ACOUSTIC CONSULTANTS LTD

Noise Impact Assessment

Proposed Residential Development Site
Land Off Old Wells Road, Shepton Mallet

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Client:		Acoustic Consultant:
REDROW Redrow Homes South West Land & Planning Department		ACOUSTIC CONSULTANTS LTD

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the external noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Introduction

Redrow Homes Limited appointed Acoustic Consultants Limited to carry out an environmental noise assessment and provide noise mitigation advice for the proposed residential development on Land off Old Wells Rd, Shepton Mallet.

The assessment takes into consideration the local authority requirements and considers the impact of traffic from the local road network near the proposed development site and sports noise.

At this stage, the layout plan of dwellings associated with the scheme are not known. The aim of this assessment is to provide outline advice to guide the design of the residential development.

The noise impact assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG) and British Standard 8233:2014 (BS8233).

The author of this report is a full Member of the Institute of Acoustics with 11 years' experience within the field and, as such, is considered suitably qualified to undertake a noise impact assessment.

2. The Site

The proposed site is to be located on a land at Old Wells Rd, Shepton Mallet.

The proposal is for outline planning permission with all matters reserved except access for the development of up to 125 dwellings, a new vehicular access on to Old Wells Road, pedestrian/cycle access, landscaping, public open space, drainage attenuation and related infrastructure and engineering works.

The site is located to the south of Old Wells Rd. To the North East there is residential housing and to the east there is Shepton Mallet AFC and public playgrounds including a skatepark. To the north west, west and south west there are empty farming fields.

The main noise source affecting the site is road traffic along Old Wells Rd. In addition, the Local Authority had raised some initial concerns from the nearby skate park with regards to noise.

However, the Local Authority agreed in the letter sent via email (31656/01/AC/JMi/) and dated 5th August 2020 that the potential impact of noise from the skatepark "*could be overcome by ensuring that no dwellings are positioned within 50m of the skate park and no 2-storey dwellings less than 85m from the skate park.*" Under this application, no dwellings are proposed within at least 85m and therefore comply with the recommendations made by the Local Authority. Therefore, it is our understanding that no further noise assessment is required to the existing skate park. The Local Authority communication letter is provided in more detail below in section 4.1.

The existing and proposed masterplan is provided in figure 1 and Figure 2 respectively.

At this stage, the layout plan of dwellings associated with the scheme are not known. The aim of this assessment is to provide outline advice to guide the design of the residential development.

Figure 1: Existing Site plan

Figure 2: Proposed Site plan

3. Planning and Noise

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in February 2019. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 170 states:

"170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 180 states:

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life
b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and
c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation. "

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise.

3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long-term vision of Government noise policy. This long-term vision is supported by three noise policy aims which are as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

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

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur. With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its own merits. The NPSE does, however, emphasise that in dealing with noise, Local Planning Authorities are required to take a balanced approach in considering the benefits of development against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

3.3. National Planning Practice Guidance, Noise (NPPG)

The National Planning Practice Guidance (NPPG) on noise, referred to here, is based on the current version (July 2019) as provided on the Planning Guidance Website. It states that *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

The document provides generic guidance on how to determine the impact of noise and what factors could be a concern. It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated on the following page.

Table 1: NPPG Noise – Perception of Effect Levels

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
Present 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 not 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			
Present and intrusive	Noise can be heard and causes 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			
Present 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
Present 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

The table does not provide any objective assessment which equates to the noted effect levels.

The NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum when taken into account against all other planning considerations.

Section 4 of this report identifies guidance which is considered to provide noise criteria equivalent to effect levels below the Lowest Observed Adverse Effect Level. This is where the perception of noise is "not noticeable" or "noticeable but not intrusive" as indicated in Table 1 above.

4. Assessment Methodology

4.1. Local Authority Communications

The Mendip District Council made the following comments with regards to the EIA of the proposed development to be located at Land to the South of Old Wells Road, Shepton Mallet.

"Date: 5 August 2020
Our ref: 31656/01/AC/JMi/
Dear Sir / Madam
The Town and County Planning (Environmental Impact Assessment) Regulations 2017 (as updated)

(...)

Noise

It is anticipated that noise will be produced during construction activities which would be controlled through the implementation of a CEMP which will include measures such as limiting working hours. These mitigation measures would be considered an integral part of the proposed development. Therefore, the effect of noise is unlikely to be considered significant.

The site is adjacent to the main Old Wells Road (B3139) and as such the traffic noise must be taken into account. The previous planning application at the site was accompanied by a noise assessment which determined that through the design and layout of the scheme, the impact of road noise on the future residents could be mitigated to an acceptable degree. As such no significant impacts are expected with regard to road noise.

Environmental Health raised concerns to the previous planning application regarding potential for noise nuisance from the nearby skate park. However, following the provision of further acoustic information it was agreed that this could be overcome by ensuring that no dwellings are positioned within 50m of the skate park and no 2-storey dwellings less than 85m from the skate park. Under this new planning application, no dwellings are proposed within at least 85m of the skate park which is reflected on the draft layout and will be carried through to the development parameters which will be submitted for approval with the future planning application.

Based on the previous planning application, implementation of a CEMP and the likely insignificant noise effects, the proposed development is not expected to give rise to any significant impacts that would require EIA."

The following sections outline the most appropriate design criteria for the development which relates to road traffic along Old Wells Road.

4.2. British Standard 8233:2014

British Standard 8233:2014 entitled 'Guidance on sound insulation and noise reduction for buildings' came into effect on 28th February 2014 and supersedes British Standard 8233:1999.

Section 7.7.2 Table 4 of the British Standard provides internal ambient noise levels for dwellings from noise sources 'without a specific character' and these are based on existing guidelines issued by the World Health Organisation in 1999.

The British Standard guideline states that noise levels should not exceed those as noted in Table 4 of the British Standard, and this is summarised below:

Table 2: British Standard 8233:2014 Internal Noise Criteria

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

British Standard 8233:2014 section 7.7.2 Note 7 states:

"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

It should be noted that where internal noise levels exceed the criteria in Table 1 it does not necessarily mean there will be unacceptable conditions within the habitable rooms.

The British Standard does not provide any internal noise criteria for maximum noise levels.

Section 3.4 of the WHO Guidelines state "For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)".

Any noise mitigation measures will need to control external noise ingress such that noise levels inside habitable rooms are within the criteria in Table 2above. These are the criteria we have worked to in our assessment.

4.3. External Amenity Areas

British Standard 8233:2014 section 7.7.3.2 entitled 'Design criteria for external noise' states:

"For traditional external areas that are used for amenity space, such as gardens and patios, 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 recognized 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, such as the convenience of living in these locations 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."

5. Noise Monitoring

5.1. Monitoring Location

A partially attended long term noise monitoring exercise was undertaken approximately between 14:25 hours on the 7th August 2020 and 8:15 hours on the 12th August 2020 to determine the existing noise climate at the site.

The monitoring locations are shown on Figure 3 below.

Figure 3: Long Term Noise Monitoring Location

5.2. Monitoring Equipment

Sound Pressure Levels were measured using an NTI XL2 sound level meter with a half-inch condenser microphone. The equipment is checked annually using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2005 and in accordance with British Standard EN 10012:2003 and traceable to the National Standards. This equipment was checked and calibrated as noted below and the certificates are available for inspection. Table 3 provides the equipment and calibration status.

Table 3: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, Cirrus Research, CR:171C	G071684	21/04/2020	141424
Microphone, Cirrus Research, MK224	211710D	21/04/2020	141427
Calibrator, Cirrus Research, CR:515	73217	22/04/2020	141426

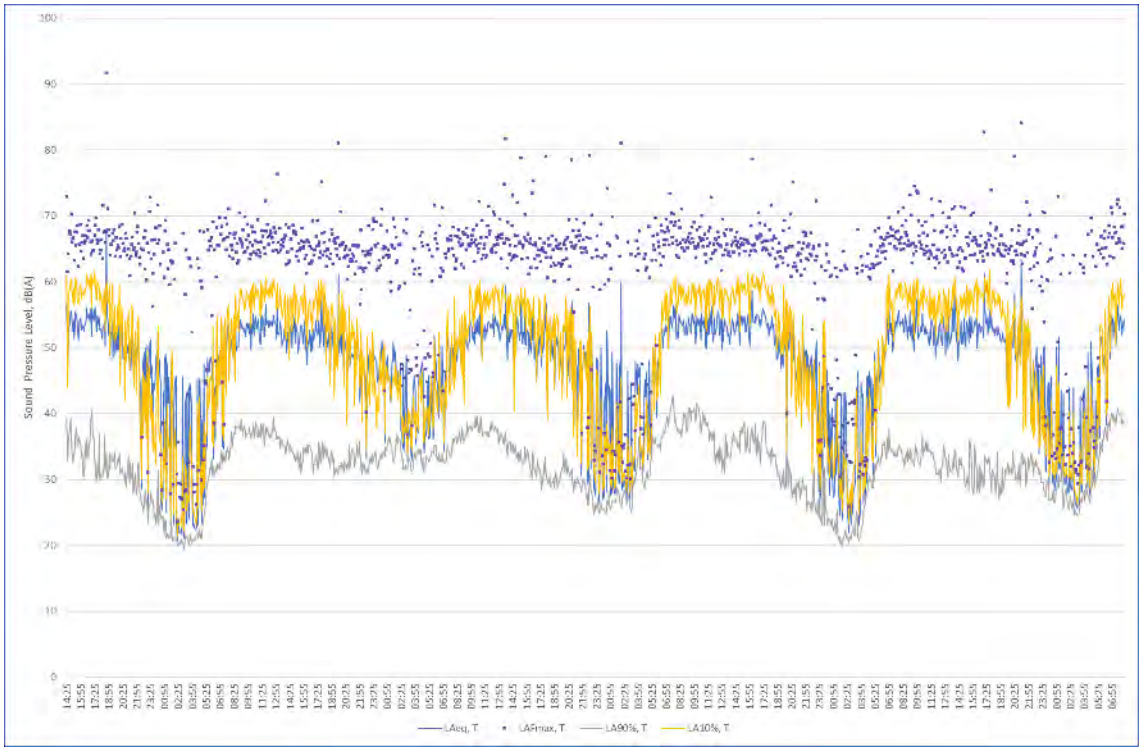
The measurement systems were checked before and after use with the calibrators and no significant drift was detected.

5.3. Weather Conditions

During the measurement period, the weather was mostly dry and calm with temperatures of approximately 15-29 degrees Celsius. Average wind speed is understood to be below 5ms^{-1}. The weather conditions are not expected to have adversely affected the measurement process.

5.4. Measured Noise Levels

A chart of the variation in ambient noise levels with time is provided below for the long term monitoring location:



The relevant data for the assessment obtained at the monitoring location is also summarised in Table 4 below.

Table 4: Summary of the measured noise levels at monitoring location.

Parameter	Monitoring Location
Daytime $L_{eq\ 16hours}$	53
Night Time $L_{eq,\ 8\ hours}$	46
Night Time $L_{max\ (F)}$ (1)	68

(1) 10th Highest measure road traffic noise level event

6. Transportation Noise Impact Assessment

6.1. Road Traffic Data

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the road traffic noise data noted above.

The software predicts road traffic noise propagation using the method of 'The Calculation of Road Traffic Noise 1988', and a verification model has been created to ensure the measured and predicted levels are comparable. This model is available upon request.

6.2. General Modelling Parameters

The noise predictions have been undertaken using the supplied plans noted above and the following general modelling parameters:

- To determine the noise levels across the site and surrounding areas, this has been taken as a hard-reflective ground which is a worst-case scenario.
- Reflections from opposite façades have been determined via the correction method (+1.5 dB).
- All dwellings have a height of 7 metres from the ground level and garages 3 metres above ground.
- The noise maps predict noise levels across the site from the noted noise sources at a height of 1.5 metres above the ground for the daytime habitable rooms and external amenity areas. For the night-time noise map the noise levels are predicted at a height of 4.5 metres above ground.
- The site topography was considered to be flat (worst case)

6.3. Road Traffic Noise Modelling Results

Noise maps have been generated to determine the noise levels across the site. The noise maps are colour-coded to show the equivalent noise level and are provided below, the colour key is as follows:

Table 5: Noise Mitigation Measures

	These areas experience a daytime noise level of less than 50 dB $L_{Aeq,16\ hour}$ and a night time noise level of less than 45 dB $L_{Aeq,8\ hour}$ and maximum noise level less than 60 dB L_{AFmax}. Based on a sound reduction of 15dB(A) through a partially open window the habitable rooms in these areas can be naturally ventilated whilst achieving the internal noise criteria of BS8233:2014. Daytime noise levels in these areas also achieve the desirable level for external amenity areas as stated in the British Standard.
	These areas experience a daytime noise level of less than 50-55dB $L_{Aeq,16\ hour}$ and a night time noise level of less than 45-50dB $L_{Aeq,8\ hour}$ and maximum noise level less than 60-70 dB L_{AFmax}. These areas can be naturally ventilated via trickle ventilators whilst achieving the internal noise criteria of BS8233:2014. Daytime noise levels in these areas also achieve the upper limit for external amenity areas as stated in the British Standard.
	These areas experience a daytime noise level of less than 55-65dB $L_{Aeq,16\ hour}$ and a night time noise level of less than 50-60 dB $L_{Aeq,8\ hour}$ and maximum noise levels 70-75 dB L_{AFmax}. These areas could be naturally ventilated via acoustic trickle ventilators whilst achieving the internal noise criteria of BS8233:2014 and in some may require sound insulation upgrades to the windows.
	These areas experience a daytime noise level in excess of 65dB $L_{Aeq,16\ hour}$ and a night time noise level of less than 60dB $L_{Aeq,8\ hour}$ and maximum noise levels above 75 dB L_{AFmax}. To achieve the internal noise criteria of BS8233:2014 the habitable rooms in these locations will require a mechanically assisted ventilation system and in some locations are likely to require sound insulation upgrades to the windows.

Figure 4: Daytime $L_{Aeq(16hr)}$ Road Traffic noise affecting development

Figure 5: Night Time $L_{Aeq(8hr)}$ Road Traffic noise affecting development

Figure 6: Night Time L_{AFmax} Road Traffic noise affecting development

6.4. Internal Ambient Noise Level Assessment

It will be necessary to design the building fabric of the residential properties that might fall within the 'yellow' colour on the northern boundary of the site along Old Wells Rd to control road traffic noise levels internally.

6.4.1. Noise Mitigation Calculation Method

Calculations for the internal ambient noise levels have been undertaken using the calculation method provided British Standard 8233:2014. The calculations have been undertaken using the building façade constructions below and predicted single figure values noted above. The calculations assume the following:

- Room size: 25m^2 to daytime rooms and 9m^2 to bedrooms
- Windows: 3m^2 to daytime rooms and 1.5m^2 to bedrooms
- Façade: 8m^2 to daytime rooms and 10m^2 to daytime bedrooms
- Vents: 1 open per room.

Alternative constructions to those noted below could be used, however they would need to be assessed to ensure they control external noise to within the BS 8233:2014 internal ambient noise level criteria.

The mitigation below is only likely to be required to the bedroom windows on the façade elevations facing Old Wells Road and falling within the yellow areas on the noise maps above. All the other areas do not need any mitigation to control external noise and can be ventilated via partially open windows to achieve the recommended BS8233:2014 internal noise levels.

It Is also likely that by inserting houses in the model, some screening effect will be added in the model and the yellow areas currently identified will be reduced.

A more detailed assessment can be provided if required when the updated site plan layout is provided to us, however, the outcome of the assessment is not expected to change.

6.4.2. External Wall Construction

The proposed external walls to the development can be of a conventional construction comprising of either masonry or light weight metal/timber frame construction.

6.4.3. Roof Construction

The dwellings could have a roof constructed using traditional techniques, such as a timber construction with concrete/slate tiles with a loft space and a plasterboard ceiling above the habitable rooms.

6.4.4. Windows and Ventilation Constructions

The windows on all elevations could be openable. However, an alternative means of ventilation should be provided to allow windows to be kept closed.

The sound insulation performance for each window and ventilator in the yellow areas are provided below in Table 6:

Table 6: Required Minimum Sound Insulation Performance of windows and Vents

Daytime Rooms		Bedrooms	
Windows Minimum $R_w + C_{tr}$	Ventilation Minimum $D_{new} + C_{tr}$	Windows Minimum $R_w + C_{tr}$	Ventilation Minimum $D_{new} + C_{tr}$
27	31	27	31

Table 7 below gives example of glazing configurations that typically provide the performances set out in above.

Table 7: Example of Double-Glazing windows

Required Window Sound Insulation Performance, $R_W + C_{tr}$ dB	Typical double-glazed window configuration
27	4 mm glass/16 mm air-gap/4 mm glass

Table 8 below gives example of ventilator configurations that typically provide the performances set out in Table 7above.

Table 8: Example of ventilators

Required Ventilator Sound Insulation Performance, $D_{neW} + C_{tr}$ dB	Typical Ventilator configuration
31	Titon - Trimvent Select Vent & C13 Canopy

It should be noted the glazing and vent specification is a standard Redrow system.

6.5. External Amenity Spaces

Figure 7 below provides the daytime noise map. It can be seen that predicted road traffic noise levels falls within the BS8233:2014/ WHO desirable amenity level of 50dB $L_{Aeq,\ 16\ hours}$ (green areas) and 55dB $L_{Aeq,\ 16\ hours}$ (blue areas). It is also likely that by inserting houses in the model the predicted noise levels within amenity areas will be further reduced.

We would therefore consider the predicted amenity space external daytime noise levels to be acceptable.

Figure 7: Daytime $L_{Aeq(16hr)}$ showing amenity spaces at 1.5metres high

7. Skate Park Noise

The Mendip District Council made the following comments with regards to the potential noise impact of the existing skate park upon the proposed residential dwellings.

"Environmental Health raised concerns to the previous planning application regarding potential for noise nuisance from the nearby skate park. However, following the provision of further acoustic information it was agreed that this could be overcome by ensuring that no dwellings are positioned within 50m of the skate park and no 2-storey dwellings less than 85m from the skate park. Under this new planning application, no dwellings are proposed within at least 85m of the skate park which is reflected on the draft layout and will be carried through to the development parameters which will be submitted for approval with the future planning application. "

Based on the above, it is our understanding that no further noise assessment is required and the impact of skate park noise upon the development is acceptable.

8. Summary & Conclusions

Redrow Homes Limited appointed Acoustic Consultants Limited to carry out an environmental noise assessment and provide noise mitigation advice for the proposed residential development on Land off Old Wells Rd, Shepton Mallet.

The assessment takes into consideration the local authority requirements and considers the impact of traffic from the local road network near the proposed development site and sports noise.

At this stage, the layout plan associated with the scheme are not known. The aim of this assessment is to provide outline advice to guide the design of the residential development.

Mitigation measures are required to control external noise to facades that are likely to be located on the northern boundary and falling within the yellow areas identified in the noise maps above of the site adjacently to Old Wells Road. With the proposed fabric construction and suitable ventilation provisions noted above, the predicted internal equivalent noise levels are generally within the British Standard 8233:2014 criteria of 35 dB $L_{Aeq\ (16\ hour)}$ during the day and within 30 dB $L_{Aeq\ (8\ hour)}$ during the night.

In addition, under the proposed residential development no dwellings are expected to be proposed within at least 85m of the skate park located to the east which is reflected on the proposed site layout and therefore follows the recommendations made by the Local Authority; see section 4.1 above. Therefore, it is our understanding that no further noise assessment is required and the impact of skate park noise upon the development is acceptable.

We would consider external noise to be suitably controlled within the habitable rooms of the residential development and good internal conditions can be achieved.

The layout of the site is not known however the modelling indicates acceptable external amenity space levels can be achieved across the site and to be within the recommended BS8233/ WHO 50-55 dB $L_{Aeq,\ 16\ hours}$ noise levels. This is shown above in Figure 7 noise map.

As such, we would consider that noise is suitably controlled and below the LOAEL of the NPPG within dwellings and external amenity areas. The proposed development is not adversely affected by noise.

9. Appendix 1 – Glossary of Acoustic Terminology

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-pascals to 100 pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent sound absorption area of a room, A - hypothetical area of a totally absorbing surface without diffraction effects, expressed in square metres (m^2), which, if it were the only absorbing element in the room, would give the same reverberation time as the room under consideration.

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Reverberation time, T – time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped NOTE Reverberation time is usually measured in octave or third octave bands. It is not necessary to measure the decay over the full 60 dB range. The decay measured over the range 5 dB to 35 dB below the initial level is denoted by T30, and over the range 5 dB to 25 dB below the initial level by T20.

Weighted sound reduction index, R_w – single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies NOTE The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see Annex C and BS EN ISO 717-1).

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in pascals (Pa), typically from 20 micro-pascals to 100 pascals, but commonly simplified onto the decibel scale.

Weighted standardized impact sound pressure level, $L'_{nT,w}$ - single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.

NOTE weighted standardized impact sound pressure level is used to characterize the insulation of floors in buildings (see Annex C and BS EN ISO 717-2).

Weighted standardized level difference, $D_{nT,w}$ – single-number quantity that characterizes the airborne sound insulation between rooms. NOTE Weighted standardized level difference is used to characterize the insulation between rooms in a building (see Annex C and BS EN ISO 717-1).

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