ACOUSTIC CONSULTANTS LTD

Noise Impact Assessment

Royal National Hotel, London
Proposed Buzz Gym Tenancy

Reference: 9363/SL

Client:	Planning Consultant:
IMPERIAL LONDON HOTELS	Over 30 years of success and still planning WALSINGHAM PLANNING SPECIALIST PLANNING & DEVELOPMENT CONSULTANTS

Document Control

Version:	Revision Description:	Date:	Author:	Reviewed by:
1.0	First Issue	12/01/22	Samuel Lawrence	Blake Lucas

The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustic, and vibration aspects as included in this report. We provide advice only in relation to noise, vibration and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and, on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

Table of Contents

1. Introduction

Imperial London Hotels appointed Acoustic Consultants Limited to provide noise and acoustic advice for the proposed gym to be operated by Buzz Gyms within the basement below their premises at the Royal National Hotel.

On site testing was conducted on 16th December 2021 to determine airborne and structural noise transfer between the basement gym space, which is proposed to change to a 24-hour operation, to the sensitive spaces directly above within the hotel.

This report provides information on the measured survey data, our observations from the site visit and comments with respect to the application to move Condition 6 of the existing planning permission.

The noise assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG), British Standard 8233:2014 (BS8233) and the ANC Good Practice Guide on Gym Assessments.

2. The Site and Proposals

The site is an existing subterranean gym located below the Royal National and Tavistock Hotels (both owned by Imperial Hotels) in Central London. It is proposed for the currently vacant gym space to be let out to Buzz Gym.

Buzz Gym require permission for 24-hour operation of the entire gym. The planning permission for the gym was granted in stages and resultantly one half has no restriction on the hours of operation, while the other is permitted to open only between 09:00 to 23:00 hours Monday to Saturdays and 09:00 to 22:00 hours on Sundays and Bank Holidays.

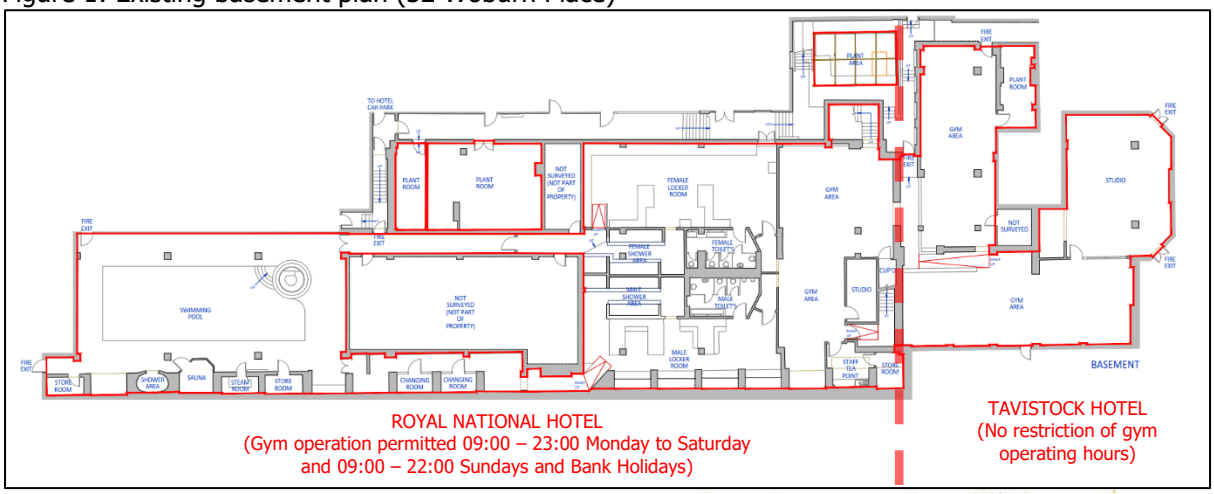
The current permitted hours of operation are set out in Condition 6 (Reference PS9704503) and these are understood to apply to the basement area of the gym below the Royal National Hotel only, whereas there are restrictions on the area below the Tavistock Hotel. A planning application is to be submitted to remove Condition 6 to regularise the 24-hour permission across the full gym area.

Buzz Gym propose to refurbish the basement area of the gym, including the formation of a new weights room within the existing swimming pool.

Directly above the relevant basement areas of the gym are located a number of commercial premises at ground floor level, including the Crazy Salad café, Portland Food & Wine off licence, Chongqing restaurant and the Royal National Hotel's London Pub. Above these are located vacant offices and a prayer room at mezzanine level and guest bedrooms at first floor level all within the Royal National Hotel building. The offices, prayer room and majority of the commercial premises do not operate during the night-time hours the permitted gym usage is proposed to be extended to include.

The existing basement plan of the gym is shown below, with hours of operation and hotel adjacencies labelled (as advised by the client). The ground floor areas of the gym are understood to not have any restrictions on the hours of operation.

Figure 1: Existing basement plan (32 Woburn Place)



3. Planning and Noise

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in July 2021. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 174 states:

"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 185 states:

"185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation. "

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise, and refers you to the NPSE.

3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long-term vision of Government noise policy. This long-term vision is supported by three noise policy aims which are as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

avoid significant adverse impacts on health and quality of life;
mitigate and minimise adverse impacts on health and quality of life; and
where possible, contribute to the improvement of health and quality of life."

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur. With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its own merits. The NPSE does, however, emphasise that in dealing with noise, Local Planning Authorities are required to take a balanced approach in considering the benefits of development against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

3.3. National Planning Practice Guidance, Noise

The National Planning Practice Guidance (NPPG) on noise, referred to here, is based on the current version (July 2019) as provided on the Planning Guidance Website.

It states that *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

The document provides generic guidance on how to determine the impact of noise and what factors could be a concern.

It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated below.

Table 1: NPPG Noise – Perception of Effect Levels

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels.

The NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum when taken into account against all other planning considerations.

Section 4 of this report identifies guidance which is considered to provide noise criteria equivalent to effect levels below the Lowest Observed Adverse Effect Level. This is where the perception of noise is "not noticeable" or "noticeable but not intrusive" as indicated in Table 1 above.

4. Assessment Criteria

4.1. British Standard 8233:2014

British Standard 8233:2014 entitled "Guidance on sound insulation and noise reduction for buildings" came into effect on 28th February 2014.

4.1.1. Residential

Section 7.7.2 Table 4 of the British Standard 8233:2014 provides internal ambient noise levels for dwellings from noise sources 'without a specific character'.

The British Standard guideline states that noise levels should not exceed those as noted in Table 2 of the British Standard. These criteria are based on the guidance provided within WHO 1999 and are summarised below:

Table 2: British Standard 8233:2014 Internal Noise Criteria

Activity	**Location**	**Daytime (07:00 to 23:00)**	**Night-time (23:00 to 07:00)**
Resting	Living Room	35 dB $L_{Aeq,16\ hour}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16\ hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\ hour}$	30 dB $L_{Aeq,8\ hour}$

Section 7.7.2 Note 4 of the British Standard states *"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values".*

British Standard provides no definitive criteria for maximum noise levels from individual events ($L_{Amax,F}$). Section 3.4 of the "Guidelines for Community Noise" published by the World Health Organisation in 1999 (WHO 1999) states *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)".*

As such it would be considered acceptable if the maximum noise level from individual events do not exceed 45 dB $L_{Amax(F)}$ no more than 10 to 15 times during the night-time period. As the events could be regular within gyms, we would advise the 45 dB $L_{Amax(F)}$ is applied as an upper limit.

4.1.2. **Hotel Rooms**

Section H.4 of BR8233:2014 sets out indoor ambient noise level ranges for hotel bedrooms and states the following:

> *"The noise level in any hotel bedroom, with windows closed, from all external sources, including road, rail and air traffic and noise from activities outside the hotel and any adjacent premises, are to be within the range of average noise levels in Table H.3."*

Table 3: BS8233:2014 internal ambient noise level criteria in hotels (Table H.3)

Indoor ambient noise level ranges for hotel bedrooms

Period	Noise level
Daytime (07:00 – 23:00 hrs)	30 – 40 dB $L_{Aeq,1hour}$
Night-time (23:00 – 07:00 hrs)	25 – 35 dB $L_{Aeq,1hour}$
Night-time (23.00 – 07.00 hrs)	45 – 55 dB L_{Amax}

NOTE Some hotels may set lower noise levels, depending on location.

4.1.3. **Hotel Ancillary Spaces**

Section 7.7.4 of BS8233:2014 sets out design ranges for offices and places of workshop in Table 6. These could be applied to the mezzanine offices and prayer room above the gym space.

Table 6 **Typical noise levels in non-domestic buildings**

Activity	Location	Design range dB $L_{Aeq,\,T}$
Speech or telephone communications	Department store Cafeteria, canteen, kitchen	50 – 55
	Concourse Corridor, circulation space	45 – 55
Study and work requiring concentration	Library, gallery, museum	40 – 50
	Staff/meeting room, training room	35 – 45
	Executive office	35 – 40
Listening	Place of worship, counselling, meditation, relaxation	30 – 35

Please note these criteria apply only during daytime hours, when the offices and prayer room will be used, and as such will not affect the assessment for the proposed gym to operate 24/7 (i.e. throughout the night).

5. Site Tests

Testing was undertaken at the existing site on the 16th December 2021 to establish the existing sound insulation performance between the basement gym and sensitive spaces above.

5.1. Equipment

Sound Pressure Levels were measured using a Class 1 sound level meter with a half-inch condenser microphone, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection. The table below provides the equipment and calibration status.

Table 4: Equipment and Calibration Status

Equipment Description, Manufacturer & Model	Serial Number	Date of Calibration	Calibration Cert Number
SLM, NTI, XL2	A2A-13617-E0	13/03/2020	UK-20-012
Pre-Amp, NTI, MA220	7727	13/03/2020	UK-20-012
Microphone, NTI, MC230A	A16151	13/03/2020	UK-20-012
Calibrator, Larson Davis, CAL200	12605	09/03/2021	37321
Amplification & Loudspeaker System, Opera 402D	L346004702	n/a	n/a

The measurement system was checked before and after use with the noted calibrator and no significant drift was detected.

5.2. Test Methodology

Acoustic Consultants Limited were met on site by representatives of Imperial Hotels and Buzz Gym. We were informed that the existing swimming pool was to be fitted out as a weights room and advised to test there as the worst-case space.

The client then directed us to sensitive hotel spaces above the proposed weights room and advised that these were in line with Portland Food & Wine on the building façade. We were shown to a vacant office space on the mezzanine floor and an empty guest bedroom directly above this on the first floor (Room 1250). These spaces are separated from the proposed gym area by a buffer of the commercial spaces on the ground floor level of the building.

Buzz Gym provided a 25-kilogram dumbbell for testing structural noise transfer, generally in accordance with Method 1 of the ANC Gym Acoustics Guidance (expected to be formally published in 2022). The Buzz Gym operative dropped weights from knee height both directly onto the existing tiles around the perimeter of the swimming pool, then onto Buzz Gym's preferred 40-millimetre gym floor tile and lastly onto a 20-millimetre alternative floor tile. The dumbbell was dropped 10 times in each scenario and observations and measurements made above in both the mezzanine office and first floor bedroom.

We then undertook airborne sound insulation tests between the proposed weights room and the sensitive spaces above (office and Room 1250).

5.3. **Test Observations**

Structural noise due to weights dropping (both directly onto the existing floor and onto each proposed gym tile) and airborne noise transfer from the proposed weights area was inaudible over the residual noise climate (ingress of road traffic and other environmental noise on Woburn Place) and not measurable within the vacant office or bedroom above within the Royal National Hotel.

We also listened for structural vibrations within the columns in the office and walls of the bedroom. No structural noise could be identified in the office's columns in any test scenario. Impulsive noise was just perceptible within the wall of the bedroom (Room 1250) when the dumbbell was dropped directly on the existing floor in the swimming pool space, but not when dropped onto the 40-millimetre or 20-millimetre tiles.

These observations were made in the worst-case test rooms we were directed to measure in by the client. Drawings showing the room layouts within the hotel above or details of the building structure are understood not to be available and could not be issued to us for inspection prior to the site visit. Structural noise transfer may differ in different areas of the building.

6. Noise Impact Assessment

6.1. Sound Insulation within Royal National Hotel

6.1.1. Structural Noise

Structural noise was not audible in either of the test rooms; however, was just perceptible within the walls of the first guest bedroom (Room 1250) when the dumbbell was dropped directly onto the existing floor.

Although structural noise due to the 25-kilogram weight being dropped directly onto the floor was inaudible over the residual noise climate in the centre of the bedroom and barely perceptible in the wall, the impact of heavier weights is unknown, as is the degree of structural noise transfer into rooms other than where we were instructed to measure.

The impact tests were also conducted onto the tiles of the existing swimming pool room, which will naturally be removed when the weights room is fitted out. The tiles are not likely to have provided significant impact resilience but the performance when dropping directly onto the main floor structure is unknown as it was not possible to test.

On the basis of the above, we recommended that Buzz Gym's proposed 40-millimetre floor tile is installed, at a minimum, across the full floor area of the weights room and anywhere else where impacts on the floor may occur.

We would also advise that the gym prohibits the dropping of weights onto the floor via a management policy as good practice, though this cannot be relied upon to prevent dropping weights in lieu of installing the 40-millimetre tiles.

6.1.2. Airborne Noise

The source signal was inaudible over the residual noise climate and not possible to measure in the mezzanine office or first floor bedroom (Room 1250) during the on-site testing.

When walking between the source and receive rooms during the airborne sound test, the consultant noted that a column within the prayer room adjacent to the mezzanine office appeared "excited" (i.e. noise from the speaker below may have been radiating from it); however, the Imperial Hotels operative advised that the noise audible the column was due to plant from the Royal National's London Pub below.

The client advised that columns are continuous throughout the building. Although the noise of the speaker in the receive room were inaudible for the source and receive columns that the client advised were worst-case, flanking noise transfer through the columns may be more significant in other locations.

The rooms on the mezzanine floor and the gym within the basement are both owned by the hotel, with latter proposed to be let out to Buzz Gym. The gym already has permission to operate during the daytime hours when the currently vacant offices and prayer room would be occupied; extending the hours of use of the gym to 24-hours a day would not affect the offices and prayer room above, as they are vacated during night-time hours.

No columns were identified in the numerous first floor guest rooms we entered – these may therefore already be enclosed within service areas between the rooms, though drawings are not available for review to confirm the location of the columns. There is a buffer of two floors (ground floor commercial and mezzanine offices/prayer room) between the gym and guest bedrooms. It is therefore unlikely that airborne sound transfer to the bedrooms would or have any observed effect during the proposed extension of hours incorporating night-time use of the gym. Both spaces are owned by the hotel and sound insulation between the rooms should not be considered a planning issue.

We have been advised that there will be a restriction of amplified music being played through the gym's PA system during night-time hours nonetheless. We would recommend this management policy is retained to minimise the chance of any night-time gym operation being audible within bedrooms.

On the basis of the above, no specific mitigation measures to address noise of the gym within the hotel during the proposed night-time use are considered necessary for planning purposes.

The columns in the offices, prayer room and the gym below could be independently lined with two layers of dense 12.5mm plasterboard (total surface mass 20 kg/m^2) with 50-millimetres of mineral wool in the cavity at the hotel's discretion. This should not be considered a planning issue and could be retrofitted if necessary.

6.2. Operational Noise Affecting Other Premises

The portion of the gym currently restricted by the permitted operating hours set out in Condition 6 is located at basement level under the Royal National Hotel; however, directly above the gym space are located the following commercial premises at ground floor level: Crazy Salad, Portland Food & Wine, Chongqing and The London Pub.

As the uses of the premises at ground level comprise a café, an off licence, a restaurant and a public house, all of which are considered no more sensitive during night-time hours than during the day, the removal of the restriction of the operational hours of the gym to permit 24-hour use would not be expected to affect the ground floor premises.

It should also be noted that, according to business hours shown online, these premises generally close before 23:00 hours, with the exception of the Portland Food & Wine off licence which operates 24 hours a day. Night-time use of an off-licence is no more

sensitive than its operation during the daytime hours which the gym currently has permission to operate in.

Therefore, we would consider no specific noise mitigation measures are required for planning to address operational noise transfer into the adjacent commercial premises.

6.3. Potential Noise Emission to Surrounding Dwellings

6.3.1. Operational Noise

The location of the worst-case sensitive receiver other than rooms within the hotel is unknown. The worst-case building not part of the Royal National Hotel or Tavistock Hotel is the building opposite on Woburn Place. It is understood that the building opposite once contained student flats based on historical Google Street View imagery, so may still contain residential elements.

There are no atmospheric openings or building façade elements of the gym fronting onto Woburn Place and facing the building noted above, as the proposed gym is located underground, with plant rooms located to the rear and shielded by the hotel buildings on all sides (see below).

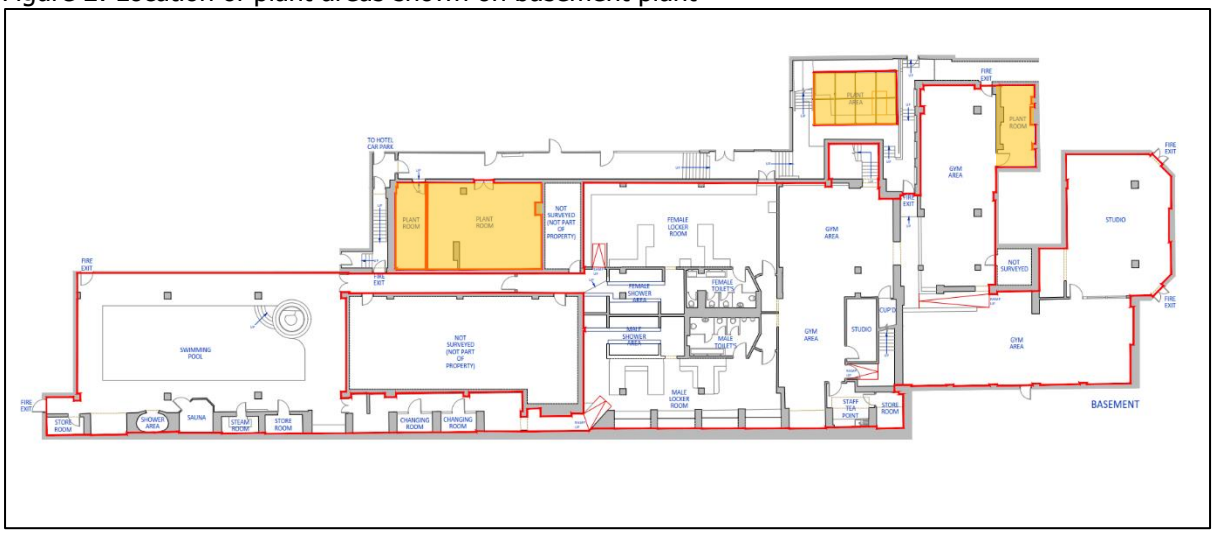
We have been advised that there will be a restriction of amplified music being played through the gym's PA system during night-time hours. We would recommend this management policy is kept in place as good practice. Worst-case operations requiring amplified music (such as exercise classes) will only be scheduled to occur during daytime hours.

As such, operational noise breakout would not be expected to have any perceptible effect on dwellings during the night.

6.3.2. Plant Noise

We are not aware of any proposals for new plant to serve the basement gym and plant noise is outside the scope of our instruction. However, the basement plan shows that several plant rooms are located towards the rear side of the gym towards the hotel car park as highlighted below. These are therefore likely shielded from any nearby dwellings by the hotel building.

Figure 2: Location of plant areas shown on basement plant



Plant noise would not be expected to affect any other dwellings because all plant rooms are positioned to the rear of the basement (towards the hotel car park and rear alley contained within the Royal National Hotel and Tavistock Hotel buildings) and shielded from the surrounding area.

7. Summary and Conclusion

Imperial London Hotels appointed Acoustic Consultants Limited to provide noise and acoustic advice for the proposed extension of hours to gym to be operated by Buzz Gyms within the basement below their premises at the Royal National Hotel.

On site testing was conducted on 16th December 2021 to determine airborne and structural noise transfer between the basement gym space, which is proposed to change to a 24-hour operation, to the sensitive spaces directly above within the hotel.

This report provides information on the measured survey data, our observations from the site visit and comments with respect to the application to move Condition 6 of the existing planning permission.

We would consider the impact of 24/7 gym operation to be acceptable when assessed at the nearest sensitive receivers (hotel above).

We would consider noise need not be a material constraint in determining the planning application and the extension of use to meet the aims of the NPPF, NPPG and NPSE.

8. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure pA – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.

A-weighted sound pressure level, L_{pA} - quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$L_{pA} = 10 \log_{10} (p_A/p_0)^2$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
p_0 is the reference sound pressure (20 µPa)

Background sound level, $L_{A90,T}$– A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

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.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{AeqT} = 10\lg_{10}\left\{(1/T)\int_{t1}^{t2}[p_A(t)^2/p_0^2]dt\right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 µPa); and
$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

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. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

Rating level, $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, eVDV – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).

ACOUSTIC
CONSULTANTS LTD

Head Office: 194 West Street, Bedminster, Bristol, BS3 3NB
T: 0117 986 2956

www.acoustic-ltd.co.uk

Registered Office: 194 West St, Bristol, BS3 3NB Registered No: 8544901