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MILLER HOMES LTD

Proposed Residential Development at Victoria Road West, Hebburn

Assessment of Noise Levels and Noise Amelioration Measures

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APPENDICES

SUMMARY

This report presents assessment of noise affecting the proposed residential development (334 housing units) at Victoria Road West, Hebburn.

The main purpose of the report is to

- present all measured noise levels **(Section 4)**
- use measured noise data to determine noise exposure of proposed residential units **(Section 5)**
- detail appropriate noise amelioration schemes (enhanced building envelope sound insulation and/or screening) where necessary **(Section 6, in particular Table 5).** Table 5 defines numerous options for the configuration of the appropriate sound insulation performance of the building envelope. All these options, by full calculation (BS8233 detailed method, Annex G.2) show that the appropriate target noise levels within the proposed housing will be met.
- The final choice of noise amelioration inclusions (to be determined by developer) should ultimately be submitted to the Local Planning Authority for approval.

Subject to final definition and the subsequent provision of noise amelioration measures, the residents of the proposed dwellings will be provided with acceptable internal and external (private amenity areas) noise environments, in line with all current guidance.

1 INTRODUCTION

1.1 Context

1.1.1 Miller Homes Ltd commissioned a noise assessment at a proposed residential development site (see Figure 1) at Victoria Road West, Hebburn, South Tyneside.

1.1.2 The noise climate at the site is influenced by rail noise (predominantly Metro Trains but some freight) from the line to the west and road noise from the busy Victoria Road West (situated directly to the east). Detailed noise measurements were carried out on Friday 15 July 2016. There is minor industrial noise from the industrial estate to the south.

1.1.3 A noise report (Assessment of Noise Levels and Noise Amelioration Measures dated 29 July 2016) was submitted and issues were subsequently raised by South Tyneside Council's Environmental Protection Section relating to noise.

1.1.4 The purpose of this assessment is to address the issues raised, re-examine the noise climate and determine existing noise levels across the site and consider all noise amelioration measures and sound insulation measures likely to be relevant to the site and building envelope such that the appropriate noise levels due to the various sources may ultimately be achieved.

Figure 1: Site Location

2 LEGISLATIVE FRAMEWORK AND PLANNING POLICY

2.1 National Planning Policy Framework

2.1.1 The National Planning Policy Framework (NPPF) came into force in March 2012 and superseded numerous planning guidance and policy documents. The NPPF does not provide specific policies or define noise limits, but rather is intended to enable the planning system to support the Government's aims and objectives with respect to sustainable development, and provides a general framework within which planning applications for development "*must be determined in accordance with the [Local] development plan*".

2.1.2 The NPPF states that "*the planning system should contribute to an enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability*".

2.1.3 The NPPF represents the Government's commitment in favour of sustainable development, through its intention to make the planning system more streamlined, localised and less restrictive.

2.1.4 Additional national planning guidance is provided in the Government's Noise Policy Statement for England (NPSE – "the Noise Policy"), to which the framework makes specific reference as the main source of national guidance on planning and noise.

2.1.5 The Noise Policy has a long term vision to "*Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development".* The vision is supported by three key aims intended to promote sustainable development with respect to noise so that *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

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

2.1.6 The Noise Policy recognises that it is not currently possible to define a single objective noise level having specific effects on people, hence the emphasis on "*promoting*" improvements to health and quality of life though effective management of noise, considered in the context of the wider environment and factors other than noise.

2.1.7 No specific criteria are provided by the NPPF or the Noise Policy to enable planning decisions to be made. In the absence of such guidance, the assessment of external noise levels for acceptable amenity criteria has been undertaken in consideration of the guidance provided in British Standard BS 8233: 2014 *Guidance on Sound Insulation and Noise reduction in buildings*.

2.1.8 This Standard provides, not only advice on acceptable external noise levels, reflecting those given in the World Health Organisation's 1999 *Guidelines for Community Noise*, but also advises on suitable design specifications for building envelopes to achieve suitable internal noise levels.

2.2 BS 8233: 2014 Guidance on Sound Insulation and Noise reduction in buildings

2.2.1 BS 8233 defines a range of ambient noise levels for design criteria, such that suitable conditions are achieved in certain internal and external environments. The noise levels that normally satisfy these criteria for most people are defined in Table 1.

Table 1:
Indoor ambient noise levels for dwellings

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

2.2.2 The levels shown in the table are based on the existing guidelines issued by the WHO and 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.

2.2.3 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting internal noise level.

2.2.4 The advice provided states that where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved.

2.2.5 It is considered desirable that external areas that are used for amenity space, such as gardens and patios that noise levels do not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$. However, it is also recognized that these guideline vales are not achievable in all circumstances where development might be desirable. Therefore, development should be designed to achieve the lowest practicable levels in these external amenity areas, but not prohibited.

2.3 WHO Guidelines for Community Noise

2.3.1 In 1999 the World Health Organisation proposed Guidelines for Community Noise. The scope of the WHO's effort to derive guidelines for community noise was to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

2.3.2 The guidelines suggest that during the daytime, few people are highly annoyed at L_{Aeq} levels below 55 dB(A), and few are moderately annoyed at L_{Aeq} levels below 50 dB(A). Sound levels during the evening and night should be 5–10 dB lower than during the day. For intermittent noise, it is emphasized that it is necessary to take into account both the maximum sound pressure level and the number of noise events.

2.3.3 Table 2 presents the various guideline values for community noise in various situations.

Table 2:
Guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	dB L_{Aeq}	Time period (hours)	L_{Amax}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16	
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, night-time	45	8	60

2.3.4 Indoor guideline values for bedrooms are 30dBL_{Aeq} for continuous noise and 45dBL_{Amax} for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source.

2.4 BS 4142: 2014 Methods for rating and assessing industrial and commercial sound

2.4.1 BS 4142:2014 describes methods for rating and assessing sound of an industrial and/or commercial nature and is used to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.4.2 The procedure is based on comparing the measured or predicted noise level from the source in question immediately outside a dwelling with the "background noise level" (L_{A90}) that would otherwise exist in the absence of the specific noise. The "rating level" is derived by adding any correction that is necessary, due to certain characteristics of the noise to the "specific noise level".

2.4.3 The “specific noise level” is the equivalent continuous A-weighted sound pressure level (L_{Aeq}) of the noise, at the assessment position, over a time period specified in the standard. The assessment position must be outside the dwelling or other noise sensitive building affected by the noise and the measurements must be representative of the specific noise and the background noise level.

2.4.4 Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location a character correction is added to the specific sound level to obtain the rating level and this can be approached in 3 ways:

- Subjective method
- Objective method for tonality
- Reference method

2.4.5 The significance of sound of an industrial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. Therefore, it is essential to place the sound in context.

2.4.6 Essentially there is a sliding scale of 0 to +6dB for tonality which the standard "can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible".

2.4.7 For impulsivity, the standard states that "A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible".

2.4.8 Section 11 of BS4142 states to subtract the measured background sound level from the rating level and consider the following:

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.4.9 Therefore, if the initial estimate of the impact needs to be modified due to context, all pertinent factors should be taken into consideration. Paragraph 8.5 of BS4142:2014 states that:

> *Note: where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognised that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.*

2.4.10 Section 11, Para 3) goes on to state that:

> *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*
>
> *I. façade insulation treatment;*
>
> *II. ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
>
> III. *acoustic screening.*

2.4.11 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impact will lead to complaints and not every complaint is proof of an adverse impact.

3 SURVEY DETAILS

3.1 Instrumentation and weather conditions

3.1.1 The equipment used during the surveys is detailed in Appendix B and is fully compliant with that specified as Type 1 in British Standard BS EN61672 - 1: 2003: "*Electroacoustics. Sound level meters Specifications*."

3.1.2 All the statistical analysis was directly carried out within the Sound Level Meter to yield Equivalent Continuous Noise Levels (Leq), Percentile Noise Levels (L_1,L_{10},L_{50},L_{90},L_{99}) and maximum/minimum (MAXL, MINL) noise levels during the measurement periods.

3.1.3 On-site calibration checks were performed before and after all measurements with no variation in calibration level observed. Equipment was also within a valid period of laboratory calibration.

3.1.4 The sound level meter was mounted on a tripod with the microphone 1.4m above the immediate ground level, where appropriate and positioned at least 3.5m from any reflecting surface.

3.1.5 A windshield was fitted over the microphone at all times during the survey periods to reduce the effects of any wind induced noise.

3.1.6 The average daytime temperature was 17ºC with a light southerly breeze, less than 2m/s. There was no precipitation or wet roads during the survey periods.

3.2 Noise monitoring locations

3.2.1 Noise measurements were made at a total of 5 measurement positions (see Figure 2 and Photographs 1 – 5) to assess industrial, metro and road traffic noise. Measurement positions and procedures are described below.

Figure 2: Measurements Positions

Photograph 1: Position 1: 10m from Metro Boundary – clear view

Photograph 2: Position 2: 8m from Victoria Road – clear view

Photograph 3: Postion 3: 25 metres from site Metro Boundary – 2.5 metres high clear view

Photograph 4: Position 4: 20 metres from site Metro Boundary, 30 metres from industry boundary

Photograph 5: Position 5: 10 metres from site Metro Boundary, 10 metres from industry boundary

3.3 Noise measurement procedure

3.3.1 Metro noise measurement positions (Positions 1, 3 & 5) were selected to monitor the Maxima from passing Metro trains as this is the dominant noise on the western side of the site.

3.3.2 Position 2 gives detailed statistical noise parameters directly relevant to road traffic noise from the busy Victoria Road to the east. Position 4 & 5 were to monitor noise from industrial facilities to the south.

Road Traffic Noise Measurement

3.3.3 For road traffic noise assessment, various statistical noise measurements, including A-weighted Equivalent Continuous Noise Levels and A-weighted Percentile Noise Levels were taken on Friday 15 July 2016. Measurements were made in consecutive hours between 11:00hrs and 14:00hrs.

3.3.4 The above procedure is sufficient to reliably determine 3 consecutive hourly values of LA_{10}, in accordance with the "shortened measurement procedure" as described in Calculation of Road Traffic Noise (Ref 3, para 43). As noise at all main measurement positions was dominated by noise from the moderately busy B1329, a sampling time of 10-20 minutes in each hour was sufficient (Ref 3, para 41.2).

Metro Noise Measurement

3.3.5 For Metro noise assessment, noise was continuously monitored in order to determine maximum levels associate with pass-by events. This monitoring also included various statistical noise measurements, including A-weighted Equivalent Continuous Noise Levels and A-weighted Percentile Noise Levels (Appendix E), were taken on Friday 15 July 2016. In addition, noise levels were measured over a full 24-hour period on 11/12th October 2016.

Industrial Noise Measurement

3.3.6 Measurements were made close to the southern boundary over a 24 hour period to determine any industrial noise, particularly during the night time. Various statistical noise measurements, including A-weighted Equivalent Continuous Noise Levels and A-weighted Percentile Noise Levels (L90), were undertaken on Tuesday 11th – Wednesday 12th October 2016.

4 RESULTS

4.1 Road Traffic Noise

4.1.1 Measured noise levels at position 2 adjacent to Victoria Road West are given in Table 3. Equivalent Continuous Noise Levels (LA_{eq}), Percentile Noise Levels (L_{10}, L_{90}) and Maximum/Minimum noise levels during the measurement periods are noted. Measurement Positions in relation to the proposed development are shown in Figure 2.

Table 3:
Daytime noise survey results dB(A) 15 July 2016

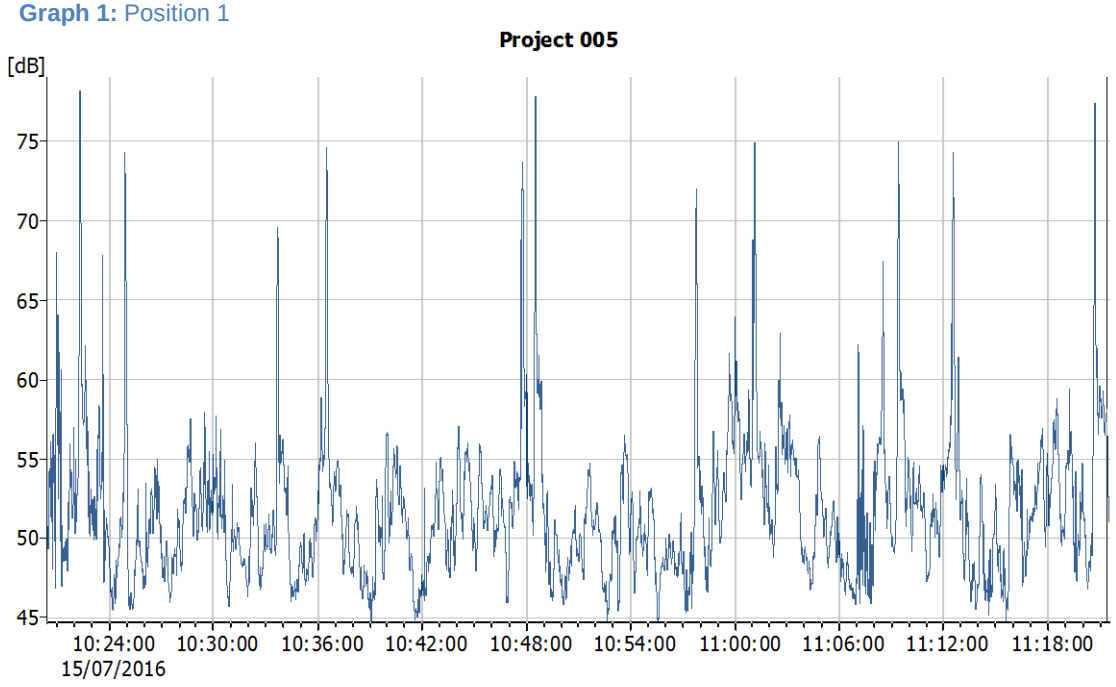
Location	Start Time	Duration	L_{Aeq}	L_{A10}	L_{AF90}	L_{Amin}	L_{Amax}	Calculated L_{Aeq} (16hr)
2 (free field)	11:25	00:15:50	68.8	72.2	67.8	51.9	75.2	**69**
	12:01	00:12:23	68.6	72.5	66.7	52.1	76.7	
	13:15	00:25:50	69.0	72.0	67.3	51.4	84.5	

LA_{eq}(16hr) Calculated according to guidance of PPG24 (Ref 1) and CRTN (Ref 2)
LA_{eq}(16hr) = LA_{10}(18hr) – 2 = (LA_{10}(3 hour Daytime average) – 1) – 2
Although PPG24 is revoked the calculation methods are still valid

4.2 Metro Noise

4.2.1 The time history graphs at Positions 1, 3 and 5 are shown in Graphs 1 - 3 below.

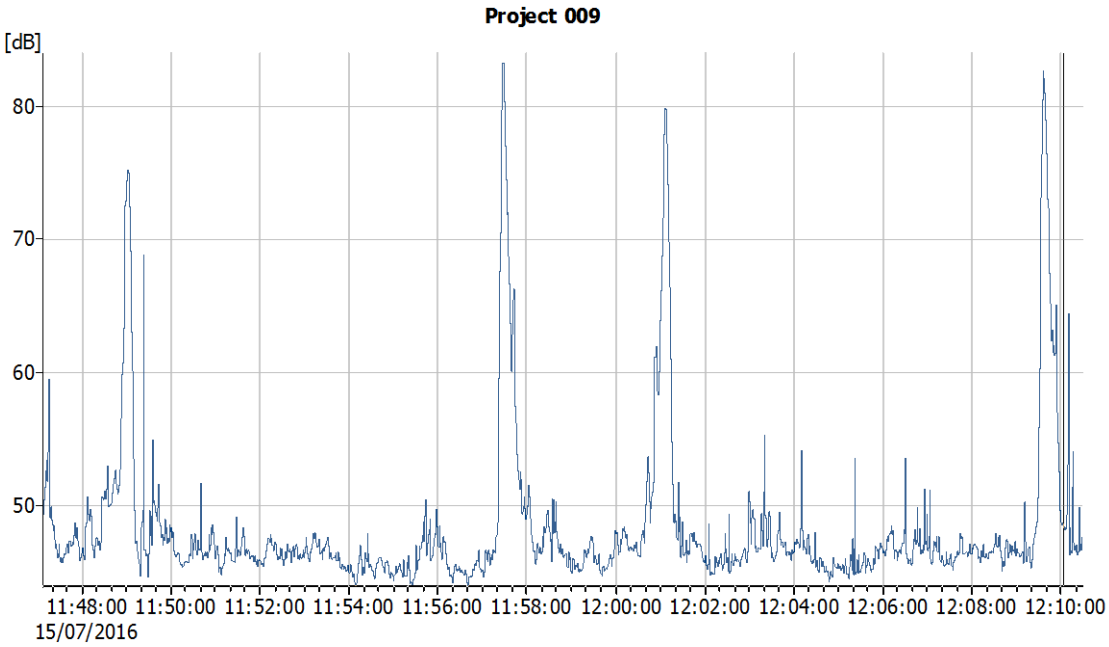
Graph 1: Position 1



4.2.2 Maxima at Position 1 are 70 – 78 dB(A)

4.2.3 Noise levels measured at Location 3 are shown in the graph below.

Graph 2: Position 3



4.2.4 Maxima at Position 3 are 75 – 84 dB(A)

4.2.5 Noting that Position 3 is 25 metres from the Metro boundary and Position 1 is 10 metres from the boundary, maxima can be seen to be some 5 - 6 dB(A) higher even at the increased distance. Indeed, this was why additional monitoring was carried out at Position 3, as it was discernibly the case. The increased noise is possibly associated with the elevated rail track in this vicinity.

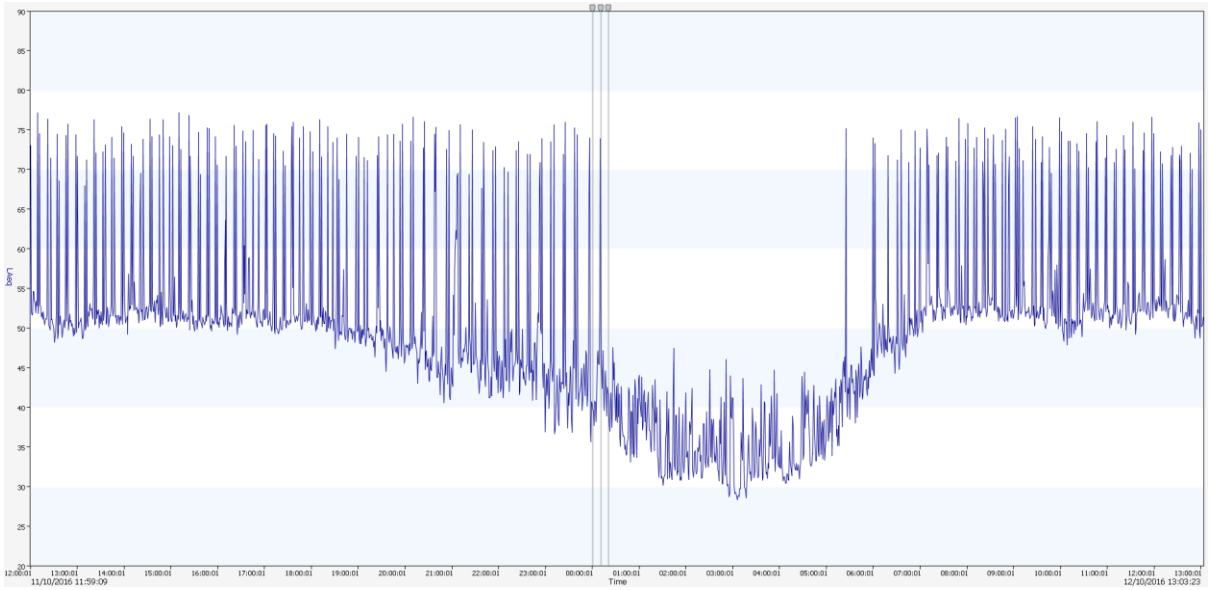
4.2.6 Warning horns (Metro approaching crossing) are audible and included in the pass-bys for Positions 1 & 3.

4.2.7 Hourly noise levels measured at Location 5 over a full 24-hour period are shown in Table 4 and Graph 3 overleaf.

Table 4: 24-hour noise data from Position 5 dB(A)					
Start Time	End Time	LAFMax	LAF10	LAF90	LAeq
11/10/2016 12:00	11/10/2016 13:00	89.9	54.3	48.7	65.9
11/10/2016 13:00	11/10/2016 14:00	90.1	54.0	49.3	65.2
11/10/2016 14:00	11/10/2016 15:00	89.8	55.0	49.9	65.2
11/10/2016 15:00	11/10/2016 16:00	90.4	53.7	49.3	66.1
11/10/2016 16:00	11/10/2016 17:00	88.9	54.2	49.4	63.9
11/10/2016 17:00	11/10/2016 18:00	89.8	53.5	49.0	66.6
11/10/2016 18:00	11/10/2016 19:00	88.6	52.9	47.9	64.5
11/10/2016 19:00	11/10/2016 20:00	88.9	51.6	45.7	64.6
11/10/2016 20:00	11/10/2016 21:00	89.7	50.3	42.3	65.2
11/10/2016 21:00	11/10/2016 22:00	89.1	55.3	41.7	63.6
11/10/2016 22:00	11/10/2016 23:00	87.3	50.8	41.0	62.6
11/10/2016 23:00	12/10/2016 00:00	89.2	48.1	37.0	64.4
12/10/2016 00:00	12/10/2016 01:00	57.3	45.1	33.9	41.5
12/10/2016 01:00	12/10/2016 02:00	59.0	41.9	30.6	38.5
12/10/2016 02:00	12/10/2016 03:00	56.8	39.7	30.0	36.8
12/10/2016 03:00	12/10/2016 04:00	54.1	39.7	28.8	36.2
12/10/2016 04:00	12/10/2016 05:00	53.8	40.2	30.7	36.7
12/10/2016 05:00	12/10/2016 06:00	87.3	45.9	35.8	56.6
12/10/2016 06:00	12/10/2016 07:00	88.1	52.3	45.0	63.1
12/10/2016 07:00	12/10/2016 08:00	89.9	55.4	50.4	65.2
12/10/2016 08:00	12/10/2016 09:00	88.7	54.6	50.5	65.9
12/10/2016 09:00	12/10/2016 10:00	89.7	55.7	49.9	66.1
12/10/2016 10:00	12/10/2016 11:00	89.0	54.9	49.0	65.1
12/10/2016 11:00	12/10/2016 12:00	89.2	54.5	49.7	65.3
12/10/2016 12:00	12/10/2016 13:00	89.5	54.7	49.7	64.7

4.2.8 The daytime ambient noise level is 65dB$L_{Aeq,16hr}$ and the night time is 58dB$L_{Aeq,8hr}$ and is influenced by metro trains with maxima during the night time up to 89dBL_{Amax}. There was little audible industrial noise, other than the steady state noise from the extract unit to the side of the building of Laminform

Graph 3: 24 hour noise profile at Position 5



4.3 Industrial Noise

4.3.1 Low level industrial noise was also discernible at Position 3 from the vicinity of the south west corner of the adjacent industrial estate. This was noted to be around 46dB(A) and steady state at Position 3. Upon moving closer (Position 4, some 30 metres from the boundary with the industrial estate) this noise level did not increase. This might be explained by screening. As Background Noise Level at Position 1 was of the order of 46 dB(A) (L_{A90}) this level of industrial noise is unlikely to be significant in terms of BS4142. In any case, the recommended noise amelioration measures in this area (due to Metro Noise) will be more than adequate to cope with any likelihood of noise nuisance from this industrial source.

4.3.2 The above results enable reliable assessment of the noise levels affecting the proposed development.

5 DISCUSSION

5.1 Summary of Expected Noise Exposure of Proposed Development

Road Traffic Noise:

5.1.1 A summary of the above for the effects of road traffic at closest proposed housing units to Victoria Road would be:

LA_{eq}(16 hour Daytime)	**up to**	**69 dB(A)**
LA_{eq}(8 hour Night Time)	**less than**	**64 dB(A)**
Maxima	**up to**	**75 dB(A)**

5.1.2 The above detailed results (Table 2) enable reliable assessment of the noise levels affecting the proposed development (as shown in Figures 3 – 5).

Metro Noise

5.1.3 As with most train related noise the emphasis is on Maximum Noise Levels rather than Equivalent Continuous Noise Levels.

5.1.4 Assuming the presence of screening measures as described in Section 6.3 below, a summary of the above for the effects of Metro traffic at closest proposed housing units to the Metro Line would be:

LA_{eq}(16 hour Daytime)	**up to**	**66 dB(A)**
LA_{eq}(8 hour Night Time)	**less than**	**60 dB(A)**
Maxima	**up to**	**88 dB(A)**

5.1.5 The above detailed results (Graphs 1 & 2) enable reliable assessment of the noise levels affecting the proposed development (as shown in Figures 3 – 5).

Industrial Noise

5.1.6 The Victoria Road West Industrial Estate is situated directly at the southern boundary of the proposed development. There are no prevailing dominant noise sources from this area, although a large extract system is “steady state” audible at the south west corner of the site. A large vehicle MOT/Repair Workshop is situated directly adjacent. The remainder of the boundary is to small industrial units which do not generally create any significant noise. Detail of industrial operations, noise levels associated with the operations carried on within the industrial estate and appropriate noise amelioration measures are given in Section 6.4, below.

5.2 Façade and Amenity Space Noise Levels

5.2.1 Discussions and assessments below relate to the scheme as shown in Figures 3 - 5. The screening measures described in Section 6.3 are assumed present (shown in blue). Expected façade noise levels (LA_{eq}(16hr, Daytime)) and Maxima are summarised. Expected amenity garden noise levels are also shown in Figure 5.

5.2.2 Subsequent discussions of relevant noise amelioration measures refer to these noise levels.

Figure 3: Proposed Development – Expected Worst Case 1st Floor Facade Noise Levels (Road and Metro)

Figure 4: Proposed Development – Expected Worst Case Ground Floor Facade Noise Levels

Figure 5: Proposed Development – Expected Amenity Garden Noise Levels

5.3 Summary of Design Criteria

5.3.1 The following are working design criteria for residential parts of this proposed development:

Resting Rooms	**LA_{eq}(16hr Daytime) < 35dB(A),**
	LA_{eq}(8hr Night Time) < 30dB(A)
Living Rooms	**LA_{eq}(16hr Daytime) less than 35dB(A)**
Amenity Gardens	**LA_{eq}(16hr Daytime) less than 55dB(A)**
Maxima	**LA_{Max}(Night Time) not generally exceeding 45dB(A)**

5.3.2 As night time noise levels are at least 5dB(A) less than daytime levels, meeting the above criteria for daytime hours will automatically ensure appropriate night time conditions.

5.3.3 Noting the results of the noise survey and hence the noise levels affecting the site as proposed (Section 5 and Figures 2 & 3), ensuring these criteria are met will require some attention to noise screening on site and to noise amelioration measures of the building envelope and windows exposed to noise levels shown in red in Figures 2 and 3.

5.3.4 Recommended screening and enhancements to sound insulation of the building envelope in these instances are discussed below in Section 6.

6 NOISE AMELIORATION MEASURES

6.1 Building Envelope Sound Insulation

6.1.1 The recommendations of this report for relevant noise amelioration define various possible combinations for wall, glazing, ventilation (acoustic parameters) and roof/ceiling construction, all of which should enable the guidance criteria defined above to be met.

6.1.2 Options given in this section (see Table 5) are based on calculations of resultant noise levels in habitable rooms as dependent upon measured/estimated external façade noise levels (Sections 4 & 5) and the insulation properties of the wall, glazing, roof/ceiling and ventilation. These calculations are based on typical habitable rooms with 2.5M^2 glazed area and a room volume of 50M^3 and “reverberation time” of 0.7 seconds.

6.1.3 The calculations are all carried out according to the full calculation method of BS8233:2014 (Annex G.2). Each insulation option identified within Table 4 (i.e. every row of the table defining glazing performance, ventilator acoustic performance and roof/ceiling type) should, according to the calculation procedure, enable the appropriate guidance criteria to be met.

6.1.4 Ultimately, the chosen configurations of sound insulation enhancements involve considerations of design and, therefore, must be finally defined by the developers/architects. Only relevant recommendations for relevant combinations which may be expected to meet the acoustic requirements can be provided. The finalised inclusions should be forwarded to the Local Planning Authority for approval.

Glazing

6.1.5 The weakest part of a building façade in terms of sound insulation is generally the glazed areas and windows are the main point of entry for external noise into a dwelling. The insulation of various glazing configurations has been assessed by reference to the Glazing Sound Reduction Index (R_W) incorporated into the BS8233:2014 detailed calculation method and therefore takes into account an increased low frequency content usually associated with road traffic.

6.1.6 Glazing configurations and the acoustic insulation rating of such are specified in terms of dB(R_W).

Ventilation

6.1.7 Enhanced glazing must be closed to provide the required benefit and it is consequently necessary to provide the required ventilation by suitably sound attenuated means.

6.1.8 The acoustic rating of such ventilators, when assessed as a façade element, is specified in terms of dB($D_{ne,W}$).

Roof Construction

6.1.9 In high noise level situations it is also necessary to ensure that roof/ceiling constructions also provide sufficient sound insulation in way of top floor habitable rooms.

6.1.10 Typical pitch roof constructions are categorised in guide calculations as 4 alternatives:

1 single ceiling boarding no mineral wool
2 single ceiling boarding with 100mm mineral wool
3 double ceiling boarding with 100mm mineral wool
4 double ceiling boarding with 100mm mineral wool solid layer (19mm ply) under tiles/felt.

6.1.11 Other roof constructions (e.g. flat roof) may be included in guide calculations according to their estimated or specified performance levels **dB(R_W).**

Walls

6.1.12 Walls, usually masonry, provide good sound insulation such that they need not be considered in relation to the above.

6.1.13 However, for lightweight walling construction methods (e.g. curtain walling) due attention must be given to design for appropriate sound insulation.

6.1.14 These may be included in guide calculations according to their estimated or specified performance levels dB(R_W).

6.2 Range of Building Envelope Recommended for this Development

6.2.1 Building envelope sound insulation enhancements that are recommended for those facades of this development subject to significant noise levels, as identified in Figures 3 & 4 (noise levels shown in red), are given in Table 5.

6.2.2 Whether or not it is deemed necessary to ameliorate for Night Time Maxima is open to interpretation and this is further discussed in 6.4 below.

6.2.3 It is important to note that Table 5 details effective sound insulation enhancements:

- Glazing (configuration and acoustic performance, **dB(R_W)**)
- Ventilator (acoustic performance, **dB($D_{ne,W}$)**)
- Roof/Ceiling (as Type 1, 2, 3 or 4) – if top floor and pitch roof

As dependent upon

- External Façade Noise Level (left hand column) – dB(A) (as in Figures 3 & 4)

6.2.4 The resultant internal noise level (reverberant within receive room) is given in the right hand column of Table 5. In all cases these will be below the relevant guidance target level.

6.2.5 Any of these options, or equivalent performance configurations, may be used.

6.2.6 The architect/developer may choose the options (or equivalent) that best suit their development.

6.2.7 Ultimately, the chosen configurations of sound insulation enhancements involve considerations of design and, therefore, must be finally defined by the developers/architects. Relevant recommendations can only be provided for relevant combinations which may be expected to meet the acoustic requirements. The finalised inclusions should be forwarded to the Local Planning Authority for approval.

Table 5:
Building Envelope Enhanced Insulation Options

External Noise Level dB(A)	Glazing Config Glass/Cavity/Glass	Glazing dB(Rw)	Ventilator dB(Dnew)	Ceiling Roof (*)	External Internal Reduction dB(A)	Internal Noise Level dB(A)
88	10mm/200mm/6mm	49	56	4	45.4	**43**
81	10mm/12mm/6.4mm PVB	40	45	3	37.3	**44**
81	10mm/12mm/6mm	38	43	3	36.0	**45**
80	10mm/12mm/6.4mm PVB	40	45	3	37.3	**43**
80	10mm/12mm/6mm	38	43	3	36.0	**44**
72	10mm/12mm/6.4mm PVB	40	45	3	37.3	**35**
72	10mm/12mm/6mm	38	43	3	36.0	**36**
72	10mm/12mm/4mm	36	41	3	34.3	**38**
72	6mm/12mm/6.4mm PVB	34	39	3	32.4	**40**
72	6mm/12mm/6mm	33	38	3	31.4	**41**
72	4mm/12mm/4mm	31	37	2	29.4	**43**
69	10mm/12mm/6.4mm PVB	40	45	3	37.3	**32**
69	10mm/12mm/6mm	38	43	3	36.0	**33**
69	10mm/12mm/4mm	36	41	3	34.3	**35**
68	10mm/12mm/6.4mm PVB	40	45	3	37.3	**31**
68	10mm/12mm/6mm	38	43	3	36.0	**32**
68	10mm/12mm/4mm	36	41	3	34.3	**34**
66	10mm/12mm/4mm	36	41	3	34.3	**32**
66	6mm/12mm/6.4mm PVB	34	39	3	32.4	**34**
66	6mm/12mm/6mm	33	38	3	31.4	**35**
61	6mm/12mm/6.4mm PVB	34	39	3	32.4	**29**
61	6mm/12mm/6mm	33	38	3	31.4	**30**
61	4mm/12mm/4mm	31	37	2	29.4	**32**
59	6mm/12mm/6mm	33	38	3	31.4	**28**
59	4mm/12mm/4mm	31	37	2	29.4	**30**

Key:

80	**Maxima**
62	**LA_{eq}(16hr Daytime)**
(PVB)	Standard Laminated Glass (or equivalent)
(*)	Roof/Ceiling Type (e.g. 3 = Double Boarded Ceiling plus Absorbently Lined Loft Cavity) (See Section 7.1)

6.2.8 Different glazing options may be used to achieve the same insulation performance (dB(R_W)). In general, for small cavity glazing (~12mm) reduction to 10mm cavity, to accommodate frame rebate sizes, would not be significant in terms of noise reduction. Other glazing configurations giving equivalent performance would be acceptable. In all cases windows may be openable but should be well sealed when closed. Ventilation systems should allow the appropriate air change capability (other than "purge ventilation" which may be achieved by opening windows) without resort to open (or partially open) windows.

6.2.9 It is recommended that consideration is given to using the better options, particularly where window sizes are relatively large.

6.2.10 Night time noise levels will be reduced by some 7dB(A) such that the above glazing configuration will provide for equally acceptable night time conditions as all internal Night Time Noise Levels will be reduced to below 30dB(A) and worst case Maxima will be below 45dB(A).

Table 5 - Important Note:

The right hand column is the resultant internal noise levels due to the external Façade Noise Level (left hand column).

For a façade with External Level - (marked in Red in Figures 3 & 4)

Select required amelioration package for External Level - Column 1
(May be any of the options or equivalents)

Possible amelioration configurations are detailed on row - Columns 2, 3, 4, 5

Overall estimated noise reduction External to Internal - Column 6

Resultant Noise Level within room is given - Column 7
(These are ALL below the required (Guidance) noise limit)
(The most suitable, or otherwise equivalent, maybe selected)
(Different configurations will require calculation to show acceptable performance)

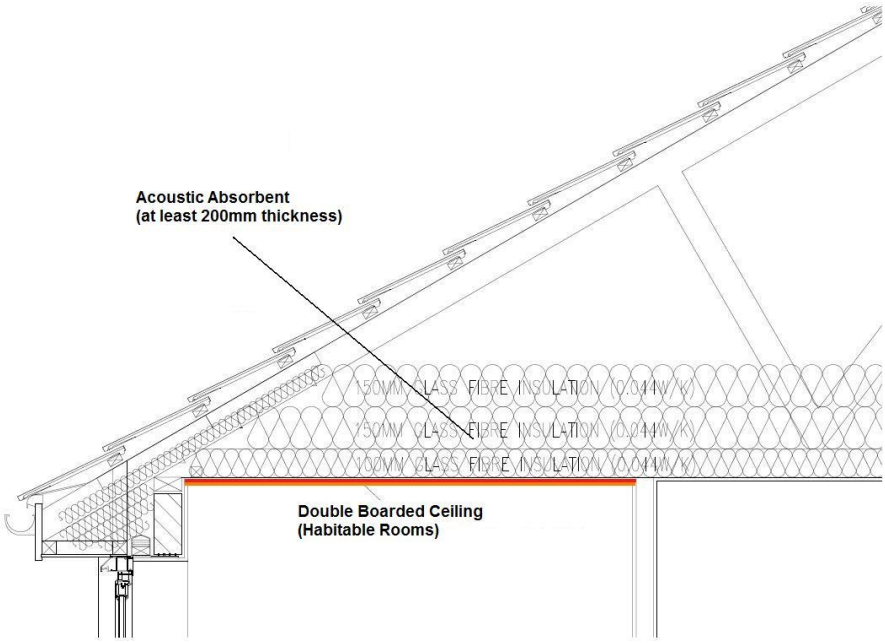
Glazing/Walls – Explanatory Notes

6.2.11 The above calculations are based upon a glazed area of 2.5m^2 in standard masonry walls. If the design departs significantly from this, such as curtain walling or significantly larger glazed areas then this should be taken into account in determination of the final scheme. “Curtain Wall” makeup should be designed to provide for at least 50dB(R_w) Sound Insulation.

Roof/Ceiling – Explanatory Notes

6.2.12 Noting the pitch roof construction, it is recommended that double boarded ceilings of overlapped plasterboarding taped, skimmed and sealed (see Figure 6). The felt layer should be well sealed at all edges such that there are no air paths to noisy external areas. The loft cavity should contain at a 200mm layer of sound absorbent material such as mineral wool or fibre glass (see Roof Type 3, above).

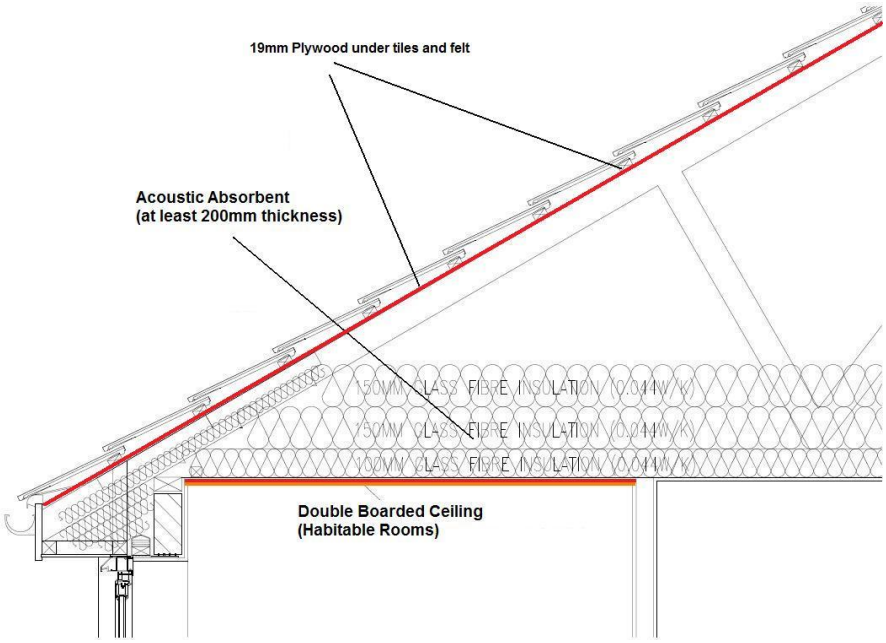
Figure 6: Suggested Roof Construction



6.2.13 However, if there are to be any "attic" type rooms, roof/ceiling structures would need to be sound insulated with system to provide of the order of 50dB(R_w). This would typically require incorporation of solid boarding (plywood or otherwise) under tiles/felt and double boarding on resilient bars under rafters. The cavity between boarding should contain sound absorbent material. It is recommended that the incorporation of suitable a proprietary system from British Gypsum or Sheffield Insulation or similar companies and note that extreme care is required at installation to ensure the required level of insulation is not compromised. The effectiveness of the resilient bars is usually crucial. It will also be necessary to design for adequate ventilation of the roof and incorporation of thermal building regulations without significantly compromising sound insulation.

6.2.14 Where external Maxima are 88dB(A) (south western units closest to Metro Line), it is additionally recommended that a 19mm or greater plywood layer under tiles and felt in addition to the double boarded ceilings of overlapped plasterboarding taped, skimmed and sealed (see Figure 7). The felt layer should be well sealed at all edges such that there are no air paths to noisy external areas. The loft cavity should contain at a 200mm layer of sound absorbent material such as mineral wool or fibre glass (see Roof Type 4, above).

Figure 7: Suggested Roof Construction



Ventilation – Explanatory Notes

6.2.15 For habitable rooms with windows in facades subject to the noise levels identified in Table 5, ventilation systems enabling adequate ventilation without recourse to open windows to noisy facades should be incorporated. Suppliers should be informed of the overall reduction required (Table 5, Column 6).

6.2.16 The reductions will typically require ventilation units or schemes to provide a sound reduction of 37 - 56 dB($D_{ne,W}$) or better (as identified in Column 4) (See Appendix D for supplier list).

6.2.17 Table 5 is recommended for guidance and suppliers may offer alternative solutions based on the noise data provided within this report.

6.2.18 L A Environmental are unable to make recommendations for the specification of ventilation systems in relation to The Building Regulations Part F (Ventilation – Approved Document F). It is our understanding that if wall or window mounted ventilators are used they should provide the above level of acoustic insulation (dB($D_{ne,W}$)) whilst still providing the basic ventilation requirements (i.e. non-purge situations) for each habitable room for which they are required. It is our understanding that a passive ventilation unit will provide for sufficient ventilation in circumstances such as these. Should a purge ventilation requirement arise then windows may be opened in the normal manner.

6.2.19 Reputable suppliers will usually provide a free design service to satisfy both acoustic and ventilation requirements (see Appendices D & E). The noise levels detailed in this report should enable them to configure and recommend appropriate ventilation solutions.

6.3 Screening Measures

6.3.1 The above assessment assumes the presence of some 2 metres effective height screening at the site boundary with the Metro line.

6.3.2 At the northern section the Metro line is same level as the site and a 2 metre close board fence (7kgm/m^2) or heavier is required. A wall or other barrier type is also possible.

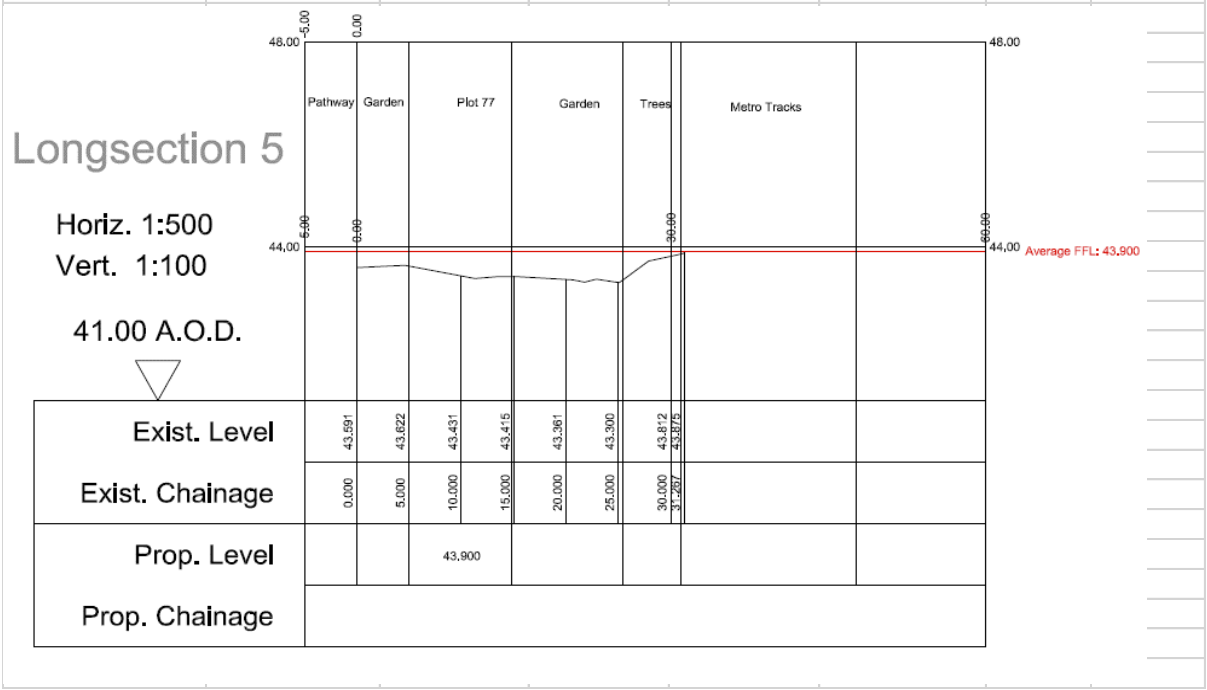
6.3.3 At the southern section the Metro Line elevates to approximately 1 metre above site level (see Photo 3). However, following development of the site floor levels will be increased by around 0.5m in the south western part of the site and the 2 metre effective height of screening must be present in addition to the height of the retaining wall (which may need repair).

6.3.4 Based on cross sections provided by Queensbury Design a reduction of 12dB(A) has been calculated:

Barrier attenuation

Source height (g/l+2m)	Receiver height (g/l+1.5m)	Barrier height (g/l+2m)	Distance between source and barrier (a)	Distance between barrier and receiver (b)	Distance between source and receiver (c)
44	45.4	46	4.5	15	19.5

SB	BR	SUM	SR	Difference	pld
4.924	15.012	19.936	19.550	0.386	12.4



6.3.5 These measures are assumed to be in place for the above noise assessment to prevail.

6.4 Industrial Noise

6.4.1 The Victoria Road West Industrial Estate is situated directly at the southern boundary of the proposed development. There are no prevailing dominant noise sources (in comparison to Metro Noise) from this area, although a large extract system is "steady state" audible at the south west corner of the site. A large vehicle MOT/Repair Workshop is situated directly adjacent. The remainder of the boundary is to small industrial units which do not generally create any significant noise. Detail of industrial operations, noise levels associated with the operations carried on within the industrial estate are summarised below with reference to Figure 8.

Figure 8: Industrial Noise

MOT/Vehicle Repair

6.4.2 At these premises vehicle maintenance and MOT Testing is carried out during the daytime and on occasions until midnight. However, there are no external noise sources and the entrance is to the south side of the building and, therefore, screened from the proposed development. There are no apertures or plant to the rear (see Photo 6) of the building and, certainly with proposed additional screening, disturbing noise is unlikely to prevail.

Photograph 6: Rear of MOT Premises

Laminform Extract Unit

6.4.3 The only audible source of industrial noise on the proposed development site was the external extract plant associated with Laminform Plastics (see Figure 8 and Photo 7). This is broad band and steady state and generates some 46dB(A) at the south west corner of the proposed development (as discussed in Section 4.3). This system operates from 09:00hrs until 17:00hrs at the latest. At this south western corner of the site the dominant noise will be Metro Noise and associated Maxima and this marginal industrial noise is adequately ameliorated by the proposed measures for Metro Noise and, specifically for any industrial noise.

Photograph 7: Laminform Extract Plant

Other Industrial Units

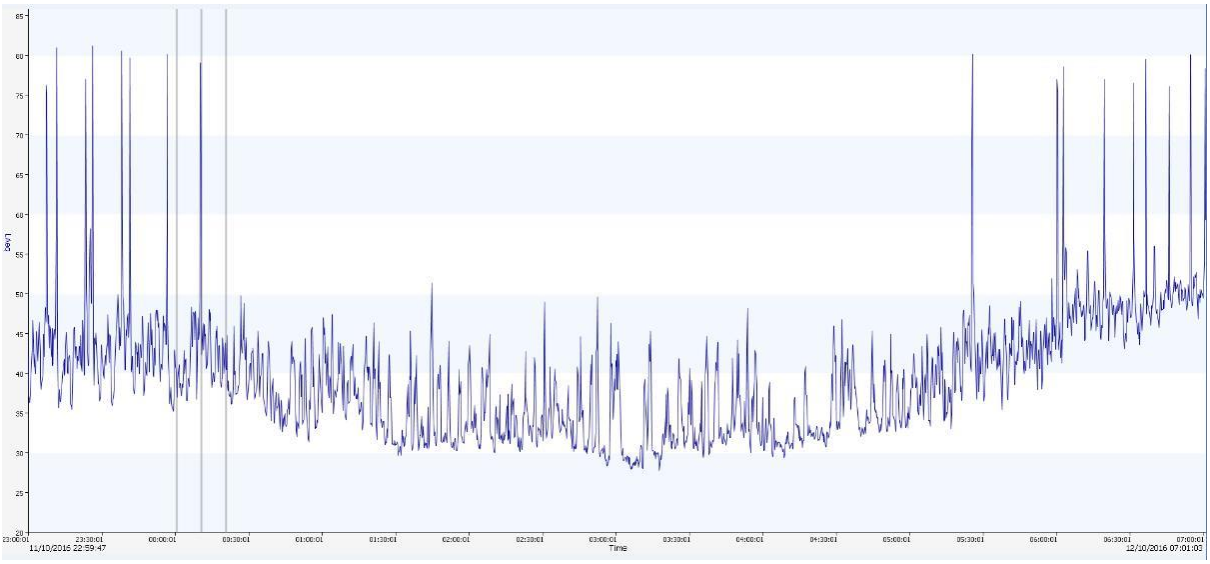
6.4.4 Other industrial units are small single units and not typically used for intense manufacturing or noise producing activities. Some are used for storage. One unit carries out uPVC window manufacture on a small scale. Whilst there may be intermittent noise it is unlikely to give rise to nuisance noise at the proposed development.

6.5 Monitored Industrial Noise

6.5.1 In order to further assess any possible industrial noise 24-hour monitoring was carried out from a position at the south west corner of the site (see Photograph 5).

6.5.2 Monitored noise at a position on site and to the rear of the MOT Garage premises is shown in Figure 8. The only significant source of noise is the passing Metro Trains, easily discernible in the trace. Some 18 trains pass during Night Time hours and levels are as previously described in Section 4.2.3.

Graph 4: 24 hour noise measurements



6.5.3 Noting the prevailing Metro Noise at the south west corner of the site, little additional noise amelioration is strictly required. This is also evident in noise monitoring where the only audible industrial noise was the Laminform Extract system (09:00 – 17:00, Monday – Friday).

6.5.4 However, as with all industrial estates there is some residual likelihood of delivery noise and intermittent manufacturing noise which may be audible from time to time. Under these circumstances recommendations for additional noise amelioration are as described below and in Figure 9 (overleaf):

1) Provision of a 1.8 metre close board screening fence (or equivalent) to acoustically (and visually) screen any industrial activity from residential areas (shown in Blue in

Figure 9). This is only necessary where existing bunding effectively screening the industrial estate is not retained.

2) Provision of Sound Attenuating Vents to habitable rooms (1st Floor and above, as Ground floor protected by screening measures) in those units directly facing the industrial estate so that residents are able to provide for sufficient ventilation without resort to open windows.

Figure 9: Recommended Addition Amelioration Measures re Potential Industrial Noise

6.6 Other Considerations

Maxima

6.6.1 Although there is some freight rail traffic on this line this is not significant in comparison to Metro Noise which is regular throughout the day. All maxima, even if at night, are assessed and amelioration is in place to ensure all guidance noise levels are met. Graph 3 shows the results of 24 hour monitoring on this stretch of railway/Metro Line and the inactivity at Night Time is obviously apparent.

Night Time Noise

6.6.2 BS8233 allows for some 10 Night Time Maxima before there is a requirement for further amelioration. However, in this instance, as train passages are up to 18 per day and occur in early morning (prior to 7am) relevant amelioration is recommended to meet the internal Night Time Maxima of 45dB(A) (BS8233).

6.6.3 In the case of road traffic noise, Night Time Noise Levels will be reduced by at least 5dB(A) from Daytime Noise Levels and the amelioration recommended for Daytime Noise will be more than sufficient for Night Time.

7 CONCLUSIONS

7.1.1 A noise assessment has been carried out for a proposed residential development at Victoria Road West, Hebburn.

7.1.2 Prevailing noise levels (industrial, road and Metro noise) have been measured in detail and assessed according to representative "worst case" conditions. Detailed noise measurement has been carried out on a typical weekday. All potential issues with regard to noise and the resulting noise exposure may be ameliorated. The measured data presented allows the full and appropriate assessments.

7.1.3 On the basis of the proposed layout to date, noise amelioration measures for appropriate enhancement of the sound insulation of the building envelope of noise affected facades have been recommended. These have been assessed according to "worst case" noise levels estimated on the basis of the detailed noise measurement. These assessments assume the presence of some 2 metres effective height screening at the site boundary with the Metro line (see Section 6.3).

7.1.4 Recommendations for appropriate noise amelioration measures are given in Section 6 (in particular Table 5 cross-referenced to Figures 3 – 5). These relate to the inclusion of additional sound insulation measures in the building envelopes at those facades affected by Metro Noise, road traffic noise and, to a lesser extent, by any possible industrial noise. Subject to final definition and the subsequent provision of noise amelioration measures, as discussed above, the residents of the proposed dwellings will be provided with acceptable internal and external (private amenity areas) noise environments.

7.1.5 Ultimately, the chosen configurations of sound insulation enhancements involve considerations of design and cost and, therefore, must be finally defined by the developers/architects. Relevant recommendations can only be provided for relevant combinations which may be expected to meet the acoustic requirements. The finalised inclusions should be forwarded to the Local Planning Authority for approval.

7.1.6 This report has been compiled from the results of noise measurements undertaken in July and October 2016 and are considered to be representative of the prevailing noise climate.

Appendix A: Glossary of Acoustic Terminology

Decibel (dB): a unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 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): 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 level 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).

LAeq,T : the equivalent continuous sound level -the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). LAeq,T is used to describe many types of noise and can be measured directly with an integrating sound level meter. It is written as Leq in connection with aircraft noise.

Maximum and Minimum (L_{Amax} and L_{Amin})
The simplest statistical parameters are the maximum level (L_{Amax}) and the minimum level (L_{Amin}) during the measurement period. The L_{Amax} is often used as a measure of the most obtrusive facet of the noise, even though it may only occur for a very short time and is the level of the maximum Root Mean Square reading. L_{Amin} is rarely used, but can be a useful way of identifying a constant noise amongst other intermittent noises.

Fast Time-weighting: An averaging time used in sound level meters, equivalent to 1/8 second.

Slow Time-weighting: An averaging time used in sound level meters, equivalent to 1 second.

Percentile Parameters ($L_{n,T}$)

Percentile parameters, L_n values, are useful descriptors of noise. The L_n value is the noise level exceeded for n per cent of the measurement period, which must be stated. The L_n value can be anywhere between 0 and 100. The two common ones are discussed below, but sometimes other values will be encountered.

Background Noise ($L_{A90,T}$)

The most commonly used percentile level is the $L_{A90,T}$, which is the 90th percentile level and is the level exceeded for 90 per cent of the time, T. It will be above the L_{min} and has been adopted as a good indicator of the “background” noise level. It is specified in BS 4142:1997 as the parameter to assess background noise levels. Whilst it is not the absolute lowest level measured in any of the short samples, it gives a clear indication of the underlying noise level, or the level that is almost always there in between intermittent noisy events. BS4142:1997 advises that the measurement period should be long enough to obtain a representative sample of the background level.

Level exceeded for 10% of the Time ($L_{A10,T}$)

$L_{A10,t}$ is the 10th percentile, or the level exceeded for 10 per cent of the time, and was used for road traffic noise assessments since it had been shown to give a good indication of people’s subjective response to noise. Although the L_{Aeq} has largely superseded its use for traffic, $L_{A10,T}$ may still be found in acoustic reports discussing road traffic. It is still used to assess traffic noise to determine eligibility for noise-insulation grants where a road is altered or a new one proposed. The $L_{A10,T}$ can be useful in assessing the overall noise climate, for example, if the $L_{A90,T}$, $L_{A10,T}$ and $L_{Aeq,T}$ are all within a few dB, then this indicates that the noise source is fairly constant.

Appendix B: Building Envelope Sound Insulation Calculations

Enhancements to Building Envelope Sound Insulation

Glazing

The weakest part of a building façade in terms of sound insulation is often the glazed areas. The insulation of various glazing configurations may be assessed by reference to the full calculation methods of BS8233:1999 & 2014 (which take account of spectral content of external façade noise level) (Ref 1, Sect 6,7).

Glazing configurations and the acoustic insulation rating of such are specified in terms of dB(R_w).

Ventilation

Enhanced glazing must be closed to provide the required benefit and it is consequently necessary to provide the required ventilation by suitably sound attenuated means.

The acoustic rating of such ventilators, when assessed as a façade element, is specified in terms of dB($D_{ne,w}$).

Roof Construction

In high noise level situations it is also necessary to ensure that roof/ceiling constructions also provide sufficient sound insulation in way of top floor habitable rooms.

Typical pitch roof constructions are categorised in guide calculations as 4 alternatives:

1 single ceiling boarding no mineral wool
2 single ceiling boarding with 100mm mineral wool
3 double ceiling boarding with 100mm mineral wool
4 double ceiling boarding with 100mm mineral wool solid layer (19mm ply) under tiles/felt.

Other roof constructions (e.g. flat roof) may be included in guide calculations according to their estimated or specified performance levels **dB(R_w).**.

Walls

Walls, usually masonry, provide good sound insulation such that they need not be considered in relation to the above.

However, for lightweight walling construction methods (e.g. curtain walling) due attention must be given to design for appropriate sound insulation. These may be included in guide calculations according to their estimated or specified performance levels **dB(R_w).**

Calculation procedures are “calibrated” by inputting the example from BS8233, Annex G.2. The results are summarised below to show exact equivalence

Data for all enhanced building envelope combinations are then pasted into identical spreadsheets to yield the basic Sound Insulation Summary Table within the report (Table 5).

Calibration of Calculation Procedures

Selected SRI (PASTE IN ROW BELOW)					Area	Rw	Rtra						
Element 1	6mm/12mm/6mm				1.5	33	27	24	26	29	33	28	24	33
Element 2	Brick Wall				8.5	50	45	27	40	44	45	51	56	60
Element 3	Roof				15	43	38	24	28	34	40	45	49	52
Element 4	-				0.00001	1000	1000	1000	1000	1000	1000	1000	1000	1000
Element 5	-				0.00001	1000	1000	1000	1000	1000	1000	1000	1000	1000
				Tot Area	25									
Ventilation One								38	37	36	35	36	34	34
	Length	Height	Breadth	Volume										
Room Dimension	3	2	5	30										
					Tot Surface Area									
					93		A	63	125	250	500	1000	2000	4000
(ENTER) Reverb Time (Secs):							0.5	0.44	0.44	0.345	0.302	0.302	0.32	0.32
Calcs Via BS8233							A	63	125	250	500	1000	2000	4000
Est Absorption (A)							9.66	10.98	10.98	14.00	15.99	15.99	15.09	15.09
10 Log (Stot/A)							4.13	3.57	3.57	2.52	1.94	1.94	2.19	2.19
SPL(A)(Façade.ext)							69.6	-25.0	57.0	60.0	63.0	64.0	65.0	2.0
10*Log(T1.S1/A)	6mm/12mm/6mm						-35.09	-32.64	-34.64	-38.70	-43.28	-38.28	-34.03	-43.03
Resulting SPL (Inside)							34.54	-57.64	22.36	21.30	19.72	25.72	30.97	-41.03
10*Log(T2.S2/A)	Brick Wall						-45.56	-28.11	-41.11	-46.17	-47.75	-53.75	-58.49	-62.49
Resulting SPL (Inside)							24.07	-53.11	15.89	13.83	15.25	10.25	6.51	-60.49
10*Log(T3.S3/A)	Roof						-36.09	-22.64	-26.64	-33.70	-40.28	-45.28	-49.03	-52.03
Resulting SPL (Inside)							33.54	-47.64	30.36	26.30	22.72	18.72	15.97	-50.03
10*Log(T4.S4/A)	-						-1059.85	-1060.40	-1060.40	-1061.46	-1062.04	-1062.04	-1061.79	-1061.79
Resulting SPL (Inside)							-990.23	-1085.40	-1003.40	-1001.46	-999.04	-998.04	-996.79	-1059.79
10*Log(T5.S5/A)	-						-1059.85	-1060.40	-1060.40	-1061.46	-1062.04	-1062.04	-1061.79	-1061.79
Resulting SPL (Inside)							-990.23	-1085.40	-1003.40	-1001.46	-999.04	-998.04	-996.79	-1059.79
10*Log (10*Tdne/A)								-38.40	-37.40	-37.46	-37.04	-38.04	-35.79	-35.79
Resulting SPL Inside							32.77	-63.40	19.60	22.54	25.96	25.96	29.21	-33.79
Total SPL Inside	(A-weighted is calc via A-weight stats)						38.60	-46.15	31.42	28.84	28.51	29.31	33.28	-32.94
	(A-weighted is calc via Octaves)						37.7							

Appendix C: Equipment

Instrumentation		
Sound Level Meter:	Bruel and Kjaer Type:	2250
	Serial No:	3007524
Microphone:	Bruel and Kjaer Type:	4189
	Serial No:	2237664
Calibrator:	Bruel and Kjaer Type:	4231
	Serial No:	1730932

Calibration was carried out before and after each measurement exercise using the "Charge Injection" facility within the Type 2260 Meter, enabling reference to previous calibrations of the instrument and providing warning of any significant change of sensitivity of the whole measurement chain (microphone and electronics) since the initial calibration. Full reference to all instrumentation is given above. Instrumentation was also checked with the above Calibrator.

Appendix D: Suppliers of Acoustic Ventilation Systems

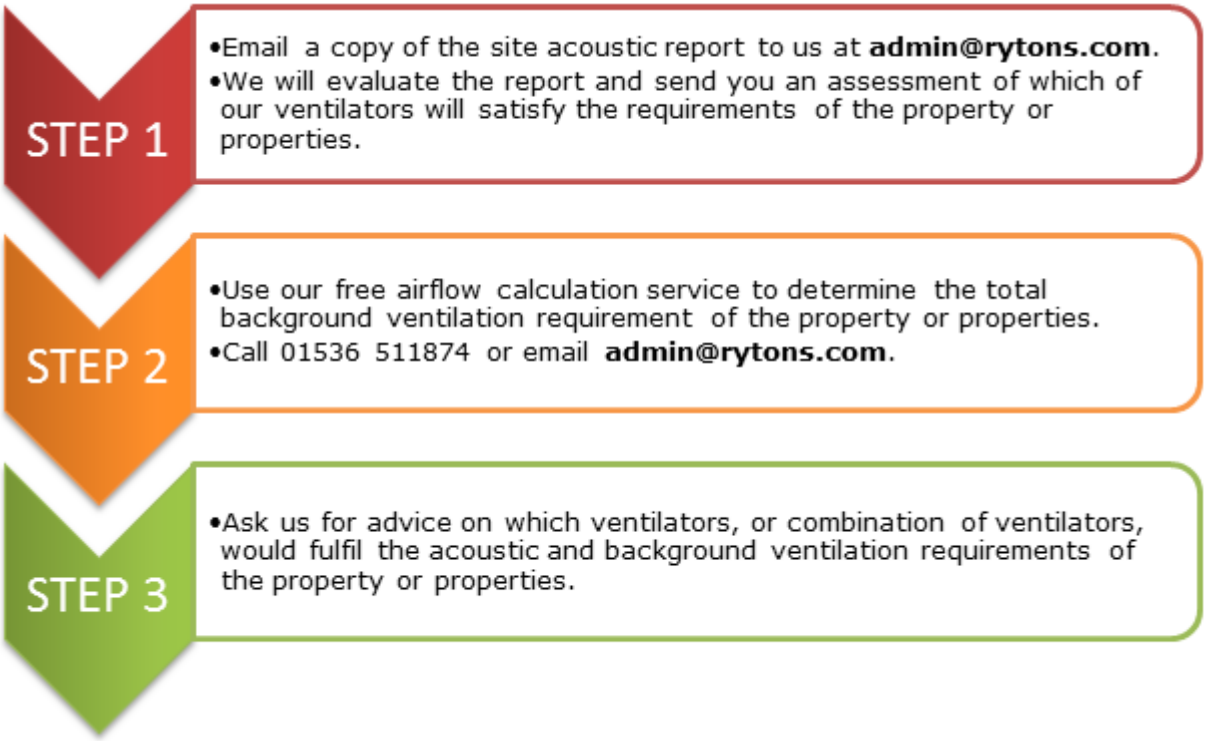
Rytons Building Products Ltd Design House Kettering Business Park Kettering Northants NN15 6NL	01536 511874	Mr Anthony Irwin
Airflow Developments Limited Aidelle House Lancaster Road Cressex Business Park High Wycombe Bucks HP12 3QP	01494 525252	Mr Ian Thompson (07825 668782)
Passivent Brooklands Road Sale Cheshire M33 3SS	0161 962 7113	
Air Domestique Installations Ltd 31, Berkely Road London N15 6HH	0181-880-2426	``
Greenwood Air Management Brookside Industrial Estate Rustington West Sussex BN16 3LH	01903-771021	

Appendix E: Example of Acoustic Ventilation System Advice

Free acoustic ventilation evaluation service from Rytons

Working out the background ventilation requirements of properties with acoustic issues can be a juggling act between satisfying the acoustic requirements and providing sufficient ventilation to the Building Regulations.

To simplify this task we have a simple 3 step plan which will take you from acoustic report to product detailing quickly and easily.



Good to know:

- All Rytons Acoustic Background Ventilators provide in excess of the 5000mm² equivalent area threshold required by Part F, which allows the number of units used in a property to be kept to a minimum.
- All Rytons Acoustic Background Ventilators feature a fully adjustable vent on the inside allowing the occupier to regulate the airflow in each habitable room.
- All Rytons Acoustic Background Ventilators are independently tested by the BRE for both acoustic performance and equivalent area; your assurance that the figures are accurate and verifiable.
- Background ventilators are efficient and low cost to buy. With zero running and maintenance expenses for the occupants they are also less likely to be tampered with.

- NBS Plus specifications are available to cut and paste straight into your documentation from the product pages of our website at www.vents.co.uk

Rytons products are available **next working day** across the whole of the UK.

For product information, product guides, BRE acoustic test reports,
BBA Certificates and more visit our website at
www.vents.co.uk
or call **01536 511874**.

Contact Us

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