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GLEESON DEVELOPMENTS LTD

Proposed Development at Glen Street, Hebburn

Noise Assessment

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GH/GS/002

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APPENDICES

1 INTRODUCTION

1.1 Context

1.1.1 Gleeson Developments Ltd. appointed L A Environmental Ltd to undertake an assessment of the existing noise climate for a proposed residential development at land off Glen Street in Hebburn.

1.1.2 The proposed development is for the construction of around 31 residential dwellings along with associated gardens, car parking with access off Glen Street to the north east of the site.

1.1.3 Noise measurements have been carried out within the site to establish the existing noise climate adjacent to the metro line which lies to the north of the site. Consideration has also been given to the noise from the electricity substation located in the south west corner of the site.

1.1.4 Where necessary appropriate noise mitigation measures will be recommended to achieve acceptable internal noise limits in accordance with BS 8233[1] and the WHO Guidelines[2].

1.1.5 Noise measurements, interpretation of the data and guidance was made in accordance with the following documentation:

- National Planning Policy Framework (NPPF) 2012
- [1]BS 8233: 2014 "Guidance on sound insulation and noise reduction for buildings"
- [2]World Health Organisations (WHO) "Guidelines for Community Noise" (1999)

1.1.6 Report No. GH/GS/001 was submitted with the application in February 2015. Comments were received about the layout of the dwellings from the Council's Environmental Protection Section in an email from Christina Snowdon, Senior Planner at South Tyneside Council to Chris Dodds on 2nd April 2015. These concerns were addressed, in particular, with relation to maximum noise levels at Plots 18 and 19 and the number of occurrences during the night time.

1.1.7 It was demonstrated in a memo dated 19th May 2015 that maximum noise levels could be reduced to within the recommendations of the World Health Organisation guide values with upgraded double glazed units. However, the Council's Environmental Protection Section were still concerned about the position of Plots 18 and 19 in relation to their close proximity to the metro line and the general amenity for future occupants of those dwellings.

1.1.8 A meeting was held on 8th June 2015 with South Tyneside Council's Senior Planner and two representative of the Environmental Protection Section. A proposed revised layout was presented where the positions of Plots 18 and 19 had an increased separation distance from the metro rail line. It was agreed that further calculations would be carried out in order to determine the maximum noise levels at these plots with an increase in the proposed acoustic barrier on the northern boundary from 2m to 2.5m.

1.1.9 Details of the outcome of these calculations were presented in a memo dated 9th June 2015 and were ultimately agreed with the Environmental Protection Section. This updated report incorporates the original assessment [Report No. GH/GS/001] and the data presented in the memo dated 9th June 2015.

1.2 Site location

1.2.1 The site is located on land to the north of Glen Street in Hebburn, Tyne & Wear. Directly to the north of the site lies the metro line between Jarrow to the west and Platform 1 of Hebburn station, which is directly opposite the north east corner of the site. There are existing residential dwellings immediately south on Glen Street and two medical centres to the north east.

2 NOISE GUIDELINES & STANDARDS

2.1 National Planning Policy Framework

2.1.1 The National Planning Policy Framework (NPPF) came into force in March 2012 and represents the government's commitment to sustainable development, through its intention to make the planning system more streamlined, localised and less restrictive.

2.1.2 On the 6th March 2014 Planning Practice Guidance on Noise was published which advises on how planning can manage potential noise impacts in new development. The guidance is relevant as the proposed development would be sensitive to the prevailing acoustic environment.

2.1.3 The NPPF provides a set of overarching aims, which broadly reflect those already contained in the Noise Policy Statement for England (NPSE) which is aimed at the avoidance of significant adverse impacts and reduction of other adverse impacts on health and quality of life.

2.1.4 Consideration should be given to whether or not a good standard of amenity can be achieved.

2.1.5 The framework states that:

Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.1.6 Further NPPF aims related to noise include:

Clause 109

The planning system should contribute to and 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;

2.1.7 In line with the Explanatory Note of the Noise Policy Statement for England (NPSE), this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.

2.1.8 The NPSE includes some context within the explanatory note to assessing noise impact and uses established concepts from toxicology currently being applied to noise impacts, these include:

Observed Effect Levels

- **Significant observed adverse effect level**: This is the level of noise exposure above which significant adverse effects on health and quality of life occur.
- **Lowest observed adverse effect level**: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.
- **No observed effect level**: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.

2.1.9 It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times.

2.1.10 It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

2.1.11 Table 1 summaries the noise exposure hierarchy, based on the likely average response.

Table 1:

Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No effect	**No Observed Effect**	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but no such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
	Noise can be heard and small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.1.12 No specific criteria are provided by the above guidance to enable planning decisions to be made. In the absence of such guidance, quantification of noise impact in terms of guidance such as BS8233 can therefore be considered as appropriately assessing the potential noise impact with regard to toxicology concepts and hence in line with the principles of the NPPF, PPG on Noise and the NPSE.

2.2 BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

2.2.1 BS 8233 suggests criteria, such as suitable sleeping/resting conditions, and proposes noise levels that normally satisfy these criteria for most people. It provides guidance for the control of noise in and around buildings.

2.2.2 To achieve satisfactory sound insulation inside the building, it is necessary to know how each space is to be used so that appropriate noise criteria can be chosen. It can then be designed appropriately for the relevant parts of the proposed building and appropriate noise levels can be selected.

2.2.3 The British Standard suggests appropriate noise levels for different situations and the criteria for indoor ambient noise levels for various types of room are given in Table 2.

Table 2:
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 $L_{Aeq,8hour}$

2.2.4 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.

2.2.5 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 noise level.

2.2.6 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.

2.2.7 It is considered desirable that external areas that are used for amenity space, such as gardens and patios that noise levels do not exceed 50dB $L_{Aeq,T}$ with an upper guideline value of 55dB $L_{Aeq,T}$. 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 3 presents the various guideline values for community noise in various situations.

Table 3:
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 which correlates with the "good" criteria in BS8233. Lower noise levels may be disturbing depending on the nature of the noise source.

3 SURVEY DETAILS

3.1 Instrumentation and weather conditions

3.1.1 The equipment used during the surveys is listed below.

- Brüel and Kjær 2250-L Sound Level Meter, Serial number 3000297
- Prepolarized free-field ½" microphone type 4189, Serial number 2745928
- Brüel and Kjær 4231 Sound Level Calibrator, Serial number 3001385
- Kestrel 2000 Pocket Weather Meter, Serial no. 1873075

3.1.2 All equipment is fully compliant with that specified as Type 1 in British Standard BS EN61672 - 1: 2003: "Electroacoustics. Sound level meters Specifications."

3.1.3 On-site calibration checks were performed before and after all measurements with no variance 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 1.3m above the immediate ground level 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 Weather conditions on Tuesday 27th January 2015 were dry and bright. There was a westerly breeze less than 2m/s with 10% cloud cover and an average temperature of 4°C. There was no precipitation.

3.2 Noise measurement procedure

3.2.1 The existing daytime noise climate was measured over periods considered representative of the noise climate at three locations within the site between approximately 10:30 and 12:30 on Tuesday 27th January 2015 to establish the noise climate at the nearest proposed residential dwellings to the metro line and the electricity sub-station.

3.2.2 No night time levels were measured as there are fewer metro train movements between the period 23:00 and 07:00 hours. To assess the impact of metro train during the night, prediction calculations have been carried out.

3.3 Noise monitoring locations

3.3.1 The monitoring locations were selected to represent the position of the façades of the closest proposed dwellings to the metro line. The locations were 1m from the northern boundary and are shown in Figure 1.

3.3.2 A further position was selected to determine the noise produced by the electricity substation in the south west corner of the site.

Figure 1: Noise monitoring locations. Map sourced from Dwg No.GH44:L:01C Dated 11.02.15

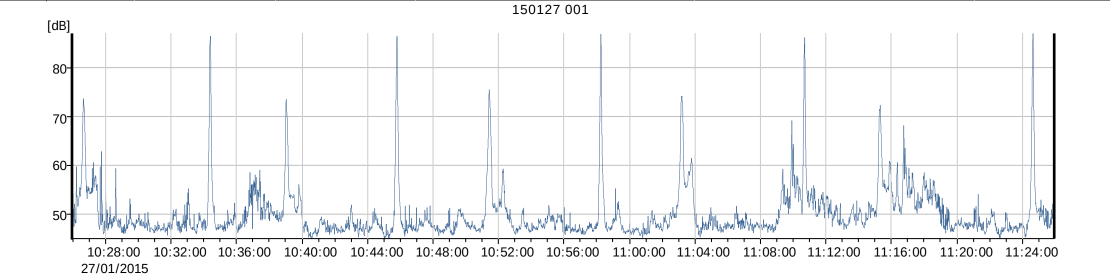
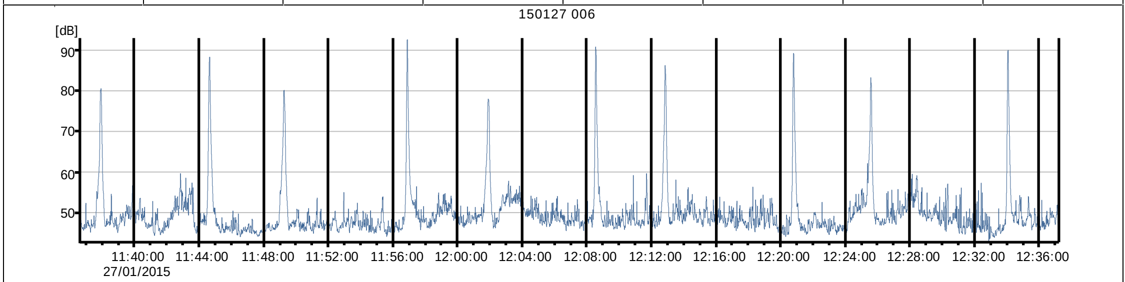
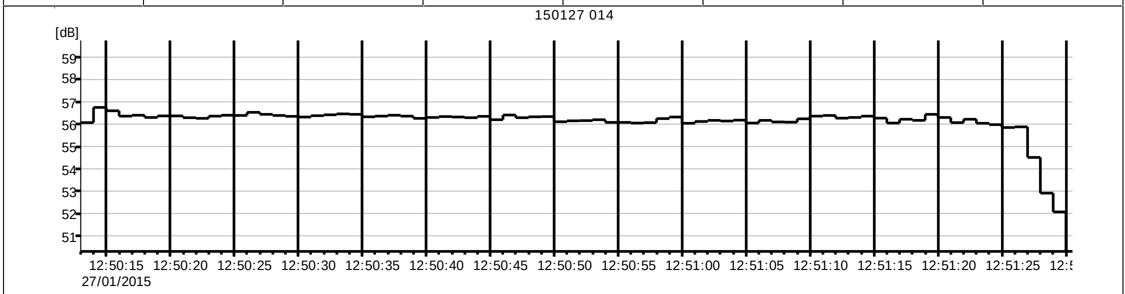
4 RESULTS

4.1 Daytime

4.1.1 The noise measurement results are summarised in Table 4 below.

Table 4:

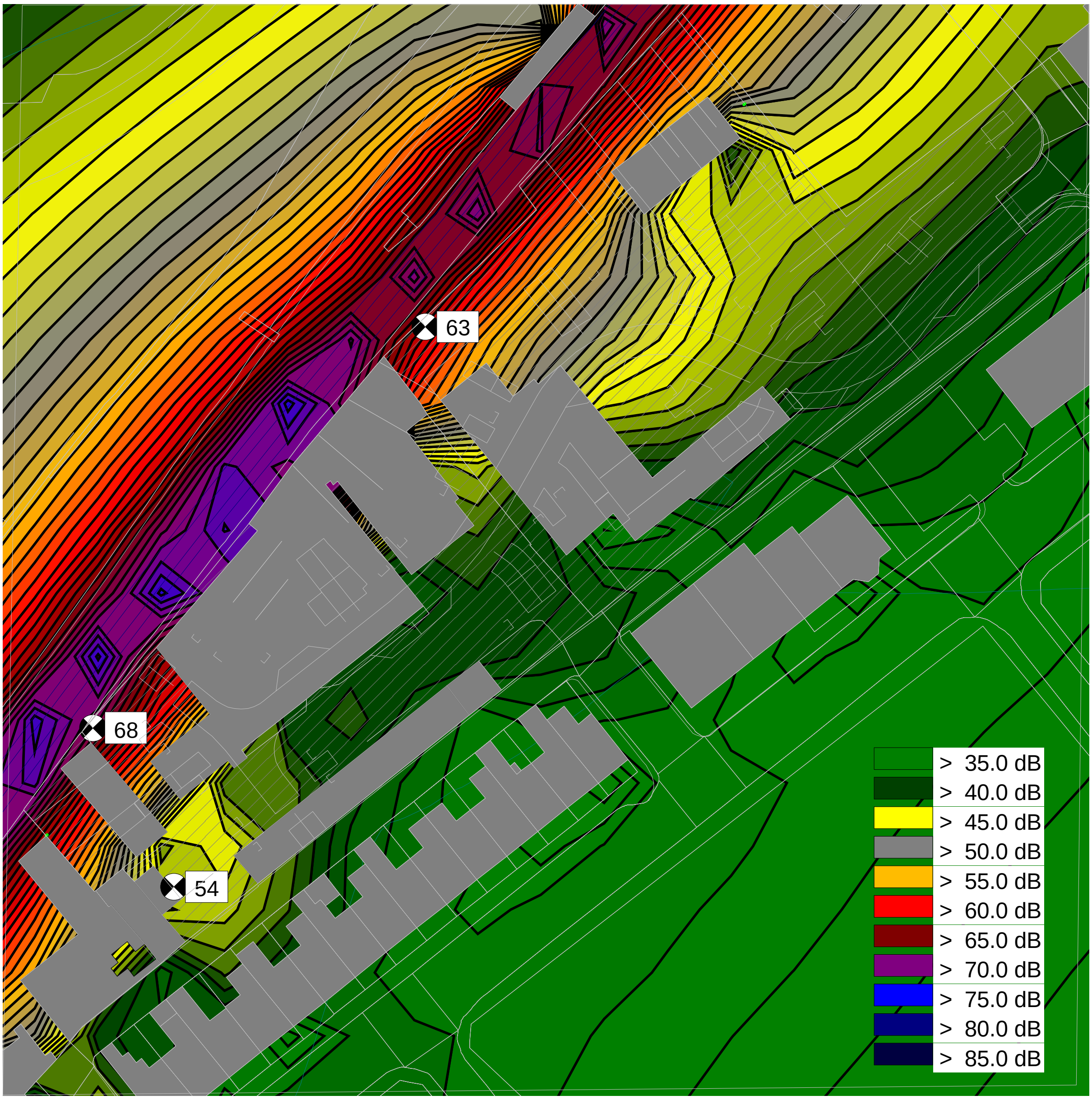
Measured daytime noise survey results dB(A)

Location	Start Time	Stop Time	$L_{Aeq,1hr}$	L_{A10}	L_{AFmax}	L_{Amin}	L_{A90}
NML1	10:25	11:25	63	55	88	44	47
							
NML2	11:36	12:37	68	54	95	43	46
							
NML3	12:50	12:51	56	57	57	50	56
							

4.1.2 Noise sources included distant road traffic on the surrounding road network, high altitude aircraft, birdsong and road traffic on Glen Street to the south, including a street cleaner which passed frequently throughout the survey period. On the occasions when metro trains passed on the line to the north, this was the main noise source.

4.1.3 The measured levels have been imported into noise modelling software to predict noise levels across the whole of the site and the results of the prediction exercise are shown in the noise contour plan overleaf.

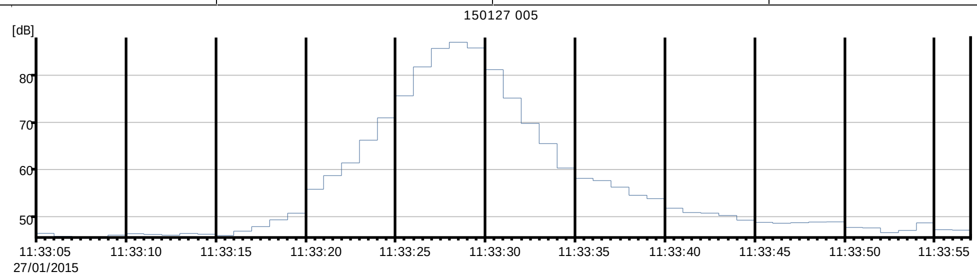
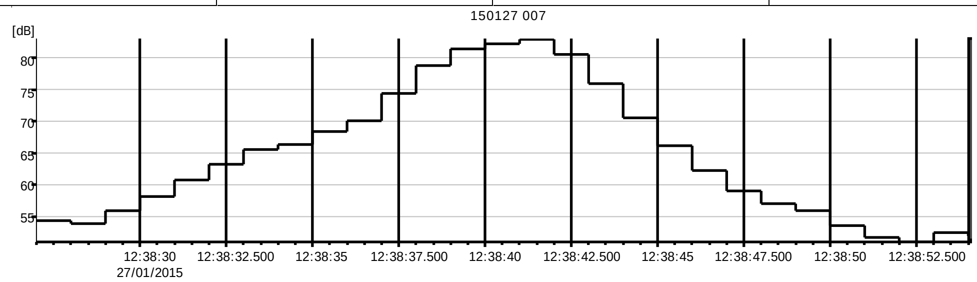
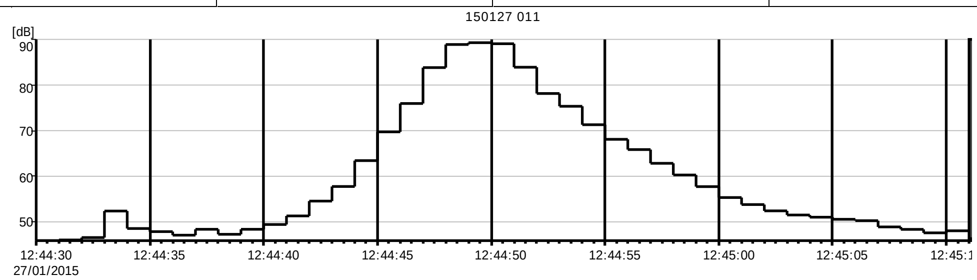
Figure 2: Existing Site Noise Levels dBL_{Aeq}



4.2 Night time

4.2.1 No night time monitoring was carried out. However, individual metro train pass by noise levels L_{AE} (sound exposure levels) can be converted into an overall $L_{Aeq,8hr}$ night time noise level based on the frequency of train movements.

4.2.2 The L_{Aeq} and L_{AE} levels measured during a metro train pass-bys are shown in Table 5.

Table 5: Noise levels during a metro train pass by dB(A)			
Direction of travel	**Measurement Period (mins:secs)**	**L_{Aeq}**	**L_{AE}**
Location 1			
Eastbound	01:50	61.9	82.3
			
Westbound	00:53	74.9	92.2
			
Location 2			
Eastbound	00:28	74.6	89.0
			
Westbound	00:42	78.7	94.9
			

4.2.3 The graphs shows the varying noise level over the period it took for the train to pass the two monitoring locations.

4.2.4 The total number of trains passing the site, during the period 23:00 to 07:00, have been taken from the passenger timetable which is detailed in Appendix B. From the published timetable the total number of metro passenger trains passing the site each weekday is detailed in Table 6.

Table 6: No. of metro passenger trains between Hebburn - Jarrow	
Direction of travel	**No. between 23:00 - 07:00**
Eastbound (Platform 1)	8
Westbound (Platform 2)	8

4.2.5 Prediction calculations have been undertaken to determine the night time noise climate at the nearest proposed dwellings to the track, based on the above information.

5 DISCUSSION

5.1 NPPF & NPSE

5.1.1 If a development meets the recommendations of BS8233 and any associated local authority noise requirements, it can be considered as being below the level where there is no detectable adverse effect on health and quality of life due to noise, and this meets the NOEL (No Observed Effect Level) set out in the NPSE.

5.2 Daytime

5.2.1 Noise levels were measured at potentially the most noise sensitive locations within the site. Recorded levels represent the noise climate at the nearest proposed façades to the metro rail line which runs from east to west along the northern boundary of the site.

5.2.2 Measurements were carried out over a period of approximately 2 hours and are considered representative of the typical daytime noise climate over the period 07:00 to 23:00 hours.

5.2.3 Average noise levels were 63dB$L_{Aeq,16hr}$ at Location 1 and 68dB$L_{Aeq,16hr}$ at Location 2 and were mainly influenced by metro trains passing the site. The noise climate at Location2 was higher as a result of trains travelling at greater speed passed this point. Location 1 was opposite the end of Platform 1 and trains are either slowing to a stop or accelerating away from Platform 2.

5.2.4 The measured levels were above the WHO guidelines of 55dBL_{Aeq} which is the level at which few people would be highly annoyed during the daytime.

5.2.5 Consideration should therefore be given to reducing the noise from this source and potential mitigation measures are discussed in Section 6.

5.3 Night time

5.3.1 The passenger timetable shows there are 8 metro trains passing the site in each direction between the hours 23:00 and 07:00. The night time A weighted 8 hour L_{eq} noise level can be predicted at the closest proposed residential dwelling using the following equation:

$$L_{Aeq,\,8\text{-hour}} = L_{AE} - 10\log(t) + 10\log(n)$$

where t = time period
n = no. of events in t

Table 7: Predicted Night time noise levels dB(A)					
LOCATION 1	L_{AE}	10log(t)	10log(n)	Noise Level	Combined Noise Level $dBL_{Aeq,8hr}$
Eastbound	82.3	-44.6	+9.0	46.7	**57**
Westbound	92.2	-44.6	+9.0	56.6	
LOCATION 2	L_{AE}	10log(t)	10log(n)	Noise Level	Combined Noise Level $dBL_{Aeq,8hr}$
Eastbound	89.0	-44.6	+9.0	53.4	**60**
Westbound	94.9	-44.6	+9.0	59.3	

5.3.2 The calculated noise level at Locations 1 and 2 are therefore $57dBL_{Aeq,8hr}$ and $60dBL_{Aeq,8hr}$ respectively and are between 6 – 8dB(A) lower than the daytime noise levels.

5.4 Maximum Noise Levels

5.4.1 Following revision of the layout, maximum noise levels as a result of metro train pass-bys will be reduced as a result of greater separation distance between the source and the receiver. Table 8 below demonstrates the reduction as a result of distance attenuation, which has been calculated to be between 4 and 6dB(A), depending on eastbound or westbound train movements and the resulting maximum levels at the closest point of the façade to the tracks.

Table 8: Predicted Night time noise levels dB(A)					
Direction of metro train	Measured L_{Amax} @ 1m from boundary	Distance from source (m)	Distance from metro line to Plot 19	Reduction in L_{Amax} as a result of distance	Ground floor L_{Amax} levels @ Plot 19
Eastbound	81.6	7.05	11	4	**78**
Westbound	89.8	3.62	8	6	**83**
Eastbound	81.2	7.05	11	4	**77**
Westbound	95.1	3.62	8	6	**89**
Eastbound	79.8	7.05	11	4	**76**
Westbound	91.1	3.62	8	6	**85**
Eastbound	87.1	7.05	11	4	**83**
Westbound	90.7	3.62	8	6	**84**
Eastbound	84.8	7.05	11	4	**81**
Westbound	90.6	3.62	8	6	**84**

5.4.2 The maximum noise levels at the gable end façade of Plot 19, which has no habitable windows in it, range from 76 to 89dBL_{Amax}. [Figures rounded].

5.4.3 To assess the impact at night it has been assumed that maximum noise levels would be similar to those measured during the day. Consideration has been given to the upper floor at night, where bedrooms are located. As ground absorption reduces with height noise levels will be slightly higher at the first floor bedroom window level and it has been calculated that there would be an increase of approximately 1dB(A) between the ground and first floor levels.

6 NOISE MITIGATION MEASURES

6.1 External Daytime Noise Levels

6.1.1 The gardens of the dwellings located on Plots 6 to 15, 18 and 19 are adjacent to the northern boundary and therefore parts of the gardens would be subject to noise levels in the region of 63 – 68dB$L_{Aeq,16\ hour}$, without any mitigation measures.

6.1.2 Principally there are three ways in which noise levels at sensitive receptors can be minimised:

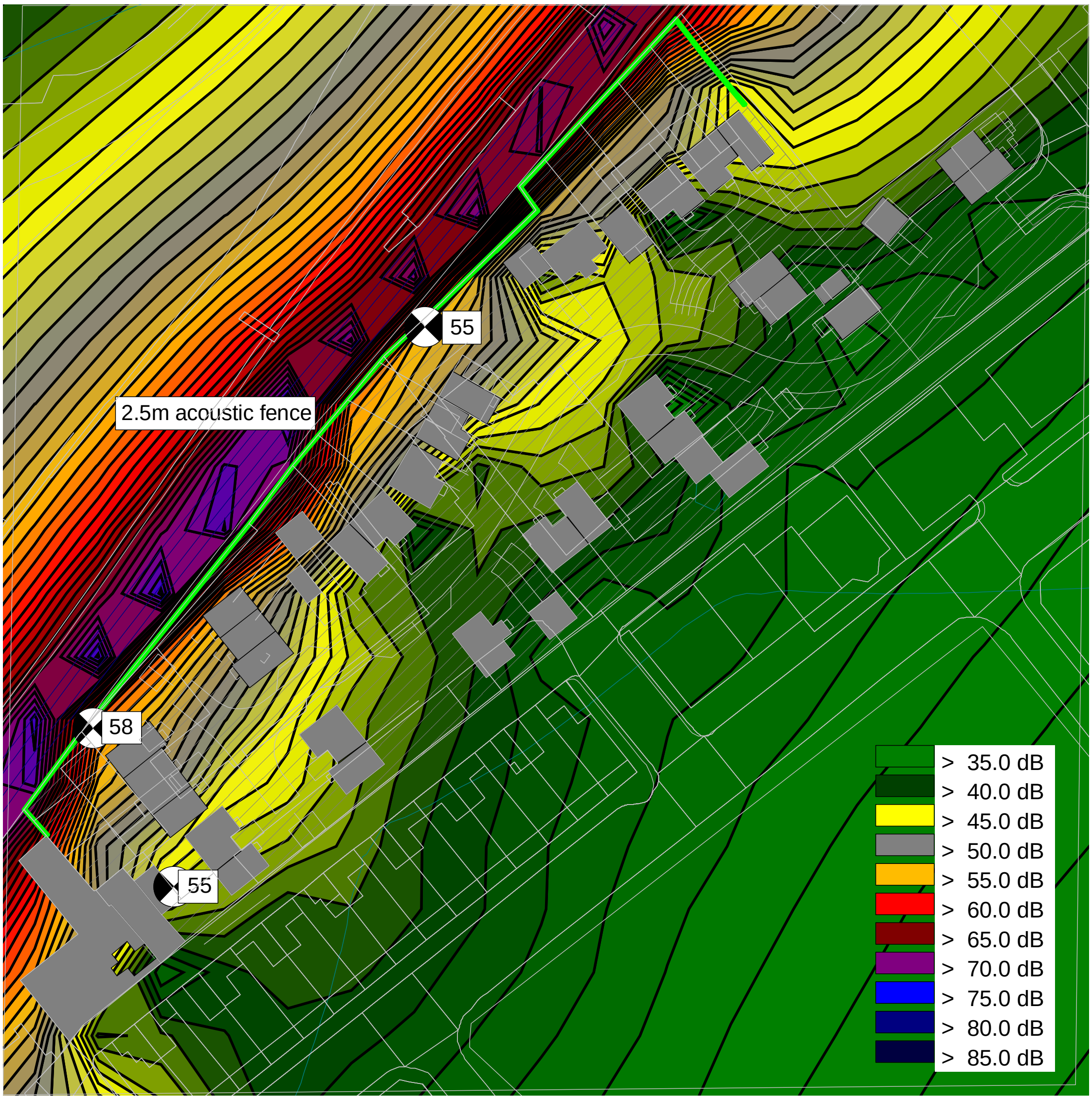
- Reduction at source
- Ensuring adequate distance between the source and receiver
- The use of barriers between the source and receiver

6.1.3 Where it is not possible to reduce noise to a sufficient level at source, or increase the distance between the source and the noise sensitive location, screening should be considered.

6.1.4 The use of acoustic barriers can be very effective in dealing with outdoor noise propagation and it is proposed that an acoustic fence is erected along the northern boundary and part of the eastern and western boundaries to protect the amenity of gardens at the closest dwellings on plots nearest to the metro rail line.

6.1.5 Cadna noise modelling software has been used to predict future noise levels across the site following the implementation of mitigation measures which includes the erection of a 2m high acoustic fence along the boundaries where shown. The resulting noise contours across the site are shown in Figure 3.

Figure 3: Predicted Daytime Noise Levels with 2.5m acoustic fence (dBL_{Aeq})



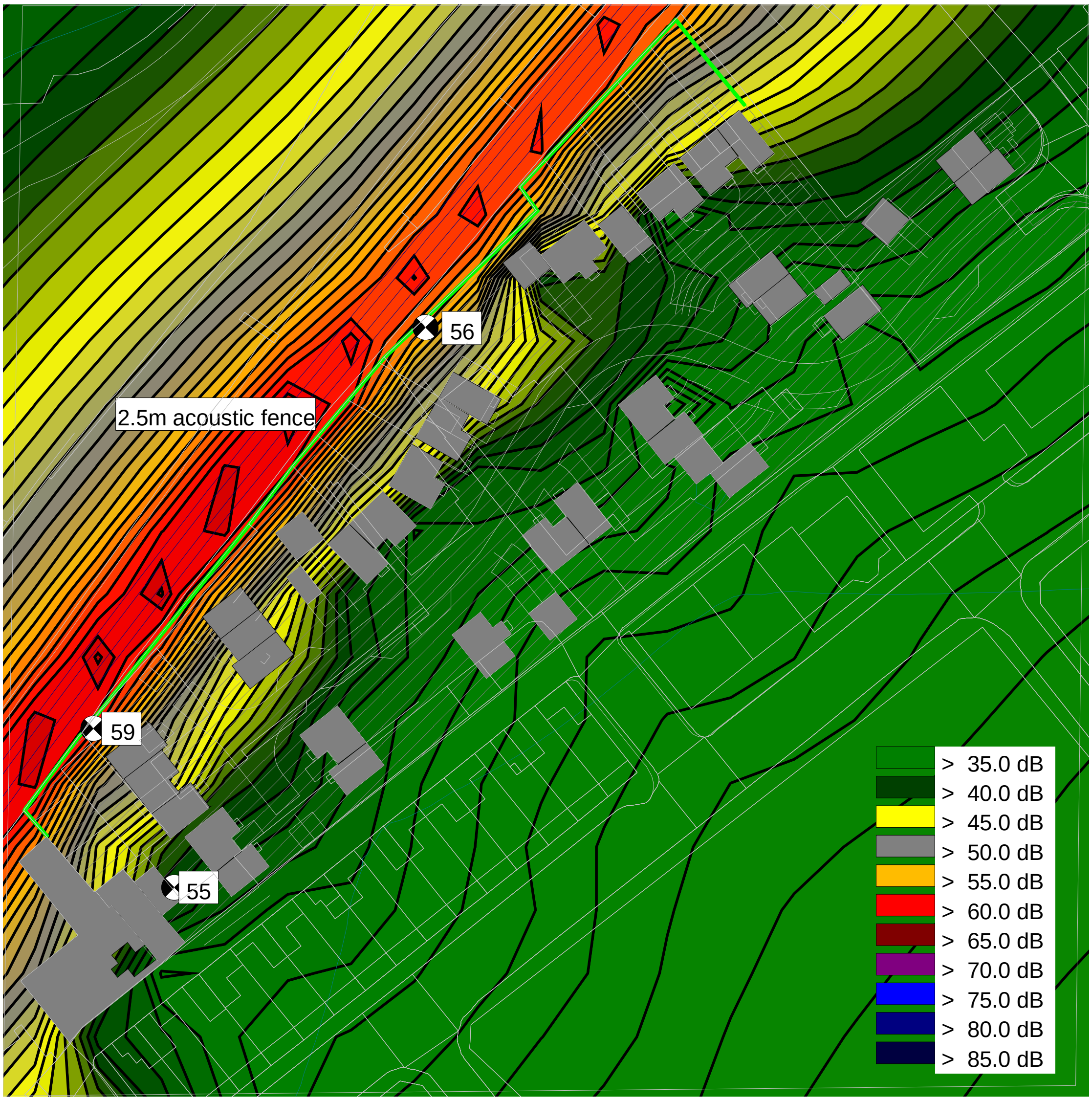
6.1.6 It has been demonstrated that the noise level close to the northern boundary are likely to be on or slightly exceed the upper guideline value of $55dBL_{Aeq}$. BS8233:2014 does however recognise that the guideline values are not achievable in all circumstances where development might be desirable. The Guidance goes on to state that "*In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as convenience of living in these location or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited*".

6.1.7 For the majority of the time noise levels are below 50dB(A) which is a desirable level. It is only when metro trains pass that levels exceed 55dB(A) and only occurs for, typically, up to one minute. For all dwellings a level of 55dB(A) or less is achievable within some part of the garden.

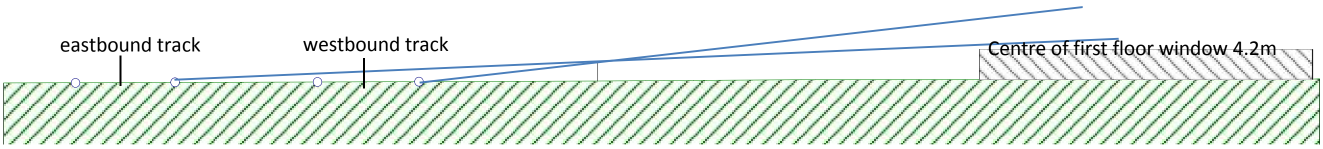
6.2 External Night time Noise Levels

6.2.1 It has been predicted that, based on the number of metro trains operational during the hours 23:00 – 07:00, noise levels are between 6- 8dB(A) lower than the daytime. Night time noise levels have been predicted at a height of 4m, which is equivalent to the first floor window height using CadnaA noise modelling software. The results are shown in Figure 4.

Figure 4: Predicted Night time noise levels @4m (dBL_{Aeq})



6.2.2 An acoustic fence is proposed on the site boundary and the effectiveness of this has been calculated based on a barrier height of 2.5m. The cross section below demonstrates that a 2.5m barrier on the northern boundary interrupts the line of sight to the first floor bedroom window.



6.2.3 A simple but straightforward approach to calculating the effect of barriers is proposed in BS5228 which states that either a 5dB or 10dB reduction can be made depending on whether the receiver is partially or completely screened from the noise source. The figure above demonstrates that the main source of noise (i.e. the interaction between the wheels and the track) is completely screened from the centre of the first floor window by the barrier and therefore a reduction of at least 5dB(A) could be expected as a result.

6.2.4 For an acoustic barrier to perform in the manner that the calculations predict, there must be no holes or weaknesses in the structure of the barrier. There should be no gaps between the barrier and the ground, in order to prevent sound passing underneath the barrier. An example of the type of fence to be erected on the northern boundary is given in Appendix E.

6.2.5 More detailed calculations can be undertaken to determine the degree of screening which depends on the relative positions of the source and receptor and where the diffracting edge along the top of the barrier cuts the vertical plane. The degree of screening is calculated from the path difference of the diffracted ray path and the direct ray path.

6.2.6 The potential barrier correction calculated for both the east and westbound tracks are shown in the tables below.

Barrier attenuation - westbound track

Source height	Receiver height (first floor)	Barrier height	Distance between source and barrier (a)	Distance between barrier and receiver (b)	Distance between source and receiver (c)
0.1	4.2	2.5	2.5	5.5	8
SB	BR	SUM	SR	Difference	pld
3.466	5.757	9.222	8.989	0.233	11.1

Barrier attenuation - eastbound track

Source height	Receiver height (first floor)	Barrier height	Distance between source and barrier (a)	Distance between barrier and receiver (b)	Distance between source and receiver (c)
0.1	4.2	2.5	5.7	5.5	11.2
SB	BR	SUM	SR	Difference	pld
6.185	5.757	11.941	11.927	0.015	6.7

Note: The additional attenuation referred to as ground absorption should be ignored when calculating the effects of barriers since the near ground rays are obstructed. Therefore, in reality the attenuating benefits of the barrier may not be as great.

6.3 Maximum Night time Noise Levels

6.3.1 The resulting maximum noise levels at Plot 19 are shown in Table 9.

Table 9:

Predicted Maximum Night time noise levels dB(A)

	Ground floor L_{Amax} levels @ Plot 19	L_{Amax} levels at 1st floor (4m)	Attenuation as a result of barrier	External L_{Amax} with 2.5m high fence	Required reduction to meet 45dL_{Amax} internally
Eastbound	**78**	79	7	72	27
Westbound	**83**	84	11	73	28
Eastbound	**77**	78	7	71	26
Westbound	**89**	90	11	79	34
Eastbound	**76**	77	7	70	25
Westbound	**85**	86	11	75	30
Eastbound	**83**	84	7	77	32
Westbound	**84**	85	11	74	29
Eastbound	**81**	82	7	75	30
Westbound	**84**	85	11	74	29

6.3.2 The predicted highest maximum level is 79dBL_{Amax}. To achieve a level of 45dBL_{Amax} internally would require 34dB attenuation.

6.4 Insulation provided by windows

6.4.1 The closest proposed dwellings are located on Plots 18 and 19 and are orientated so that the gable facades face the rail line. The noise levels at the front and rear facades would be up to 3dB(A) lower as a result of screening by the building itself. Therefore, noise levels of 55dB$L_{Aeq,16hr}$ are expected at the ground floor windows of the closest plots to the metro rail line.

6.4.2 The main point of entry for external noise into a dwelling is generally the windows as these are the lightest and thinnest component of a building façade.

6.4.3 Information relating to the noise insulation provided by various insulating glass units (IGU) has been sourced from Pilkington Datasheet (2014) and the figures detailed in Table 10 have been sourced from BS EN 12354-4:2000 "Building acoustics. Estimation of acoustic performance in buildings from the performance of elements. Transmission of indoor sound to the outside".

Table 10: **Typical noise reductions for glazing**	
Configuration Insulating Glass Unit (IGU) Float glass, thickness in mm	**Noise reduction C_{TR} dB(A)**
4 / 6 to 20 mm / 4	25
6 / 6 to 20 mm / 6	27
6 / 6 to 20 mm / 4	28
10 / 6 to 20 mm / 4	30
10 / 6 to 20 mm / 6	32

6.4.4 Calculations for the required glazing can be carried out based on the existing noise levels and required internal noise levels. The simplest method of calculating this is as follows:

Required Noise Reduction (C_{TR})= External Noise level $dBL_{Aeq,T}$ - Required Internal Noise Level $dBL_{Aeq,T}$

6.4.5 This is a simplified calculation however it presents the highest glazing specification which would be required as it does not take into account factors such as the size of the windows or the noise insulation provided by the wall or any room absorption.

Daytime

6.4.6 The guideline value for resting in living rooms during the day from BS8233:2014 states that it is desirable that the internal ambient noise does not exceed $35dBL_{Aeq,16hr}$ between 07:00 and 23:00.

6.4.7 Glazing configuration (or equivalent) shown in Table 11 are recommended as appropriate for windows of habitable rooms on the northern boundary of the site.

Table 11: **Required Configuration Insulating Glass Unit – daytime**				
Plot	**Predicted External Facade Level $dBL_{Aeq,16hr}$ at ground floor**	**Glazing Specification (glass/cavity/glass)**	**Noise Reduction Range dB(A)**	**Resultant Internal Noise Level dB(A)**
18-19	58	4 / 6 to 20 mm / 4	~25	~33
11-15	<55	4 / 6 to 20 mm / 4	~25	~30
6-10	<50	4 / 6 to 20 mm / 4	~25	~25

(PVB) – Pilkington Standard Laminated Glass (or equivalent)

6.4.8 Other glazing configurations giving equivalent performance would be acceptable. In all cases windows should be openable but should be well sealed when closed.

6.4.9 It is therefore possible to meet a desirable internal noise value of 35dBL_{Aeq} or below in the all ground floor habitable rooms with glazing configuration 4 / 6 to 20 mm / 4.

Night time

6.4.10 The predicted night time noise level at the closest proposed façade to the metro rail line was 59dBL_{Aeq} at Location 2. However, there are no habitable rooms at this location and bedroom windows are on the front and rear elevations which would benefit from a reduction of 3dB(A) as a result of the screening provided by the building. Therefore, noise levels at the closest bedroom window on Plot 18 and 19 would be in the region of 56dB$L_{Aeq,8hr}$.

6.4.11 BS8233:2014 recommends that a level of less than 30dB$L_{Aeq,8hr}$ should be achieved to preserve the restorative process of sleep.

6.4.12 Table 12 presents the noise insulation required to achieve this standard within the dwellings on the northern boundary, closest to the metro rail line.

Table 12: Required Configuration Insulating Glass Unit – night time

Plot	Predicted External Facade Level dB$L_{Aeq,8hr}$	Glazing Specification (glass/cavity/glass)	Noise Reduction Range dB(A)	Resultant Internal Noise Level dB(A)
18-19	56	6 / 6 to 20 mm / 6	~27	~30
11-15	<50	4 / 6 to 20 mm / 4	~25	~25
6-10	<45	4 / 6 to 20 mm / 4	~25	~20

6.4.13 The desirable internal value given in BS8233:2014 of 30dB$L_{Aeq,8hr}$ could be achieved in all bedrooms with the appropriate glazing configuration.

Maximum Night time Noise Levels

6.4.14 The predicted highest maximum level is 79dBL_{Amax}. To achieve a level of 45dBL_{Amax} internally would require at least 34dB attenuation. Data from the Pilkington Optiphon Laminated Glass for noise control datasheet, dated June 2014 is provided in Appendix C.

6.4.15 It has been agreed between Gleeson Homes and the Environmental Protection Section that an increased glazing specification to 10mm/16mm argon/9.1mm Pilkington optiphon, or an equivalent glazing which provides 45Rw (40Ctr) sound insulation will be installed within the bedrooms of Plots 18 and 19.

6.4.16 Ctr is an adjustment to the Rw scale that can be used for selecting a product to reduce noise from urban road traffic and other noise sources with a large component of low frequencies and is applicable to train noise.

6.4.17 Table 10 demonstrates the internal noise levels from each train pass by as measured during the day on 27th January 2015.

Table 13:
Required Configuration Insulating Glass Unit – night time

Direction of travel	Predicted noise level at Plot 19 (dBL_{Amax})	Noise reduction of Insulating Glass Unit 10 mm/ 16mm argon/9.1mm Pilkington Optiphon	Resultant Internal Noise Level dBL_{Amax}	Meets internal guide value of 45dBL_{Amax}
Eastbound	72	40	32	Y
Westbound	73	40	33	Y
Eastbound	71	40	31	Y
Westbound	79	40	39	Y
Eastbound	70	40	30	Y
Westbound	75	40	35	Y
Eastbound	77	40	37	Y
Westbound	74	40	34	Y
Eastbound	75	40	35	Y
Westbound	74	40	34	Y

6.4.18 It has been demonstrated that with an increase in the height of the acoustic barrier to 2.5m and the installation of higher specification windows, maximum noise levels as a result of metro trains can be reduced to 45dBL_{Amax} or below

6.4.19 This meets with the WHO guidelines that states for a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB LAmax more than 10–15 times per night.

6.5 Ventilation

6.5.1 The glazing configuration detailed above would provide sufficient noise insulation to achieve acceptable internal noise levels within the habitable rooms of dwellings on Plots 6 – 10, 11 – 15, 18 & 19. However, the windows would have to remain closed to meet the guide values in dwellings on Plots 11 – 15, 18 & 19.

6.5.2 The Building Regulations supporting documents on ventilation recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, as would be the case for habitable rooms in the closest dwellings to the metro line, trickle ventilators can be used and sound attenuating types are available. The Building Regulations 2010 Approved Document F: Ventilation provides guidance as to a suitable ventilator. An example of such is provided in Appendix D. However, windows may remain openable for rapid or purge ventilation, or at the occupants choice.

6.5.3 Ventilators to non-habitable rooms or spaces which do not require special acoustic measures may have standard trickle ventilation. For the purposes of this noise assessment, separate kitchens, bathrooms, WC's are considered as non-habitable spaces.

7 CONCLUSION

7.1.1 A noise assessment has been carried out for the proposed residential development site on land situated off Glen Street in Hebburn.

7.1.2 Metro trains passing the site were found to be the predominant noise source impacting on the daytime noise climate. During a one hour period there are up to 5 trains in each direction.

7.1.3 During the night time period there are a total of 16 metro trains scheduled, the majority of which are between 06:00 and 07:00 and 23:00 to 00:00 hours.

7.1.4 The assessment has included measurements of the daytime noise climate at the closest proposed dwelling to the metro rail line which passes the site in a southwest - northeast direction along the northern boundary of the site.

7.1.5 Prediction calculations have also be undertaken to determine the night time noise climate across the site.

7.1.6 The suitability of the noise climate at the site for residential development has been assessed. The assessment has been undertaken in accordance with the National Planning Policy Framework (NPPF) and the Noise Policy Statement for England (NPSE). Noise assessment and design targets for internal and external noise levels recommended in BS8233 have been used to quantify noise impact and determine suitability for residential development with due regard to effects on health and quality of life as set out in the NPSE.

7.1.7 It is proposed to erect a 2.5m high acoustic fence along the northern boundary to reduce the noise impact from passing metro trains. The background noise climate is 46dBL_{A90} and for the majority of the time noise levels are well within the guideline value of 55dB L_{Aeq} which is desirable to prevent any significant community annoyance. However, during metro train passbys, which occur for a period of generally up to 1 minute noise levels increase to above 55dB L_{Aeq}. The proposed acoustic fence would reduce noise levels to below 55dBL_{Aeq} in all gardens.

7.1.8 Acceptable internal daytime noise levels of 35dB$L_{Aeq,16\ hour}$ or below could be achieved across the site in all proposed habitable rooms with the utilisation of suitable double glazing units with the configuration 4/6 to 20mm/4 or similar. This specification provides a reduction of 25dB(A) between external and internal levels.

7.1.9 To achieve acceptable maximum noise levels in the bedrooms of Plots 18 and 19 would require enhanced glazing specification. It has been agreed between the Client and the Council that glazing configuration 10mm/16mm argon/9.1mm Pilkington optiphon, or an equivalent glazing which provides 45Rw (40Ctr) sound insulation will be installed within the bedrooms of Plots 18 and 19.

Summary of Noise Attenuation Scheme

7.1.10 A summary of the mitigation measures required to meet the relevant standards during the daytime are summarised in Table 14 below.

Table 14: Summary of Noise Attenuation Scheme at Ground Floor

Plot	Proposals to meet External Noise Criteria 55dB$L_{Aeq,\ 16hr}$	Proposals to meet Internal Daytime Noise Criteria 35dB$L_{Aeq,16hr}$		
		External Noise Level at nearest habitable window to metro line	Insulating Glass Unit (IGU)	Ventilators
6-10	2.5m high acoustic fence on north and eastern boundaries*	<50 dB $L_{Aeq,16hr}$	4 / 6 to 20 mm / 4	Not Required
11-15	2.5m high acoustic fence on northern boundary*	50 – 53 dB $L_{Aeq,16hr}$	4 / 6 to 20 mm / 4	Not Required
18-19	2.5m high acoustic fence on north and western boundaries*	58 dB $L_{Aeq,16hr}$	4 / 6 to 20 mm / 4	29Rw reduction

**** Position of acoustic fence is shown as a green line on Figures 3 and 4***

7.1.11 A summary of the mitigation measures required to meet the relevant standards during the night time are summarised in Table 15 below.

Table 15: Summary of Noise Attenuation Scheme at First Floor

Plot	Proposals to meet Internal Night time Noise Criteria 30dB$L_{Aeq,8hr}$		
	External Noise Level at nearest habitable window to metro line	Insulating Glass Unit (IGU)	Ventilators
6-10	<45 dB $L_{Aeq,16hr}$	4 / 6 to 20 mm / 4	Not Required
11-15	<50 dB $L_{Aeq,16hr}$	4 / 6 to 20 mm / 4	Not Required
18-19	57 dB $L_{Aeq,16hr}$	10mm/16mm argon/9.1mm Pilkington optiphon	45Rw reduction

7.1.12 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 noise level. Therefore, consideration should be given to a suitable window mounted acoustic ventilator in living rooms and bedrooms on Plots 18 and 19. An example of such is provided in Appendix D.

7.1.13 This report has been compiled from the results of noise measurements undertaken in January 2015 and are considered to be representative of the prevailing noise climate.

7.1.14 It is considered that the site can be developed for suitable residential development in planning and noise terms, as acceptable noise levels can be achieved following the design and implementation of suitably specified noise mitigation measures. The noise assessment methodology and conclusions therefore meet the principles set out in the NPPF and NPSE.

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: Metro Timetable

Metro timetable
Hebburn

Platform 1 to South Shields

Valid from 5 January 2014

Platform 1 — Hebburn to South Shields

Monday to Friday

05 00	06 00	07 00	08 00	09 00	10 00	11 00	12 00	13 00	14 00	15 00	16 00	17 00	18 00	19 00	20 00	21 00	22 00	23 00	00 00
05 27	06 04						then at 02, 14, 26, 38 & 50 minutes past each hour until						18 02	19 10	20 09	21 09	22 09	23 09	No Service
	06 22												18 14	19 25	20 24	21 24	22 24	23 24	
	06 34												18 26	19 39	20 39	21 39	22 39	23 39	
	06 47												18 37	19 56	20 54	21 54	22 54		
													18 57						

Saturday

05 00	06 00	07 00	08 00	09 00	10 00	11 00	12 00	13 00	14 00	15 00	16 00	17 00	18 00	19 00	20 00	21 00	22 00	23 00	00 00
05 33	06 09	07 10	08 10	09 10				then at 02, 14, 26, 38 & 50 minutes past each hour until					18 02	19 10	20 09	21 09	22 09	23 09	No Service
	06 25	07 25	08 25	09 25									18 13	19 25	20 24	21 24	22 24	23 24	
	06 39	07 39	08 40	09 38									18 26	19 39	20 39	21 39	22 39	23 39	
	06 56	07 54	08 47	09 50									18 37	19 55	20 54	21 54	22 54		
			08 55										18 57						

Sunday

05 00	06 00	07 00	08 00	09 00	10 00	11 00	12 00	13 00	14 00	15 00	16 00	17 00	18 00	19 00	20 00	21 00	22 00	23 00	00 00
No Service	06 47	07 17	08 10	09 09						then at 09, 24, 39 & 54 minutes past each hour until								23 09	No Service
		07 40	08 40	09 39														23 24	
				09 54														23 39	

Journey times from this station	Public holidays	Key
to South Shields about 12 minutes	This timetable will change on Public Holidays; for information call at any Nexus Travelshop, phone Traveline or visit our website.	Please check front of trains for destinations

nexus.org.uk/metro

traveline public transport info
www.traveline.info
0871 200 22 33
Calls cost 10p per minute plus network extras

Appendix B: Metro Timetable cont.

Metro timetable
Hebburn

Platform 2 to St James via the coast

METRO

Valid from 5 January 2014

Platform 2 — Hebburn to St James via the coast

Monday to Friday

05 00	06 00	07 00	08 00	09 00	10 00	11 00	12 00	13 00	14 00	15 00	16 00	17 00	18 00	19 00	20 00	21 00	22 00	23 00	00 00
05 58	06 34	then at 08, 20, 32, 44 & 56 minutes past each hour until											18 08	19 10	20 09	21 09	22 09	23 09*	00 08*
	06 53												18 19	19 25	20 24	21 24	22 24	23 24*	
													18 31	19 39	20 39	21 39	22 39*	23 39*	
													18 42	19 54	20 54	21 54	22 54*	23 54*	
													18 55						

Saturday

05 00	06 00	07 00	08 00	09 00	10 00	11 00	12 00	13 00	14 00	15 00	16 00	17 00	18 00	19 00	20 00	21 00	22 00	23 00	00 00
No Service	06 03	07 09	08 10	09 10	then at 08, 20, 32, 44 & 56 minutes past each hour until								18 08	19 10	20 09	21 09	22 09	23 09*	00 08*
	06 38	07 25	08 25	09 21									18 19	19 25	20 24	21 24	22 24	23 24*	
	06 55	07 39	08 40	09 31									18 31	19 39	20 39	21 39	22 39*	23 39*	
		07 54	08 55	09 44									18 42	19 54	20 54	21 54	22 54*	23 54*	
				09 56									18 55						

Sunday

05 00	06 00	07 00	08 00	09 00	10 00	11 00	12 00	13 00	14 00	15 00	16 00	17 00	18 00	19 00	20 00	21 00	22 00	23 00	00 00
No Service	No Service	07 16	08 16	09 09	then at 09, 24, 39 & 54 minutes past each hour until												22 09	23 09*	00 08*
		07 46	08 46	09 39													22 24	23 24*	
																	22 39*	23 39*	
																	22 54*	23 54*	

Journey times from this station

to Pelaw	about	4	minutes
to Heworth	about	6	minutes
to Gateshead	about	11	minutes
to Central Station	about	13	minutes
to Monument	about	15	minutes
to Haymarket	about	17	minutes
to South Gosforth	about	23	minutes
to Whitley Bay	about	42	minutes
to St James	about	69	minutes

Public holidays

This timetable will change on Public Holidays; for information call at any Nexus Travelshop, phone Traveline or visit our website.

Key

* Terminates at Benton
* Terminates at Manors

Please check front of trains for destinations

nexus.org.uk/metro

traveline public transport info

www.traveline.info
0871 200 22 33
Calls cost 10p per minute plus network extras

Appendix C: Insulating Glass Units Specification

Pilkington **Optiphon**™

Glass	Sound reduction index (dB)									
	Octaveband Centre Frequency (Hz)						$R_w(C;C_{tr})$	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Single glazing										
6.8 mm Pilkington **Optiphon**™	26	27	31	36	40	39	36 (-1; -4)	36	35	32
8.8 mm Pilkington **Optiphon**™	24	28	34	38	37	43	37 (-1; -4)	37	36	33
9.1 mm Pilkington **Optiphon**™	26	29	34	38	38	43	37 (-1; -3)	37	36	34
12.8 mm Pilkington **Optiphon**™	30	32	37	39	41	51	39 (0; -2)	39	39	37
13.1 mm Pilkington **Optiphon**™	30	33	37	40	41	50	40 (0; -2)	40	40	38
Insulating glass units										
6 mm / 16 mm argon / 6.8 mm Pilkington **Optiphon**™	22	27	35	42	41	48	38 (-2; -5)	38	36	33
6 mm / 16 mm argon / 8.8 mm Pilkington **Optiphon**™	24	26	40	48	46	54	41 (-3; -7)	41	38	34
8 mm / 16 mm argon / 9.1 mm Pilkington **Optiphon**™	24	29	41	47	47	55	43 (-3; -7)	43	40	36
10 mm / 16 mm argon / 9.1 mm Pilkington **Optiphon**™	29	33	44	46	49	57	45 (-2; -5)	45	43	40
8.8 mm Pilkington **Optiphon**™ / 16 mm argon / 12.8 mm Pilkington **Optiphon**™	26	36	46	50	52	63	47 (-2; -7)	47	45	40
9.1 mm Pilkington **Optiphon**™ / 20 mm argon / 13.1 mm Pilkington **Optiphon**™	29	39	49	52	55	63	50 (-3; -8)	50	47	42

Measurements undertaken in accordance with BS EN ISO 10140 and R_w (C; C_{tr}) determined in accordance with BS EN ISO 717-1
For insulating glass units, there is little difference in the sound insulation for cavity widths in the range 6 to 16 mm
Pendulum body impact resistance to BS EN 12600 for all Pilkington **Optiphon**™ is Class 1 (B) 1
To achieve low U values in insulating glass units, Pilkington **Optiphon**™ can be combined with low emissivity glass from the Pilkington **K Glass**™ or Pilkington **Optitherm**™ ranges
To calculate performance data for Pilkington products, please use our Spectrum online calculator at www.pilkington.co.uk/spectrum
For glass combinations to achieve an R_w value higher than 50 dB, please contact us for more details

Appendix D: Acoustic Ventilator Specification

Simon

Acoustic Solutions - Simons have launched a range of acoustic ventilators to assist clients in creating a satisfactory solution for all their acoustic requirements. All ventilators in the range meet the requirements of Document F and Document E of the Building Regulations

Simon Acoustic Ventilators

Specification

- Sound reduction of up to 41dB
- All models have been independently tested in accordance with BS EN ISO 717-1:1997 (airborne sound insulation & BS EN 20140-10:1992)
- Acoustic canopy available in any standard RAL colour and silver anodised finish
- Available in 5 internal options
- All options can be supplied on carrier bar
- Some models available with humidity control
- All models have a minimum Equivalent Area of 2,500^{mm2}
- Meets World Health Organisation recommended reduction of 33dB

BVQi ISO 9001

R.W. Simon Limited System Works, Hatchmoor Industrial Estate, Torrington, Devon EX38 7HP United Kingdom
Tel: 01805 623721 Fax: 01805 624578 E-mail: info@rwsimon.co.uk
Web: www.rwsimon.co.uk

Simon
Simon
Air Management Systems

Appendix E: Acoustic Fence Specification

jakoustic barriers - welcome to an acceptable level of noise and a better quality of life...

Jakoustic fencing is designed to protect your property from noise pollution, caused by traffic, machinery or people, giving you a better quality of life by allowing you to use areas of your garden that have become no-go areas and also by providing a security fence that will protect you from unwanted visitors. Jakoustic comes in two styles: Reflective and Absorptive. Reflective does as it suggests, it reflects noise away from your property, this is the most commonly used type. For sites that have noise issues within a confined space where reverberation is a problem, the Absorptive barrier will also, as the name suggests, absorb a high percentage of the noise, rather than reflecting it straight back. To be sure that you get the most suitable fence for your specific situation we recommend consulting a qualified Sound Engineer to ensure you get the vey best advice. (Please ask us for details of independent Sound Engineers).

Jakoustic Reflective - The Facts:

The fence consists of posts, boards, and is supplied with special fixings. The boards are machined to a finished size of 125 x 34mm - this is nearly 50% heavier than standard acoustic fencing. The edges are machined with a combination of an interlocking "vee" coupled with a tongue and groove. Fence are available from 2m to a massive 12m high. The height of the fence will be determined by the site conditions.

The Posts - for most applications, from 2-4.0m high fencing, are of a unique tuning fork design which traps the boards, ensuring continuous sound insulation. The posts used for heights over 2m are reinforced with a steel spur, coated black. As with all Jackson's timber products the timber has been treated with the unique Jakcure process which guarantees the products for 25 years against rot and insect attack, it also complies with highways standard for timber treatment.

Absorptive Jakoustic barrier is similar in design but with an additional layer of absorbent material applied to the back, which is then contained within a plastic membrane, then secured with 50mm half round machined timbers.

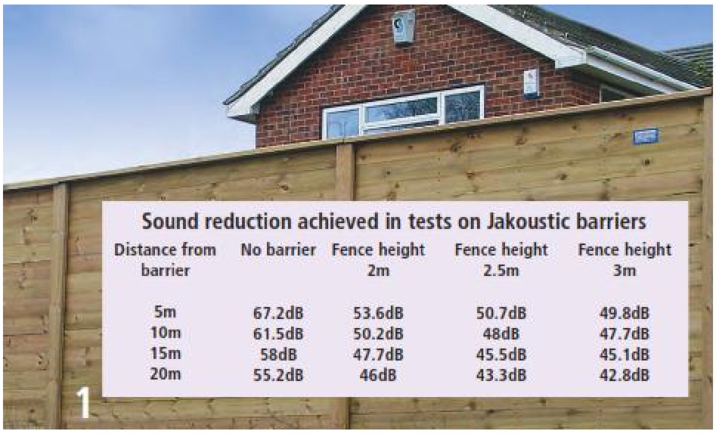
As illustrated in the table at the top of the opposite page opting for a jakoustic barrier can, decrease noise by at least 10 decibels (dB). To put this into perspective when you consider motorway traffic produces 70dB and conversational speech rates as 60dB, 10dBs is a really significant reduction.

Pics:
1.Jakoustic barrier 2. Jakoustic Absorptive rear view showing plastic membrane
3. Jakoustic Reflective Barrier 4. Matching automated Jakoustic gates
5. Detail of 2 - 4m post with first board showing the unique "vee" profile.
6. Close up of the interlocking vee section
7. Side view of Jakoustic panel and post

Jacksons Fencing is a Secured by Design Licensed Company with products which meet technical standards endorsed by ACPO (Association of Chief Police Officers) CPI (Crime Prevention Initiatives) Ltd.

Secured by Design
SBD
Official Police Security Initiative

Appendix E: Acoustic Fence Specification cont



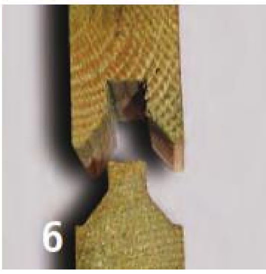
Sound reduction achieved in tests on Jakoustic barriers

Distance from barrier	No barrier	Fence height 2m	Fence height 2.5m	Fence height 3m
5m	67.2dB	53.6dB	50.7dB	49.8dB
10m	61.5dB	50.2dB	48dB	47.7dB
15m	58dB	47.7dB	45.5dB	45.1dB
20m	55.2dB	46dB	43.3dB	42.8dB

garden fencing

The above data shows the results from measurements taken during a field trial, which simulated the latest British Standard test procedure for acoustic fencing in a practical location. The generated noise source was directly behind the barrier - barrier length 9.6m.

"I'm delighted, I can now hold a normal conversation in my garden."
This was the reaction of Mrs Young of Canterbury, after having Jakoustic installed to reduce the constant deafening din from a nearby busy road.



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