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Noise Impact Assessment for Proposed Residential Development

Prepared for:
Greenhill Construction
The Green House
Esperanto Way
Newport
NP19 0RD

Site address:
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NP19 7BH

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BRIEF FOR CONSULTANCY:

This report has been prepared by Acoustics & Noise Limited, Newport, South Wales, for Greenhill Construction, The Green House, Esperanto Way, Newport, NP19 0RD under the instructions of Mr Stuart Jones.

Order No: n/a

OBJECTIVES:

To investigate the potential noise impact from an adjacent industrial area on the proposed residential development at Herbert Road using CAD modelling techniques.

Where applicable recommend mitigation to meet the impact criteria.

NON TECHNICAL SUMMARY:

Full details of the proposed development are presented by others which set the basis against which this assessment has been conducted.

This report assesses the noise impact on a proposed residential development from activities associated with a potential future use of an adjoining site suitable for industrial use.

This report assess the impact from a hypothetical future use as a goods yard as agreed with Claire Edwards, EHO with Newport City Council.

Noise levels from such an operation have been modelled using advanced 3D acoustic modelling techniques and the impact these noise levels may have on the proposed development have been assessed against an existing condition attached to the development site.

The results of the assessment indicate that noise levels across the majority of the proposed residential development will satisfy the criteria for external noise levels generated by the hypothetical goods yard.

This assessment identifies that, for the worse case scenario modelled, the external noise levels within the amenity areas of Plots 37-40, Plots 103-107 and plots 148-151 exceed the external noise criteria by a maximum of 2dB.

This "*worse case scenario*" represents the extremely unlikely conditions whereby the noise is generated continuously and without any breaks for the whole assessment period which is 16 hours for the daytime period and 8 hours for the night time period.

The results of this assessment indicate that the majority of the site will be exposed to noise levels generated by the hypothetical goods yard below the criteria levels and that the internal noise criteria levels can be met whilst using an open window ventilation strategy.

Several plots have been identified where mitigation is required to satisfy the internal noise criteria levels.

To achieve the internal noise criteria levels, plots 1-44, 99-107 and 148-157 require mitigation in the form of standard thermal 4/20/4 glazing units in the closed position and an agreed mechanical ventilation system to provide the necessary ventilation rates.

The conclusions of this report are based on a worse case scenario where activities at the hypothetical goods yard are continuous throughout the assessment period and consider the noise emissions from the goods yard only.

1.0 DESCRIPTION OF SITE

1.1 The site is located at Herbert Road, Newport, NP19 7BH.

1.2 The Site is located on the eastern bank of the River Usk to the north of Newport city centre within a predominantly residential area.

1.3 The Site is approximately 5.83ha in area and is currently vacant land, bounded by the Glan Usk Primary School to the north, a railway with residential properties beyond to the east, an industrial area to the south and the River Usk to the west. No buildings currently exist on the Site.

2.0 DISCUSSION

2.1 It is proposed to develop the site for residential accommodation with 250 units.

2.2 Noise and Vibration impact assessments for the significant noise sources have been completed by Waterman Energy, Cardiff to be included in the EIS for the proposed development.

2.3 Immediately to the south of the proposed development there is an area of industrial land that is currently vacant.

2.4 Newport City Council Environmental Health has raised concerns about the potential impact on the proposed residential development from future operations at this industrial site.

2.5 Acoustics and Noise Ltd have been engaged to carry out a noise impact assessment for the potential activities at this site.

3.0 ASSESSMENT METHODOLOGY

3.1.1 This assessment has been based on an agreed scenario with Newport City Council. This is based on a potential use as an open air goods yard with the use of fork lift trucks.

3.1.2 The application site currently benefits from planning consent for an alternative residential development (outline planning permission 00/0768 and reserved matter 03/1531). The following condition was attached to the reserved matters consent:

"…full details of noise attenuation measures including external noise mitigation measures, acoustic glazing and mechanical ventilation to ensure internal noise levels within the proposed residential units do not exceed 40 dB(A) Leq (16 hours) during the day and 35 dB(A) during the night and external noise levels do not exceed 50 dB(A) Leq during the daytime…"

3.1.3 This report uses the above existing condition to assess the impact from the hypothetical use of the industrial area as a goods yard as agreed with Claire Edwards, EHO with Newport City Council.

3.2 **Noise Sources**

3.2.1 To represent the activities associated with a goods yard, this report has included the following operations:

- Fork Lift Truck x 2
- Truck x 1 (<20km/h)
- Hammering and Banging

3.2.2 Noise levels for these operations have been obtained from the SourceDB v2.02 database of industrial noise sources included with the modelling software.

3.3 **Noise Sensitive Properties**

3.3.1 The proposed residential layout presented in Appendix 1 indicates that there are several properties that will overlook or back onto the adjacent industrial area.

3.3.2 This report assesses the noise impact at the following proposed properties:

- Plots 1 to 44 to the West and South West of the noise source
- Plots 25 to 38 to the west of the noise source
- Plots 39 to 40 to the west of the noise source
- Plot 101-102 to the north of the noise source
- Plots 103 to 107 to the north of the noise source
- Plots 148 to 157 to the north of the noise source

3.3.3 These properties are identified as being the most exposed to the potential noise generating activities at the industrial area.

3.3.4 Properties further from the noise source will be significantly less exposed to noise from this industrial area due to increased propagation loss due to distance and the acoustic shielding from the properties along the boundary of the site.

3.4 **Relevant Guidance**

3.5 As a matter of best practice, this assessment has been undertaken based on the relevant guidance on noise. This includes:

3.6 **ISO 9613 [1]**

3.6.1 Part 1 of this standard specifies an analytical method of calculating the attenuation of sound as a result of atmospheric absorption for a variety of meteorological conditions

3.6.2 Part 2 describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level (as described in ISO 1996) under meteorological conditions.

3.7 3D ACOUSTIC CAD MODELLING

3.7.1 The proposed site is large and benefits from acoustic CAD modelling of the road traffic noise levels across the whole of site using B&K Predictor Type 7810 V9.1 Software. This noise prediction software allows for the investigation of noise emissions in complex or large outdoor environments. The software can be used to analyse industrial noise sources and traffic measurements to the latest European and U.K. Standards.

3.7.2 A major advantage of using this method is the ability to remodel changes and alterations to the site and/or sources.

3.7.3 Results are displayed in easily understood noise contours overlaid onto a background image of the proposed development on top of a Google Earth™ image of the area.

3.7.4 CAD Model Construction

3.7.4.1 A vector drawing of the proposed development, 'SW49 (04)_Site Layout', in addition to information on the relative ground heights was provided by Mr Stuart Jones of Greenhill Construction.

3.7.4.2 The houses are modelled at 9.95m AOD and the adjacent industrial area is modelled at 7.0m AOD.

3.7.4.3 A Google Earth™ image was generated for the development area and used as a background for the model.

3.7.4.4 Using the vector drawing as a background, the proposed residential buildings were placed into the model with each building assigned a height of 8m.

3.7.4.5 A 5.1m barrier was positioned along the northern and western boundary of the industrial area. This barrier represents a 2.6m acoustic fence on top of the 2.5m retaining wall located at 7m AOD.

3.7.4.6 The external activities were modelled as a 2D area source positioned at a height of 1.5m and located on the adjacent industrial site.

3.7.4.7 The external noise sources agreed with Claire Edwards include 2 forklift trucks, 1 lorry driving around the yard and hammering/banging.

3.7.4.8 Because the exact locations of these sources are unknown, the total noise level from these sources has been 'smeared' over the 'area noise source' using a correction factor (see Appendix 3).

3.7.5 **CAD Model Prediction**

3.7.5.1 Receivers are placed 0.5m from the most exposed building façades within the proposed residential development.

3.7.5.2 The receivers were positioned at heights of 1.5m and 4.5m to represent the ground floor and first floor of each property and are each set to calculate the external free field levels.

3.7.5.3 A 1.5m high noise contour grid covering the whole site is then constructed. The grid represents the free field noise levels throughout the site and is actually a collection of receivers set 5m apart.

3.7.5.4 This grid is used to display the predicted noise levels within the external amenity areas of the proposed development.

3.7.5.5 Using the Predictor 9.1 software, calculations are made for each receiver position using the included noise sources. External free-field noise levels are calculated for the 1.5m high grid covering the proposed site.

3.7.5.6 Calculations are made with activity noise assumed to be continuous throughout to represent worse case.

3.7.5.7 This, of course, is an extremely unlikely scenario given that there would have to be breaks in the operation over extended periods.

3.7.5.8 The software calculations for noise propagation follow the procedures set out in ISO 9613, Part 2 [2].

3.7.5.9 The external noise levels for the assessment period are in the form of easily understood noise contour maps and are shown in Appendix 2.

3.7.5.10 These contours show the free field noise levels across the whole of the proposed development and indicate the areas that satisfy the external noise criteria (green) and the areas where the noise levels exceed the criteria (red).

3.7.5.11 The external noise levels at the most exposed habitable rooms and the noise levels within the amenity areas across the whole site can now be compared with the noise criteria limits detailed above.

4.0 CONCLUSIONS

4.1 Whilst it is accepted that the current use of the industrial area would not impact on the proposed residential development layout, concerns have been raised by Newport City Council that in the future, there is the potential for unrestricted noise levels to be generated by future tenants of the site.

4.2 Claire Edwards of Newport City Council has proposed that a noise impact assessment be completed for a 'goods yard' type of operation.

4.3 **External Noise Criteria**

4.3.1 External noise levels from this hypothetical goods yard are presented in Appendix 2.

4.3.2 Figure 2 details the noise levels at a height of 1.5m. These levels represent the external free-field noise levels across the proposed development attributable to the activities within the goods yard.

4.3.3 The noise contours detailed in Figure 2 show where the external criteria has been exceeded. These areas are indicated in red for clarity. The green areas indicate where the external noise criteria have been satisfied.

4.3.4 The proposed layout drawing is overlaid onto the contour map to aid the determination of all amenity areas that exceed the external noise criteria of 50 dB $L_{Aeq,16hr}$.

4.3.5 The results of the assessment indicate that noise levels across the majority of the proposed residential development will satisfy the criteria for external noise levels generated by the

hypothetical goods yard. These areas are shown in green in Figure 2.

4.3.6 The red areas shown in Figure 2 indicate where the external noise criteria have been exceeded.

4.3.7 This assessment identifies that the external noise levels within the amenity areas exceed the external noise criteria as follows.

- Plots 37-40 between 50 and 52 dB
- Plots 103-107 and plot 148 between 51 and 52 dB
- plot 151 between 50 and 51 dB

4.3.8 The calculations assume that the operations at the goods yard are continuous throughout the assessment period which in practice would be extremely unlikely.

4.4 **Internal Noise Criteria**

4.4.1 This assessment considers the sensitive night time period only.

4.4.2 As the operational activities are assumed to be independent of the assessment period and the internal noise criteria is more onerous for the night time period, it follows that by satisfying the night time criteria, the day time criteria is also satisfied.

4.4.3 If we assume that the noise reduction from outside to inside with the window open for ventilation is 15 dB as stated by the World Health Organization, then to satisfy the internal noise criteria of 35 dB $L_{Aeq,8hrs}$ for the sensitive night time period, the external noise levels from the hypothetical goods yard should be no greater than 35 + 15 = 50 dB $L_{Aeq,8hrs}$.

4.4.4 All properties exposed to external operational noise levels from the hypothetical goods yard below this 50 dB $L_{Aeq,8hr}$ limit will satisfy the internal noise criteria with the window open for ventilation.

4.4.5 The external noise levels at each property are detailed in Figure 2 and Figure 3. The noise contour maps indicate the external noise levels surrounding each property.

4.4.6 Figure 2 details the external noise levels for the habitable rooms at ground floor level and Figure 3 details the external noise levels for the habitable rooms at first floor level.

4.4.7 The green areas indicate where the external noise levels are less than 50 dB $L_{Aeq,8hr}$. The red areas indicate where the external noise levels are greater than 50 dB $L_{Aeq.8hr}$.

4.4.8 The majority of the proposed development falls within the green areas and the internal noise criteria for these properties can be satisfied with an open window ventilation strategy.

4.4.9 For all properties that fall within the red areas the internal noise criteria for these properties cannot be satisfied with an open window ventilation strategy.

4.4.10 The calculated noise levels for the following plots indicate that an open window ventilation strategy would not be suitable at night.

- Plots 1-44
- Plots 99-107
- Plots 148-157

4.5 For the above plots mitigation is required so that the internal noise level criteria can be satisfied.

4.6 Calculations for the required mitigation are detailed in Appendix 5 and have been made for the bedroom of Plot 102 which is exposed to the highest external noise levels generated by the continuous activity at the hypothetical goods yard (see Table 2).

4.7 It follows that the remaining plots that require mitigation will satisfy the internal noise criteria as they are exposed to lower noise levels.

5.0 RECOMMENDATIONS

5.1 Calculations detailed in Appendix 5 show that the internal noise criteria for plots 1-44, 99-107 and 148-157 can easily be satisfied with '*standard thermal*' 4/20/4 glazing units when in the closed position.

5.2 For plots 1-44, 99-107 and 148-157 where mitigation is recommended, the necessary ventilation rates will need to be provided by an agreed mechanical ventilation system.

P.A.T. 08/04/14
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Appendix 1
Site Layout

A1.0 SITE LAYOUT

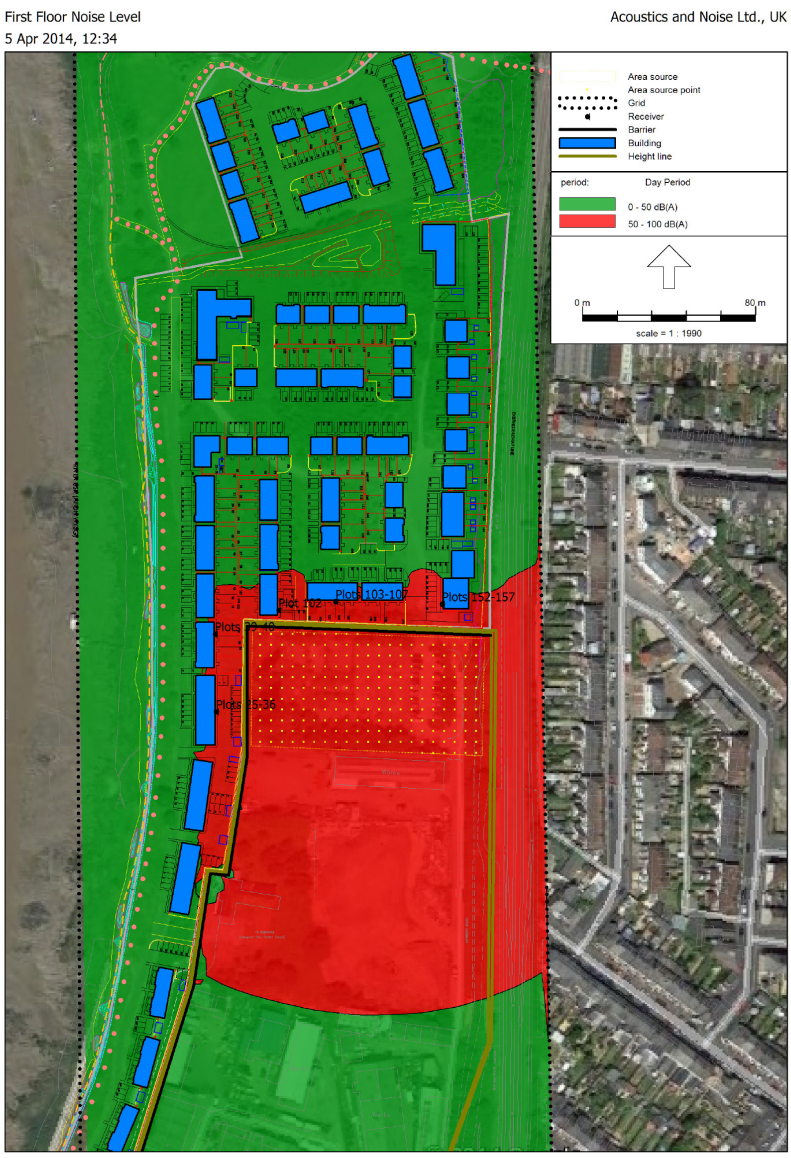
Figure 1 – Proposed Site Layout

Appendix 2
Modelling Results

A2.0 MODELLING RESULTS

Figure 2 – Calculated External Noise Contours @1.5m

Figure 3 – Calculated External Noise Contours @4.5m



Appendix 3
Data and Calculations used in Model

A3.0 DATA AND ASSUMPTIONS USED IN MODEL

Table 1 – Sound Power Levels

	63	125	250	500	1000	2000	4000	8000
Forklift (5T electric)	39.2	47.2	57.2	66.2	78.2	80.2	78.2	69.2
Truck (<20km/h)	72.3	81.0	85.1	89.7	93.4	90.7	83.7	76.8
Hammer Noise	75.2	85.2	91.2	96.2	100.2	88.2	95.2	89.2
Forklift (5T electric)	39.2	47.2	57.2	66.2	78.2	80.2	78.2	69.2
Total (dB)	77.0	86.6	92.2	97.1	101.1	93.1	95.7	89.5
Area Correction (-10Log(Area))	-37.6	-37.6	-37.6	-37.6	-37.6	-37.6	-37.6	-37.6
Total Lw (dB/m2)	39.4	49.0	54.6	59.5	63.5	55.5	58.1	51.9

**The external noise sources have been modelled within an area of 5780m^2*

Assumptions Made In Model and Effects

The external noise sources include forklift truck movements, truck movements and hammering/banging. These activities have been agreed with Claire Edwards of Newport City Council as being reasonable activities associated with an open air goods yard.

The exact locations of these activities are unknown so have been modelled as a 2D area source at a height of 1.5m and covers the whole industrial area adjacent to the proposed development.

There is a 5.1m barrier between the industrial area and the proposed residential development. This represents a 2.6m high acoustic barrier on top of the 2.5m retaining wall. The barrier has been placed on the industrial site at 7.0m AOD.

A ground factor of 0.0 has been used in the calculations to represent hard ground covering as worse case.

No consideration of any attenuation due to atmospheric conditions has been made to represent worse case.

The noise contour calculations are at a height of 1.5m and 4.5m to represent the external noise levels at ground floor and first floor levels.

Appendix 4
Calculated Noise Levels at Receptors

A4.0 CALCULATED NOISE LEVELS AT FAÇADE RECEPTORS

Table 2 – Calculated Noise Levels at Most Exposed Properties

Plot	Height (m)	$L_{Aeq,1hr}$ (dB)
Plot 102	1.50	48.9
Plot 102	4.50	58.7
Plots 103-107	1.50	49.3
Plots 103-107	4.50	57.1
Plots 152-157	1.50	47.8
Plots 152-157	4.50	55.2
Plots 25-36	1.50	47.9
Plots 25-36	4.50	56.2
Plots 39-40	1.50	46.3
Plots 39-40	4.50	54.6

A4.1 The results in Table 2 are the calculated free-field noise levels at the position of the most exposed properties.

A4.2 The calculations assume that the activity noise is continuous throughout to represent worse case.

Appendix 5
Internal Noise Calculations

A5.0 INTERNAL NOISE CALCULATIONS

A5.1 Building Envelope

A5.1.1 The following calculations apply the procedures detailed in 'Sound Control for Homes' [2].

A5.1.2 These procedures require the following information for accurate calculation of the sound insulation requirements of the building envelope:

External noise level.
Maximum allowable sound level in the room.
Surface area of the relevant portion of the building envelope.
Area of sound absorption in the room.

A5.1.3 The following formula is used to determine the façade sound insulation against road traffic noise:

Level Difference = $L_1 - L_2 = R - 10 \log (S/A)$

Where L_1 *- Sound level 2m outside the façade (dB)*
L_2 *- Received sound level in the room (dB)*
R - Sound reduction index (dB)
S - Surface area, room façade element (m^2)
A - Absorption in the room (m^2)

A5.1.4 For housing design purposes a more simple approach is proposed by 'Sound Control for Homes':

The surface area and area of sound absorption can be ignored. In typically furnished domestic rooms they have little effect on the final result.

A typical external noise spectrum is adopted and the sound insulation of the building envelope described in terms of the difference between inside and outside levels in dB(A).

A5.1.5 This outside-inside level difference, denoted by $R_{A(traffic)}$, is based on the typical urban road traffic noise spectrum.

A5.1.6 This term can also be represented by $R_w + C_{tr}$ where R_w is the weighted sound reduction index and C_{tr} is the correction against low frequency performance and is based on urban road traffic noise as stated in BS EN ISO 717-1 [3].

A5.1.7 In this case the significant source of noise is from vehicle movements at low speed and therefore the correction term C_{tr} is appropriate.

A5.1.8 Calculations have been made for the most exposed facades within the proposed development. These will be the facades that face the industrial area directly.

A5.1.9 If we assume that the glazing area is 30% of the total internal wall area for a typical habitable room then using the chart in Figure 49 presented in 'Sound control for homes' [2] we can calculate the composite sound insulation for the façade by adding a correction factor to the sound reduction for the glazing.

A5.1.10 Composite façade sound reduction calculations are shown in Table 3 below.

Table 3 – Composite façade sound reduction

Description	Term	Value	Comment
Total Glazing Area as percentage of Wall Area	%	30	Assumption for typical room
Walls, Rwall	RA(Traffic)	47	Sound Control for Homes, Table 14, Timber frame, brick facing
Glazing, Rwindow	Rw + Ctr	26	Saint Gobain Acoustic Database, 4/20/4
Rwall - Rwindow		21	
Add to Rwindow		5	from Figure 49
Composite Facade	Rw + Ctr	31	

A5.2 Internal Noise Calculations

A5.3 The results of the 3D acoustic Cad modelling indicate that the highest external noise levels are predicted for plot 102 at first floor height. This would correspond to a bedroom.

A5.4 Using the calculated composite façade sound reduction and the results from the 3D CAD model for external noise levels we have predicted the internal noise levels inside the first floor bedroom of Plot 102 as detailed in Table 4.

Table 4 – Internal Noise Levels, Plot 102, Bedroom

Description	External Noise Level LAeq,1hr (dB)
Plot 102, bedroom	59
Composite Sound Reduction	31
Internal Noise Level	28

The above calculations assume that the glazing is 4mm glass/20mm air gap/4mm glass and that they are in the closed position.

Appendix 6
References

A6.0 REFERENCES

1 ISO 9613 Acoustics – Attenuation of sound propagation outdoors Parts 1 & 2

2 "Sound Control for Homes", Building Research Establishment and Construction Industry Research and Information Association, 1993

3 BS EN ISO 717-1:1997, 'Acoustics - Rating of sound insulation in buildings and of building elements, Part 1: Airborne sound insulation', British Standards