

Report No. 0289.1 rev 0  
July 2015

**PROPOSED DEVELOPMENT, 275 SANDYCOMBE ROAD, KEW**

**RAILWAY NOISE ASSESSMENT**



**Report prepared by:**

Duncan Newhall BSc MIOA  
DKN Acoustics  
1 Wine Street  
Bradford on Avon  
Wiltshire BA15 1NS

**On behalf of:**

ACI Properties Ltd  
60 Gordon Road  
London  
W5 2AR

<b>CONTENTS</b>	<b>Page</b>
1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION	2
3.0 NOISE SURVEY	3
4.0 ACOUSTIC CRITERIA	5
5.0 NOISE ASSESSMENT & RECOMMENDATIONS	7
6.0 SUMMARY AND CONCLUSIONS	11
Appendix I – Noise units and indices	12
Appendix II – Noise survey results	13
Figure 1 – Site location plan	16
Figure 2 – Proposed ground floor	17
Figure 3 – Proposed first floor	18
Figure 4 – Proposed second floor	19
Figure 5 – Proposed rear elevation	20

## **1.0 INTRODUCTION**

- 1.1 DKN Acoustics has been instructed by ACI Properties Ltd to carry out an assessment of railway noise potentially affecting the residential element of the proposed development at 275 Sandycombe Road, Kew.
- 1.2 The assessment has included:
- Review of site drawings;
  - 24-hour noise measurement survey of railway noise;
  - Assessment of noise levels; and
  - Recommendations for appropriate outline noise control measures to proposed residential facades.
- 1.3 Noise levels referred to in the text of this report have been rounded to the nearest whole decibel (dB), as fractions of dBs are imperceptible. A description of the relevant noise units and noise characteristics is provided in Appendix I.
- 1.4 The noise survey and assessment has been carried out by Duncan Newhall, who is a Member of the Institute of Acoustics (IOA) and holder of the IOA Diploma in Acoustics and Noise Control. DKN Acoustics is an independent acoustic consultancy.

## **2.0 SITE DESCRIPTION**

- 2.1 The existing site comprises a single storey corrugated sheet metal building within a plot to the south-west of the railway lines of the London Underground (District Line) and suburban rail services running at ground level.
- 2.2 The existing use is Class D2, currently used as a billiards room, reception room, ancillary non-residential accommodation and judo club. The proposal is to retain the existing Class D2 use (judo and gymnastics use) at basement and ground floors to the rear of the development.
- 2.3 7 no. residential units will be provided, rising from ground to second floor level (front) and at first floor level only (rear) overlooking the railway.
- 2.4 An outdoor residential amenity area is proposed at second floor level to the rear, with 2 no. private gardens located centrally in the site at ground floor level. Both areas will be provided by screening to the railway by a 1m high parapet wall and intervening buildings respectively.
- 2.5 The site location plan and sample of proposed layout plans are shown in Figures 1-5.

### **3.0 NOISE SURVEY**

- 3.1 A 24-hour noise survey was conducted from 12:25 hours on Monday 15 October 2012. This survey was carried out immediately outside the rear first floor window of the adjacent property at 2 South Avenue. The measurement location provided an unobstructed line of sight/angle of view to the railway lines. The approximate measurement location is shown in Figures 1 and 5.
- 3.2 It is expected that any change in current noise levels compared with the 2012 survey date will be insignificant. Railway noise was the main source affecting the measured levels and noise conditions are not expected to have changed in the interim.
- 3.3 The measurement location is therefore considered representative of the nearest proposed rear residential facade of 275 Sandycombe Road (Unit 5).
- 3.4 A series of continuous 5-minute measurements were recorded. A windshield was fitted to the microphone throughout.
- 3.5 Weather conditions were dry and calm with occasional showers, which represented reasonable conditions for noise measurement.
- 3.6 Noise levels were recorded in terms of the overall A-weighted noise levels, including octave band frequency analysis. A glossary of the main noise descriptors measured is included in Appendix I.
- 3.7 The overall A-weighted noise levels are summarised in Table 1 below. The full set of measured levels is shown in Appendix II.

**Table 1: Summary of mean measured noise levels (rear of 2 South Avenue), dB**

Measurement period	Noise level			
	L <sub>Aeq</sub>	L <sub>Amax</sub>	L <sub>A10</sub>	L <sub>A90</sub>
Day (07:00-23:00 hours)	64	80	66	47
Night (23:00-07:00 hours)	61	78	54	42

Note: levels as measured, not in free-field conditions

3.8 Railway noise was the main source affecting the measured levels, with aircraft noise also present.

3.9 The measured L<sub>Aeq</sub> noise levels were 64 dB (daytime) and 61 dB (night-time). The mean night-time L<sub>Amax</sub> noise level recorded was 78 dB.

*Noise measurement equipment*

3.10 All noise measurements were undertaken using a fully-calibrated RION NA-28 Type 1 sound level meter (serial no. 00991176), including pre-amplifier model NH-23 (serial no. 81217) and microphone model UC-59 (serial no. 01421). The calibration of the meter was checked before and after the survey, using calibrator model NC-74 (serial no. 34794362) with no variation in level noted.

## 4.0 ACOUSTIC CRITERIA

### **BS 8233: 2014**

- 4.1 Appropriate guidance on acoustic design goals for residential development is set out in British Standard 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'. The World Health Organisation 'Guidelines for community noise' generally concurs with the recommendations of BS8233: 2014.
- 4.2 The desirable criteria recommended by BS8233: 2014 for dwellings are shown in Table 2.

**Table 2: Table 4 of BS 8233: 2014 desirable indoor ambient noise levels for dwellings**

Activity	Location	Time period	
		07:00-23:00 hrs (day)	23:00-07:00 hrs (night)
Resting	Living room	35 dB $L_{Aeq,16hour}$	n/a
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	n/a
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Note 1: Table 4 provides recommended levels for overall noise in the design of a building. These are the sum of structure-borne and airborne noise sources. Groundborne noise is assessed separately and is not included as part of these targets, as human response to groundborne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

Note 2: The levels shown in Table 4 are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4.

Note 3: These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

Note 4: 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.

Note 5: If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

Note 6; Attention is drawn to the Building Regulations [30, .31, 32]

Note 7: Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

- 4.3 It should be noted that Note 7 states that the levels shown in Table 2 may be relaxed (i.e. increased) by up to 5 dB and still provide reasonable conditions for residential amenity, where development is considered necessary or desirable. However, to provide a robust assessment, the adopted noise criteria in habitable rooms are 35 dB  $L_{Aeq}$  daytime and 30 dB  $L_{Aeq}$  night-time.
- 4.4 Note 4 above makes reference to railway noise. Due to the site location, a further adopted acoustic criterion is to ensure that the  $L_{Amax}$  noise level in bedrooms at night does not normally exceed 45 dB. This was a recommendation of the 1999 version of BS8233 and the WHO Guidelines state that this level should not normally be exceeded for 10-15 occasions at night.
- 4.5 BS8233: 2014 also states the following for external areas of residential developments:

*"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB  $L_{Aeq,T}$ , with an upper guideline value of 55 dB  $L_{Aeq,T}$  which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*

*Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB  $L_{Aeq,T}$  or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."*



## 5.0 NOISE ASSESSMENT & RECOMMENDATIONS

5.1 The noise assessment considers the following noise control recommendations. These may typically be controlled by appropriate planning condition.

*Habitable rooms overlooking the railway (rear of Unit 5)*

5.2 Detailed daytime and night-time noise calculations have been undertaken to predict the level of noise break-in to proposed first floor habitable rooms (living rooms and bedrooms of proposed Unit 5) to the rear of the development overlooking the railway.

5.3 The calculations take into account the octave band frequency content of the external noise levels and the cumulative noise break-in through the proposed component building facade elements (i.e. glazing, ventilation units, walls and roof). The detailed noise calculations will be provided on request.

5.4 Table 3 below summarises the outline facade noise control recommendations for the most exposed facade. These measures have been calculated to meet the adopted BS8233: 2014 noise criteria discussed in the previous section.

**Table 3: Minimum recommended façade measures for most exposed rooms (rear of Unit 5)**

Living/dining rooms		Bedrooms	
Glazing	Ventilation	Glazing	Ventilation
10/12/8mm double glazing or 8/10/8.8mm laminated double glazing or 6/100/4mm secondary glazing	Silavent Freshflo SM2/P Acoustic Vent Type A or similar	10/12/8.4mm laminated double glazing or 8/12/8.8mm laminated double glazing or 6/100/4mm secondary glazing	Silavent Freshflo SM2/P Acoustic Vent Type A or similar

Note: e.g. 10/12/8mm glazing means 10mm glazing/12mm cavity/8mm glazing

5.5 Acoustic vents have been recommended for habitable rooms, to reduce the need to open windows for ventilation and therefore maintain the acoustic integrity of the facade.

### DKN Acoustics

- 5.6 The above recommendations assume a masonry external wall construction and non-lightweight roof construction for the new-build areas of the development. These are required to avoid lightweight constructions which may otherwise offer insufficient attenuation of external noise.

*Habitable rooms in other areas*

- 5.7 The above glazing and ventilation specifications will be more than adequate for habitable rooms located elsewhere on the development. At these other locations, noise levels will be significantly lower due to attenuation provided by additional distance from the railway and acoustic screening provided by intervening buildings.
- 5.8 The recommended measures are also expected to be more than adequate to attenuate road traffic noise for the proposed habitable rooms to the front of the development overlooking Sandycombe Road. These comprise living rooms only (Units 1-4 & 6-7) and are set back from the front boundary of the site.
- 5.9 The recommended noise control measures will ensure that the BS8233: 2014 recommendations shown in Table 2 are achieved in habitable rooms.

*Outdoor areas*

- 5.10 The proposed central garden areas of the development at ground floor level will be very well screened from railway noise by the proposed intervening buildings rising to first floor level. These spaces will also benefit from increased distance attenuation from the railway compared with the boundary measurement location, where 64 dB  $L_{Aeq}$  was measured during the daytime. It is therefore predicted that the acoustic screening and distance attenuation combined will enable the daytime railway noise level in these garden areas to meet the 50-55 dB  $L_{Aeq}$  range typically recommended as desirable by BS8233: 2014.
- 5.11 The proposed amenity area at second floor level to the rear will include a 1m high parapet wall around its entire perimeter constructed from solid, imperforate masonry. This will provide useful acoustic screening of railway noise to the amenity area behind. The south-eastern flank will also include the stair access construction rising to 2.5m in height. This will provide additional extended height acoustic screening and reduced angle of view to the railway lines from the amenity area.

5.12 It is predicted that the above measures will fully break the line of sight from the railway to a seated person in the amenity area. With the additional distance attenuation to the centre part of the amenity space, it is predicted that the noise level will meet or approach the 50-55 dB  $L_{Aeq}$  range recommended as desirable by BS8233: 2014 at this location.

5.13 The measures provided in the design will follow the recommendations of BS8233 to achieve the 'lowest practicable levels' and which state more fully that:

*'However, it is also recognised that these guideline values [of 50-55 dB  $L_{Aeq}$ ] are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.'*

*Separating partitions with Class D2 use*

5.14 The assessment of potential noise transfer between the proposed Class D2 use and residential accommodation is beyond the scope of this assessment. The typical noise level generated within the proposed Class D2 use is expected to be generally low. However, the following outline comments are provided:

- Separating partitions of the development will need to meet the minimum sound insulation requirements of Part E of the Building Regulations. However, it is recommended that the separating partitions between the Class D2 use areas and residential spaces achieve a better standard of sound insulation than this minimum requirement. This measure would further reduce potential noise transfer from the Class D2 use.
- The construction design may therefore need to incorporate outline measures such as acoustic wall and ceiling linings, acoustic floating floors and acoustically-lined columns (if present).
- Windows in the Class D2 use area may need to remain closed during any use generating higher noise levels. This may in turn require the use of air-conditioning comfort cooling plant to reduce the need to open windows.

- Should amplified music be required in the Class D2 use (e.g. to accompany gymnastics performance), a noise-limiting device may need to be installed to limit the amplified music noise and low frequency (bass beat) content at source.

5.15 The above matters may be adequately controlled by appropriate planning condition.

## **6.0 SUMMARY AND CONCLUSIONS**

- 6.1 A noise assessment has been carried out of the residential element of the proposed development at 275 Sandycombe Road, Kew.
- 6.2 The site is affected by railway noise to the rear of the existing building.
- 6.3 A 24-hour noise survey has been undertaken at the adjacent site to the rear of the site.
- 6.4 Appropriate façade noise control measures have been recommended to ensure that the internal noise levels of proposed habitable rooms and outdoor amenity space will meet the recommendations of BS8233: 2014 for residential amenity.
- 6.5 With the correct implementation of the recommended noise control measures, it is therefore considered that the planning permission may be granted. These matters may be adequately controlled by appropriate planning condition.

## Appendix I – Noise units and indices

### Sound pressure level and the decibel (dB)

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain). An increase in noise level of 10 dB(A) is roughly perceived as a doubling of the sound source. A 3 dB(A) change in noise level is generally the minimum perceptible difference.

### Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or Hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz. Young people with normal hearing can hear frequencies in the range 20 Hz to 20,000 Hz. However, the upper frequency limit gradually reduces as a person gets older.

### Glossary of Terms

When a noise level is constant and does not fluctuate over time, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below.

**L<sub>Aeq</sub>** The A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L<sub>Aeq</sub> is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

**L<sub>Amax</sub>** The maximum A-weighted noise level that was recorded during the monitoring period.

**L<sub>A10</sub>** The A-weighted noise level exceeded for 10% of the time period. L<sub>A10</sub> is commonly used as a descriptor of road traffic noise.

**L<sub>A90</sub>** The A-weighted noise level exceeded for 90% of the time period. L<sub>A90</sub> is used as a measure of background noise.

**D<sub>nT,W</sub>** Weighted standardised level difference. The single number quantity which characterises the airborne sound insulation between rooms in a building (i.e. not laboratory testing). The higher the D<sub>nT,w</sub>, the better the sound insulation performance.

**L'<sub>nT,W</sub>** The weighted standardised impact sound pressure level. The single number quantity used to characterise the impact sound insulation of floors in a building (i.e. not laboratory testing) over a range of frequencies.

**SEL or L<sub>AE</sub>** Sound exposure level which is the level of sound of 1 second duration, that has the same sound energy as the actual noise event considered.

### A-weighting

The human ear responds differently to different frequencies of sound. A-weighting is the method of adjusting measured sound pressure levels to take into account human hearing and our uneven frequency response. For example, an A-weighted Leq noise level of 95 dB can be written as either Leq of 95 dB(A) or LAeq of 95 dB.

**Appendix II – Noise survey results**

**Table A1: Measured noise levels 15-16 October 2012, dB**

Time start	Time end	Noise level, dB				Time start	Time end	Noise level, dB			
		L <sub>Aeq</sub>	L <sub>Amax</sub>	L <sub>A10</sub>	L <sub>A90</sub>			L <sub>Aeq</sub>	L <sub>Amax</sub>	L <sub>A10</sub>	L <sub>A90</sub>
12:25	12:30	63.6	80.5	64.8	45.8	16:25	16:30	64.5	80.7	66.3	43.0
12:30	12:35	59.9	77.7	63.2	44.0	16:30	16:35	61.9	74.4	67.1	42.0
12:35	12:40	58.8	72.6	62.0	46.0	16:35	16:40	63.4	81.8	66.0	43.6
12:40	12:45	64.5	83.5	64.7	46.3	16:40	16:45	62.5	76.3	67.1	43.7
12:45	12:50	65.1	82.0	65.3	45.4	16:45	16:50	58.6	74.9	63.3	41.1
12:50	12:55	62.2	78.8	65.8	48.5	16:50	16:55	66.1	82.0	68.6	47.0
12:55	13:00	65.4	81.7	68.0	47.7	16:55	17:00	62.7	78.1	66.8	46.2
13:00	13:05	62.7	78.8	67.2	47.2	17:00	17:05	67.1	81.9	71.9	44.6
13:05	13:10	62.8	80.1	62.6	44.0	17:05	17:10	64.8	77.7	70.4	45.4
13:10	13:15	62.3	78.4	63.4	45.9	17:10	17:15	64.8	81.5	67.0	45.5
13:15	13:20	64.1	80.5	68.7	45.2	17:15	17:20	63.3	82.5	65.3	45.4
13:20	13:25	59.0	72.7	62.7	45.0	17:20	17:25	65.0	82.1	67.2	43.2
13:25	13:30	65.0	83.1	63.8	46.7	17:25	17:30	65.3	80.8	69.2	43.6
13:30	13:35	60.8	75.8	65.3	45.2	17:30	17:35	63.8	77.1	69.2	46.2
13:35	13:40	63.9	78.8	65.9	46.7	17:35	17:40	61.2	74.9	65.6	45.5
13:40	13:45	60.7	76.6	63.2	44.9	17:40	17:45	67.1	86.5	70.1	49.4
13:45	13:50	65.6	80.8	67.3	45.2	17:45	17:50	62.8	76.8	66.8	46.5
13:50	13:55	60.6	79.6	61.9	46.3	17:50	17:55	63.1	78.0	66.2	47.2
13:55	14:00	64.8	79.7	64.8	48.2	17:55	18:00	63.0	78.3	67.6	46.5
14:00	14:05	61.5	74.1	66.3	46.2	18:00	18:05	64.2	76.3	69.6	48.8
14:05	14:10	64.3	80.0	66.9	45.8	18:05	18:10	63.1	76.9	67.7	47.0
14:10	14:15	61.5	77.6	63.7	46.7	18:10	18:15	62.9	75.8	67.2	48.9
14:15	14:20	66.5	85.3	68.0	45.7	18:15	18:20	65.8	83.5	67.4	49.4
14:20	14:25	60.4	78.0	62.7	44.5	18:20	18:25	62.9	78.5	66.5	48.3
14:25	14:30	65.5	80.7	68.0	49.4	18:25	18:30	65.8	82.0	68.7	47.5
14:30	14:35	60.8	75.9	64.1	45.9	18:30	18:35	60.3	75.6	62.8	46.1
14:35	14:40	66.5	81.8	66.6	47.5	18:35	18:40	62.7	76.7	66.6	49.4
14:40	14:45	61.9	80.2	63.5	49.0	18:40	18:45	66.6	82.1	68.1	48.1
14:45	14:50	65.2	80.5	68.1	46.1	18:45	18:50	61.9	76.1	65.9	46.4
14:50	14:55	60.0	78.1	61.2	45.8	18:50	18:55	63.1	78.9	67.1	46.3
14:55	15:00	62.5	79.4	66.7	47.1	18:55	19:00	64.7	78.9	68.6	47.2
15:00	15:05	65.2	80.3	69.1	46.7	19:00	19:05	61.9	78.0	66.0	46.4
15:05	15:10	64.6	80.6	67.1	46.1	19:05	19:10	65.8	81.5	68.2	46.8
15:10	15:15	62.9	80.5	66.7	46.0	19:10	19:15	61.1	77.1	65.8	47.3
15:15	15:20	66.0	83.7	66.3	46.6	19:15	19:20	66.8	80.9	71.8	46.5
15:20	15:25	64.4	83.0	66.8	46.9	19:20	19:25	64.5	77.7	69.1	45.7
15:25	15:30	66.1	80.6	70.8	47.8	19:25	19:30	61.6	76.8	66.1	44.7
15:30	15:35	58.6	72.1	63.0	47.0	19:30	19:35	62.0	77.1	66.2	45.7
15:35	15:40	63.4	77.8	66.5	46.6	19:35	19:40	64.7	82.9	66.4	46.8
15:40	15:45	63.0	78.8	67.2	44.4	19:40	19:45	62.8	78.0	65.8	45.4
15:45	15:50	58.5	75.0	56.6	41.0	19:45	19:50	63.4	81.4	66.8	44.6
15:50	15:55	64.8	81.2	67.9	43.9	19:50	19:55	63.9	79.6	65.9	45.7
15:55	16:00	64.2	76.3	69.0	44.0	19:55	20:00	65.3	82.9	65.6	45.5
16:00	16:05	65.9	82.0	68.8	42.2	20:00	20:05	60.8	76.7	65.3	47.1
16:05	16:10	63.0	76.9	66.1	41.2	20:05	20:10	63.8	80.1	68.1	46.3
16:10	16:15	64.4	82.7	66.0	44.5	20:10	20:15	64.6	81.0	67.3	45.1
16:15	16:20	66.0	83.1	68.8	44.5	20:15	20:20	62.6	75.1	67.1	47.4
16:20	16:25	62.9	79.4	66.0	44.6	20:20	20:25	64.9	78.6	70.1	45.7

Time start	Time end	Noise level, dB				Time start	Time end	Noise level, dB			
		LAeq	LAmx	LA10	LA90			LAeq	LAmx	LA10	LA90
20:25	20:30	66.5	81.3	70.0	47.1	00:25	00:30	63.2	82	60.8	41.4
20:30	20:35	62.3	76.0	67.0	44.0	00:30	00:35	65.2	85.1	57.4	40.2
20:35	20:40	62.5	78.2	66.0	45.0	00:35	00:40	41.9	55	66.2	47.7
20:40	20:45	63.6	76.7	69.0	44.4	00:40	00:45	64.9	81	50.8	40.1
20:45	20:50	62.7	77.2	66.7	45.0	00:45	00:50	42.5	62.6	68.2	44.9
20:50	20:55	61.3	77.7	64.0	44.4	00:50	00:55	58.9	78.7	67.5	44.2
20:55	21:00	68.7	90.3	69.1	45.6	00:55	01:00	46.4	58.5	51.6	39.6
21:00	21:05	63.6	79.5	65.5	44.3	01:00	01:05	61.0	79.8	71.1	46.2
21:05	21:10	66.4	83.3	69.2	46.6	01:05	01:10	45.0	52.9	55.2	42.3
21:10	21:15	62.4	75.4	67.3	45.9	01:10	01:15	42.5	48	69.2	48.3
21:15	21:20	65.1	81.3	67.5	45.9	01:15	01:20	42.4	58.7	52.6	44.3
21:20	21:25	60.5	75.6	65.5	43.5	01:20	01:25	44.9	61	65.0	41.6
21:25	21:30	63.4	77.8	67.2	45.7	01:25	01:30	44.0	50.7	61.6	41.7
21:30	21:35	64.3	80.9	66.3	44.3	01:30	01:35	44.9	57	56.8	40.7
21:35	21:40	64.6	83.5	66.2	46.8	01:35	01:40	44.5	70.2	45.7	39.7
21:40	21:45	62.5	78.0	66.1	43.7	01:40	01:45	45.8	60.1	67.7	45.5
21:45	21:50	67.1	84.4	64.1	42.3	01:45	01:50	48.1	53.5	70.0	49.1
21:50	21:55	60.0	79.0	57.7	43.8	01:50	01:55	46.5	57.7	52.1	44.2
21:55	22:00	64.7	84.1	64.1	42.9	01:55	02:00	44.6	54.1	56.8	40.4
22:00	22:05	59.4	75.1	63.4	42.6	02:00	02:05	48.1	60.9	58.5	39.5
22:05	22:10	65.5	85.3	64.1	43.7	02:05	02:10	44.1	52.4	63.8	37.5
22:10	22:15	64.0	82.0	66.0	42.9	02:10	02:15	46.0	53.5	56.2	45.0
22:15	22:20	62.1	78.5	63.3	45.0	02:15	02:20	48.8	58.2	58.2	40.0
22:20	22:25	64.8	81.8	66.6	46.7	02:20	02:25	46.3	54.6	59.9	38.7
22:25	22:30	61.7	75.9	66.4	43.4	02:25	02:30	45.7	52.8	60.4	40.4
22:30	22:35	62.9	80.5	62.4	42.9	02:30	02:35	44.7	50.6	60.0	38.8
22:35	22:40	61.0	79.3	58.0	42.9	02:35	02:40	43.1	48.3	58.3	38.6
22:40	22:45	62.0	80.0	57.2	42.0	02:40	02:45	47.0	54.5	51.5	44.1
22:45	22:50	60.0	78.1	55.9	43.0	02:45	02:50	46.1	55.5	47.1	42.9
22:50	22:55	57.0	76.1	49.5	41.5	02:50	02:55	47.3	52.7	46.7	40.4
22:55	23:00	63.5	78.8	65.8	43.9	02:55	03:00	51.1	58.2	45.7	41.6
23:00	23:05	56.9	75.4	66.5	43.0	03:00	03:05	46.3	54.7	54.9	47.7
23:05	23:10	63.6	80.6	61.2	45.6	03:05	03:10	47.8	55.6	44.7	39.4
23:10	23:15	64.5	82.1	48.6	39.6	03:10	03:15	44.2	50.6	57.2	43.1
23:15	23:20	47.2	70.8	69.0	45.0	03:15	03:20	51.4	57.3	53.9	45.7
23:20	23:25	59.8	77.8	59.0	41.5	03:20	03:25	51.6	58.4	48.1	40.0
23:25	23:30	61.6	76.9	71.0	47.8	03:25	03:30	53.7	61.9	50.8	43.4
23:30	23:35	53.9	71.9	65.8	42.8	03:30	03:35	53.8	60.9	57.1	49.0
23:35	23:40	58.2	74.8	63.4	45.6	03:35	03:40	52.7	60.3	56.8	46.5
23:40	23:45	64.1	82	50.3	39.8	03:40	03:45	52.9	62.7	48.9	41.6
23:45	23:50	57.4	77.7	51.2	39.1	03:45	03:50	70.9	91.2	50.7	45.0
23:50	23:55	45.5	68.2	70.4	47.1	03:50	03:55	49.2	56.6	45.1	38.7
23:55	00:00	58.7	76.9	71.1	48.4	03:55	04:00	51.4	61.9	49.3	39.5
00:00	00:05	58.0	76.3	64.2	39.9	04:00	04:05	48.5	59.6	55.3	46.2
00:05	00:10	58.6	74.8	59.5	43.3	04:05	04:10	47.7	53.3	52.5	41.7
00:10	00:15	60.1	79.5	51.7	40.8	04:10	04:15	72.6	91.9	54.0	47.7
00:15	00:20	62.2	81.5	53.5	40.2	04:15	04:20	45.8	55.9	49.6	41.7
00:20	00:25	58.7	78	68.5	48.1	04:20	04:25	43.0	50	54.1	45.9



Time start	Time end	Noise level, dB				Time start	Time end	Noise level, dB			
		LAeq	LAmx	LA10	LA90			LAeq	LAmx	LA10	LA90
04:25	04:30	41.0	46.7	48.1	40.1	08:25	08:30	61.1	77.6	63.0	49.7
04:30	04:35	41.4	46.4	52.4	44.0	08:30	08:35	65.0	84.6	67.4	48.0
04:35	04:40	56.3	73.1	45.9	41.0	08:35	08:40	60.1	77.1	62.5	48.6
04:40	04:45	45.3	52.9	48.6	41.2	08:40	08:45	64.3	77.5	68.9	52.5
04:45	04:50	42.1	49.7	51.4	43.7	08:45	08:50	58.9	75.3	62.3	49.5
04:50	04:55	40.2	45.4	49.0	40.7	08:50	08:55	63.4	83.4	63.3	49.9
04:55	05:00	56.2	75.2	43.9	38.6	08:55	09:00	65.1	81.5	65.7	51.2
05:00	05:05	60.1	79.1	47.9	41.8	09:00	09:05	62.7	77.6	66.2	48.5
05:05	05:10	57.5	74.2	50.3	40.6	09:05	09:10	65.4	81.3	67.2	52.0
05:10	05:15	57.1	74.2	50.4	42.5	09:10	09:15	63.4	80.7	67.0	50.4
05:15	05:20	41.6	47.2	46.5	41.6	09:15	09:20	63.7	81.3	63.0	50.4
05:20	05:25	40.9	47.7	50.5	43.4	09:20	09:25	62.4	75.4	65.8	50.0
05:25	05:30	57.2	74.7	50.1	38.8	09:25	09:30	60.8	80.1	64.2	51.0
05:30	05:35	60.5	75.2	50.5	43.9	09:30	09:35	66.3	85.6	66.9	47.8
05:35	05:40	55.9	75.4	48.2	41.1	09:35	09:40	64.8	80.7	68.2	47.6
05:40	05:45	60.1	79	47.4	40.5	09:40	09:45	63.4	77.6	67.8	50.0
05:45	05:50	44.5	56.3	48.9	41.2	09:45	09:50	60.4	77.0	63.1	51.4
05:50	05:55	64.7	83.2	50.0	43.8	09:50	09:55	64.7	79.1	69.4	48.9
05:55	06:00	60.5	77.4	46.7	40.5	09:55	10:00	65.9	85.0	67.2	53.4
06:00	06:05	63.9	78.4	46.7	40.7	10:00	10:05	62.5	77.2	66.3	51.0
06:05	06:10	65.7	77.9	48.1	38.6	10:05	10:10	61.7	76.1	62.8	50.3
06:10	06:15	63.0	78.2	46.6	40.5	10:10	10:15	63.6	78.5	66.4	50.1
06:15	06:20	62.6	76.3	45.9	39.4	10:15	10:20	61.8	77.2	65.9	49.0
06:20	06:25	65.9	83.8	45.3	38.3	10:20	10:25	63.0	82.1	65.6	52.1
06:25	06:30	65.7	81.4	45.3	40.2	10:25	10:30	63.7	79.5	66.0	50.5
06:30	06:35	67.5	82.4	45.2	39.3	10:30	10:35	65.6	81.5	67.9	50.0
06:35	06:40	64.2	79.3	42.9	38.5	10:35	10:40	61.4	78.7	64.0	49.2
06:40	06:45	63.2	78.9	43.7	38.7	10:40	10:45	64.5	80.2	66.6	49.2
06:45	06:50	64.9	76.2	43.5	37.5	10:45	10:50	63.3	79.4	65.5	48.8
06:50	06:55	66.9	81.3	43.6	38.7	10:50	10:55	65.4	80.0	69.5	50.6
06:55	07:00	64.4	77.8	42.9	36.9	10:55	11:00	62.0	78.1	65.0	51.2
07:00	07:05	68.3	82.6	72.8	50.5	11:00	11:05	63.7	79.8	64.9	51.5
07:05	07:10	66.3	79.5	71.3	48.5	11:05	11:10	64.9	82.9	63.2	50.4
07:10	07:15	66.1	79.0	70.5	48.5	11:10	11:15	61.7	76.9	65.1	50.8
07:15	07:20	65.5	81.5	67.0	49.5	11:15	11:20	63.2	80.3	65.2	52.1
07:20	07:25	62.1	77.0	65.6	47.8	11:20	11:25	63.4	81.0	65.5	51.6
07:25	07:30	64.7	78.1	69.3	49.3	11:25	11:30	66.1	85.5	65.9	51.0
07:30	07:35	61.3	74.4	65.2	48.5	11:30	11:35	63.4	78.3	66.9	51.4
07:35	07:40	59.3	76.0	61.8	48.1	11:35	11:40	65.0	80.2	68.7	50.4
07:40	07:45	63.6	77.7	67.4	48.7	11:40	11:45	61.7	77.1	63.3	49.1
07:45	07:50	58.7	71.8	62.3	49.8	11:45	11:50	63.7	79.6	68.3	52.0
07:50	07:55	62.5	78.4	66.1	48.3	11:50	11:55	64.2	80.9	68.2	49.6
07:55	08:00	60.4	73.4	64.0	50.3	11:55	12:00	61.7	75.8	65.0	49.5
08:00	08:05	67.7	84.4	69.1	48.8	12:00	12:05	67.2	84.6	69.1	50.4
08:05	08:10	57.5	72.3	60.9	49.6	12:05	12:10	62.8	80.9	64.2	51.4
08:10	08:15	65.4	81.3	68.3	48.6	12:10	12:15	63.7	78.5	66.6	51.3
08:15	08:20	62.8	77.3	67.4	50.6	12:15	12:20	65.7	83.1	67.1	49.8
08:20	08:25	63.1	79.4	66.0	50.4	12:20	12:25	60.9	77.5	63.1	50.5

Figure 1 – Site location plan

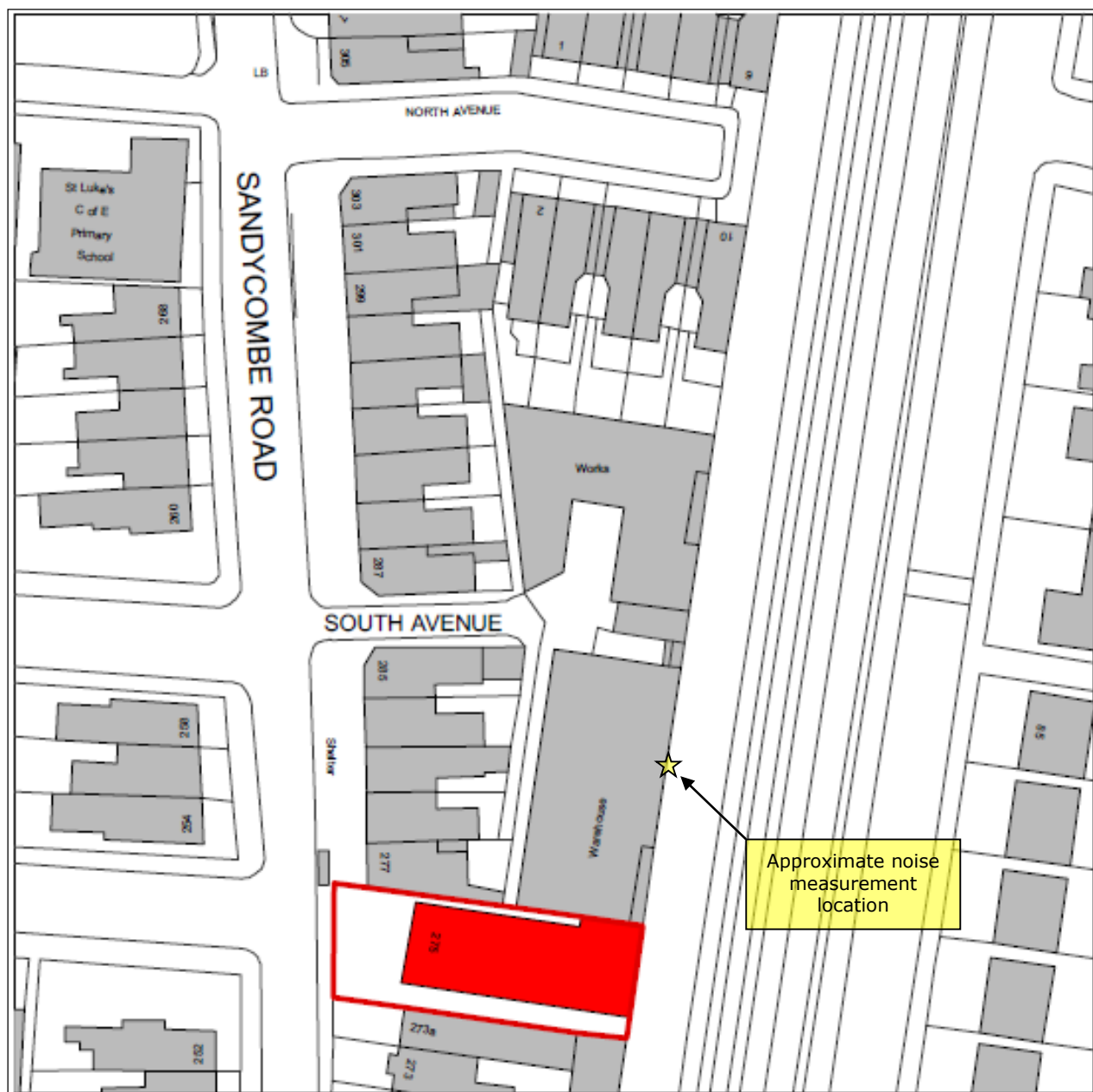


Figure 2 – Proposed ground floor

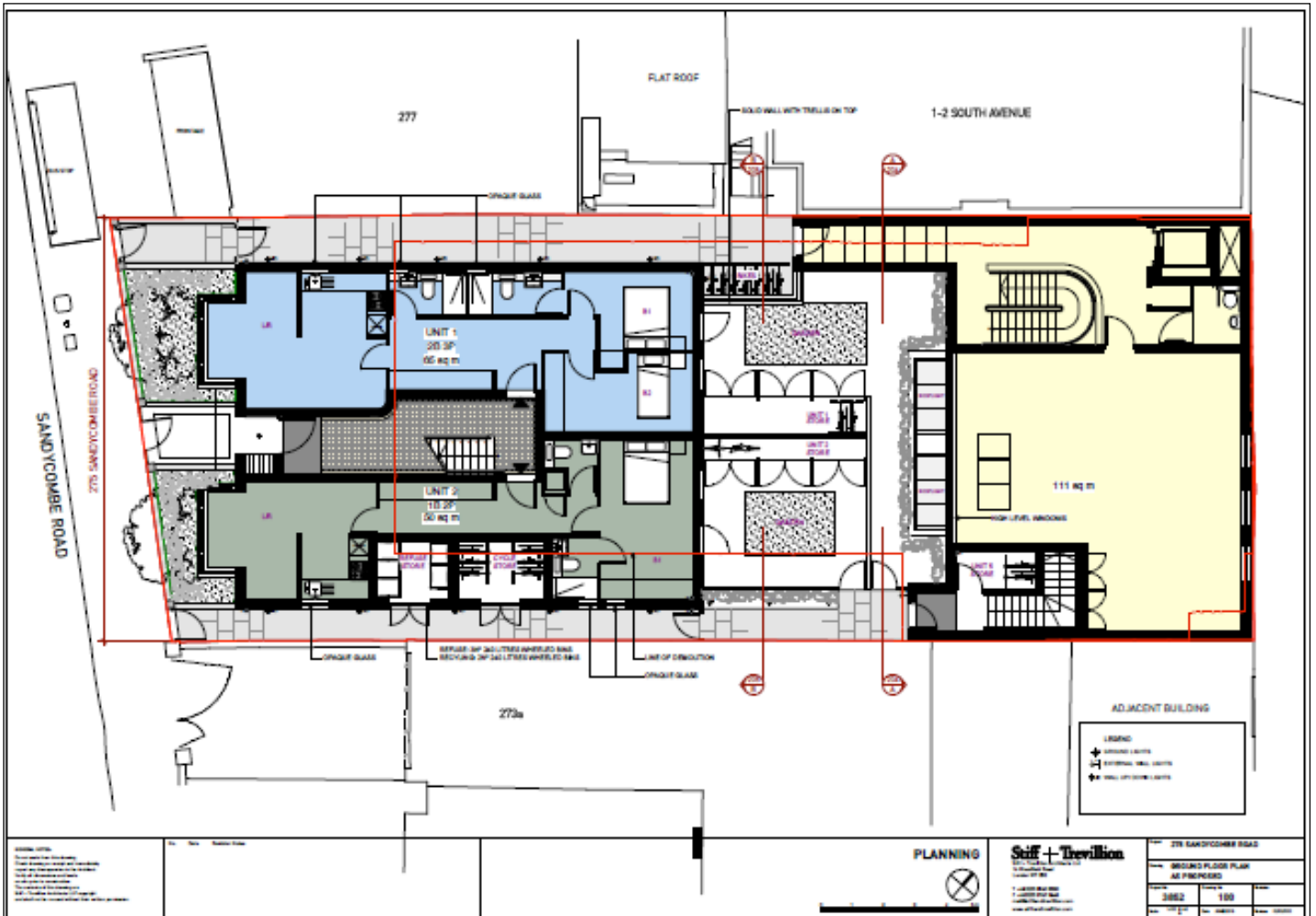


Figure 3 – Proposed first floor

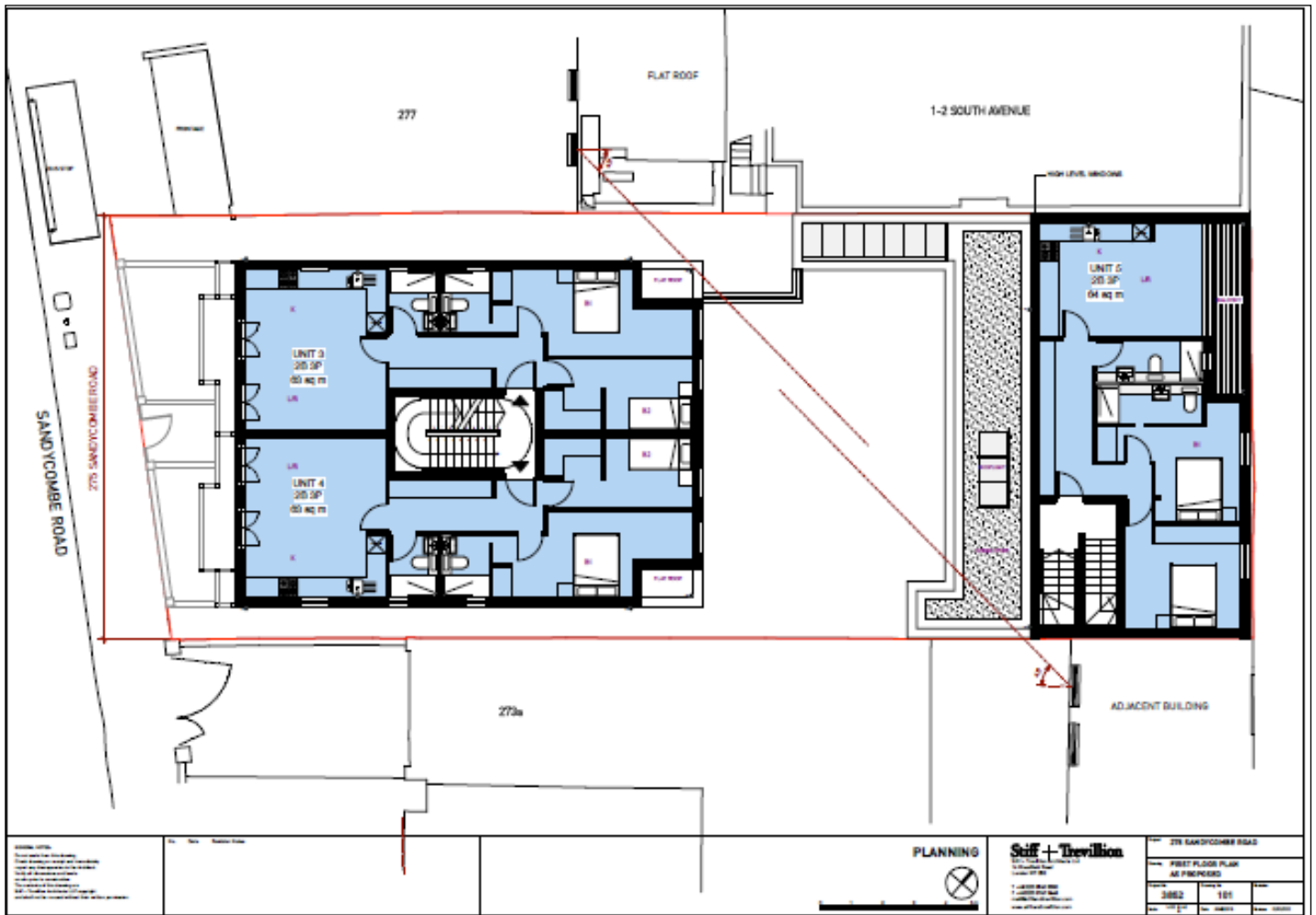


Figure 4 – Proposed second floor

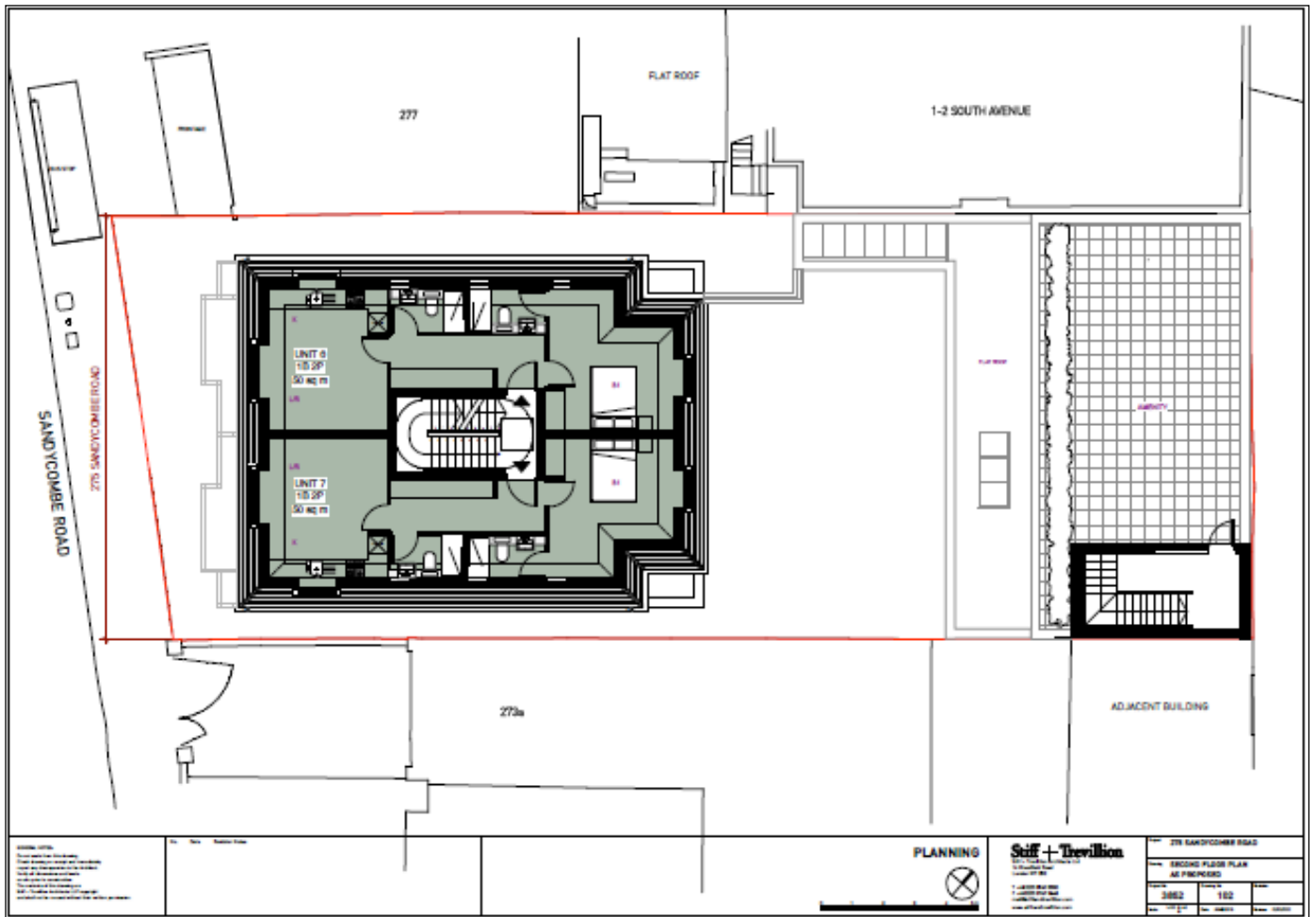


Figure 5 – Proposed rear elevation

