



Noise Constraints Assessment

Stansty Chain Road, Wrexham

Reference: 50-024-R1-6

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NOISE CONSTRAINTS ASSESSMENT

Stansty Chain Road
Wrexham

Prepared for:



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EXECUTIVE SUMMARY

BACKGROUND

Site Address	Stansty Chain Road, Wrexham
National Grid Reference	E 332500 N 352032
Proposed Development	Proposed residential development comprising up to 455 residential properties along with access and associated car parking and landscaping.
Report Objectives	The objectives of this report are to: Identify, measure and assess the potential impact of any existing noise sources in the immediate vicinity of the Site upon proposed residential receptors. The report follows current and relevant British Standards in order to provide a robust assessment.

ASSESSMENT

Surveys Completed	E3P has been provided with previously measured data for the Site including for rail traffic sound and commercial sound. However, E3P has undertaken attended road traffic noise measurements in order to account for the change in speed limit since the initial surveys were undertaken. These included for Mold Road and the A483.
Assessments	A 3D noise model has been constructed to assess transportation sound impact upon the proposed receptors. With regards transportation sound, this is assessed in accordance with the criterion, for day and night, given in BS 8233:2014. Consideration has also been given to the WHO (2018) Guidelines. Commercial/industrial sound has been assessed by predicting the Rating Level at the receptors which has been compared with the typical background sound level, accounting for any acoustic characteristics associated with the sound in accordance with BS 4142:2014+A1:2019.
Mitigation Requirements	The report has provided recommendation on suitable Site layout, along with the proposed earth bunds, and recommended various acoustic barriers, in addition and on top of the proposed bunds, in order to control transportation sound. Local acoustic barriers may be required for certain garden areas, depending on orientation. Furthermore, higher specification glazing and/or alternative ventilation systems may be required in certain areas of the Site due to the impact of sound internally. Detailed break-in calculations have been provided for sample areas of the Site.

CONCLUSIONS

With good acoustic design and mitigation measures in place, this assessment has shown that no adverse impact is predicted day or night at the receptors due to transportation sound. This has been reiterated following discussions with the Environmental Health Department at Wrexham Council.

As such, noise need not be a material consideration in the granting of planning permission if the recommendations of this report are followed and included within the design stage.



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1. INTRODUCTION

1.1. BACKGROUND

E3P were commissioned by Russell Homes to undertake a Noise Constraints Assessment for a proposed residential development on land off Stansty Chain Road in Wrexham, to be referred to hereafter as '*the Site*'.

This assessment looks to determine the key noise sources in the immediate vicinity of the Site and to assess their impact, if any, upon proposed residential receptors and to specify mitigation measures, where required.

1.2. PROPOSED DEVELOPMENT

Russell Homes intend to develop the Site for residential use comprising of detached, semi-detached and mews dwellings and apartments along with access and associated car parking and landscaping.

The key sources of sound impacting upon the Site is road traffic associated with Mold Road and the A483. Furthermore, but to a lesser extent, rail traffic and commercial sound are also audible on Site.

This assessment has been undertaken in accordance with the following supplied drawings:

-  Development Framework Rev L dated 26th February 2021.

The Development Framework is shown in Figure 1 of Appendix II.

1.3. LIMITATIONS

Where a noise or vibration survey is required to inform an assessment, E3P will endeavour to ensure that all noise and vibration measurements taken are robust, representative and reliable in order to inform an accurate assessment.

Where mitigation measures are specified in this report, it should be noted that these measures are relative to a specific sound or vibration source, both in terms of the measured sound pressure and vibration level and the character of the sound source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, E3P cannot be held responsible for any subsequent variations in the proposed mitigation performance.



2. ASSESSMENT METHODOLOGY

2.1. PLANNING POLICY WALES (2014)

Noise can affect people's health and well-being and have a direct impact on wildlife and local amenity. Noise levels provide an indicator of local environmental quality. The objective of a policy for noise is to minimise emissions and reduce ambient noise levels to an acceptable standard. Noise Action Plans, drawn up by the Welsh Ministers in relation to Wales under the Environmental Noise Directive, and the Wales Regulations, aim to prevent and reduce environmental noise where necessary and preserve environmental noise quality where it is good.

Noise-sensitive developments, such as hospitals, schools and housing, that need to be located close to the existing transportation infrastructure to facilitate access, should be designed in such a way as to limit noise levels within and around those developments. Such development should be located away from existing sources of significant noise including air transport and some industrial activities or programmed development such as improved or new roads. Policies should also be designed to ensure, as far as possible, that potentially noisy developments are in areas where noise will not be such an important consideration or where its impact can be minimised.

Noise can be a material planning consideration, for example in proposals to use or develop land near an existing source of noise or where a proposed new development is likely to generate noise. Local planning authorities should make a careful assessment of likely noise levels and have regard to any relevant Noise Action Plan before determining such planning applications and in some circumstances, it will be necessary for a technical noise assessment to be provided by the developer.

Special consideration is required where noise-generating development is likely to affect a protected species, or is proposed in or near statutorily designated areas, including urban 'quiet areas' designated in Noise Action Plans. The effect of noise on the enjoyment of other areas of landscape, wildlife and historic value should also be considered.

2.2. NOISE AND SOUNDSCAPE ACTION PLAN 2018-2023

The noise action plan for Wales has a broader focus than simply controlling the level of noise. It links to the notion of creating appropriate soundscapes, meaning the right acoustic environment in the right time and place. The towns and cities serve us in a variety of ways, and it is believed should therefore contain a variety of soundscapes appropriate to the land use.

The Action Plan draws from information provided in Professional Practice Guidance (ProPG) and the relevant British Standards to recommend that placemaking, soundscapes and good acoustic design are considered and incorporated into the design and development of any new sites. It provides guidance on numerous sources of sound but does not set any guidelines, beyond those given in the British Standards.

It does relate to the European noise indices of the day-evening-night level, L_{den} , and the night level, L_{night} , which are used in the World Health Organisation's Environmental Noise Guidelines for the European Region (2018) but does not go so far as to stipulate the criterion from the guidelines. As such, and following discussions with Wrexham County Borough Council, the assessment that follows will primarily focus on the British Standards.



2.3. PLANNING GUIDANCE (WALES), TECHNICAL ADVICE NOISE (WALES) 11, NOISE (1997)

This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should consider in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.

Noise Exposure Categories (NECs) have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport related noise sources.

A recommended range of noise levels is given in Table 2.1 for each of the NECs for dwellings exposed to noise from road, rail, air and mixed sources. However, in some cases it may be appropriate for local planning authorities to determine the range of noise levels they wish to attribute to the various NECs. Where there is a clear need for new residential development in an already noisy area some or all NECs might be increased by up to 3 dB(A) above the recommended levels. In other cases, a reduction of up to 3 dB(A) may be justified.

TABLE 2.1 NOISE EXPOSURE CATEGORIES FOR DWELLINGS

NOISE SOURCE	ASSESSMENT PERIOD	NOISE EXPOSURE CATEGORY, $L_{Aeq,T}$ dB(A) ⁽¹⁾			
		A	B	C	D
Road Traffic	Daytime 07:00-23:00	<55	55-63	63-72	>72
	Night-time 23:00-07:00 ⁽²⁾	<45	45-57	57-66	>66
Rail Traffic	Daytime 07:00-23:00	<55	55-66	66-74	>74
	Night-time 23:00-07:00 ⁽²⁾	<45	45-59	59-66	>66
Air Traffic ⁽³⁾	Daytime 07:00-23:00	<57	57-66	66-72	>72
	Night-time 23:00-07:00 ⁽²⁾	<48	48-57	57-66	>66
Mixed Sources ⁽⁴⁾	Daytime 07:00-23:00	<55	55-63	63-72	>72
	Night-time 23:00-07:00 ⁽²⁾	<45	45-57	57-66	>66

Notes:

⁽¹⁾ **Noise levels:** the noise level(s) ($L_{Aeq,T}$) used when deciding the NEC of a site should be representatives of typical conditions.

⁽²⁾ **Night-time noise levels (2300-0700):** sites where individual noise events regularly exceed 82dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8H}$ (except where the $L_{Aeq,8H}$ already puts the site in NEC D).

⁽³⁾ **Aircraft noise:** daytime values accord with the contour values adopted by the Department of Transport which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2 dB(A) higher than those of other sources because of ground reflection effects.

⁽⁴⁾ **Mixed sources:** this refers to any combination of road, rail, air and industrial noise sources. The "mixed source" values are based on the lowest numerical values of the single source limits in the table. The "mixed source" NECs should only be used where no individual noise source is dominant.



To check if any individual noise source is dominant (for the purposes of this assessment) the noise level from the individual sources should be determined and then combined by decibel addition (remembering first to subtract 2 dB(A) from any aircraft noise contour values). If the level of any one source then lies within 2 dB(A) of the calculated combined value, that source should be taken as the dominant one and the site assessed against the appropriate NEC for that source, rather than using the "mixed source" NECs. If the dominant source is industrial noise see paragraph B17 of Annex B.

If the contribution of the individual noise sources to the overall noise level cannot be determined by measurement and/or calculation, then the overall measured level should be used and the site assessed against the NECs for "mixed sources".

When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four NECs the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC, as below:

-  **A** - Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
-  **B** - Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
-  **C** - Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
-  **D** - Planning permission should normally be refused.

2.4. BRITISH STANDARD BS 8233:2014+A1:2019 – GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS

2.4.1. NOISE CRITERIA LIMITS

The scope of this standard is the provision of recommendations for the control of noise in and around buildings including residential dwellings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

The standard suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 2.2.

TABLE 2.2 BS 8233:2014 RECOMMENDED INTERNAL NOISE LEVELS

CRITERION	TYPICAL SITUATION	DESIGN CRITERION, $L_{Aeq,T}$ (dB)
Suitable Resting and Sleeping Conditions	Living Room	35
	Bedroom	30



BS 8233 goes on to recommend noise levels for gardens:

It is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. 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 might be warranted.

BS 8233 goes on to say:

In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.

2.4.2. VENTILATION REQUIREMENTS

Where a partially open window cannot be relied upon to provide an adequate level of façade sound insulation performance, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 within BS 8233 states:

The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

Alternatively, acoustic ventilation units (see 7.7.2 below) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans.

Section 7.7.2 states:

NOTE 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.

2.5. WORLD HEALTH ORGANISATION (WHO) (1999) – GUIDELINES FOR COMMUNITY NOISE

The WHO gives guidance on desirable levels of environmental noise. The levels presented in the WHO Community Guidelines are those at which adverse effects become measurable. The 1980 WHO document suggested that "general daytime outdoor noise levels of less than 55 dB(A) $L_{eq,16hr}$ are desirable to prevent any significant community annoyance." This level is an external free-field noise level. The 1980 document also stated in relation to internal levels, "that night-time noise levels of 35 dB(A) $L_{eq,8hr}$ or less will not interfere with the restorative process of sleep".



A report was submitted to the WHO in 1995 for consideration as a revision to the 1980 document and revised community guidelines were issued in 2000. In the 2000 guidelines, it is considered that the sleep disturbance criteria should be taken as an internal noise level of 30 dB $L_{Aeq,8\text{ hr}}$ or an external level of 45 dB $L_{Aeq,8\text{ hr}}$. It also recommends that internal L_{Amax} levels of 45 dB and external L_{Amax} levels of 60 dB should be limited where possible.

2.6. BS 4142: 2014 'METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND'

This standard describes methods for rating and assessing sound of an industrial or commercial nature which includes:

-  Sound from industrial and manufacturing processes;
-  Sound from fixed installations which comprise mechanical and electrical plant and equipment;
-  Sound from the loading and unloading of goods and materials at industrial and / or commercial premises; and
-  Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial Site.

The procedure detailed in the standard compares the measured or predicted specific noise level from any of the above with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.

The specific noise level also acknowledges the reference time intervals depending upon whether the noise source operates during daytime (1-hour) or night-time (15-minute) periods.

There are several 'penalties' which can be attributed to the specific sound level depending upon the 'acoustic features' of the sound level under investigation as follows:

Tonality

-  +2 dB: where the tonality is just perceptible;
-  +4 dB: where the tonality is clearly perceptible; and
-  +6 dB: where the tonality is highly perceptible.

Impulsivity

-  +3 dB: where the impulsivity is just perceptible;
-  +6 dB: where the impulsivity is clearly perceptible; and
-  +9 dB: where the impulsivity is highly perceptible.



Intermittency

- ✳️ +3dB: where the intermittency is readily distinctive against the acoustic environment.

In addition to the above, there is a penalty for 'other sound characteristics' of +3 dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment. BS 4142 goes on to state that the rating level is equal to the specific sound level if there are no such features present or expected to be present.

Assessment of the rating level relative to the background sound level can yield the following commentary:

- ✳️ Typically, the greater this difference (between the rating level and the background sound level), the greater the magnitude of impact;
- ✳️ A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- ✳️ A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and
- ✳️ 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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

It is common that a Local Planning Authority (LPA) will specify their own criterion and, where this is the case, this criterion will usually take precedence over a simple comparison of the rating level against the background sound level.



3. SURVEY RESULTS

The measurement positions are detailed in Figure 1 of Appendix II.

E3P have been provided previously measured data undertaken by REC Ltd, on behalf of Russell Homes, in November 2016. Given the time elapsed, E3P have undertaken repeat measurements for Mold Road and the A483. However, the previously measured data for rail traffic and commercial sound have been adopted from the REC measurements, these are detailed in Sections 3.1 and 3.2.

During both surveys, no noise was noted at the neighbouring farm shop and abattoir.

3.1. RAIL TRAFFIC SOUND SURVEY – REC LTD

Table 3.1 details the derived daytime and night-time noise levels from the REC Survey. The survey was carried out over the following time period:

 11:00 to 16:40 Wednesday 23rd November 2016.

The following noise measurement position was chosen for the Background and Ambient Sound Survey:

 Noise Measurement Position 1 (NMP1): Located on the north eastern boundary of the Site with full line of sight to the railway line. Dominant sources of noise included road traffic associated with the A583 and occasional rail movements.

Table 3.1 details the source noise levels for individual train pass-bys along with the derived daytime and night-time noise levels. The daytime and night-time noise levels are derived by way of online train timetables.



TABLE 3.1 SUMMARY OF MEASURED SOURCE NOISE LEVELS FOR NMP1 – RAILWAY LINE

TIME	MEASURED SOUND PRESSURE LEVEL, $L_{Aeq,T}$ (dB)	DIRECTION TOWARDS	DURATION (seconds)
11:25	71.1	Wrexham	8
11:40	72.6	Bidson	10
12:30	75.5	Wrexham	10
12:40	72.4	Bidson	17
13:30	68.1	Wrexham	17
13:45	74.7	Bidson	13
14:35	76.0	Wrexham	10
14:50	69.3	Bidson	43
15:35	70.3	Wrexham	9
15:50	72.5	Bidson	13
16:20	72.2	Wrexham	13
16:30	76.7	Bidson	12
Daytime Noise Level, $L_{Aeq,16hr}$			52.3
Night-time Noise Level, $L_{Aeq,8hr}$			43.8
Night-time 10th Highest Maximum Noise Level, $L_{Amax,fast}$			78.6

3.2. COMMERCIAL SOUND SURVEY – REC LTD

During the survey at NMP1, REC advised that they also monitored any activity associated with the adjacent commercial premises. As such, REC noted no commercial sound was audible at the time of the Survey. Furthermore, any noise that may be audible will be masked by road traffic sound associated with the A483.

As such, no commercial sound assessment has been undertaken.

3.3. ROAD TRAFFIC SOUND SURVEY – MOLD ROAD

E3P has conducted a Road Traffic Noise Survey in order to measure the level of noise generated by vehicles using Mold Road. The survey was carried out over the following time periods in accordance with Calculation Road Traffic Noise (CRTN):

- 📅 10:41 to 13:41 Monday 3rd June 2019.

The following noise measurement position was chosen for the Road Traffic Noise Survey:

- 📍 Noise Measurement Position 2 (NMP2): Located adjacent to the existing dwelling bounding the Site approximately 4m from the nearby kerbstone of Mold Road. The microphone was located at a height of 1.5m above ground level and in free-field conditions. The sound climate was dominated by road traffic sound on Mold Road with distant traffic along the A483 audible but not dominant.



A summary of the measured sound pressure levels from the Road Traffic Noise Survey are presented in Table 3.3.

TABLE 3.2 SUMMARY OF MEASURED NOISE LEVELS FOR NMP2 – MOLD ROAD

MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)			
	L _{Aeq,T}	10th Highest L _{Amax,fast}	L _{A90,T}	L _{A10,T}
10:41	74.1	86.5	60.2	78.8
11:41	74.1		59.6	78.8
12:41	73.2		58.0	78.1

3.4. ROAD TRAFFIC SOUND SURVEY – A483

E3P has conducted two separate Road Traffic Noise Surveys in order to measure the level of noise generated by vehicles using the A483, one during term time and the other during school holidays. The survey was carried out over the following time periods in accordance with CRTN:

- 📍 12:32 to 15:32 Friday 31st May 2019; and
- 📍 10:00 to 13:00 Tuesday 18th June 2019.

The following noise measurement position was chosen for the Road Traffic Noise Survey:

- 📍 Noise Measurement Position 3 (NMP3): Located to the north east of the Site, on Ty Gwyn Lane approximately 15m from the nearby kerbstone of the A483. The microphone was located at a height of 1.5m above ground level and in free-field conditions. The sound climate was dominated by road traffic sound on the A483. This position was considered suitable as full of line of sight to both carriageways was achieved and the traffic conditions were identical to those along the boundary with the Site.

A summary of the measured sound pressure levels from the Road Traffic Noise Survey are presented in Table 3.3.



TABLE 3.3 SUMMARY OF MEASURED NOISE LEVELS FOR NMP3 – A483

SUMMARY OF MEASURED NOISE LEVELS FOR NMP 5 - A100				
MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)			
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$	$L_{A90,T}$	$L_{A10,T}$
School Holidays				
12:32	69.7	81.6	64.6	72.3
13:32	70.2		65.1	72.6
14:32	70.0		64.7	72.4
Term Time				
10:00	69.8	80.3	62.8	72.7
11:00	69.4		61.8	71.7
12:00	69.1		62.2	71.7

The derived $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ from the two separate measured data were similar with only a difference of 0.4 dB between the daytime noise levels.

During the survey, conditions remained dry and wind speeds rarely exceeded 5 m/s.

The equipment outlined in Table 3.4 was used for the noise survey.

TABLE 3.4 NOISE MEASUREMENT EQUIPMENT AND CALIBRATION DATES

MEASUREMENT POSITION	EQUIPMENT DESCRIPTION	MANUFACTURER & TYPE NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE
NMP3 and NMP4	Sound Level Meter	01dB Fusion	12039	21st June 2021
	Pre-amplifier	01dB Pre22	Internal	
	Microphone	01dB 40CE	330832	
	Calibrator	01dB Cal31	87281	8th March 2020
Calibration Level at Start of Survey: 93.4 dB		Calibration Level at End of Survey: 93.4 dB		Drift: 0.0 dB

The sound level meter was field calibrated on site using the above-mentioned calibrator prior to and after noise measurements were taken. No significant drift was witnessed as noted above. Calibration certificates are available upon request.



4. NOISE CONSTRAINTS ASSESSMENT

For the purposes of this assessment, E3P has used noise modelling software, CadnaA 2019 MR1, to determine the impact of noise from road and rail traffic.

The following inputs have been included in the model:

- Development Framework.
- Site elevations have been taken as existing by way of a 2 m grid Digital Terrain Model (DTM) which contains public sector information licensed under the Open Government Licence v3.0.
- Existing buildings that provide shielding from any of the noise sources have been included in the model.
- A reflection order of 2 has been used in all calculations.
- Noise levels generated using ISO 9613-1 and ISO 9613-2 "Acoustics – Attenuation of sound during propagation outdoors" as incorporated into CadnaA software.

4.1. TRANSPORTATION SOUND IMPACT ASSESSMENT

Figures 2 and 3 determine the noise levels across the Site during the daytime and night-time periods, respectively, due to road traffic associated with Mold Road and the A483 in accordance with the Welsh Government NECs.

Table 4.1 below details the 16-hour and 8-hour L_{Aeq} and the 10th highest maximum noise level for the roads and railway lines used in the model.

TABLE 4.1 MEASURED AND CALCULATED DAYTIME AND NIGHT-TIME NOISE LEVELS

SOURCE	CALCULATED DAYTIME NOISE LEVEL, $L_{Aeq,16hr}$ (dB)	CALCULATED DAYTIME NOISE LEVEL, $L_{Aeq,8hr}$ (dB)	MEASURED 10TH HIGHEST MAXIMUM NOISE LEVEL, $L_{Amax,fast}$ (dB)	MEASUREMENT DISTANCE (m)
A483	69.4	60.5	81.6	15
Mold Road	75.6	66.0	86.5	4
Railway Line	52.3	43.8	78.6	10

The grids determine that, during the daytime and night-time periods, most of the Site falls within NEC B with only partial areas of the south eastern and western boundaries of the Site falling within NEC C. As such, noise should be considered when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection. For areas close to the roads falling within NEC C, a commensurate level of protection should be provided and could be set by way of conditions.

Following this, Russell Homes have provided an illustrative layout which is to be used for information purposes only to determine whether acceptable levels of noise can be achieved and, if so, what measures are to be incorporated into any final design. As part of the Development Framework, the following earth bunds are accounted for in the model for the assessments to follow:



-  5 m high earth bund/fence combination for the area north of Stansty Chain Road, which is split to allow a footpath to cut through.
-  5 m high earth bund/fence combination for a short run for the area south of Stansty Chain Road; and
-  2.5 m high fence along the boundary of the Archaeological area.

As such, Sections 4.1.1 and 4.1.2 assess the site in accordance with the Development Framework and advises on any measures, in addition to the above.

4.1.1. EXTERNAL AMENITY AREA NOISE LEVEL ASSESSMENT

The noise model has been used to predict noise levels in proposed developable areas where gardens are to be located, please see Figure 4. The predicted levels range from below 55 dB and up to 65 dB in the developable areas. If gardens were to be unprotected in these areas, the upper criterion of 55 dB would be exceeded in the areas along the A483 and Mold Road.

With regards to the above, the Environmental Health Department requested that the WHO Guideline noise indices of L_{den} and L_{night} should be considered alongside the above in Table 4.1. However, when considering Mold Road and the A483, calculations result in near identical levels for $L_{Aeq,16hr}$ and L_{den} when following the procedure given in Method 3 of the TRL Document. Furthermore, the L_{night} is equal to the $L_{Aeq,8hr}$. The greatest variance is with the A483 between the L_{den} being 69.9 dB opposed to the modelled level of 69.4 dB $L_{Aeq,16hr}$. This level of variance is not considered significant and, as such, the noise models shown in the Figures can be used to consider the British Standard criteria as well as the WHO Guidelines.

As such, consideration towards good acoustic design and the potential for additional mitigation measures are required in order to achieve 55 dB in the worst affected gardens. Section 5.0 recommends appropriate measures.

4.1.2. INTERNAL NOISE LEVEL ASSESSMENT

With regards internal noise levels, E3P has assumed a standard glazing specification of 4 mm glass/20 mm air space/4 mm glass affords sound insulation performance in the order of 32 dB however this is for a pink noise spectrum. The same unit, weighted for road traffic noise using the '+C_{tr}' correction, has a sound insulation performance value of approximately 28 dB and so this value has been used to calculate internal noise levels. It also goes on to recommend that a partially open window provides approximately 15 dB attenuation.

The model has been used to predict the worst-case façade noise levels at ground and first floors for each boundary. Given that the layout is indicative only, further detail is not required. Tables 4.2 and 4.3 detail the daytime and night-time internal noise level assessments respectively.



TABLE 4.2 DAYTIME INTERNAL NOISE LEVEL ASSESSMENT – ROAD TRAFFIC

PLOT	WORST CASE PREDICTED NOISE LEVEL, $L_{Aeq,16hr}$ (dB)	INTERNAL NOISE LEVEL WITH WINDOWS CLOSED (dB)	DIFFERENCE WITH CRITERION, +/- (dB)	INTERNAL NOISE LEVEL WITH WINDOWS OPEN (dB)	DIFFERENCE WITH CRITERION, +/- (dB)
Northern Area – Eastern Boundary	62	34	-1	47	+12
Central Area – Eastern Boundary	63	35	0	48	+13
Southern Area – South East Boundary	64	36	+1	49	+14
Southern Area – Western Boundary	65	37	+2	50	+15
Central Area – Western Boundary	64	36	+1	49	+14
Northern Area – Western Boundary	56	28	-7	41	+6



TABLE 4.3 NIGHT-TIME INTERNAL NOISE LEVEL ASSESSMENT – ROAD TRAFFIC

PLOT	PREDICTED NOISE LEVEL, $L_{Aeq,8hr}$ (dB)	INTERNAL NOISE LEVEL WITH WINDOWS CLOSED (dB)	DIFFERENCE WITH CRITERION, +/- (dB)	INTERNAL NOISE LEVEL WITH WINDOWS OPEN (dB)	DIFFERENCE WITH CRITERION, +/- (dB)
Northern Area – Eastern Boundary	52 $L_{Aeq,8hr}$	24	-11	37	+7
	70 $L_{Amax,fast}$	38	-7	55	+10
Central Area – Eastern Boundary	54 $L_{Aeq,8hr}$	26	-9	39	+9
	70 $L_{Amax,fast}$	38	-7	55	+10
Southern Area – South East Boundary	55 $L_{Aeq,8hr}$	27	-8	40	+10
	71 $L_{Amax,fast}$	39	-6	56	+11
Southern Area – Western Boundary	58 $L_{Aeq,8hr}$	30	-6	43	+13
	63 $L_{Amax,fast}$	31	-14	48	+3
Central Area – Western Boundary	56 $L_{Aeq,8hr}$	28	-7	41	+11
	62 $L_{Amax,fast}$	30	-15	47	+2
Northern Area – Western Boundary	47 $L_{Aeq,8hr}$	19	-16	32	+2
	57 $L_{Amax,fast}$	25	-20	42	-3

The Tables show that standard thermal double glazing is sufficient for most living rooms and all bedrooms in relation to road and rail traffic. However, higher specification glazing may be required for certain living rooms along the south east and western boundaries. Additionally, alternative ventilation is required for certain habitable rooms and dwellings across the Site. As such, Section 5.0 outlines the requirements.



5. MITIGATION

5.1. GOOD ACOUSTIC DESIGN

Good acoustic design should avoid “unreasonable” acoustic conditions and prevent “unacceptable” acoustic conditions. Good acoustic design is not just compliance with recommended internal and external noise exposure standards. Good acoustic design should provide an integrated solution whereby the optimum acoustic outcome is achieved, without design compromises that will adversely affect living conditions and the quality of life of the inhabitants or other sustainable design objectives and requirements.

Given the potential for plots to fall within NEC C and for noise levels in developable areas to be in exceedance of 55 dB – along the boundaries with the roads – good acoustic design is essential in these areas. Specifically, the following will need to be considered when designing the site and plot layouts:

- ✿ Plots bounding the roads will need to be orientated such that the garden areas are protected by the building envelope and buildings should wrap around the sides, where possible, to protect the gardens.
- ✿ Gaps between dwellings along the boundaries with the roads should be kept to a minimum to avoid noise creep into the gardens behind.
- ✿ Where possible, mews dwellings would be ideal along the roads.
- ✿ Public open space or nature corridors along the roads would be advantageous as these provide a buffer to the plots. This is already shown in the design with well planted bunds along the eastern boundary.
- ✿ Wherever possible, windows for habitable rooms should face away from the noise sources so that opening windows does not necessarily result in an exceedance of the criteria. However, where this is not possible, internal levels can be controlled by way of mitigation.

With the above implemented, E3P has a high confidence that noise levels in gardens can be 55 dB or below, indeed scenarios have been run to determine what noise levels can be achieved and, by way of good acoustic design, levels below 55 dB can be achieved in the worst affected gardens with even lower levels of noise achieved in the majority of gardens, assuming all gardens are protected through good acoustic design and the embedded mitigation along the south eastern boundary is implemented.

Given that, with bunding and fencing in place, the noise level at the boundary of the developable areas range between 57 and 65 dB. If gardens are protected by the dwelling, the building envelope should provide at least full line of sight removal, -10 dB, thus achieving the criterion. Gardens that have exposed edges are likely to require acoustic barriers. These have been suggested at up to 2.5 m in height.

Detailed noise grids, for indicative example layouts, have been provided to the Environmental Health Department and used to inform initial discussions prior to submission of the outline planning application. These grids were used to show how levels of 55 dB and below can be achieved for even the worst affected areas. It was agreed that good acoustic design, embedded mitigation and local fencing can achieve the relevant criterion and that the site was suitable for residential use.

Given that the layout will be subject to change and is not part of the application, these are not included within the report.



5.2. GARDEN AREAS

Section 4.1 determined that noise levels in certain garden areas, unprotected, could be up to 65 dB and so good acoustic design is paramount in these areas. Any barriers, beyond the earth bund/fence combinations, along the boundaries would need to be significant to reduce noise alone. The main barrier here will be dwellings and/or garages but barriers along Mold Road for instance, perhaps, could provide a level of flexibility to the actual layout in order to achieve the necessary criterion. Such design details can be provided at the Reserved Matters stage.

The barriers proposed can be of wooden fence or brick wall construction but must be sealed at the base, be free from holes and have a minimum mass of 10 kg/m².

5.3. HABITABLE ROOMS

The previous section determined that higher specification glazing and/or alternative ventilation will be required for certain rooms across the Site. Given the outline nature of the application, exact plots that require this are not required. However, to give a level of confidence that internal noise levels can be achieved, detailed break-in calculations have been undertaken for 3 sample worst-case locations; south eastern boundary, western boundary and central area.

The typical façade make-ups used in the calculations are shown below:

- ✳ Brick block wall.
- ✳ 4 mm glass/20 mm air space/4 mm glass glazing unit or a sample configuration where an exceedance is predicted in Tables 4.2 and/or 4.3.
- ✳ Window frame mounted trickle ventilator with a sound reduction of at least 35 dB in the open position.
- ✳ Tiles on felt, pitched roof with 100 mm wool on plasterboard ceiling.

As house types are not known, sample dimensions of a living room and bedroom from a 3-bedroom semi-detached property have been used which are assumed to form part of the site but will be subject to change at the reserved matters stage.

The detailed break-in calculations are detailed in Appendix III.

The calculations show compliance with the internal criterion by way of slightly upgraded glazing and/or trickle ventilators as part of an alternative ventilations system.

As such the below provides a brief outline of requirements based on the location of plots:



- ✿ Standard Glazing for any living rooms located on the south eastern boundary, to the south of the barriers, is sufficient. This overrides the recommendations following the simple calculation in Table 4.2;
- ✿ Higher specification glazing, here a specification of 4 mm glass/12 mm air space/8.8 mm acoustic laminate glass was used which provides a sound reduction of 38 dB R_w (-1:-4), for certain living rooms located on the western boundary of the site located close to and facing Mold Road. The exact requirements will differ along the boundary but the above and calculations show that even the worst-case living rooms and bedrooms can achieve criterion; and
- ✿ Alternative ventilation for all living rooms and bedrooms located along the south east and south west boundaries and with line of sight to the A483 and/or Mold Road, depending on orientation and proposed barriers.

The number of plots that require alternative ventilation is unknown at this stage. Furthermore, the detailed break-in calculations are calculated using simple distance attenuation without accounting for soft ground or reflections as in the model and, as such, are considered worst-case.

The eventual alternative ventilation system to be used is ultimately down to the developer and any requirements of the Local Planning Authority. Furthermore, the need for this is to provide fresh air flow and background ventilation without the need for opening windows, windows are however to remain openable for purge ventilation. The most common system is the installation of trickle ventilators to habitable rooms and extract fans installed in wet rooms. This is considered System 1 in the Building Regulations and would provide the necessary ventilation.

5.4. FUTURE CONDITIONS

Following discussions with Wrexham Council, it is understood that the conditions along the A483 are subject to change and that a number of options are currently being considered, including for the current situation to remain permanent with a 50 mph speed limit imposed and promotion of the use of public transport.



6. CONCLUSION AND RECOMMENDATIONS

E3P were commissioned by Russell Homes in order to undertake a Noise Impact Assessment for a proposed residential development on land off Stansty Chain Road in Wrexham.

A sound survey has been undertaken across the Site to account for road traffic sound associated with the A483 and Mold Road, rail traffic and any commercial sound. A 3D noise model has been constructed to assess transportation sound impact, this is assessed in accordance with the criterion, for day and night, given in BS 8233:2014.

The assessment has recommended various acoustic barriers in order to control transportation sound as well as provide recommendations on potential higher specification glazing and/or alternative ventilation.

Acoustic barriers proposed, as part of the design, are as follows:

- ✳ 5 m high earth bund/fence combination for the area north of Stansty Chain Road.
- ✳ 5 m high earth bund/fence combination for the area south of Stansty Chain Road; and
- ✳ 2.5 m high barrier along the archaeological area.

Additionally, the following barriers could be accounted for, but are not a requirement, and will depend on the final layout design:

- ✳ Localised fencing at affected gardens may be required.

Given the outline nature of the application, further detail will be required at the Reserved Matter. However, the report has recommended good acoustic design and the implementation of mitigation measures, which are reasonable and achievable. When followed these measures will result in no adverse impact day or night at the receptors due to transportation sound. Accordingly, it will be possible to demonstrate a detailed design at the reserved matters that is in line with acoustic level and design standards.

Design measures should include gaps between dwellings kept to the minimum, 3 m, garages strategically located to protect gardens, gardens located to the rear of dwellings which will front the sound source and, wherever possible, access roads/driveways constructed between the receptors and sound source.

This report has also advised on likely glazing specifications and alternative ventilation systems that may be required along certain boundaries and within the Site.

As such, noise need not be a material consideration in the granting of planning permission as long as the recommendations of this report are followed and included within the design stage of the Reserved Matters.

END OF REPORT



APPENDIX I

GLOSSARY OF ACOUSTIC TERMINOLOGY

NOISE

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source. The most widely used weighting mechanism that best corresponds to the response of the human ear is the "A"-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective but, as a general guide, a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE A1 TYPICAL SOUND PRESSURE LEVELS

SOUND PRESSURE LEVEL	LOCATION/EXAMPLE
0	Threshold of hearing
20–30	Quiet bedroom at night
30–40	Living room during the day
40–50	Typical office
50–60	Inside a car
60–70	Typical high street
70–90	Inside a factory
100–110	Burglar alarm at 1 m away
110–130	Jet aircraft on take off
140	Threshold of pain



ACOUSTIC TERMINOLOGY

TABLE A2 TERMINOLOGY

DESCRIPTOR	EXPLANATION
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2E-05 Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. "A" weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
L_{Aeq, T}	L _{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
L_{Amax}	L _{Amax} is the maximum A-weighted sound pressure level recorded over the period stated. L _{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L _{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the "fast" sound level meter response.
L₁₀ and L₉₀	If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L _n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L ₁₀ is the level exceeded for 10% of the time and as such can be regarded as the "average maximum level". Similarly, L ₉₀ is the "average minimum level" and is often used to describe the background noise. It is common practice to use the L ₁₀ index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, as measured outside and away from buildings.
Fast	A time weighting used in the root-mean-square section of a sound level meter with a 125-millisecond time constant.
Slow	A time weighting used in the root-mean-square section of a sound level meter with a 1000-millisecond time constant.



APPENDIX II

DETAILED BREAK-IN

CALCULATIONS

Detailed Internal Noise Break-in Calculation Sheet

Stansty Chain Road, Wrexham

Project: Stansty Chain Road, Wrexham
Plot: South East Boundary
E3P Project No. 50-024

	Measured Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
Measured Freefield Leq 16hr (Living Room) (dB)	71.9	65.0	62.3	63.4	67.0	52.4
Measured Freefield Leq 8hr (Bedroom) (dB)	62.7	56.6	54.1	55.1	58.3	45.2
Measured 10th highest Lmax,fast (dB)	77.4	70.2	77.6	75.6	74.4	61.0
Corrected Freefield Daytime Noise Level at Façade (dB)	66.8	59.9	57.2	58.3	61.9	47.3
Corrected Freefield Night-time Noise Level at Façade (dB)	57.6	51.5	49.0	50.0	53.2	40.1
Corrected Freefield LAmx,fast Noise Level at Façade (dB)	67.3	60.1	67.5	65.5	64.3	50.9

Building Component Dimensions - Living Room	Dimension (m sq.)
Façade Area (inc. Window)	12.27
Roof Area (facing road)	8.35
Window Area	4.34
Area of Ceiling	14.89

Building Component Dimensions - Bedroom	
Façade Area (inc. Window)	11.58
Roof Area (facing road)	8.352
Window Area	2.17
Area of Ceiling	14.48

Living Room (Daytime) - Internal Noise Break-in Calculation

	Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
<i>Specified Building Component</i>						
Window Frame Mounted Trickle Vent (Standard Dn,e,w 35dB)	31	34	39	34	41	33
4/20/4 (Rw 32dB)	20	22	21	27	38	25
Brick Block Wall	32	40	44	45	51	56
Tiles on felt, pitched roof with 100mm wool on plasterboard ceiling	22	28	34	40	45	49
Living Room Calculated Internal Noise Level (dB)	51.9	40.7	36.9	32.7	27.4	22.9
A-weighting (dB)	-26.2	-16.1	-8.6	-3.2	0	-1.1
Total A-Weighted Internal Noise Level (LAeq) (dB)	25.7	24.6	28.3	29.5	27.4	21.8
Total Combined A-weighted Internal Noise Level (LAeq) (dB)	35					

Bedroom (Night-time) - Internal Noise Break-in Calculation

	Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
<i>Specified Building Component</i>						
Window Frame Mounted Trickle Vent (Standard Dn,e,w 35dB)	31	34	39	34	41	33
4/20/4 (Rw 32dB)	20	22	21	27	38	25
Brick Block Wall	32	40	44	45	51	56
Tiles on felt, pitched roof with 100mm wool on plasterboard ceiling	22	28	34	40	45	49
Living Room Calculated Internal Noise Level (LAeq) (dB)	42.2	31.2	26.5	22.7	17.8	13.5
Living Room Calculated Internal Noise Level (LAmx,fast) (dB)	51.9	39.7	45.0	38.1	28.8	24.2
A-weighting (dB)	-26.2	-16.1	-8.6	-3.2	0	-1.1
Total A-Weighted Internal Noise Level (LAeq) (dB)	16.0	15.1	17.9	19.5	17.8	12.4
Total A-Weighted Internal Noise Level (LAmx,fast) (dB)	25.7	23.6	36.4	34.9	28.8	23.1
Total Combined A-weighted Internal Noise Level (LAeq) (dB)	26					
Total Combined A-weighted Internal Noise Level (LAmx) (dB)	40					



Detailed Internal Noise Break-in Calculation Sheet

Stansty Chain Road, Wrexham

Project: Stansty Chain Road, Wrexham
Plot: Western Boundary
E3P Project No. 50-024

	Measured Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
Measured Freefield Leq 16hr (Living Room) (dB)	68.9	66.0	67.0	69.1	75.4	56.2
Measured Freefield Leq 8hr (Bedroom) (dB)	60.0	57.5	58.4	60.2	65.9	48.6
Measured 10th highest Lmax,fast (dB)	74.5	75.1	76.7	82.7	83.3	63.8
Corrected Freefield Daytime Noise Level at Façade (dB)	59.7	56.8	57.8	59.9	66.2	47.0
Corrected Freefield Night-time Noise Level at Façade (dB)	50.8	48.3	49.2	51.0	56.7	39.4
Corrected Freefield LAmx,fast Noise Level at Façade (dB)	56.2	56.8	58.4	64.4	65.0	45.5

Building Component Dimensions - Living Room	Dimension (m sq.)
Façade Area (inc. Window)	12.27
Roof Area (facing road)	8.35
Window Area	4.34
Area of Ceiling	14.89
Building Component Dimensions - Bedroom	
Façade Area (inc. Window)	11.58
Roof Area (facing road)	8.352
Window Area	2.17
Area of Ceiling	14.48

Living Room (Daytime) - Internal Noise Break-in Calculation

	Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
Specified Building Component						
Window Frame Mounted Trickle Vent (Standard Dn,e,w 35dB)	31	34	39	34	41	33
4/12/8.8A (34 dB Rw+Ctr)	21	25	23	32	43	50
Brick Block Wall	32	40	44	45	51	56
Tiles on felt, pitched roof with 100mm wool on plasterboard ceiling	22	28	34	40	45	49
Living Room Calculated Internal Noise Level (dB)	44.6	36.3	35.8	31.4	30.1	14.5
A-weighting (dB)	-26.2	-16.1	-8.6	-3.2	0	-1.1
Total A-Weighted Internal Noise Level (LAeq) (dB)	18.4	20.2	27.2	28.2	30.1	13.4
Total Combined A-weighted Internal Noise Level (LAeq) (dB)	35					

Bedroom (Night-time) - Internal Noise Break-in Calculation

	Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
Specified Building Component						
Window Frame Mounted Trickle Vent (Standard Dn,e,w 35dB)	31	34	39	34	41	33
4/20/4 (Rw 32dB)	20	22	21	27	38	25
Brick Block Wall	32	40	44	45	51	56
Tiles on felt, pitched roof with 100mm wool on plasterboard ceiling	22	28	34	40	45	49
Living Room Calculated Internal Noise Level (LAeq) (dB)	35.4	28.0	26.7	23.6	21.3	12.8
Living Room Calculated Internal Noise Level (LAmax,fast) (dB)	40.8	36.4	35.9	37.0	29.5	18.8
A-weighting (dB)	-26.2	-16.1	-8.6	-3.2	0	-1.1
Total A-Weighted Internal Noise Level (LAeq) (dB)	9.2	11.9	18.1	20.4	21.3	11.7
Total A-Weighted Internal Noise Level (LAmax,fast) (dB)	14.6	20.3	27.3	33.8	29.5	17.7
Total Combined A-weighted Internal Noise Level (LAeq) (dB)	26					
Total Combined A-weighted Internal Noise Level (LAmax) (dB)	36					



Detailed Internal Noise Break-in Calculation Sheet

Stansty Chain Road, Wrexham

Project: Stansty Chain Road, Wrexham
 Plot: Central
 E3P Project No. 50-024

	Measured Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
Measured Freefield Leq 16hr (Living Room) (dB)	71.9	65.0	62.3	63.4	67.0	52.4
Measured Freefield Leq 8hr (Bedroom) (dB)	62.7	56.6	54.1	55.1	58.3	45.2
Measured 10th highest Lmax,fast (dB)	77.4	70.2	77.6	75.6	74.4	61.0
Corrected Freefield Daytime Noise Level at Façade (dB)	60.7	53.8	51.1	52.2	55.8	41.2
Corrected Freefield Night-time Noise Level at Façade (dB)	51.5	45.4	42.9	43.9	47.1	34.0
Corrected Freefield L _{Amax,fast} Noise Level at Façade (dB)	54.9	47.7	55.1	53.1	51.9	38.5

Building Component Dimensions - Living Room	Dimension (m sq.)
Façade Area (inc. Window)	12.27
Roof Area (facing road)	8.35
Window Area	4.34
Area of Ceiling	14.89

Building Component Dimensions - Bedroom	
Façade Area (inc. Window)	11.58
Roof Area (facing road)	8.352
Window Area	2.17
Area of Ceiling	14.48

Living Room (Daytime) - Internal Noise Break-in Calculation

	Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
<i>Specified Building Component</i>						
Window Frame Mounted Trickle Vent (Standard Dn,e,w 35dB)	31	34	39	34	41	33
4/20/4 (Rw 32dB)	20	22	21	27	38	25
Brick Block Wall	32	40	44	45	51	56
Tiles on felt, pitched roof with 100mm wool on plasterboard ceiling	22	28	34	40	45	49
Living Room Calculated Internal Noise Level (dB)	45.7	34.5	30.7	26.5	21.2	16.7
A-weighting (dB)	-26.2	-16.1	-8.6	-3.2	0	-1.1
Total A-Weighted Internal Noise Level (LAeq) (dB)	19.5	18.4	22.1	23.3	21.2	15.6
Total Combined A-weighted Internal Noise Level (LAeq) (dB)	29					

Bedroom (Night-time) - Internal Noise Break-in Calculation

	Octave Band Centre Frequency (Hz)					
	63	125	250	500	1000	2000
<i>Specified Building Component</i>						
Window Frame Mounted Trickle Vent (Standard Dn,e,w 35dB)	31	34	39	34	41	33
4/20/4 (Rw 32dB)	20	22	21	27	38	25
Brick Block Wall	32	40	44	45	51	56
Tiles on felt, pitched roof with 100mm wool on plasterboard ceiling	22	28	34	40	45	49
Living Room Calculated Internal Noise Level (LAeq) (dB)	36.0	25.0	20.3	16.5	11.6	7.3
Living Room Calculated Internal Noise Level (LA _{max,fast}) (dB)	39.5	27.3	32.6	25.7	16.5	11.8
A-weighting (dB)	-26.2	-16.1	-8.6	-3.2	0	-1.1
Total A-Weighted Internal Noise Level (LAeq) (dB)	9.8	8.9	11.7	13.3	11.6	6.2
Total A-Weighted Internal Noise Level (LA _{max,fast}) (dB)	13.3	11.2	24.0	22.5	16.5	10.7
Total Combined A-weighted Internal Noise Level (LAeq) (dB)	20					
Total Combined A-weighted Internal Noise Level (LA _{max}) (dB)	27					



APPENDIX II

FIGURES

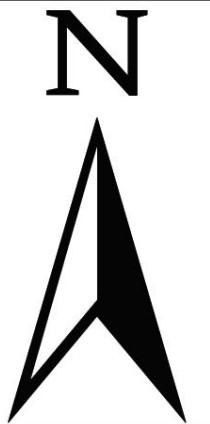
Figure 1 - Noise Survey Measurement Positions



Project:
Stansty Chain Road,
Wrexham

Project-No:
50-024

Client:
Russell Homes



Project Engineer: L Faulkner
Date: 01/03/2021

Figure 2 - Daytime NEC Grid Noise Map - Calculation at 1.5 m above ground level

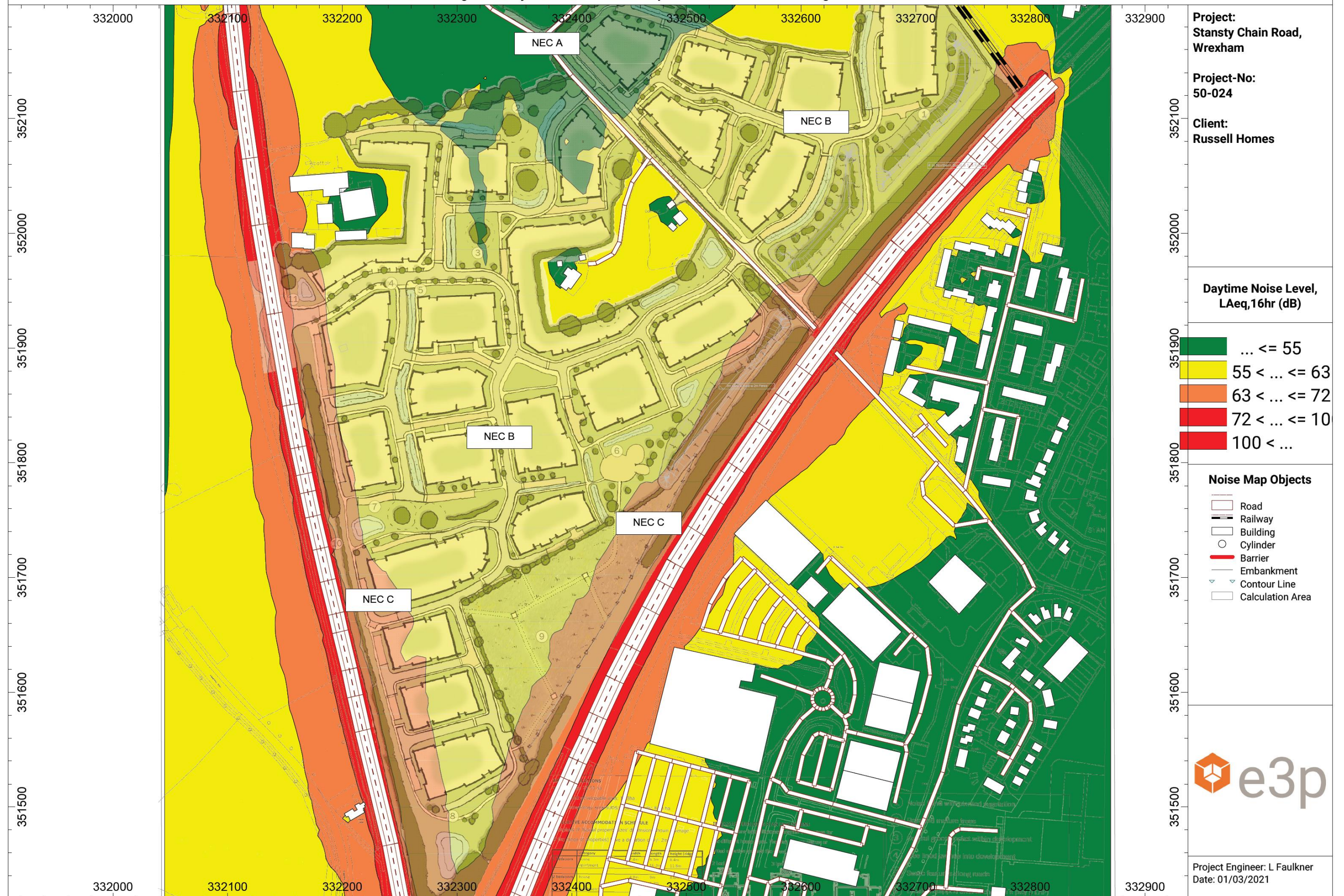


Figure 3 - Night-time NEC Grid Noise Map - Calculation at 4 m above ground level



Figure 4 - Daytime Grid Noise Map with Proposed Bunds - Calculation at 1.5 m above ground level

