

Astral House
The Runway
Ruislip
HA4 6SE

**External Building Fabric
Design Report**

On behalf of



Project Reference: 85364 | Revision: 01 | Date: 17 October 2017

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Document Information

Project Name : Astral House, The Runway, Ruislip, HA4 6SE
Project Reference : 85364
Report Title : External Building Fabric Design Report
Doc Reference : 85364/EBF
Date : 9 October 2017

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Revision	Date	Description	Prepared	Reviewed/ Approved
1	17 October 2017	References to balconies amended	NAC	JS

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1.0 Introduction

- 1.1. Noise Solutions Ltd has been commissioned by Trout Rise Developments to give acoustic design advice for the building envelope of Richmond House, a proposed residential development to be located on the grounds of an unused former car park at Astral House, The Runway, Ruislip.
- 1.2. The development is to comprise a new three-storey block, which will be occupied by six residential apartments. A noise and vibration survey has previously been undertaken to establish baseline levels across the development site, in accordance with Hillingdon Council's *Supplementary Planning Document (SPD): Noise*.
- 1.3. Recommendations are made in this report for the acoustic performance of glazing and ventilators, to provide performance capable of meeting Hillingdon council's requirements and recommendations in WHO Guidance and BS 8233:2014.

2.0 Site description

- 2.1. The proposed development site is located on the north side of The Runway, Ruislip. The site is bordered to the south by offices currently undergoing conversion to residential pursuant to Prior Approval application 42570/APP/2014/4341 and to the east by a car park. The north of the site is bordered by a railway line and South Ruislip Station. Appendix B contains an aerial photograph showing the site and surrounding area.
- 2.2. The area surrounding the site is both residential and commercial. There are numerous existing residential premises within close proximity of the site, including premises to the south east located at comparable distances from the railway line. It should be noted that the railway line is sited on a raised bank.
- 2.3. Observations with regard to the noise climate across the development site were made during daytime attendances on Thursday 4th June and Monday 8th June 2015. The main sources of noise affecting the development site have been established as follows;
 - Constant road traffic;
 - Regular aircraft flyovers and train movements;
- 2.4. The existing Astral House building was undergoing conversion works at the time of the survey. As result, the noise climate may have been affected by noise from construction activities Monday to Saturday.

- 2.5. Observations were made with regard to operational activity of other commercial premises in the local area. No significant sources of intrusive noise were observed to emanate from these sites (e.g. plant noise, delivery noise, etc.). Proposed plant

3.0 Development proposals

- 3.1. It is proposed to construct a new three-storey building within the development site. The building is to be roughly square in footprint with associated car parking to the north and a shared garden area to the south. Appendix B contains plans of the proposed development site.
- 3.2. There will be two residential apartments on each floor of the building. It should be noted that there will be no windows to bedrooms, or balconies, on the elevation fronting the railway line; small windows on the north façade serve the kitchens and bathrooms of flats 1, 3 and 5. Car parking spaces, a bin store and cycle store will be located externally. Noise associated with any car parking activity has not been included within this assessment due to the small scale of the proposals.

4.0 Assessment criteria

Overview

- 4.1. Hillingdon Council's Environmental Protection Department was previously consulted to establish requirements for noise and vibration planning assessments for residential development. It is generally requested that assessments relating the following would be required, in accordance with Hillingdon's *SPD: Noise*,
- Assessment in general accordance with PPG24 to determine the suitability of the site for residential development.
 - Outline assessment of proposed external building fabric (i.e. façade construction, glazing specification, ventilation strategy) to ensure suitable indoor amenity can be achieved within residential premises.
 - Assessment of noise levels within outdoor garden/balcony spaces.
 - Assessment of existing vibration levels to determine likely effect on buildings and occupants.
- 4.2. Assessments of the suitability of the site against the above criteria were completed in 2015 and reported in NSL's report RF85364/PNA/Rev A (dated 30 Jun 2015).

- 4.3. This report gives details of the acoustic specifications for glazing and ventilators, in accordance with the assessment criteria and methodologies described in the following sections.

Internal/external noise criteria

- 4.4. *SPD: Noise* Section 5.1 provides details of specific noise criteria to be achieved within various internal/external residential spaces. These criteria have been specified based on the guidance given in BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' and WHO document 'Guidelines for Community Noise' (1999).

Table 1 Summary of applicable internal/external noise criteria

Period	Space	Recommended Noise Level (dB)
Daytime (07:00 – 23:00)	Outdoor living areas	As low as practicable, and <50 $L_{Aeq,T}$ *
	Indoor living areas	< 35 $L_{Aeq,T}$ *
Night-time (23:00 – 07:00)	Outside bedroom windows	< 45 $L_{Aeq,T}$ *(façade) < 60 $L_{Amax, Fast}$ (façade)
	Inside bedrooms	< 30 $L_{Aeq,T}$ * <45 $L_{Amax, Fast}$

Source: Hillingdon Council SPD: Noise Section 5.1

* Time base T should be appropriate for the circumstances, typically 1 hour day and 5 minutes night.

- 4.5. The external building fabric and any internal building services plant should be designed to ensure compliance with the above internal criteria. It should be noted that the above external noise criteria during the night-time period are based on achieving suitable internal amenity through a scheme of natural ventilation (i.e. assuming an overall noise reduction of approximately 15dB for a partially open window). It is considered reasonable for these external noise limits to be exceeded provided a suitable alternative ventilation strategy (e.g. trickle vents, mechanical ventilation) can be incorporated to ensure the corresponding internal noise limits are achieved.

5.0 Noise survey

- 5.1. An environmental noise and vibration survey was undertaken to establish prevailing noise levels at the development site over an extended weekend period.

- 5.2. Measurements were taken between Thursday 4th June and Monday 8th June 2015 at a single location (P1) along the site boundary with the railway line. The location (as indicated in Appendix A) is considered representative of the worst affected façade in terms of both noise and vibration. The full set of measurement results and details of the survey methodology can be found in Appendix C.

Noise data

- 5.3. The noise survey results measured at position P1 have been summarised in the following table.

Table 2 Summary of environmental noise survey results at position P1

Period (T)	L _{Aeq,T} (dB)	Highest occurring L _{Aeq} (1 hr day / 15 min night)	Lowest occurring L _{A90} (15mins) (dB)	Range of L _{Amax} (dB)	
				Fast	Slow
Daytime (07.00 - 23.00 hours)	58 - 62	66	36	62 - 96	59 - 94
Night-time (23.00 - 07.00 hours)	54 - 56	66	29	45 - 86	43 - 81

- 5.4. Analysis of the night-time maximum (L_{AMax,F}) values measured indicates that the highest values are very infrequent. Typically, the L_{AMax} noise level exceeds 77 dB only rarely. A value of 77 dB L_{AMax,F} is therefore considered typical of the level which is rarely exceeded.
- 5.5. It should be noted that the noise climate onsite was affected by noise from localised construction activity on the Saturday morning. Measured noise levels over this five-hour period have been omitted from the above summary as they are considered unrepresentative.
- 5.6. To assist with the external building fabric specification, the 16-hour daytime and 8-hour night-time equivalent continuous (L_{Aeq}) noise levels have been calculated. These are shown in Table 3.

Table 3 Summary of environmental noise survey results at position P1

Period (T)	L _{Aeq,T} (dB)
Daytime (07.00 - 23.00 hours)	63
Night-time (23.00 - 07.00 hours)	55

- 5.7. Octave band equivalent continuous spectra have also been calculated. These are shown in Table 4. The typical noise spectrum associated with the representative L_{AMax} value (77 dB) is also shown in the table.

Table 4 Octave band frequency data at measurement position

Frequency (Hz)	Daytime $L_{Aeq,16hour}$ (dB)	Night-time $L_{Aeq,8hour}$ (dB)	Representative highest night-time $L_{AmaxF,15min}$ (dB)
63	63	56	64
125	59	51	59
250	58	50	56
500	57	48	54
1k	55	46	57
2k	53	41	54
4k	58	51	74
8k	53	49	73

- 5.8. With reference to the above, it can be seen that the spectral shape during the night-time period shows a peak at 4kHz and 8kHz. The exact source of this peak is not known, however, it occurred during a couple of intervals during each night of the survey. Although the spectral shape above represents a single $L_{Amax15min}$ measurement and is not representative of typical frequency spectra throughout the night, the event occurred regularly enough for it to be accounted for within the design of the sound insulation package.

6.0 Noise assessments

- 6.1. Discussion of internal noise levels and specification of glazing and ventilators are described in Section 7.

Assessment of outdoor amenity

- 6.2. Hillingdon's *SPD: Noise* states that noise levels in outdoor living areas should be as low as practicable and lower than 50dB $L_{Aeq,T}$. Given that garden/balcony areas would only normally be used during the daytime period, it is considered appropriate to assess external noise levels over a one-hour reference time interval. It should be noted that WHO document '*Guidelines for Community Noise*' (1999) states that noise levels within garden spaces should not exceed 50 – 55dB $L_{Aeq(16hr)}$.

Garden areas

- 6.3. Private/communal garden areas are proposed to the south of the proposed residential building. Although daytime noise levels were occasionally measured up to 66dB $L_{Aeq(1hr)}$, average daytime noise levels were established to be around 60dB $L_{Aeq(1hr)}$. It should be noted that these noise levels were established at an elevated microphone location and, therefore, are considered worst case for this assessment. Positions lower to the ground within the proposed garden areas and representative of head height may benefit from increased screening to local noise sources.
- 6.4. It is recommended that fencing is installed surrounding the private/communal garden areas to provide screening to local noise sources (i.e. the railway line and Station Approach). A suitable screen will provide around 5 – 10dB overall noise attenuation to garden areas, depending on the receiver location within the space. This should ensure average noise levels within the external garden areas will be around 50 – 55dB $L_{Aeq(1hr)}$.
- 6.5. Although average $L_{Aeq(1hr)}$ measurements may marginally exceed Hillingdon criteria, the levels will comply with the requirements given in the WHO guidelines.
- 6.6. The communal gardens will require screening from the railway line and Station Approach in order meet requirements for external residential amenity. The screen will be located along the site boundary and will be solid and imperforate to a height of 2.0m with no gaps in or under the barrier. If the screen is to be constructed from timber rather than masonry it must have a minimum density of 15kg/m². This is shown within the architect's proposal drawings.

Balconies

- 6.7. There are a number of balconies proposed to habitable spaces, however, these will not be located along the façade fronting the railway line. Hillingdon's *SPD: Noise* accepts that noise levels on balconies are typically 5dB lower than those affecting the façade due to screening provided by the balcony edge. In addition, a conservative 3dB reduction could be expected due to the reduced angle of view and screening to the railway line and local roads.
- 6.8. Based on the above and average noise levels as detailed in Section 6.2.1, noise levels could be expected to be around 52dB $L_{Aeq(1hr)}$ on the worst affected balconies. Although average $L_{Aeq(1hr)}$ measurements may marginally exceed Hillingdon criteria, the levels will comply with the requirements given in the WHO guidelines. Details of best practical mitigation measures that will implemented to reduce noise levels have been provided in Section 7.2.

- 6.9. In support of the inclusion of balconies within the scheme, it should be noted that the presence of balconies will reduce incident noise levels affecting windows of living areas behind. There are also areas of the shared garden space that will comply with Hillingdon noise criteria, such that all residents will have access to a 'quiet' area of external amenity.
- 6.10. The edge protection on proposed balconies will be constructed of a solid imperforate material to maximise the level of screening to nearby noise sources.

Discussion

- 6.11. The above assessments demonstrate that WHO guidelines will be achieved in all communal garden areas and balcony spaces. There will also be areas of the communal gardens where compliance with Hillingdon's criteria (50dB $L_{Aeq(1hr)}$) will be achieved.
- 6.12. Given the location of the site within a busy urban area, it could be considered impractical to expect compliance with Hillingdon requirements within all external amenity spaces. There are many external spaces serving existing residential properties in the area which are subject to similar, if not higher, noise levels. In addition, the units are designed for first time buyers, young professional and single/dual occupancy rather than for families and, therefore, a degree of flexibility should be allowed for given the sustainable location of the site in close proximity to transport links, shops and local services.

7.0 Design considerations

Sound insulation package

Ventilation strategy

- 7.1. With reference to BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' the laboratory measured airborne sound insulation for a partially open window is approximately 15dB.
- 7.2. Based on incident noise levels affecting the worst effected facades the required internal noise criteria will not be achievable with openable windows for natural ventilation. Consequently, it is necessary to consider how adequate ventilation is to be provided without a requirement to open windows.
- 7.3. Calculations based on the noise data provided in Table 4 indicate that the Hillingdon internal noise criteria will be achievable with suitable acoustic trickle ventilators or a whole house mechanical ventilation system installed.

- 7.4. It should be noted that the internal noise levels will increase when windows are opened, for example for short-term purge ventilation. However, this will be at the discretion of the occupants and the ventilation strategy is that adequate levels of ventilation are provided without the windows being open.
- 7.5. The assessment includes typical “low performance” trickle ventilators, with the minimum acoustic performance given in Table 5. The values quoted are the minimum weighted element level difference ($D_{n,e}$ and $D_{n,e,w}$) for the total area of ventilator required; ventilator area requirements must be confirmed by the ventilation specialist.

Table 5 Acoustic requirements for ventilators

Room type	Sound Reduction Index for ventilator (dB) at Octave Band Centre Frequencies								$D_{n,e,w}$
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Habitable spaces	31	31	32	31	33	31	31	31	34

- 7.6. In the event that a NVHR system or similar is required for non-acoustic reasons, suitable attenuation of atmospheric intake and discharge will be required, to control intrusive noise. NSL can give further advice on this, if required.

External building fabric specification

- 7.7. The specifications for the proposed façade and roof constructions are given in the architect’s drawings listed below. The acoustic performance of these constructions, based on typical generic sound insulation values, have been included within the acoustic assessment. The proposed constructions, built correctly, are capable of adequately controlling intrusive noise such that noise through the windows and ventilators (see below) will be the critical noise-path.
- 1081-C-215_P1-Ground_Floor-Wall_Types-Key_Plan
 - 1081-C-315_P2-First_Floor-Wall_Types-Key_Plan
 - 1081-C-415_P2-Second_Floor-Wall_Types-Key_Plan
 - 1081-C-700_P2-External_Walls-Types
 - 1081-C-730_P1-Typical_Roof_Details-Sheet_1
 - 1081-C-731_P1-Typical_Roof_Details-Sheet_2
 - 1081-C-732_P1-Typical_Roof_Details-Sheet_3
 - 1081-C-733_P1-Typical_Roof_Details-Sheet_4

Glazing specification

- 7.8. Noise levels have been predicted inside habitable spaces along the various façades in order to establish minimum acoustic performance requirements for the glazing specification.
- 7.9. The calculations and specifications are based on the room layouts and window and external door dimensions given in the architect's drawings listed below.
- 1081-C-200_P2-Ground_Floor-General_Arrangement
 - 1081-C-300_P3-First_Floor-General_Arrangement
 - 1081-C-400_P3-Second_Floor-General_Arrangement
 - 1081-C-610_P4-Elevations-Black_&_White-Sheet_1
 - 1081-C-611_P4-Elevations-Black_&_White-Sheet_2
 - 1081-C-650_P2-Sections-General_Arrangement
 - 1081-C-970_P1-External_Window_Schedules
 - 1081-C-980_P1-External_Door_Schedules
- 7.10. The assessment has been based on the glazing acoustic performance given in Table 6.

Table 6 Acoustic requirements for glazing specification

Room type	Sound Reduction Index for suitable glazing product (dB) at Octave Band Centre Frequencies							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Bedrooms	19	24	25	30	33	29	34	35
Other Habitable Rooms	19	24	23	30	33	33	30	32

- 7.11. The above glazing system performance specifications apply to the glazing package as a whole inclusive of glazing, framing, opening seals, etc. The performance of the glazing system will depend on many factors such as the glazing configuration, size of window panels, quality of framing, quality of sealing, etc.

- 7.12. Typically, the glazing performance specified for bedrooms can be achieved using 6 / 16 / 6 sealed double glazing. The requirement for other habitable rooms can typically be achieved using 4 / 16 / 4 sealed double glazing. These preliminary selections are for guidance only, however, and all glazing systems should be capable of meeting the performance specifications, with laboratory test certificates being made available in support of the quoted performance.
- 7.13. The glazing specification may be reduced for windows to non-habitable spaces (i.e. bathrooms).

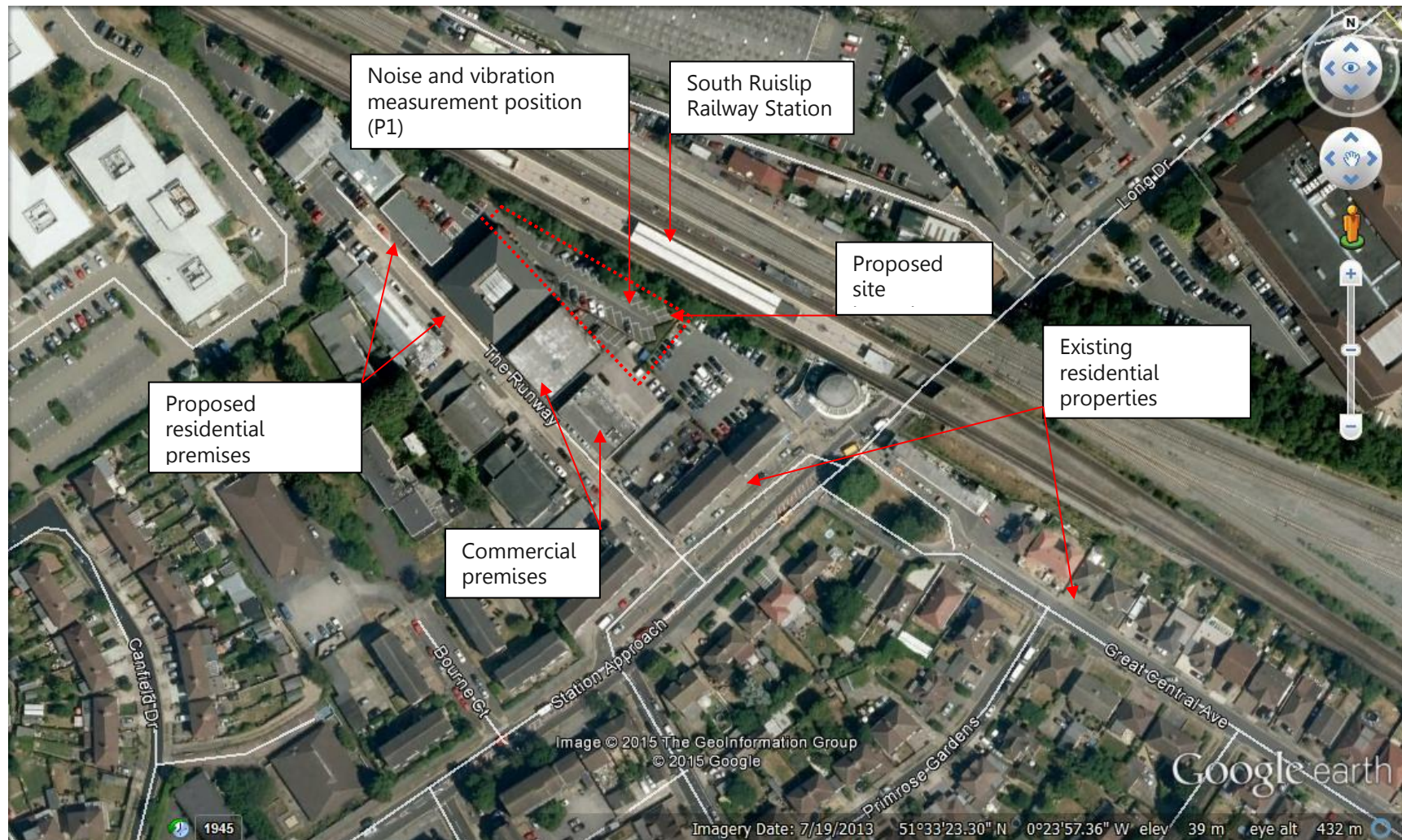
8.0 Summary

- 8.1. Noise Solutions Ltd has been commissioned by Trout Rise Developments to give acoustic advice on glazing and ventilation to Richmond House, a proposed residential development to be located on the grounds of an unused former car park at Astral House, The Runway, Ruislip.
- 8.2. The development is to comprise a new three-storey block, which will be occupied by six residential apartments. A noise and vibration survey has been undertaken to establish baseline levels across the development site. Noise and vibration assessments have been undertaken in accordance with Hillingdon Council's *Supplementary Planning Document (SPD): Noise*. These have been reported previously.
- 8.3. Acoustic performance specifications have been given for glazing and ventilators, in order that the proposed internal noise criteria are achieved.
- 8.4. Noise levels have been assessed within proposed communal/private gardens and balconies. Predictions indicate average $L_{Aeq(1hr)}$ daytime noise levels will comply with WHO requirements and tend towards compliance with Hillingdon Council criteria in all locations subject to the implementation of mitigation measures as outlined in Section 7.2.

Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A –weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level that is exceeded for 90% of the measurement time interval, T. It gives an indication of the lower levels of fluctuating noise. It is often used to describe the background noise level and can be considered to be the "average minimum" noise level and is a term used to describe the level to which non-specific noise falls during quiet spells, when there is lull in passing traffic for example.

Appendix B Aerial photograph showing site and surrounding area



Photograph 1 Courtesy of Google Earth © Infoterra Ltd

Appendix C Environmental sound survey

Details of environmental sound survey

- C.1 Unattended measurements of prevailing noise and vibration levels were taken at a single location (P1) between 15.00 hours on Thursday 4th June and 07.00 hours on Monday 8th June 2015.
- C.2 The sound level meter was programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise indices and octave band frequency data for consecutive 15-minute sample periods.
- C.3 Although not actively measured, weather conditions were suitable for the measurement of noise for a suitable duration to ensure typical prevailing noise levels could be assessed.
Measurement position

Measurement positions

- C.4 The noise and vibration monitoring equipment was located along the boundary of the site with the railway line (position P1 as indicated in Appendix A). This location was considered representative of the proposed worst case façade location in terms of noise and vibration.
- C.5 In accordance with BS 7445-2:1991 '*Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use*', noise measurements were taken under free-field conditions with the microphone positioned at a height of 2.5m. The microphone was raised such that it was level with railway line in order to assess the worst case.

Equipment

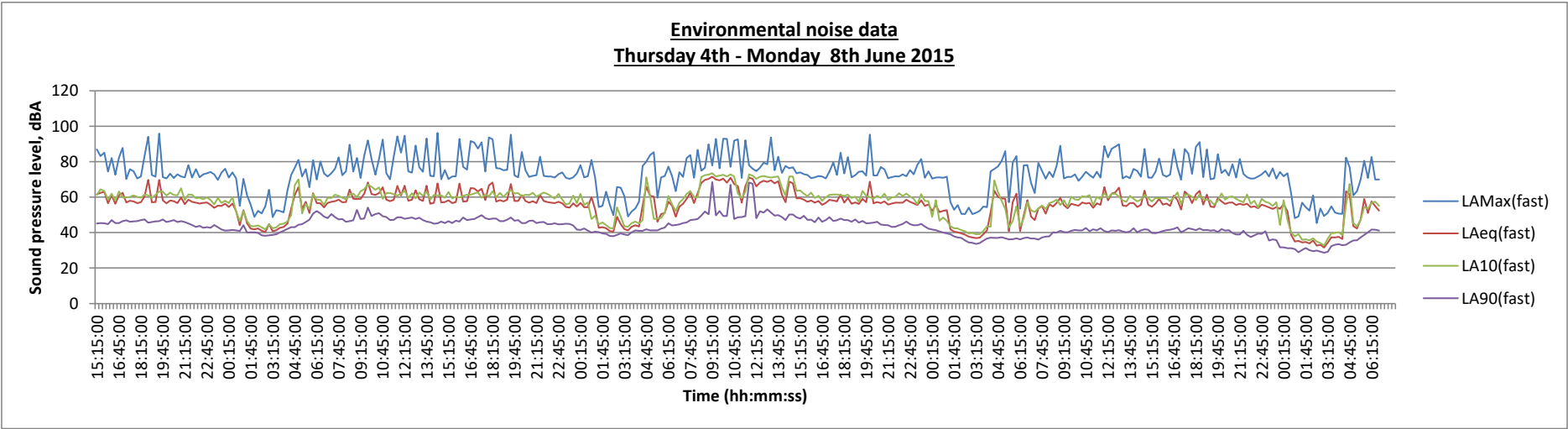
- C.6 Details of the equipment used during the course of the noise survey have been provided in the table overleaf. The sound level meter was calibrated before and after the survey; no significant change (+/-0.1 dB) in the calibration level was noted.

Equipment	Description	Model / serial no.	Calibration date	Calibration certificate no.
Sound level meter	Class 1 Sound level meter	Svantek 977 / 36190	25/06/2014	Factory Calibrated
	Condenser microphone	ACO Pacific 7052E / 57366		
	Preamplifier	Svantek SV12L / 41504		
	Calibrator	CEL 284/2 /3/01920312	09/06/2015	14755

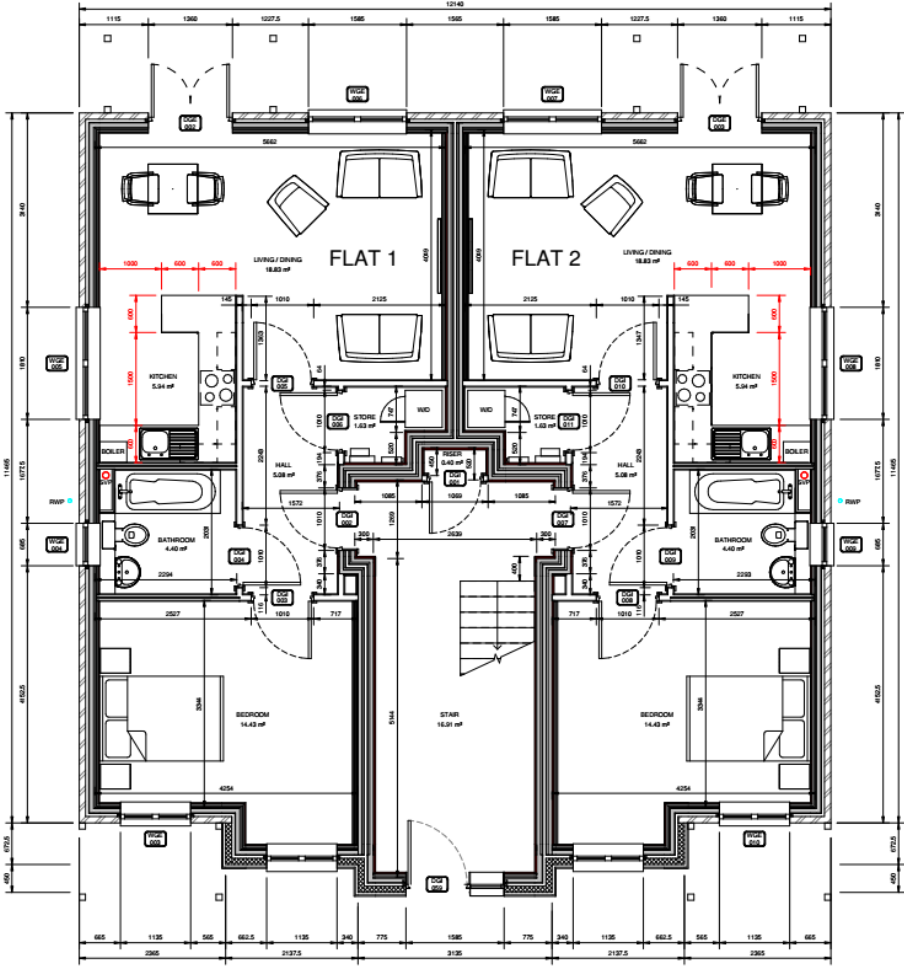
Results

- C.7 Details and observations relating to the noise climate are detailed in Section 2.0. The results of the noise survey have been provided overleaf.

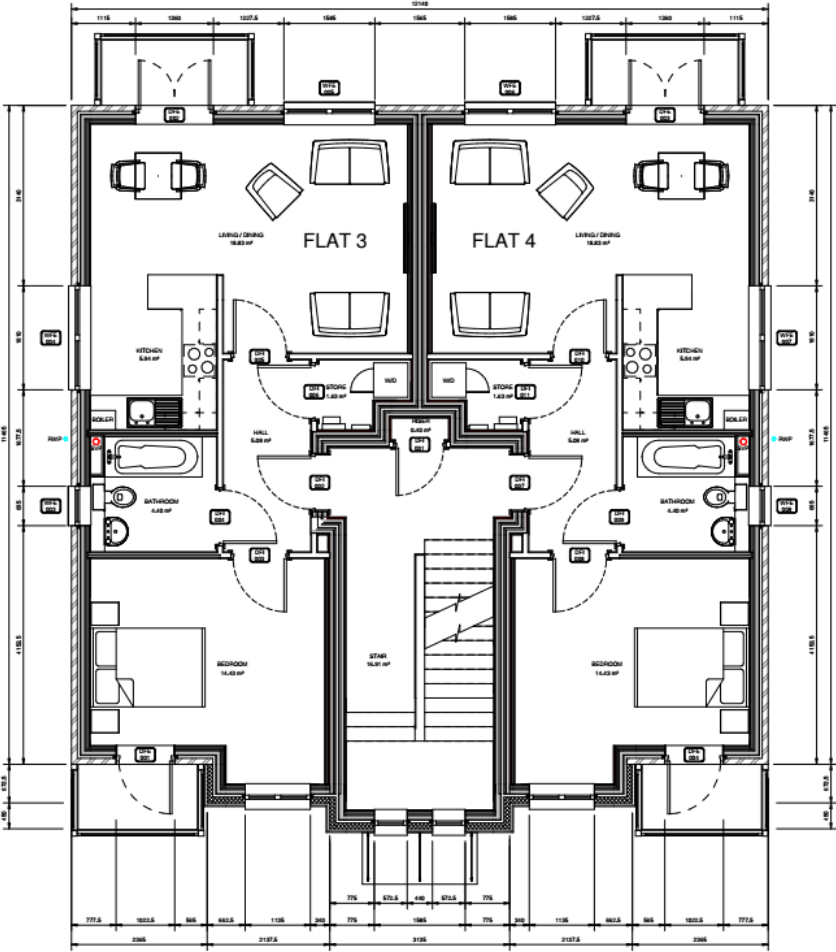
Noise survey data



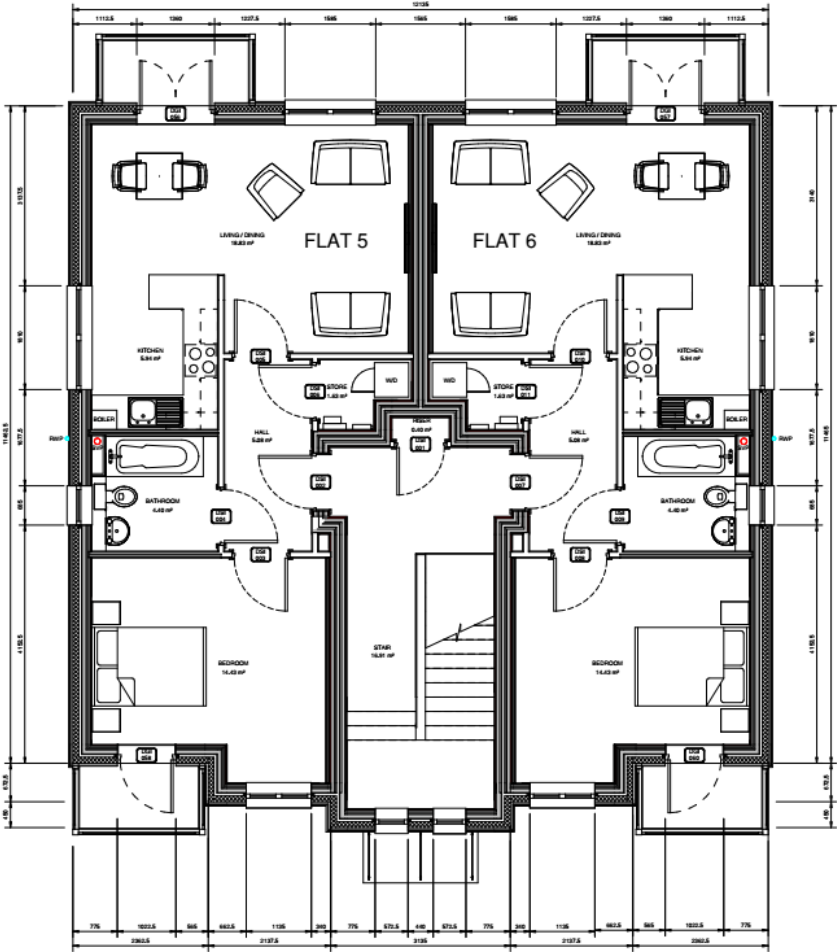
Appendix D **Proposed plans of development site**



GROUND FLOOR



FIRST FLOOR



SECOND FLOOR