Our ref: NIA/6593/16/6507/v2/Renshaw Street

22nd July 2016

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Dear Sirs

NOISE IMPACT ASSESSMENT FOR PROPOSED RESIDENTIAL AND COMMERCIAL DEVELOPMENT AT 48–54 RENSHAW STREET, LIVERPOOL

1.00 INTRODUCTION

1.01 Environmental Noise Solutions has been commissioned by Knight Frank LLP, on behalf of its client YPG Developments, to carry out a noise impact assessment for a proposed residential and commercial development at 48–54 Renshaw Street, Liverpool (hereafter referred to as the application site).

1.02 The objectives of the noise impact assessment were therefore to:

- Determine the ambient noise climate at the application site during representative periods of the daytime and night time.
- Assess the potential impact of the ambient noise climate on the proposed residential development with reference to relevant guidelines.
- Provide recommendations for a scheme of sound attenuation works, as necessary, to ensure that the future occupants of the proposed residential development do not experience any unacceptable loss of amenity due to noise.

1.03 This report details the methodology and results of the assessment and provides recommendations for the building envelope (fenestration and ventilation). It has been prepared to accompany a planning application to be submitted to Liverpool City Council for the proposed development.

1.04 This report has been prepared for YPG Developments for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult YPG Developments, Knight Frank LLP (planning agent) and ENS as to the extent to which the findings may be appropriate for their use.

1.05 A glossary of acoustic terms used in the main body of the text is contained in Appendix 1.

2.00 APPLICATION SITE SETTING AND PROPOSED RESIDENTIAL DEVELOPMENT

2.01 The application site is located in a mixed-use residential/commercial area in Liverpool city centre and currently consists of an existing two-storey building (to be demolished). The application site is bound by (see site location plan in Appendix 2):

- Renshaw Street to the east;
- Heathfield Lane to the north;
- 11-storey car park to the west; and
- Adjoining 2-storey commercial properties to the south.

2.02 Renshaw Street is moderately trafficked and is the principal noise source at the application site during the daytime and night-time.

2.03 Development proposals are for demolition of part of the existing building and erection of an eleven storey building, creating 160 units of a mix of residential studios and aparthotel units. Commercial space and other associated uses at basement and ground floor levels, including cycle store, plant room, offices, reception, store room, laundry room, gym and lobby.

3.00 BASELINE NOISE SURVEY

3.01 In order to establish the ambient noise levels at the application site, a baseline noise survey was carried out on Friday 18th March and Saturday 19th March 2016.

3.02 For the purpose of the assessment, the following noise monitoring positions were adopted (the approximate location of the noise monitoring positions is contained in Appendix 2 for reference):

- MP1 was located on the eastern façade of the development (at first floor level at 1 metre from the existing building façade) overlooking Renshaw Street.
- MP2 was located midway along the northern façade of the development (at first floor level at 1 metre from the existing building façade) overlooking Heathfield Street.
- MP3 was located at the western façade of the development (at first floor level at 1 metre from the existing building façade).

3.03 Noise measurements were undertaken using Bruel & Kjaer 2250 Type 1 integrating sound level meters. The measurement system calibration was verified immediately before the commencement of the measurement sessions and again at the end, using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration level was noted. Weather conditions throughout the survey were appropriate for monitoring.

3.04 Measurements consisted of A–weighted broadband parameters, together with linear octave band L_{eq} levels. The following table contains a summary of the measurement data for each measurement session, at each measurement position, rounded to the nearest decibel.

3.05 External measurements were made at 1 metre from the existing building façade. A –3 decibel façade enhancement correction has therefore been applied to the measured noise levels in order to establish the free field noise levels (set out in the table below).

Table 3.1 – Summary of Noise Measurement Data

Position	Date	Time	L_{Aeq} (dB)	L_{A90} (dB)	L_{A10} (dB)	L_{A1} (dB)	Comment
MP1	18/03/16	1415–1515	66	57	69	74	Road traffic on Renshaw Street dominates. Circa 700 vehicles / hour during the daytime. Circa 600 vehicles / hour during the start of the night time.
MP1	18/03/16	1515–1615	66	57	69	73	
MP1	18/03/16	1615–1715	66	59	69	73	
MP1	18/03/16	2300–0700	64	51	68	72	
Daytime ambient noise level 66 dB $L_{Aeq\ (0700–2300)}$ based on CRTN methodology Night time ambient noise level 64 dB $L_{Aeq\ (2300-0700)}$							
MP2	18/03/16	1448–1518	62	53	65	69	Road traffic on Renshaw Street dominates.
MP3	18/03/16	1525–1555	59	52	62	67	Distant road traffic.
Daytime ambient noise level circa 62 dB $L_{Aeq,\ T}$ at MP2 Daytime ambient noise level circa 59 dB $L_{Aeq,\ T}$ at MP3							

3.06 The daytime and night time ambient noise levels at the application site are dominated by road traffic on Renshaw Street. Pedestrian noise associated with neighbouring pubs/night clubs and the nearby casino was occasionally audible during the night time period but not measurable. Road traffic on Renshaw Street remains the dominant noise source.

3.07 For the prediction of daytime road traffic noise, the Department of Transport's Memorandum on the Calculation of Road Traffic Noise (CRTN) explains that the following shortened measurement procedure may be used. Measurements of L_{A10} are made over any three consecutive hours between 10:00 and 17:00 hours. Using $L_{A10\ (3\ hour)}$ as the arithmetic mean of the three consecutive values of hourly L_{A10}, the $L_{A10\ (18\ hour)}$ can be calculated from the equation:

(i) $L_{A10\ (18\ hour)} = L_{A10\ (3\ hour)} - 1$ dB

3.08 PPG24 further states that for road traffic noise:

(ii) $L_{Aeq\ (0700–2300)} \approx L_{A10\ (0600–0000))} - 2$ dB

3.09 Substituting (ii) into (i) gives the following approximation:

(iii) $L_{Aeq\ (0700–2300)} \approx L_{A10\ (3\ hour)} - 3$ dB

3.10 Based on the above formula, the daytime ambient noise level at MP1 is measured / calculated at 66 dB $L_{Aeq\ (0700–2300)}$.

3.11 The night time ambient noise level at MP1 was measured at 64 dB $L_{Aeq\ (2300–0700)}$.

3.12 Manual traffic counts indicated that road traffic on Renshaw Street decreased only slightly between daytime and night time, commensurate with the city centre setting during a Friday night.

3.13 Ambient noise levels at MP2 and MP3 decreased accordingly with increasing distance and screening from Renshaw Street. Noise associated with the adjacent car park was not significant in level and not readily discernible against the ambient climate which was formed of distant and local road traffic.

4.00 NOISE IMPACT ASSESSMENT CRITERIA

4.01 British Standard 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' sets guideline indoor ambient noise levels for dwellings, for steady external noise sources, which it is desirable, are not exceeded. These levels are reproduced in the following table.

Table 4.1 – Indoor Ambient Noise Levels in Dwellings (BS 8233:2014)

Activity	Location	0700–2300	2300–0700
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

4.02 Note 4 to the above table 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_{AFMax} depending on the character and number of events per night. Sporadic noise events could require separate values'.*

4.03 With respect to L_{AFMax} criteria, WHO Guidelines for Community Noise states '*There is evidence that the pattern of noise variation with time relates to annoyance (Berglund et al. 1976). It has been suggested that the equal-energy principle is a simple concept for obtaining a measure representative of the annoyance of a number of noise events. For example, the $L_{Aeq,T}$ of the noise from a busy road may be a good indicator of the annoyance this noise may cause for nearby residents. However, such a measure may not be very useful for predicting the disturbance to sleep of a small number of very noisy aircraft fly-overs. The disturbance caused by small numbers of such discrete events is usually better related to maximum sound pressure levels and the number of events.*

ENS comment: it is evident that BS 8233 and the WHO Guidelines for Community Noise consider that night time maxima guideline values relate to discrete, individual noise events (such as aircraft and trains etc) rather than road traffic and general community noise.

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

4.05 Building Regulations Approved Document F 'Ventilation' (2010) states that for mainly naturally ventilated buildings, it is common to use a combination of ventilators (e. g. for dwellings it is common to use intermittent extract fans for **extract ventilation**, trickle ventilators for **whole dwelling ventilation** and windows for **purge ventilation**

4.06 Purge ventilation throughout the building to aid the removal of high concentrations pollutants and water vapour released from occasional activities such as painting and decorating and or accidental releases such as smoke and burnt food or spillage of water. Purge ventilation is intermittent i.e. required only when such activities occur. Purge ventilation provisions may also be used to improve thermal comfort, although this is **not controlled** under Building Regulations.

ENS comment: it is evident that BS 8233 (and also Building Regulations) considers that adequate ventilation is provided by open trickle ventilators.

4.07 Note 7 to the above table states '*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.*'

4.08 Given the large areas of glazing proposed on the Renshaw Street façade, and the relatively high ambient noise levels from road traffic, it is considered appropriate to apply the 'reasonable' standard to indoor ambient noise levels at the proposed development.

4.09 On the basis of the above, for residential development, the following criteria are considered appropriate:

- ≤ 40 dB $L_{Aeq\ (0700\text{-}2300)}$ in living rooms and bedrooms during the daytime
- ≤ 35 dB $L_{Aeq\ (2300\text{-}0700)}$ in bedrooms during the night time

5.00 SOUND ATTENUATION SCHEME PROPOSALS

5.01 The 16-hour daytime and 8-hour night time ambient noise levels at MP1 (fronting onto Renshaw Street) have been measured / calculated at 66 dB $L_{Aeq\ (0700–2300)}$ and 64 dB $L_{Aeq\ (2300–0700)}$, respectively.

5.02 In order to calculate the sound insulation requirements of the building envelope for habitable rooms fronting onto Renshaw Street, the Building Research Establishment (BRE) building envelope insulation calculation spreadsheet was used. This spreadsheet is based on the calculation methodology advocated in BS 8233. The spreadsheet allows input of external noise levels, room dimensions and reverberation time together with parameters for the various elements of the building envelope and calculates the internal noise level in terms of the external noise level metric (L_{Aeq} in this case).

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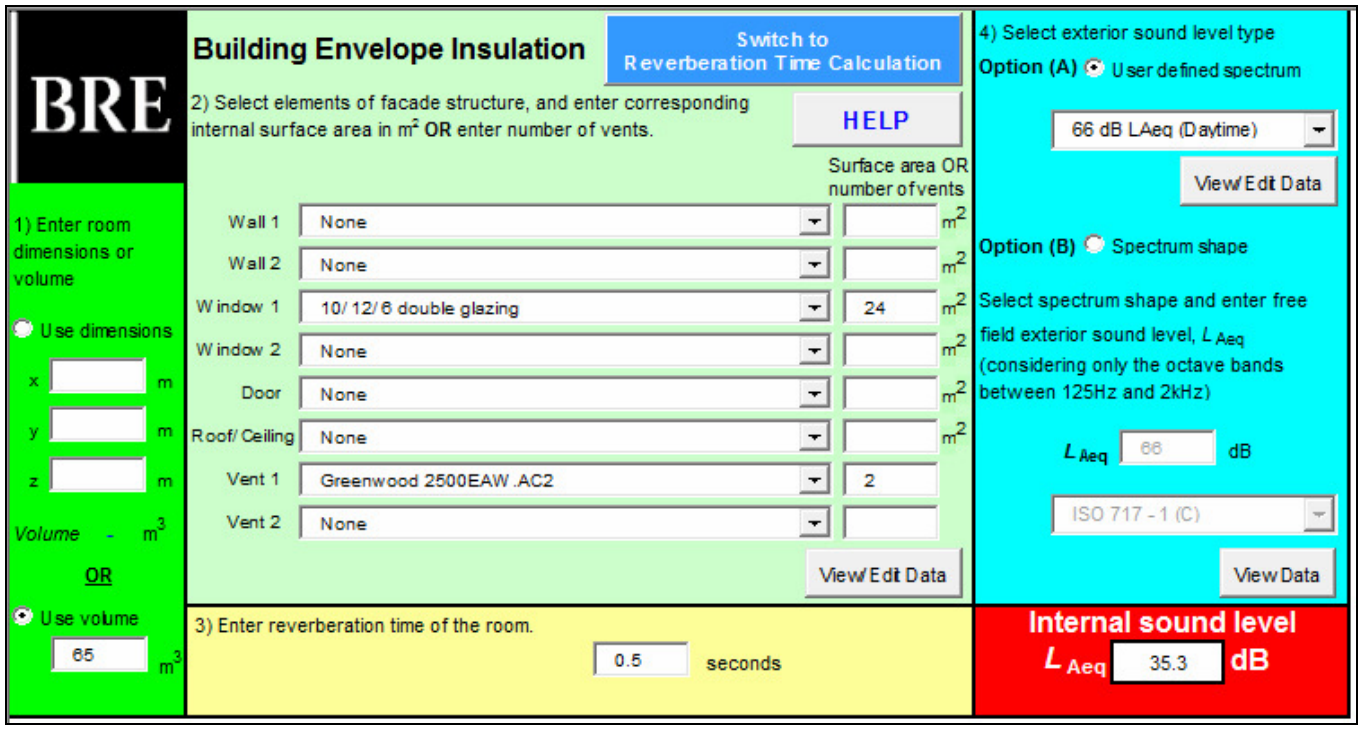
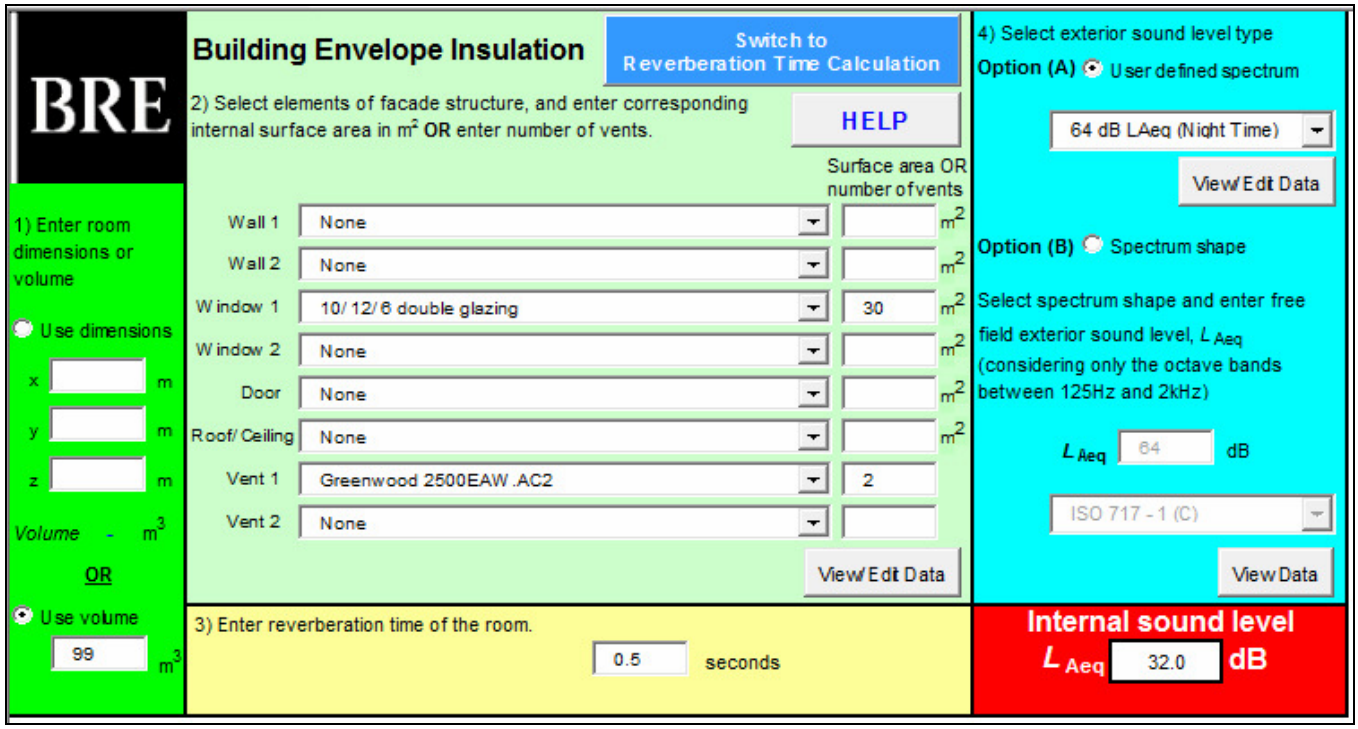
5.03 For the purpose of the assessment, the room dimensions of the worst case apartments have been used (i.e. corner apartments, which have the smallest ratio of glazing area to room volume).

5.04 The Building Research Establishment (BRE) building envelope insulation calculation spreadsheets are shown below.

Road-Fronting Apartments – Daytime



Road-Fronting Apartments – Night Time



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5.05 A scheme of sound insulation for the application site is summarised in the table below (see Appendix 3 for an annotated glazing/ventilation layout):

Table 5.1 – Scheme of Sound Insulation Works

Location	Noise Level	Internal Criteria	Glazing and Ventilation
Apartments overlooking Renshaw Street	66 dB $L_{Aeq\ (0700–2300)}$ 64 dB $L_{Aeq\ (2300–0700)}$	< 40 dB $L_{Aeq\ (0700–2300)}$ < 35 dB $L_{Aeq\ (2300–0700)}$	Enhanced glazing i.e. 10/(6-20)/6 and acoustic trickle vents $\geq$ 41 dB $D_{n,e,w}$+C
Remaining apartments (set back/screened from Renshaw Street)	$\leq$ 62 dB $L_{Aeq\ (0700–2300)}$ $\leq$ 60 dB $L_{Aeq\ (2300–0700)}$	< 40 dB $L_{Aeq\ (0700–2300)}$ < 35 dB $L_{Aeq\ (2300–0700)}$	Standard glazing i.e. 4/(6-20)/4 and acoustic trickle vents $\geq$ 41 dB $D_{n,e,w}$+C

5.06 Ventilation may be provided via acoustic trickle vents rated at least 41 dB $D_{n,e,w}$+C per 2500 mm² EA in open position, such as the Greenwood 2500EAW.AC1 or equivalent (note: 2 no. required per habitable room).

6.00 CONCLUSIONS

6.01 A noise impact assessment has been undertaken for the proposed residential and commercial development at 48–54 Renshaw Street, Liverpool.

6.02 The ambient noise climate is due to road traffic on Renshaw Street and the surrounding road network.

6.03 A scheme of sound insulation works has been developed to protect the proposed residential development from the ambient noise climate.

6.04 In conclusion, the ambient noise climate does not represent a constraint to the proposed residential development.

I trust the foregoing is sufficient for your needs. Should you have any queries regarding the above, please do not hesitate to contact me.

Yours sincerely

T. Crabb

Thomas Crabb
MIOA, Diploma in Acoustics and Noise Control
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cc File

Appendix 1
Glossary of Acoustic Terms

Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 µPa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log_{10}(p/p_0)$$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_0 = reference sound pressure (20 µPa).

A-weighting Network

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T. $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T. L_{A90} is typically taken as representative of background noise.

$L_{AF\ max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

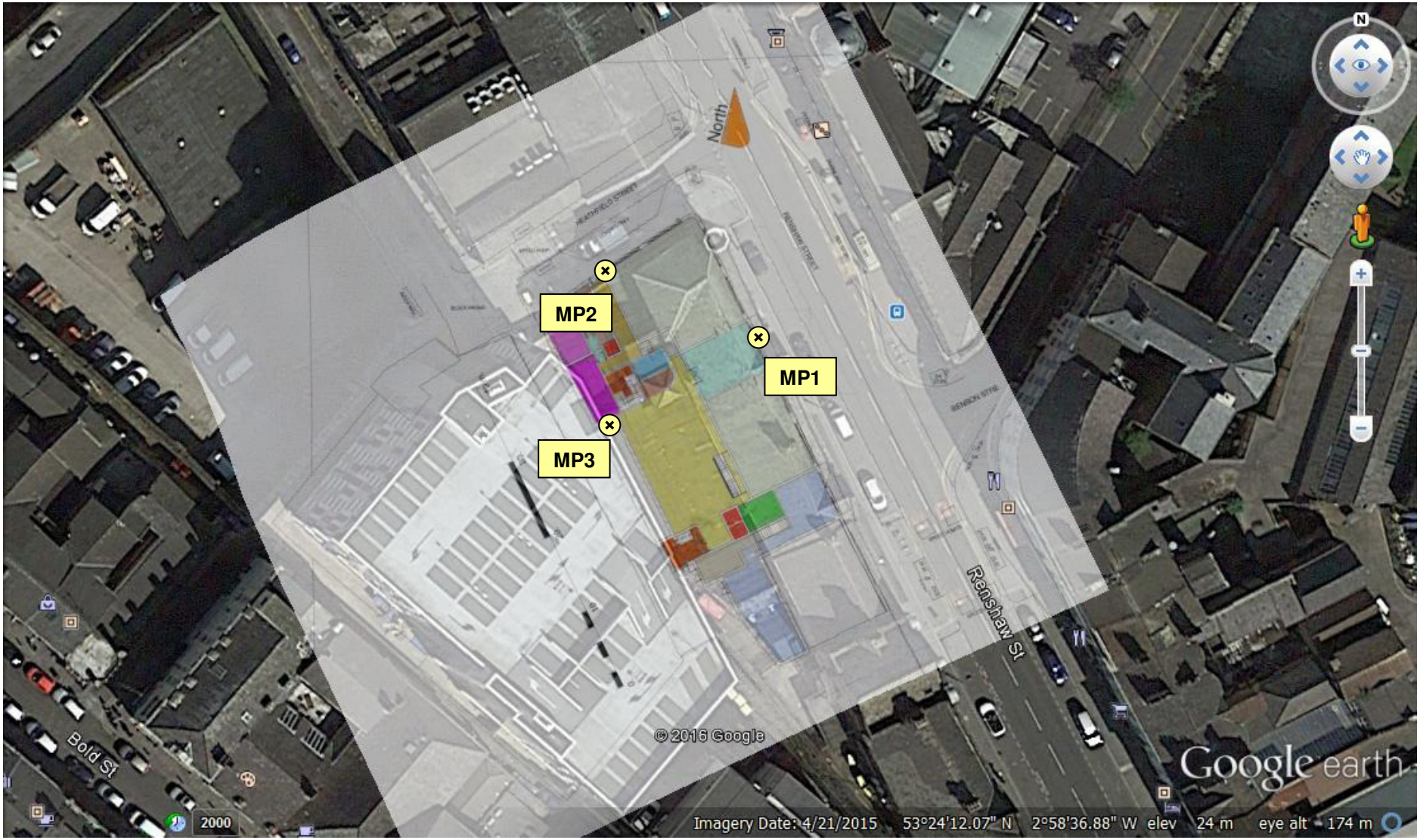
Sound Exposure Level (SEL or L_{AE})

The energy produced by a discrete noise event averaged over one second, no matter how long the event actually took. This allows for comparison between different noise events which occur over different lengths of time.

Weighted Sound Reduction Index (R_W)

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_W is used to characterise the insulation of a material or product that has been measured in a laboratory).

Appendix 2
Drawings (Site Plan / Noise Monitoring Positions)



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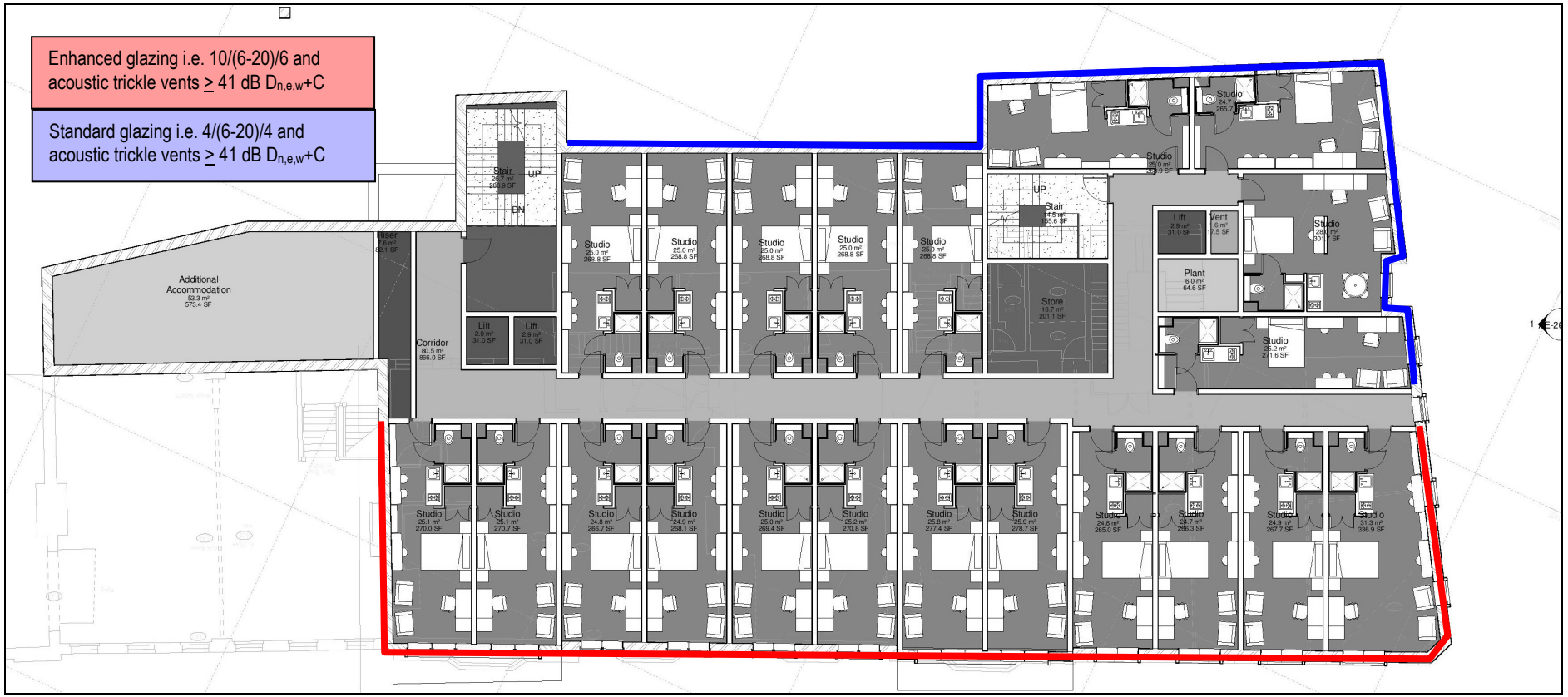
Appendix 3
Glazing/Ventilation Requirements – First Floor



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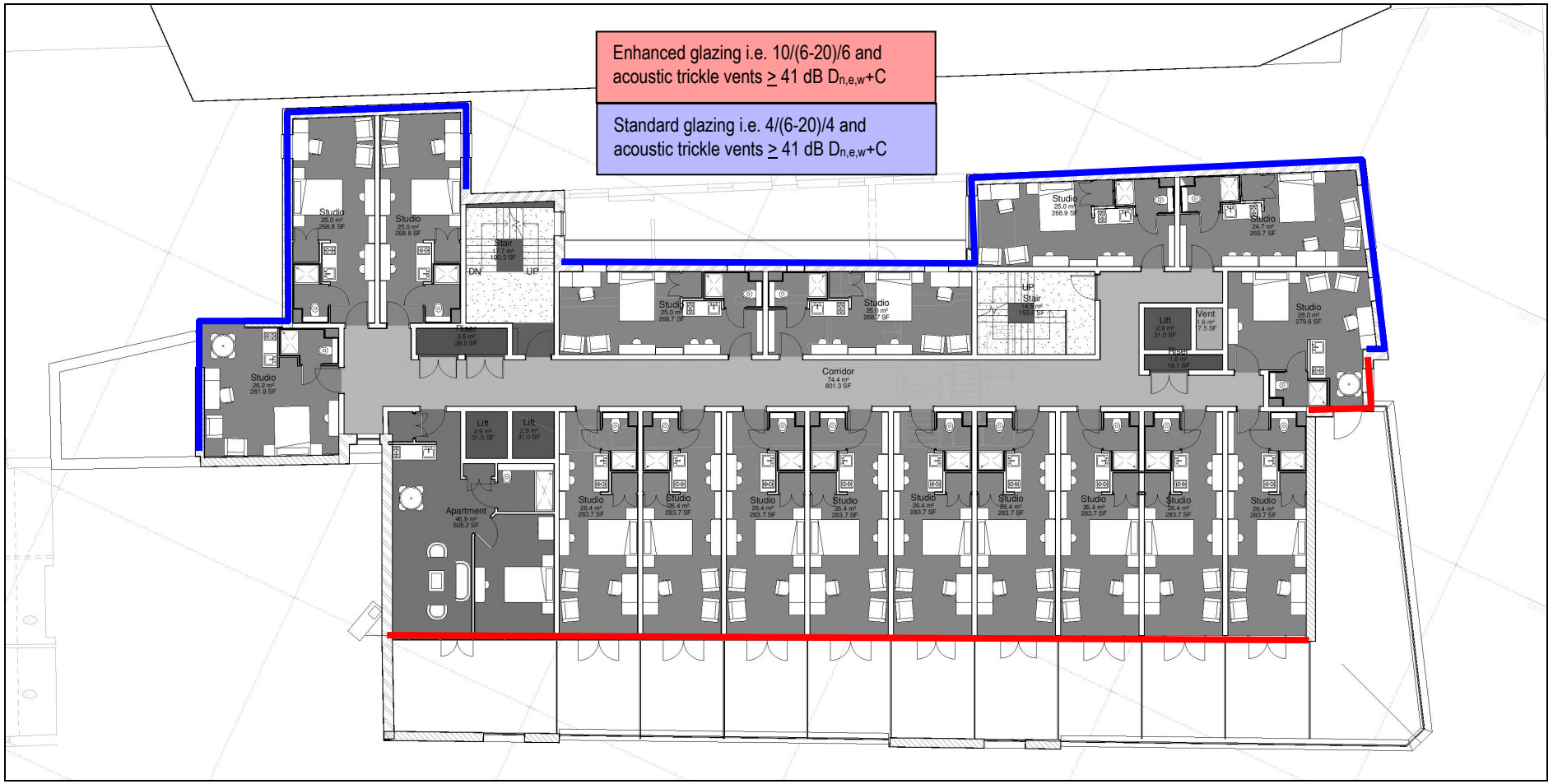
Appendix 3
Glazing/Ventilation Requirements – Second to Fourth Floors



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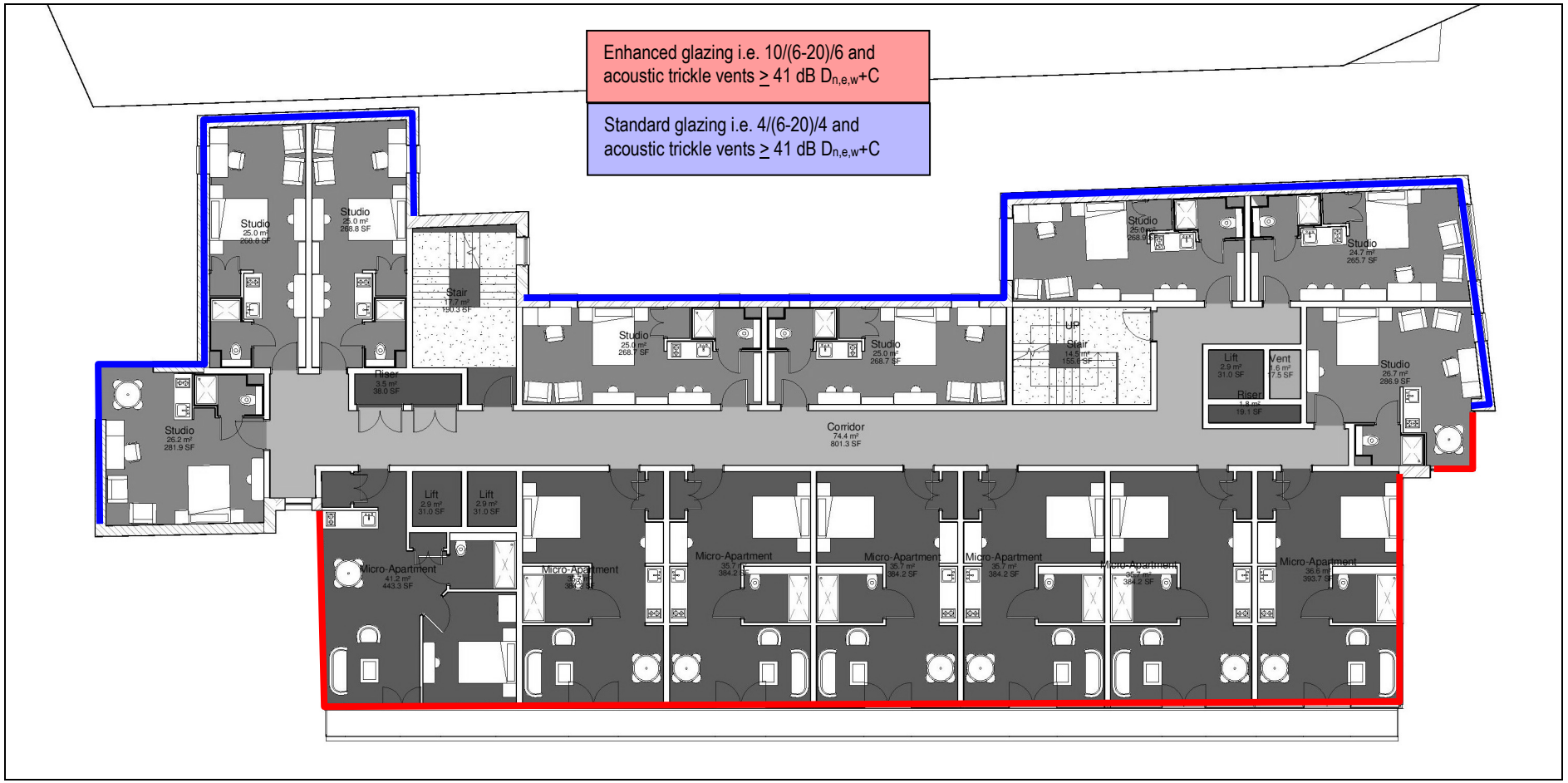
Appendix 3
Glazing/Ventilation Requirements – Fifth to Seventh Floors



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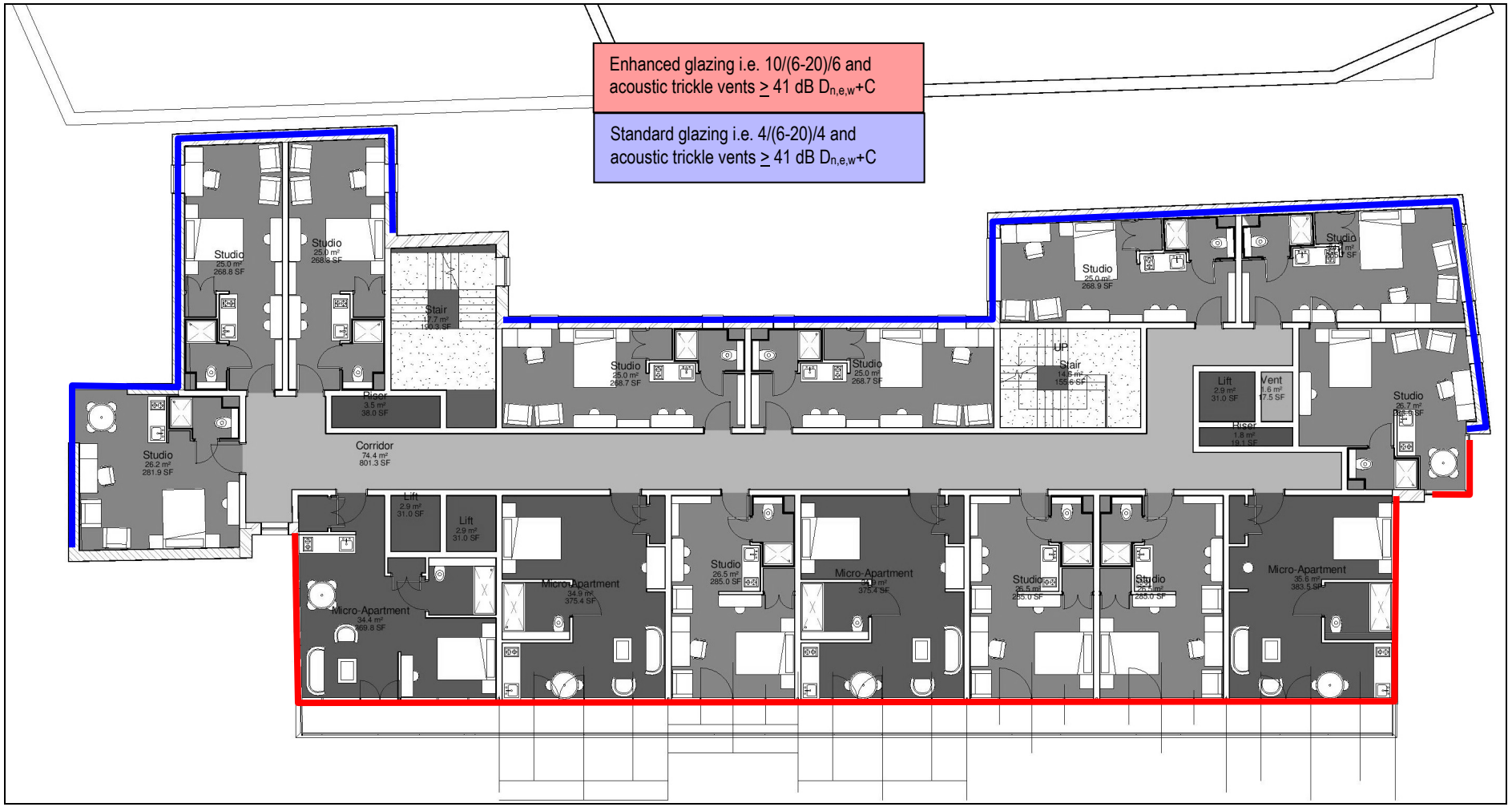
Appendix 3
Glazing/Ventilation Requirements – Eighth and Ninth Floors



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Appendix 3
Glazing/Ventilation Requirements – Tenth Floor