Acoustic Associates Sussex Ltd
Planning Application
Noise Assessment

Site: 394 – 398 Brighton Road, Shoreham by Sea, BN43

Client: Tony Stitt Fitness

Report by:	Simon Barrett BSc(Hons) MSc MIOA
Date:	25/11/2016
Project:	J2162
Issue No.:	1

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Issue No.	Date	Comments
1	25/11/2016	Initial Issue

1 Introduction

Acoustic Associates have been appointed by Tony Stitt Fitness to undertake an acoustic assessment of the proposed Gym premises at 394 – 398 Brighton Road, Shoreham by Sea.

The properties were previously used by a Frosts for Cars performance car sales showroom, which is partly directly below a block of flats and partly directly below a carpark shared with the residents of these flats.

The purpose of this document is to assess the following:

- Noise levels affecting neighbouring noise sensitive receptors (NSRs).
- Mitigation Measures, where required, to ensure that noise resulting from the operation of the premises is reduced to a level where no noise nuisance is caused to any NSRs.

The development will make use of the existing building on the ground floor level and a small area on the first floor level. The ground floor will be converted to provide changing rooms, fitness training and gymnasium facilities and a dance area. The small first floor area will be office space only.

Existing environmental noise has previously been measured close by to the site (pre conversion of the existing premises).

Data from previously measured music and instructor activities, will be used in this report.

Measurements of sound insulation between the ground floor site and the flats above have also been conducted to ascertain the level of noise breakthrough from ground floor to the first floor flats. Measurements of the effectiveness of the flats' façade have been carried out.

The noise levels for the day and evening periods have been assessed in terms of and following the guidelines of the documents listed below:

- National Planning Policy Framework (NPPF) 2012
- Planning Noise Advice Document (Sussex) 2015
- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- BS8233 (Sound insulation and noise reduction for buildings) 2014

Noise mitigation measures have been recommended in section 10 of this report based on the worst case scenario noise levels. It is considered that if mitigation measures discussed are adopted, the planning application would not be refused on noise grounds.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

The development will change the use from a previous car sales showroom use into a commercial gymnasium at 394 – 398 Brighton Road, Shoreham by Sea.

Hours of operation are to be be 06:00 – 22:00 Monday to Saturday and 06:00 – 18:00 on Sundays but with public access from 07:00 hrs. Any access prior to 07:00 on any day of the week would be for staff setting up or for cleaning activities only.

The site is bounded by one main road: the A259 Brighton Road which runs from East to West on the southern side of the site.

There are residential properties attached directly above the site on the left hand side, which would be situated above the dance studio area and partly above the gym facilities area. There are also residential properties to the left and right of the site, though not directly attached.

The principal source of ambient noise affecting both the proposal properties and the neighbouring properties is the road traffic on the main A259 Brighton Road.

2.2 National Planning Policy Framework 2012

National Planning Policy Framework 2012 document places the onus on Local Authorities to implement their own local criteria. Based upon Local Authority guidance documents it is recommended in this case that appropriate criteria are provided by:

- BS8233 (Sound insulation and noise reduction for buildings) 2014
- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- Sussex Planning Noise Advice Document 2015

Assessment methodology, predictions of building envelope sound insulation and calculations of noise propagation will follow the principles detailed within:

- ISO 9613 (1996) Attenuation of sound during propagation outdoors.
- BS8233 (Sound insulation and noise reduction for buildings) 2014

2.3 BS8233: 2014: Noise Criteria

Table 5 of BS8233 provides guidance that, for steady external noise sources, it is desirable that the internal noise levels within residential properties do not exceed those set out in the following table.

Activity	Location	Time period of day	
		07:00-23:00	23:00-07:00
Resting	Living Rooms	35dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table 1: BS8233 Criteria

2.4 WHO Noise Criteria

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and are as follows:

Room Type Target Maximum Internal Level - L_{Aeq} dB(A)

Living rooms 35 (Daytime only)

Bedrooms 30 (Night)

Room Type Maximum Internal Level – L_{Amax} dB(A)

Bedrooms 45

The target maximum internal noise level for a bedroom during the night time corresponds to the threshold of sleep disturbance. WHO state that the noise level outside a bedroom window should be less than 45 dB(A) this assumes that an open window provides 15dB attenuation.

It should be noted that there is no proposal to use the gymnasium or training facilities of the proposed development during night hours.

With regard to outdoor amenity areas WHO states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor

living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

2.5 Local Authority Criteria

The Local Authority's requirements are understood to be based upon the Planning Noise Advice Document (Sussex) 2015. This advises that noise from industrial or commercial sources should be reduced as far as is reasonably practicable.

3 Existing Background/Ambient Noise

3.1 General

The principal source of existing background / ambient noise affecting not only the proposal site but also the neighbouring residential properties is the road traffic on the busy A259 Brighton Road which passes along the south of the site in an East-West / West-East direction. Other sources are birdsong and occasional light aircraft noise.

Measurements of this existing sound level have been carried out recently at an address close-by and is considered representative. These sound levels for daytime and night time periods are shown below in table 2.

3.2 Ambient and Traffic Noise Measurements

Survey carried out by:	Simon Barrett BSc(Hons) MSc MIOA
Date of Measurement	5 – 13 March 2015 (see below for validation)
Equipment used:	Castle GA117 "Mirus"– Type 1 Sound Level Meter Castle GA607 Type 1 Field Calibrator
Weather conditions:	Dry; Wind speed: <5m/s

Table 2: Survey Equipment Used for Background Survey

The sound level meter was calibrated before commencing the noise measurements and again at the end of the measurements (@94dB no drift).

The measurements were taken at a position 7.6 metres from the kerbside of Brighton Road and 1m from the façade of the building. The results were then adjusted to free-field and distance corrected to show the level at the kerbside rather than the measurement position.

Between this former measurement location and the proposed site, there are no traffic junctions and traffic runs freely between, therefore the noise levels measured are considered representative to the proposed site. Please see Appendix A for a map showing the site location in relation to the original measurements as carried out in March 2015.

The Average noise levels measured in March 2015 were as shown in the table overleaf:

Noise Level Type	Daytime (dBA)	Night time (dBA)
Leq at kerb side	75	69
Representative L90 Background	60	44

Table 3: Existing Ambient and Background Noise Levels

The L90 area background as shown in table 3 above (measured in March 2015), shows that for daytime, the level is 60dBA, which is the Mode of values due to 7 days' of measurement. This value has been compared with the 20 minute L90 value as measured during the recent test visit on 25/11/2016, which showed an L90 value of 59.9dBA. This confirms the validity of the value in table 3. The existing L90 background level is this high due to the rate of traffic passing by on Brighton Road.

Likewise, the Leq values have been checked against a measurement carried out on 25/11/2016 at 9:45am to confirm the noise levels are still representative. These measurements were checked against the mean average of the 7 days' of measurements at the same time and the results were less than 1dB different. Therefore this original Leq measurement data from March 2015 will be classed as valid.

4 Airborne Sound Insulation between Proposed Gym and Flats

In order to enable assessment of potential noise nuisance to the flats above from the gym / dance activities in the fitness centre below, a sound insulation test was carried out to show the current level of sound insulation provided by the separating floor/ceiling.

4.1 Test Method:

Two loudspeakers were placed facing into the corners, separated from each other, at different heights in the source room and angled across the room to create a diffuse sound field. An amplifier was used to broadcast pink noise through the loudspeakers using two individual noise generators. The spectrum shape of the reverberant noise was checked to ensure that each 1/3 octave band was within 6 dB of its neighbouring bands - loudspeaker positions are adjusted if there is an issue, until the criterion is achieved.

Measurements were taken in the source room at each 1/3 octave band centre frequency between 50 Hz and 5 kHz using the “sweep” technique as described in ISO140 (30 secs.). Further measurements were then taken in the same way in the receiving room on the other side of the test element. The reverberation time was also obtained using the interrupt stationery method for each 1/3 octave centre frequency in the receiving room. This was spatially averaged over 6 positions in the room.

Ambient sound pressure levels (without the source operating) were also taken at each frequency in the receiving rooms to check that ambient noise levels were at least 10 dB below the measured levels due to generated noise and thus did not contribute to the measured levels. These too were spatially-averaged. Type of noise radiated: Broadband pink noise. Dominant sources of background noise were as follows: Road Traffic.

4.2 Test Results

The results show that the sound insulation value between ground and first is a difference of DnTw=54dB.

Full details of the calculation are shown in the Appendix B but the 1/1 octave band sound insulation provided by the separating floor is as follows:

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	16000
Sound Insulation (dB)	37.1	38.4	50.4	53.1	50.7	60.7	67.6	73.5	65.7

Table 4: 1/1 Octave Band sound insulation values for the separating floor

Please see Appendix B for the sound insulation test data showing the DnTw result.

5 Outdoor to Indoor Sound Insulation performance of Existing Flats

In addition to the airborne sound insulation test between ground and first, an additional sound insulation test was carried out to show the effectiveness of the upper flats' façade in terms of noise break-in from outdoors.

For this, a pair of simultaneously measuring sound level meters were used – one directly outside the flat facing Brighton Road and one inside the lounge of Flat 2.

A 20 minute simultaneous measurement was carried out.

The difference between the A weighted outdoor Leq and the A weighted indoor Leq is 33.1dB.

The difference between the outdoor and indoor whole-octave centre-band frequencies (and thus the sound insulation provided by the building facade) is shown in the table below.

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Insulation (dB)	22	23	27	32	34	37	32	29

Table 5: Sound Insulation of Existing Flats' Building Façade

6 Gym Music and Instructor Noise

The gym will contain two main areas with potential noise generation:

- A Dance Studio, where there will be instructed classes
- A Techno-Gym which will contain fixed weight-training, weight-lifting and cardio-vascular equipment

6.1 Gym Music and Instructor Noise

Within the dance studio will be wall-mounted speakers. The speakers are to be mounted on the walls furthest from the building façade. These speakers will link in to the gym's SONOS system and will generally run at "background levels". However during classes, it is likely that the trainer will use their own sound levels appropriate for their activity.

It should be noted that due to the above, there is no set-in-stone sound level and thus this assessment will show the maximum possible sound level in the gym without providing noise disturbance to the nearest domestic NSRs.

Acoustic Associates Sussex Ltd have previously measured fitness class music with instructor noise levels with its associated frequency profile. The typical frequency profile of this music is as follows when at a sound level of 84.4dBA (as was originally measured):

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	16000
Gym Music Level (dB)	84.2	84.2	80.1	83.4	81	69.7	69	63.1	45.4

Table 6: Typical Frequency Profile of Gym Music with Instructor

BS8233:2014 and WHO Guidelines state that to protect against anonymous noise, the sound level in a lounge or bedroom during daytime hours should be no higher than Leq 35dBA. However, considering music and gym instructor noise is not classed as anonymous it is considered that a lower sound level of no higher than Leq 30dBA is used to err on the side of caution.

6.2 Gym Music Noise via Separating Floor – Calculation based upon measurement

Considering the sound insulation of DnTw = 54dB is achieved by the separating floor between the Gym and Flat 2 Lounge, one could assume that this could allow the gym to have a maximum sound level of Leq 84dBA. However, this is very frequency dependent and thus a more thorough calculation has been carried out:

This calculation is based on the 1/1 octave band frequency profile of typical gym music and the sound insulation performance of the floor to show the sound level provided and this shows that in order to provide a sound level of 30dBA in the lounge, the gym music sound level cannot be any higher than 80dBA.

Additionally, it should be noted that during the site visit, a measurement was carried out of the current indoor ambient noise level in the lounge of a property directly above the proposed gym and this was shown to be Leq 39dBA. Thus, if the gym music is set to a level of no more than 80dBA, then the resultant 30dBA will be almost 10dB below the existing ambient noise level in the flat's lounge.

This music level will therefore have a negligible effect on the internal ambient noise level in the flat above.

6.3 Gym Music Noise via glazing break-out and break-in - Calculated

There is a second possible route for the Gym music to travel to the nearest domestic NSR and this is via the breakout from the front façade of the gym and then breaking in to the flat above via its glazing.

It has been calculated that the noise travelling via this route is negligible in comparison to the transfer of noise through the separating floor and was confirmed subjectively when measuring the sound insulation on site.

The calculation to confirm this can be found below and shows that the noise level inside the NSR via the glazing break-out / break-in route is only 15dBA when windows are closed:

Façade Area (m^2) (S)	80									
Approx. Distance (r) from Gym to NSR Window	4									
	Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	dBA
Gym Music and Instructor (reverberant)		80.2	80.2	76.1	79.4	77	65.7	65	59.1	80
Gym Glazing SRI		15	20	22	28	33	34	28	28	
Difference		65.2	60.2	54.1	51.4	44	31.7	37	31.1	
10 Log S		19.0309	19.0309	19.0309	19.0309	19.0309	19.0309	19.0309	19.0309	
Reverberant to freefield correction		-6	-6	-6	-6	-6	-6	-6	-6	
Outdoor Sound Power (Lw)		78.2309	73.2309	67.1309	64.4309	57.0309	44.7309	50.0309	44.1309	
SPL outside NSR window (Lw - 20*Log(r) -11)		55.1897	50.1897	44.0897	41.3897	33.9897	21.6897	26.9897	21.0897	42
NSR Façade SRI		22	23	27	32	34	37	32	29	
SPL inside NSR		33.1897	27.1897	17.0897	9.3897	-0.0103	-15.3103	-5.0103	-7.9103	15

Figure 1: Calculation of Gym Music and Instructor noise via the Glazing Break-out / Break-in route

In the figure above, the calculations relate to closed windows. With windows open, only an attenuation of 15dB will be applicable, thus giving an internal sound level of 27dBA, which would still be the less-dominant path.

N.B. A combined level of the above two sections is not required to be calculated because the measurement referred to in section 6.2 will have accounted for the noise transfer through the floor as well as via the break-out / break-in path.

N.N.B. Other properties nearby, though further than 4m away, such as the neighbouring properties to the sides will benefit from further sound reduction than that shown above.

7 Fixed Gym Equipment Noise

The majority of the proposed gym is made up of a space housing technical weight-training equipment with weights in a stack system and cardio-vascular equipment such as treadmills, steppers, bikes and rowing machines.

The bikes and rowing machines are magnetic meaning that there is no spinning noise associated with rotors.

The main noise associated with this room will be the clink of weights within the weight-training machines and this will not be a constant noise – operators of these machines will also be encouraged to gently lower the weights on completion of their work-out "reps".

The reverberant noise level associated with this area of the gym is estimated to be Leq 70dBA – 80dBA in any worst case 1 hour period.

Additionally, the Lmax levels of weight "clinking" noise could be as high as 100dBA but with the main frequency content of this being above 2kHz.

Considering the sound insulation measured for the separating floor is DnTw 54dB, the effective sound insulation at the relevant frequencies will be 60dB.

Whilst the WHO Guidelines do not give requirements for Lmax in dwellings during the daytime period, because the noise content is not diurnal, it would be wise to assess for the Lmax.

Based on the sound insulation performance for the separating floor the Lmax sound levels within the flat above due to weight clinks in the Gym below will be below 45dBA, which is the maximum Lmax criterion for bedrooms at night time.

Based upon the validated survey data from March 2015, it has been calculated based upon the sound reduction of the NSR's façade that the Lmax from the gym is lower than the Lmax being generated by passing traffic during daytime hours be it with windows open or closed.

8 Weight – Lifting Activity Noise

One of the noise generating activities within the main Techno-Gym area will be weight-lifting. The weights are stored on a bar, but able to be lifted off. On finishing the "lift" the weightlifter will drop the weights on to a designated area which is covered in a resilient rubber matting. This generates a significant noise impulse and a number of these weight-dropping instances have been measured in order that their noise effect could be assessed.

The following instances of lift have previously been measured within gyms where the weights are dropped on to a composite of resilient surfaces:

- A lift to shoulder height using a 60kg weight
- A lift to overhead using a 60kg weight
- A lift to shoulder height using a 100kg weight
- A lift to overhead using a 100kg weight

Measurement Condition	Where Measured	L_{Amax} Level (dB)
60kg drop from shoulder height	Internally	102.1
60kg drop from overhead	Internally	103.5
100kg drop from shoulder height	Internally	100.1
100kg drop from overhead	Internally	103.1

Table 7: Weight-drop Lmax noise levels on to 50mm resilient matting

It is currently proposed by the client that a 25mm ILP "Playtile" will be laid for the purpose of this weight dropping. There is, however, no contextual acoustic data relating to this product and weight dropping.

The data in table 7, however, is based upon dropping the weights on to a composite of multiple resilient layers, as this is the recommended approach not only acoustically, but also for mitigation of injury to the lifter and also to prevent damage to the structure and/or equipment. This is because of the force of the drop needing to be significantly dampened.

The results in table 7 are based upon the following resilient materials being in place:

- 10mm Jaymart 'Bladerunner Classic'
- 25mm Regupol FX75
- 25mm Sylomer SR28

Other similar build-ups are possible to provide a resilient layer and could indeed incorporate the proposed "ILP25" as part of it.

Based upon the results in table 7, particularly the Lmax data, it has been previously demonstrated in section 7 that with Lmax data at 100dBA in the gym, the Lmax levels within the residences above would be significantly below 45dBA.

Based upon the 1/1 octave band frequency content of the weight-dropping Lmax noise levels of the separating floor's sound insulation a calculation has been carried out to show the resultant A-weighted Lmax in the NSRs due to weight drops. This is shown in the table below:

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	dBA
Worst case Lmax in Gym	96.3	87.7	96.5	95.3	93.2	97.3	98.6	94.6	104
Sound Reduction of Floor	37.1	38.4	50.4	53.1	50.7	60.7	67.6	73.5	74.2
Resultant Lmax in NSR	59.2	49.3	46.1	42.2	42.5	36.6	31.0	21.1	**46.4**

Table 8: Calculation of Weight Drop Lmax noise levels in NSR

The table above shows that the resultant Lmax in the nearest domestic NSR due to weight dropping in the gym below would be 46dBA (rounded).

This, as with the gym music and instructor noise is below the existing Lmax due to road traffic passing by.

Recommendations relating to the resilient layers to be used in the weight-dropping area can be found in section 10 of this report.

9 A note regarding Air Conditioning Plant

It is understood from discussions with the client that the existing air conditioning plant is to be retained. The A/C condenser unit in the private car-park above the development is also to be retained. No assessment will therefore be required relating to this.

If any change is to be made it will just be the re-positioning of the internal outlets from the grid ceiling closer to the concrete floor, once the grid ceiling is removed. If this is the case it is simply advised that the units are mounted on anti-vibration mounts where practicable.

10 Recommended Noise Mitigation Measures

10.1 Ceilings

It is understood that, as a part of the development, the ceilings within this space are to be altered by the removal of the majority of the absorptive lay-in-grid ceiling tiles to enable an increase in ceiling height. This will reveal the underside of the concrete slab. It is possible that this may *reduce* the airborne sound insulation of the ceiling and so the recommended mitigation improvement to the separating construction is as follows:

Where any holes are revealed, it is recommended that they are filled with mineral wool and made good on the surface with 2 layers of 12.5mm acoustic plasterboard. However, if there are services runs it may be appropriate to install a plasterboard ceiling to conceal these. The plasterboard should be 2 layers of 12.5mm acoustic plasterboard with its joints staggered. This should ideally be mounted on a Gyplyner Universal or Casoline MF Grid system with a void of at least 50mm (partially filled with mineral wool).

10.2 Mitigation against Weight Dropping

It is recommended that users of weight-training machines are encouraged to lower the weights back in to the machine's "stack" of weights on completing their "reps". It is understood that this is common practice anyway in an attempt to keep the machines in good order, but it should be adhered to in terms of sound levels also, so as to mitigate any potential noise nuisance to neighbours.

10.3 Music Noise and Instructor Noise in the gym

It is recommended that before the dance studio or other area Music Systems are brought into regular use, a check should be carried out to ensure that, at the maximum music noise level, the music is close to inaudible inside any neighbouring residential property. For this to be the case, the music noise should be no more than JUST audible outside the neighbouring property at the site boundary.

It is recommended that the speakers, which will be wall mounted are mounted on anti-vibration (AV) mounts.

The use of AV mounts will mitigate structural sound/vibration transfer from the SONOS speakers through to the properties above.

It is understood that the gym users in the main area will have the option of listening to music at background levels or plugging in headphones / earphones to the gym equipment and listening to music through them.

Furthermore it is recommended that evening gym classes being run within the dance studio are limited to a lower sound level of no more than 75dBA.

10.4 Weight Lifting and Dropping

As detailed in section 8 of this report, it has originally been proposed that an ILP25 resilient "playtile" mat is used for the weight dropping area. However it is typically understood that due to the significant impact provided by a weight being dropped, in order to mitigate not only acoustically but also to prevent potential injury from bounces and potential damage to equipment and building, a build-up of multiple layers should be adopted.

It is understood that this method is adopted in other gyms where this activity takes place.

Whilst it is not always practicably possible to completely eliminate noises, it has been found previously that using the following layers is effective:

- 10mm Jaymart 'Bladerunner Classic'
- 25mm Regupol FX75
- 25mm Sylomer SR28

Other similar build-ups are possible to provide a resilient layer and could indeed incorporate one of these layers being the proposed ILP25.

11 Conclusion

Noise levels from the noise generating activities at the proposed re-development of 394 – 398 Brighton Road, Shoreham have been assessed.

It has been shown that, with simple and readily available mitigation measures in place, noise reaching the neighbouring residential properties will be significantly below levels that would give any cause for concern as to noise nuisance.

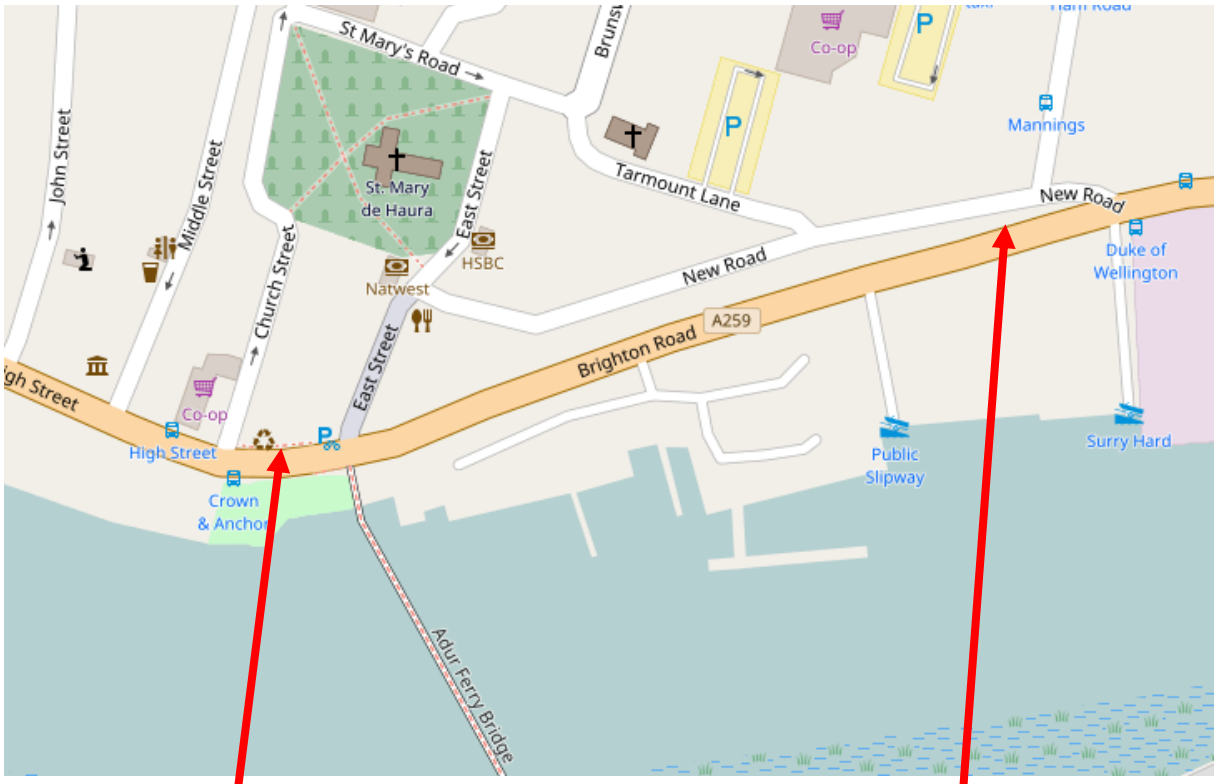
This report shows that, even with residential windows open for ventilation, noise from the proposed development is likely to be considerably below the existing ambient sound level within the nearest NSRs.

Noise levels within amenity areas of the neighbouring residential properties will also be well below the criterion levels set out by the World Health Organization criteria or by the Sussex Planning Noise Advice Document.

It is considered that if the mitigation measures in section 10 of this report are adopted, planning would not be refused on the basis of noise.

Appendix A – Nosie Survey Locations

The figure below shows the location of the noise survey carried out in March 2015 and also the proposed site for re-development in to a gym.



March 2015 Measurements

Proposed Gym Site

Appendix B – Sound Insulation of Separating Floor

Client:	Tony Stitt Fitness								
Site:	394 - 398 Brighton Road, Shoreham								
Sound insulation measurements:									
Freq.	Transm.side	Recg.side	Diff.	RT60	DnT	Std.curve		adj.curve	adv.dev
							2		
50Hz	80.2	48.6	31.6	0.50	31.6		2		
63Hz	91.9	56.6	35.3	0.50	35.3		2		
80Hz	91.8	54.7	37.1	0.50	37.1		2		
100Hz	95.2	57.9	37.3	0.50	37.3	33	2	35	0.0
125Hz	93.9	56.2	37.7	0.50	37.7	36	2	38	-0.3
160Hz	92.6	48.3	44.3	0.50	44.3	39	2	41	0.0
200Hz	93.1	43.8	49.3	0.50	49.3	42	2	44	0.0
250Hz	92.3	43.4	48.9	0.50	48.9	45	2	47	0.0
315Hz	93.4	41.7	51.7	0.50	51.7	48	2	50	0.0
400Hz	90.1	39.5	50.6	0.50	50.6	51	2	53	-2.4
500Hz	88.1	33.8	54.3	0.50	54.3	52	2	54	0.0
630Hz	86.3	33.9	52.4	0.50	52.4	53	2	55	-2.6
800Hz	84.6	34.5	50.1	0.50	50.1	54	2	56	-5.9
1kHz	81.5	34.8	46.7	0.50	46.7	55	2	57	-10.3
1.25kHz	83	31.3	51.7	0.50	51.7	56	2	58	-6.3
1.6kHz	81.3	23.8	57.5	0.50	57.5	56	2	58	-0.5
2kHz	79.6	17.3	62.3	0.50	62.3	56	2	58	0.0
2.5kHz	77.1	13.6	63.5	0.50	63.5	56	2	58	0.0
3.15kHz	77.8	15	62.8	0.50	62.8	56	2	58	0.0
4kHz	80.2	15.4	64.8	0.50	64.8		2		
5kHz	82.1	10	72.1	0.50	72.1		2		
									-28.3
						DnTw=	54		