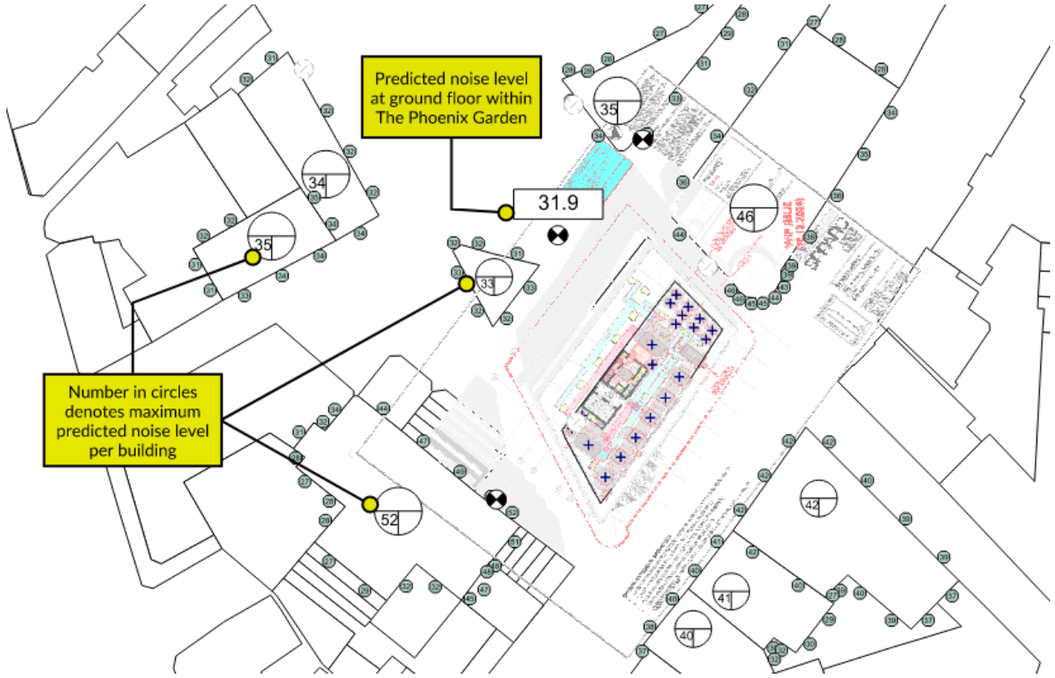


Figure 4 Plant noise assessment – normally operating plant.

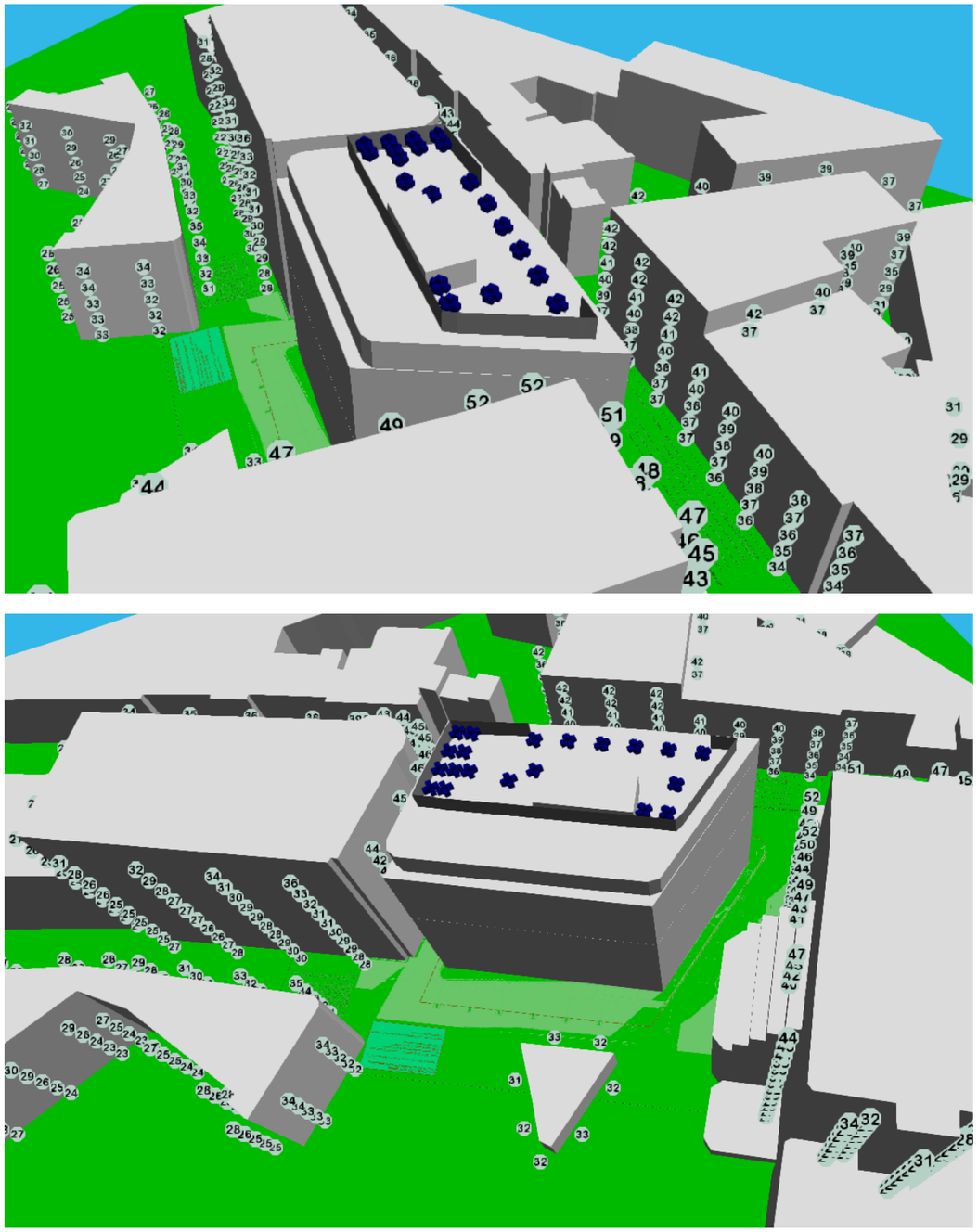


Figure 5 Plant noise assessment - normally operating plant. 3D views

10.5 Emergency plant noise assessment

The 3D computer noise model has also been utilised to assess noise from emergency plant. Output from the model is provided in the images below.

As per the assessment for normally operating plant, the predictions demonstrate that the noise mitigation measures outlined in Table 7 will enable the emergency plant noise limits to be achieved at all receptors.

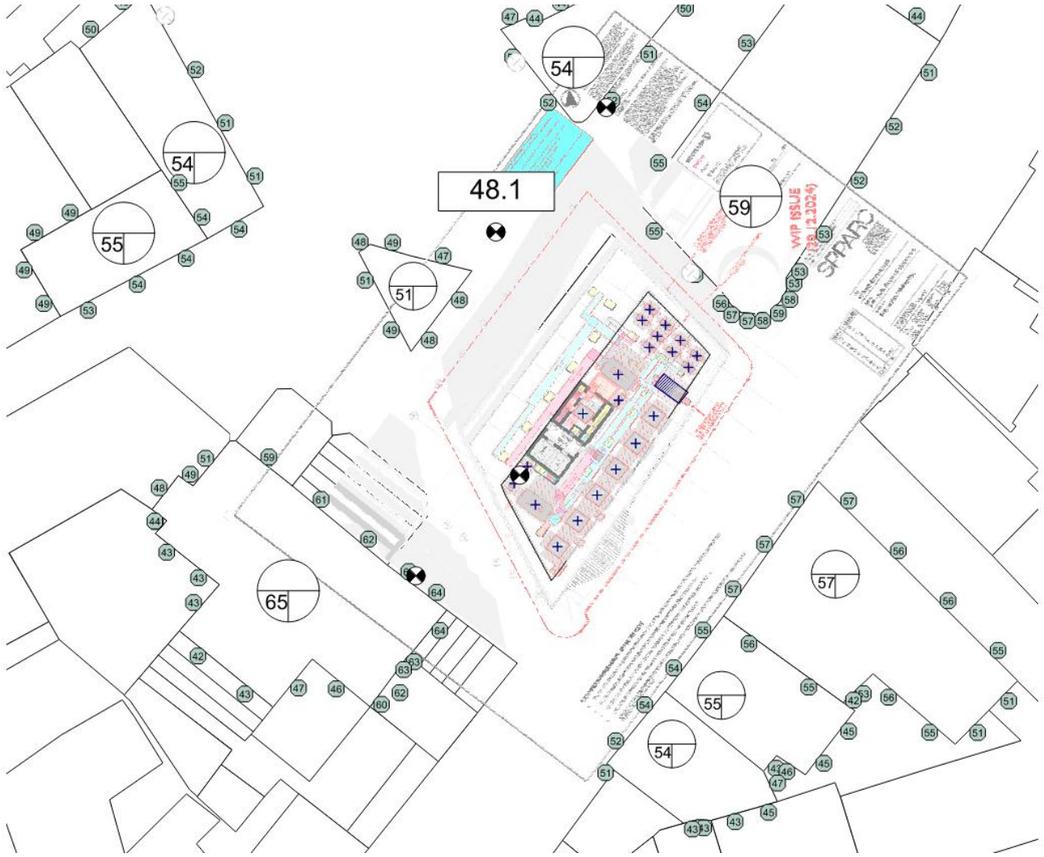


Figure 6 Plant noise assessment – emergency plant.

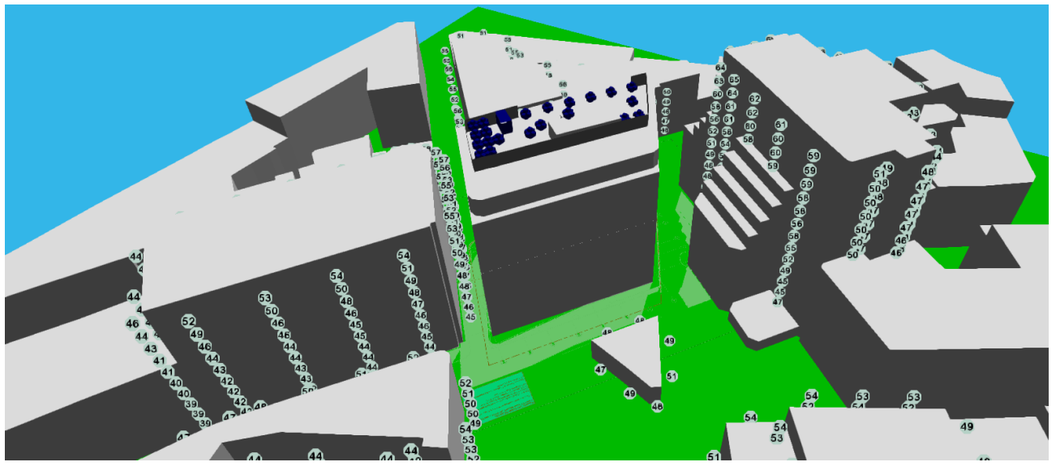


Figure 7 Plant noise assessment - emergency plant. 3D views

11. Controlling external noise to the hotel

The noise impact assessment has focused upon the impact of the proposed development on existing receptors. However, it will also be necessary to control existing external noise to appropriate internal sound levels within the hotel. Guidance on appropriate internal sound levels within residential dwellings can be found within BS 8233: 2014 *Guidance on sound insulation and noise reduction for buildings.* This standard broadly aligns with the 'Green' (LOAEL) category within Appendix 3 of LBC's Local Plan.

Based upon the results of the noise survey, achieving these internal sound levels will require the most noise exposed façades of the hotel to be designed to achieve the sound reduction performances given in Table 8.

Table 8 Preliminary sound reduction performance requirements for most noise exposed façade

Period	Parameter	External noise level	Internal sound level requirement	Façade sound reduction performance required
Daytime	Ambient – $L_{Aeq,16hr}$	65 dB	35 dB	30 dB $R_w + C_{tr}$
Night	Ambient – $L_{Aeq,8hr}$	62 dB	30 dB	32 dB $R_w + C_{tr}$
	Maximum noise events – $L_{Amax,fast}$	83 dB	42 dB	41 dB $R_w + C_{tr}$

The requirements will be driven by the need to control maximum noise events at night. The requirements are high but can be achieved with commercially available double glazed window systems in combination with relatively lightweight external wall constructions. The sound insulation performance requirements on less noise-exposed parts of the façade will be lower.

As the design is developed, detailed calculations will be undertaken to refine the performance requirements, taking into account glazing percentages, room dimensions etc. However, based upon this initial assessment, external noise can be controlled to suitable internal sound levels within the hotel elements of the scheme.

12. Conclusion

A noise impact assessment undertaken in support of the proposed redevelopment at 135-149 Shaftesbury Avenue London has concluded that noise and vibration can be controlled to appropriate levels through combination of physical noise control and management policies secured by planning condition.

On the basis of this assessment, noise and vibration should not pose an obstacle to granting planning permission for the proposed development.

Appendix A – Glossary of terms

Sound

Vibrations that travel through the air or another medium and can be heard when they reach a person's ear.

Noise

An unwanted sound that is loud, unpleasant or that causes disturbance.

Decibel (dB)

The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Octave and Third Octave Bands

The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands.

A-Weighting

The 'A' weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies. An 'A' weighted value would be written as dB(A).

L_{Amax}

The highest A-weighted noise level recorded during a measurement period. L_{Amax} can be described as 'fast' (L_{AFMax}) when measurements are sampled over a period of 0.125 ms, or 'slow' (L_{ASMax}) when measured over a sample period of 1 second.

L_{eq},

The L_{eq}, is a parameter defined as the equivalent continuous sound pressure level. Over a defined time period 'T', it is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal.

The $L_{eq,T}$ can be seen to be an "average" sound pressure level over a given time period (although it is not an arithmetic average). It is often used to describe the 'ambient sound level' and can be used to describe all types of environmental noise sources.

Typically the Leq,T will be an 'A' weighted noise level in dB(A), or denoted $L_{Aeq,T}$.

Statistical parameters $L_{N,T}$

The L_N is a parameter defined as the sound pressure level exceeded for N% of the measurement period 'T'. It is a statistical parameter and cannot be directly combined to other acoustic parameters.

The statistical parameter L_{90} (sound pressure level exceeded for 90% of the measurement period) is generally used to describe the prevailing background sound level.

The statistical parameter L_{10} is the standard statistical parameter used to describe noise from road traffic.

Statistical parameters are typically described in terms of an A-weighted noise level denoted as $L_{AN,T.}$

Specific noise Level, $L_{Aeq,Tr}$

The equivalent A-weighted ($L_{Aeq,T}$) measured sound pressure level of a specific sound source at the assessment location over the time period T.

Acoustic character

One or more distinctive features of a sound (e.g. tones, whines, whistles, impulses) that set it apart from the background noise against which it is being judged, possibly leading to a greater subjective effect than the level of the sound alone might suggest. British Standard 4142 provides an objective methodology for determining whether a sound is tonal.

Rating noise Level, $L_{Ar,Tr}$

The specific noise level of the source plus any adjustment for characteristic features of the noise. The adjustments are defined in BS 4142

Peak Particle Velocity, PPV

Peak particle velocity is a measurement of ground vibration and refers to the displacement of ground particles at surface in terms of millimetres per second (mms^{-1}). Good practice guidance establishes a direct link between this unit of measurement and the likelihood of adverse comment and building damage associated with vibration.

Axes

Vibration is measured over three 'axes' – or planes of directional travel. Typically they are referred to as the X, Y and Z axis, which are at right angles to each other. X and Y axes are used to represent 'front to back' and 'left to right' vibration travel, and Z is used to describe 'up-down' vibration.

Sound reduction index, R

This is the level of sound reduction in decibels provided by a separating element such as a window. The sound reduction index is the difference measured between the amount of energy flowing towards the element in the source room and the total amount of energy entering the receiving room (usually in the frequency range 100 Hz – 3150 Hz). R varies with frequency and is measured in a laboratory in one-third octave bands.

Weighted sound reduction index R_w.

This is a weighting procedure defined in BS EN ISO 717 Part 1 for converting one-third octave band R values to a single number quantity denoted as R_w. It is a decibel value.

Appendix B – Environmental sound survey details

Methodology

An environmental sound survey was undertaken between 10th and 18th January 2024 to establish the existing acoustic environment experienced at the site and by surrounding receptors. Measurements were undertaken in accordance with BS 7445-1:2003 *Description and measurement of environmental noise*.

The survey comprised long term measurements at two fixed positions on the roof of the existing building, supplemented by attended measurements at select locations around the site. Measurement locations are shown in Figure 8.

All measurement positions are considered free field, except for position 1 which is a façade measurement. Note that results reported within the body of this report for position 1 have been corrected to free-field conditions by subtracting 3 dB from the measured data.

Figure 8 Survey measurement locations

Weather conditions

Weather conditions throughout the survey were appropriate for environmental sound measurements, with minimal precipitation and minimal wind.

Measurement equipment details

Equipment used throughout the survey is detailed in Table 9. Equipment was site-calibrated to check sensitivity before and after measurements, with no significant drift observed.

Table 9 Equipment details

Measurement location	Instrumentation Description	Type Number	Manufacturer	Calibration expiration	Calibration Certificate Number
1	Sound Level Meter	NL-52, SN: 01276555	Rion	19/06/2024	UCRT22/1787
	½" Microphone	UC59, SN: 12612	Rion	19/06/2024	UCRT22/1787
	Pre-amp	NH-25, SN: 76774	Rion	19/06/2024	UCRT22/1787
	Acoustic Calibrator	NC-74, SN: 34172704	Rion	03/08/2024	UCRT23/2030
2	Sound Level Meter	NL-32, SN: 01161938	Rion	26/09/2024	UCRT22/2153
	½" Microphone	UC-53A, SN: 311043	Rion	26/09/2024	UCRT22/2153
	Pre-amp	NH-21, SN 21976	Rion	26/09/2024	UCRT22/2153
	Acoustic Calibrator	NC-74, SN: 34172704	Rion	03/08/2024	UCRT23/2030
3-6	Sound Level Meter	NA-28, SN: 01260201	Rion	09/02/2024	UCRT22/1215
	½" Microphone	UC-59, SN: 00281	Rion	09/02/2024	UCRT22/1215
	Pre-amp	NH-23, SN: 60104	Rion	09/02/2024	UCRT22/1215
	Acoustic Calibrator	NC-74, SN: 34172704	Rion	03/08/2024	UCRT23/2030

Results

Results from the short-term measurements are summarised below.

Location	Date and time, duration	Duration	Ambient sound level, dB $L_{Aeq,T}$	Background sound level, dB $L_{A90,T}$	Maximum sound level, dB $L_{AFmax,T}$	Notes
3	18/01/2024 11:18	10min	70	63	81	Shaftesbury Avenue – c.5 m from Zebra crossing. Sources: Road traffic and people noise. Occasional car horns. Lots of HGVs, distant sirens.
	18/01/2024 13:23	10min	70	63	83	
	18/01/2024 14:32	10min	70	63	83	
4	18/01/2024 11:31	10min	63	55	85	Stacey Street. Sources: Road traffic from Shaftesbury Avenue. Occasional vehicles (deliveries, motorbikes, cars) on Stacey Street. Distant church bells in 13:33 measurement. 14:38 measurement cut short by passer by.
	18/01/2024 13:33	10min	64	59	85	
	18/01/2024 14:38	5min59s	63	57	80	
	18/01/2024 14:44	5min	61	56	71	
5	18/01/2024 11:42	10min	58	52	76	New Compton Street on corner of St Giles Street. Sources: Residual noise from Shaftesbury Avnue. Delivery vehicles driving down New Compton Street and Stacey Street (2-3 delivery vehicles in each 10 minute period). Occasional aircraft noise audible.
	18/01/2024 13:44	10min	58	53	73	
	18/01/2024 14:55	10min	57	52	77	
6	18/01/2024 11:53	10min	56	51	71	The Phoenix Garden, approx... central within garden. Sources: Flora and fauna noise, distant people noise on New Compton Street, Phoenix Street. Residual traffic noise from Shaftesbury Avenue and Charing Cross Road. Delivery noise along Phoenix Street and New Compton Street (Medium-size goods vehicle, trucks, reversing alarms along Phoenix Street from delivery vehicle in 13:56 and 15:05 measurements.
	18/01/2024 13:56	10min	54	50	68	
	18/01/2024 15:05	10min	54	50	66	

Long term results are presented overleaf.

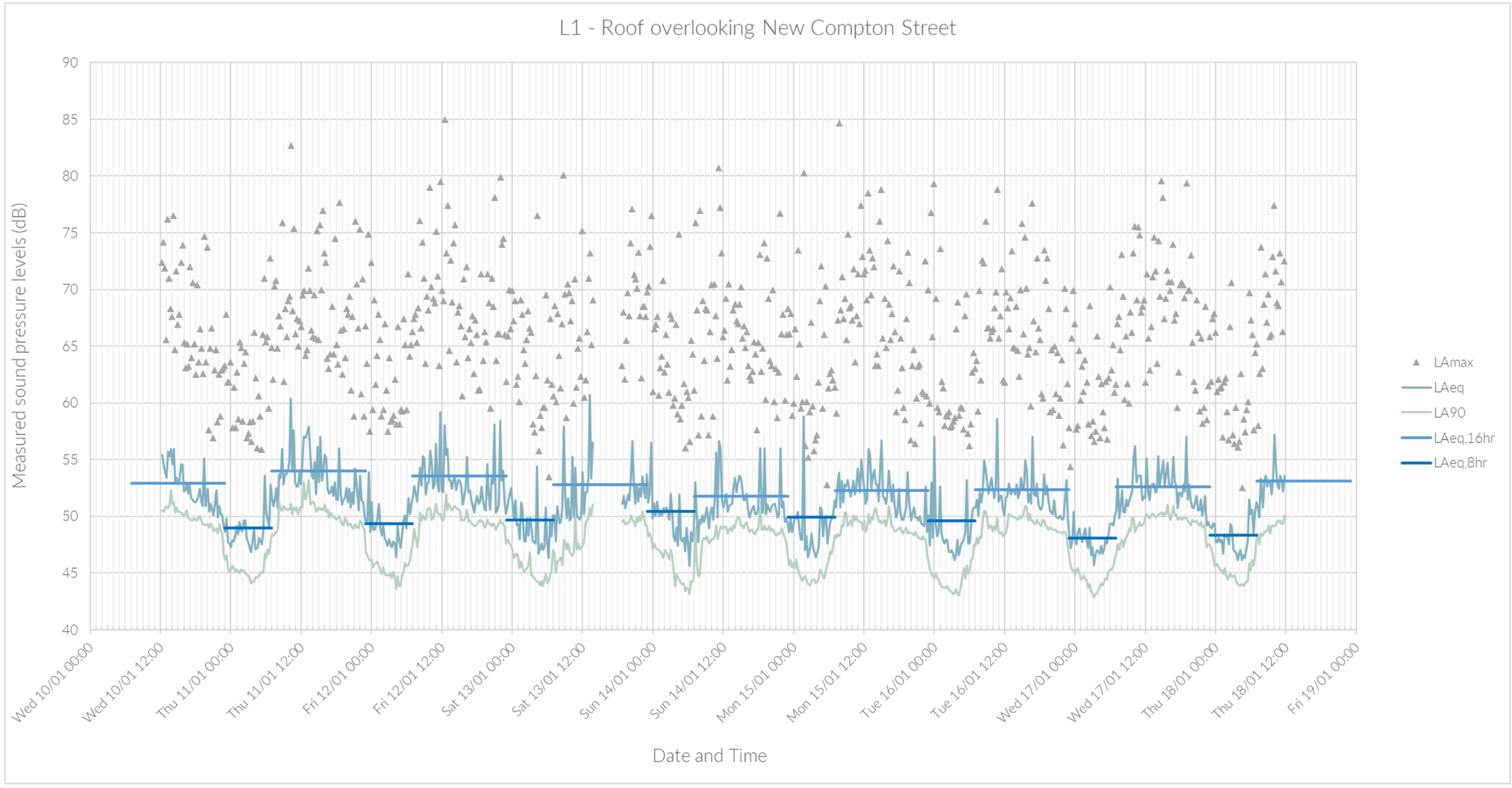
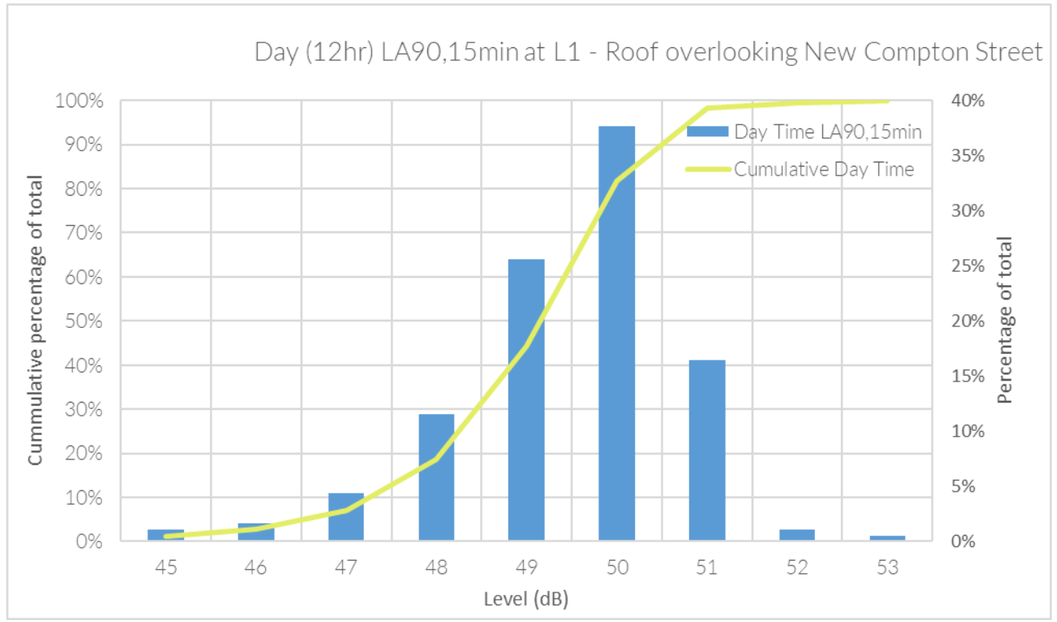
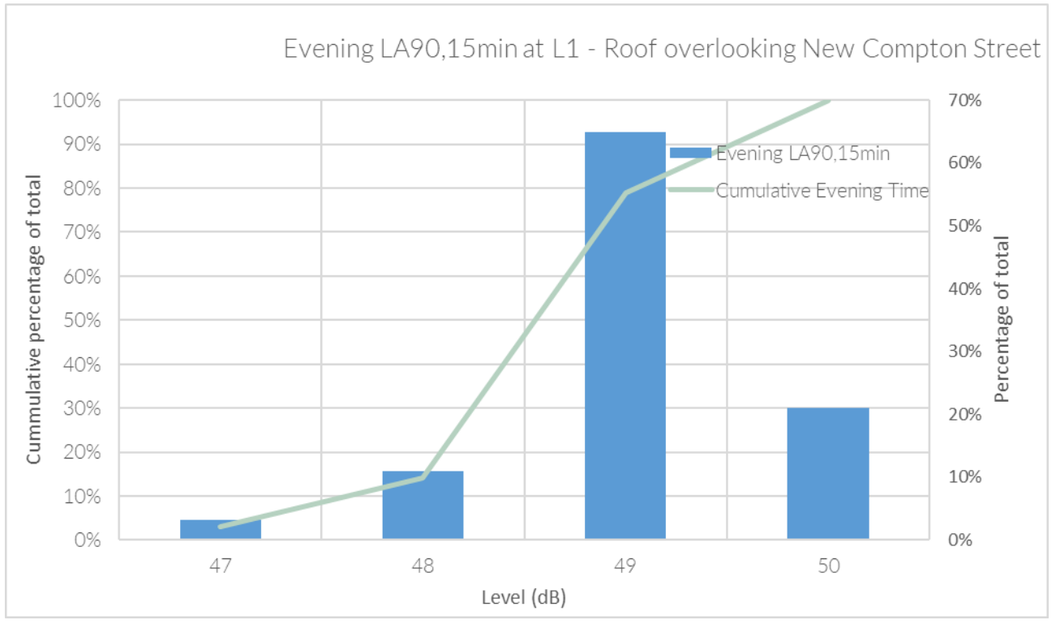


Figure 9 Long term sound monitoring results at position 1. Results have been corrected from façade to free field by subtracting 3 dB. Note that a period between 1400 and 1830 on 13th January has been omitted due to uncharacteristically high levels generated by an unknown sound source. Including this data would have raised ambient and background sound levels and therefore omission of the data represents a worst-case scenario for assessment.





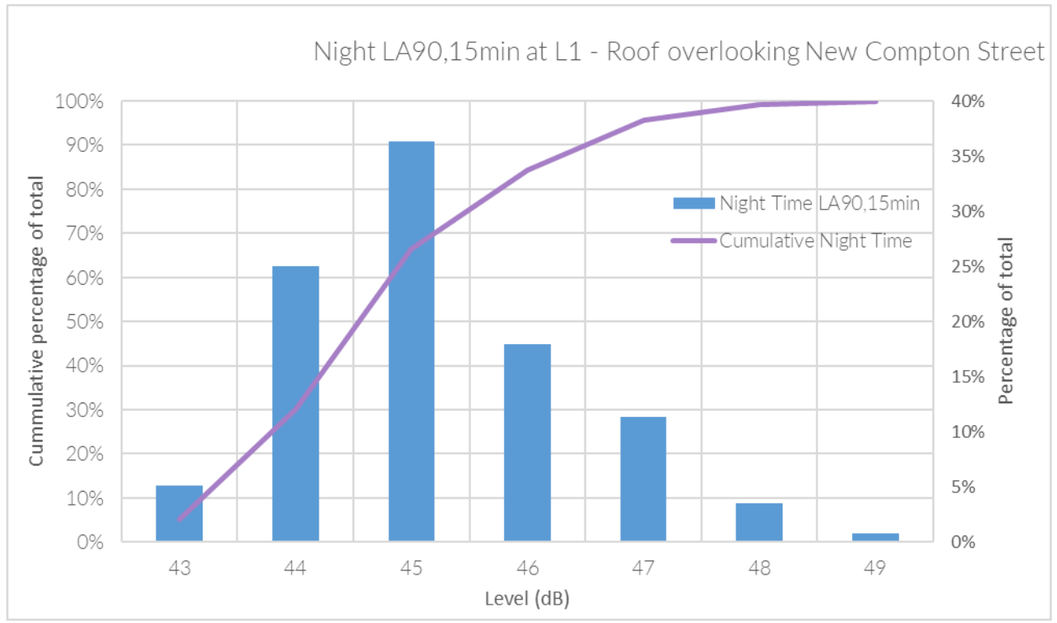


Figure 10 Statistical analysis of day, evening and night $L_{A90,15min}$ data at position 1

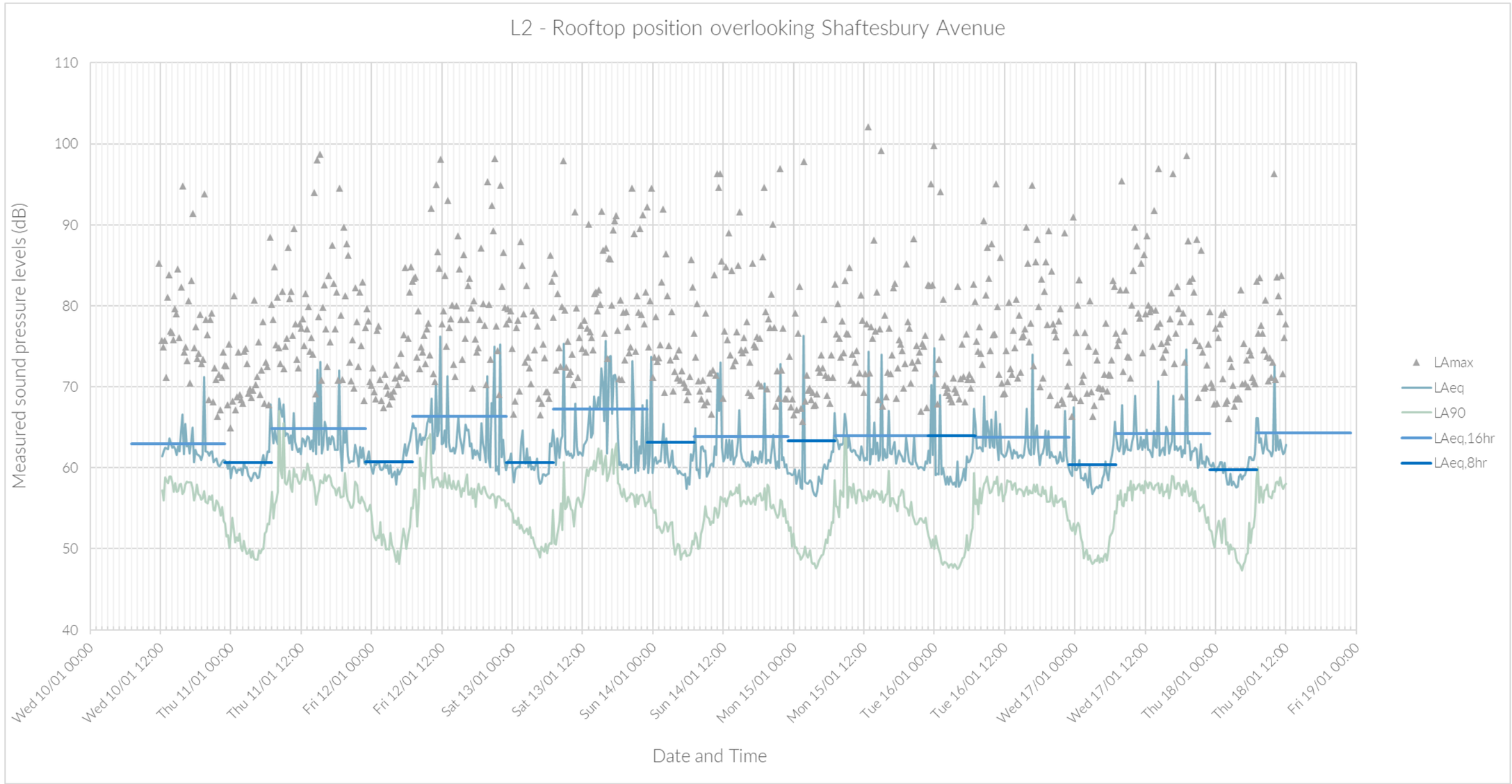
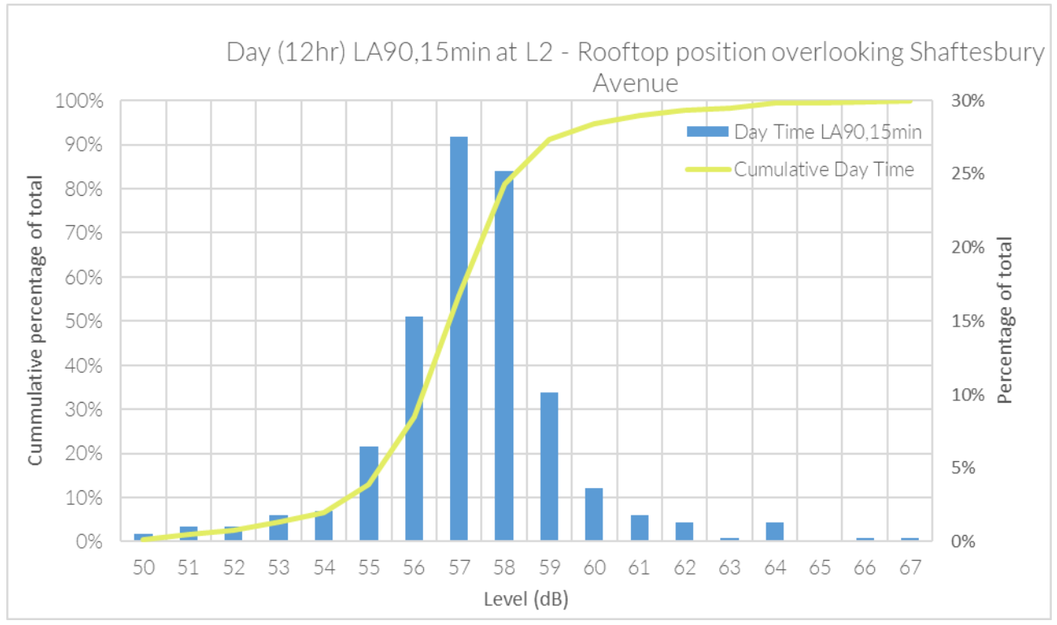
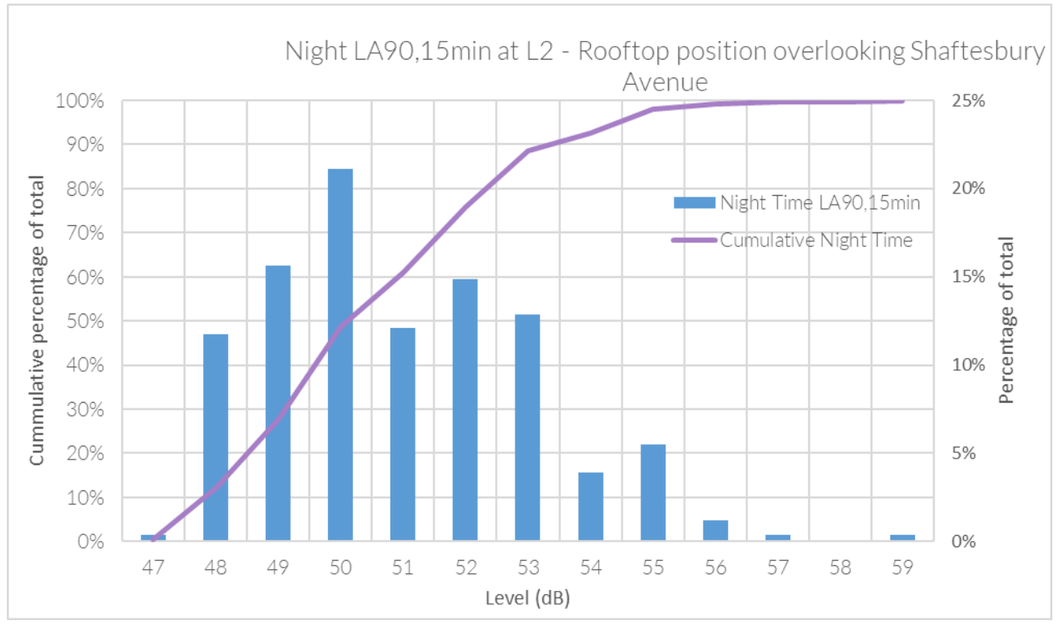


Figure 11 Long term sound monitoring results at position L2.





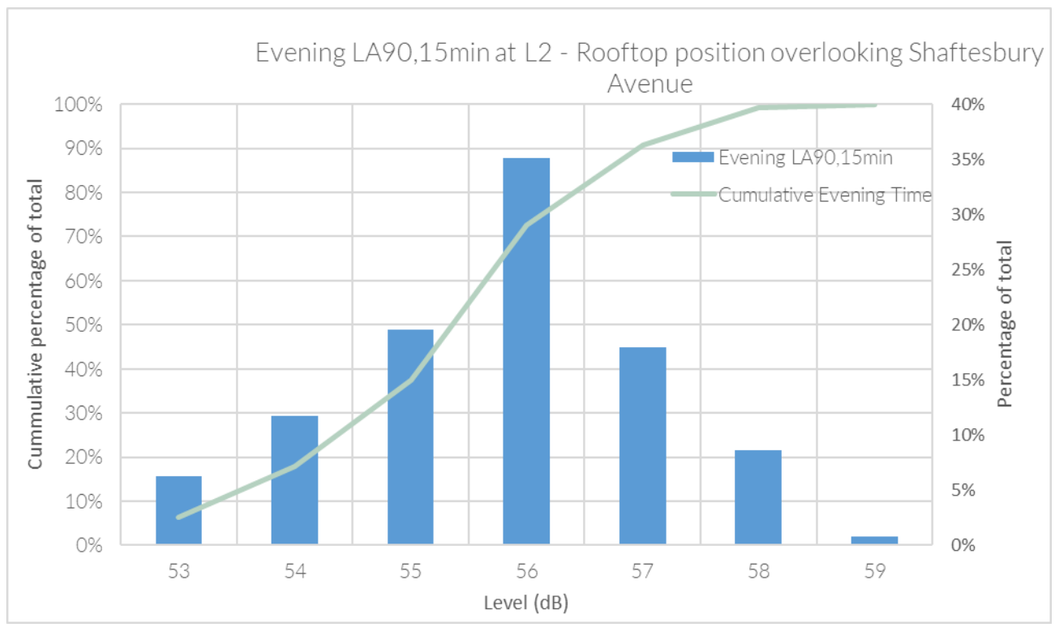


Figure 12 Statistical analysis of day, evening and night $L_{A90,15min}$ data at position 1

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