

Persimmon Homes

**Reserved Matters Application (Parcels
A2 and B6) and Discharge of
Conditions, North Littlehampton**

Noise Assessment
February 2020

Executive Park, Avalon Way, Anstey, Leicester, LE7 7GR



Document Control

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1.0 Introduction

1.1 Purpose of this Report

This report presents the findings of a noise assessment for a reserved matters application for parcels A2 and B6 of a residential development in north Littlehampton and the discharge of Conditions 37 and 38 of planning permission ref LU-47-11 which states:

"37 In addition to the measures described in Condition 36 above, any development on land within Noise Exposure Category C and D shall incorporate noise mitigation measures details of which are to be submitted to, and approved in writing by, the Local Planning Authority. These measures shall thereafter be permanently maintained."

"38 All ground level private amenity spaces shall have a predicted noise level of less than or equal to L_{Aeq} , 55dB (measured over a 1 hour period) within the first 5 metres from the building facade"

A description of the existing noise environment in and around the site is provided. Noise surveys have been undertaken and the results used to verify predictions of the short-term and long-term effects of noise. The noise levels from the proposed development have been predicted at local representative receptors using CADNA noise modelling software which incorporates ISO 9613 and CRTN methodologies and calculations.

A list of acoustic terminology and abbreviations used in this report is provided in Appendix A and a set of location plans and noise contour plots relevant to the assessment are presented in Appendix B.

1.2 Legislative Context (England)

PPG24 (from which Noise Exposure Categories were defined) was replaced by NPPF on 27 March 2012 and then updated on 24th July 2018, with a further revision on 19th February 2019. This report is intended to provide information relevant to the local planning authority and their consultees in support of a planning application for the above proposed development. Policy guidance with respect to noise is found in National Planning Policy Framework (NPPF), published on 24th July 2018. With regard to noise and planning, NPPF contains the following statement at paragraph 170:

"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

A further 2 short statements are presented at paragraph 180, which state:

"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 impact 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."*

Furthermore, paragraphs 182 and 183 state:

"182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

183. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

Practice Guidance (PPG): Noise provides further guidance with regard to the assessment of noise within the context of Planning Policy. The overall aim of this guidance is, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England, is to, *'identify whether the overall effect of noise exposure is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.'*

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the PPG and repeated as follows:

Table 1.1 Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No Specific Measures Required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect (NOEL)	No Specific Measures Required
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable 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; closing windows for some of the time because of the noise. Potential for non-awakening 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 (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Observed Adverse Effect	Prevent

The NPPF, NSPE and PPG do not, however, present absolute noise level criteria which define SOAEL, LOAEL and NOEL which is applicable to all sources of noise in all situations. Therefore, within the context of the Proposed Development, the extant planning permission, national planning policy and appropriate guidance documents including the 'World Health Organisation Community Noise Guidelines' (1999) and 'BS 8233 – Guidance on Sound Insulation and Noise Reduction for Buildings' (2014), Section 2.0 presents the noise level criteria used as a basis of this assessment.

1.3 ProPG Planning and Noise - New Residential Development

Professional Practice Guidance on Planning and Noise for new residential development (ProPG) was launched on 22nd June 2017 by the Chartered Institute of Environmental Health (CIEH), the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA). The guidance has been published to provide practitioners with guidance on the management of noise within the planning system in England.

The guidance is specifically for 'new residential development that would be exposed predominantly to noise from existing transport sources' and reflects the Government's overarching Noise Policy Statement for England (NPSE), the National Planning Policy Framework (NPPF), and Planning Practice Guidance (including PPG-Noise), as well as other authoritative sources of guidance.

The guidance provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers which complements Government planning and noise policy and guidance and, in particular, aims to:

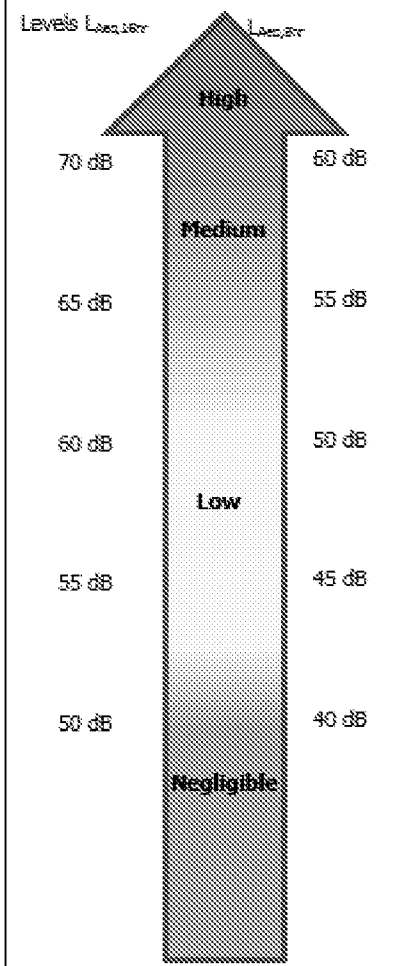
- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
- Encourage the process of good acoustic design in and around new residential developments;
- Outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
- Promote appropriate noise exposure standards; and
- Assist the delivery of sustainable development.

There are two stages of the overall approach outlined in the ProPG:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of 4 key elements which is underpinned by an Acoustic Design Statement.

With regards to Stage 1, ProPG provides guidance to produce an initial site risk assessment, pre-mitigation, with regards to noise based on the prevailing daytime and night time noise levels across the site, from which the site (or areas thereof) can be allocated a Noise Risk as shown in Figure 1.1 below, together with their corresponding sound levels as referred to in the ProPG.

Figure 1.1 ProPG Stage 1, Noise Risk Assessment

Noise Risk Assessment		Potential Effect Without Noise Mitigation	Pre-Planning Application Advice
Indicative Daytime Noise Levels $L_{Aeq,16hr}$ Indicative Night-Time Noise Levels $L_{Aeq,8hr}$		 Increasing risk of adverse effect	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. The risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice. As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigate and minimised, and which clearly demonstrates that a significant adverse noise impact will be avoided in the finished development. At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.
		No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.

2.0 Assessment Criteria

2.1 Internal Noise Assessment Criteria

In order to enable the assessment of the proposed development in terms of LOAEL and SOAEL, Table 2.1 presents equivalent noise levels and associated actions with the target noise level criteria identified. For the purpose of this assessment, the target noise level criteria are noted in *italics* in the table below.

Table 2.1 Noise Level Criteria and Actions

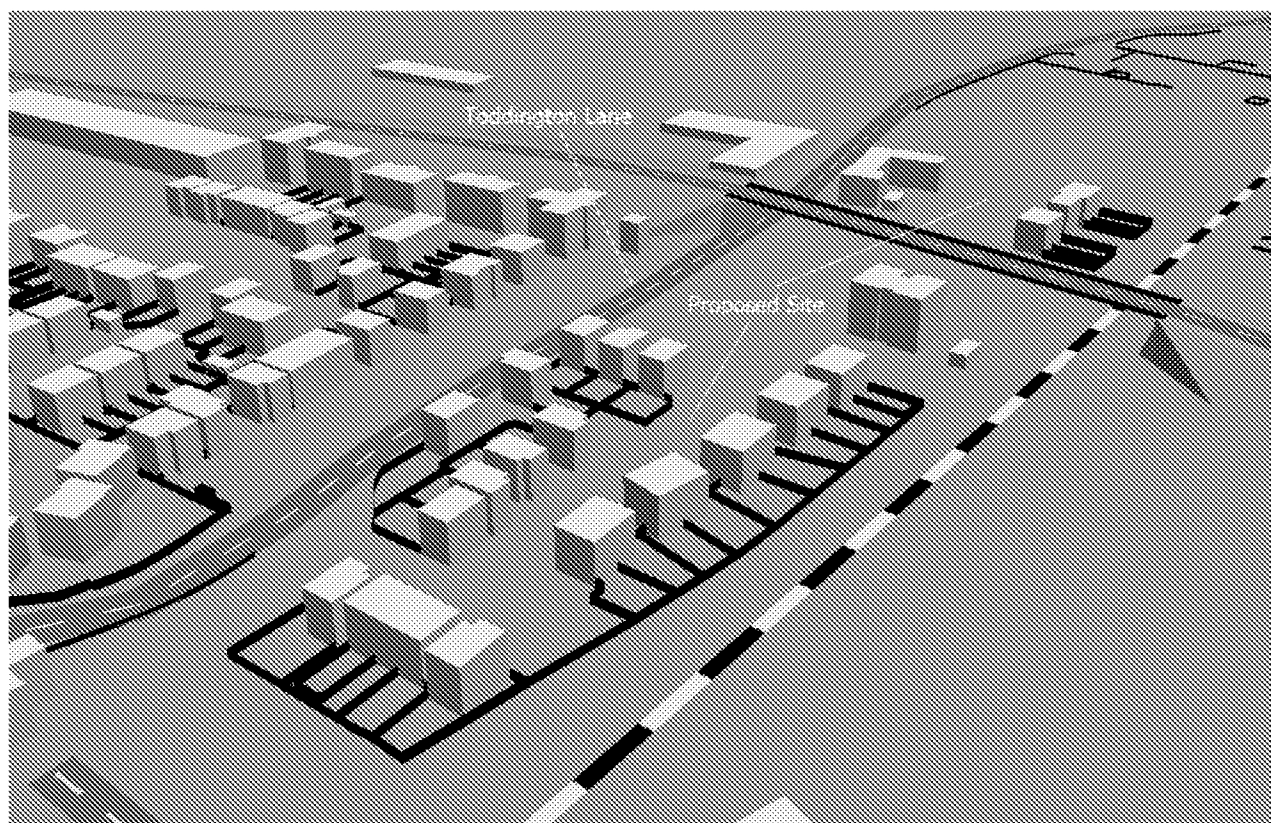
Noise Level Criteria	Effect Level	Action / Justification
Bedrooms – 30 dBL _{Aeq,8hours} / 45 dBL _{Amax} Living Rooms – 30 dBL _{Aeq,16hours} External Amenity Space – 50 dBL _{Aeq,16hours}	No Observed Adverse Effect Level	None Within BS8233 / WHO criteria
Noise levels exceed: Bedrooms – 30 dBL _{Aeq,8hours} / 45 dBL _{Amax} Living Rooms – 35 dBL _{Aeq,16hours} External Amenity Space – 55 dBL _{Aeq,16hours}	Lowest Observed Adverse Effect Level	Mitigate to achieve: <i>Bedrooms – 30 dBL_{Aeq,8hours} / 45 dBL_{Amax}</i> <i>Living Rooms – 35 dBL_{Aeq,16hours}</i> <i>External Amenity Space – 55 dBL_{Aeq,16hours}</i> Within BS8233 / WHO criteria
Noise levels exceed: Bedrooms – 30 dBL _{Aeq,8hours} Living Rooms – 35 dBL _{Aeq,16hours} External Amenity Space – 55 dBL _{Aeq,16hours}	Significant Observed Adverse Effect	Avoid However, if due to other design considerations noise criteria is not achievable or that the target criteria can be achieved for certain periods (e.g. when windows are closed), the following noise levels may be acceptable as an upper limit: Bedrooms – 35 dBL _{Aeq,8hours} Living Rooms – 40 dBL _{Aeq,16hours} External Amenity Space – 60 dBL _{Aeq,16hours} This is on the basis that the guideline noise values do not represent people's response to noise in all cases with the specified criteria only a marginal exceedance of the target criteria.
Noise levels with mitigation exceed: Bedrooms – 35 dBL _{Aeq,8hours} Living Rooms – 40 dBL _{Aeq,16hours} External Amenity Space – 60 dBL _{Aeq,16hours}	Unacceptable Observed Adverse Effect	Prevent

3.0 Assessment Methodology

3.1 Noise Modelling Methodology

Three dimensional noise modelling has been undertaken based on the monitoring data to predict L_{Aeq} and L_{Amax} noise levels at a large number of locations both horizontally and vertically. CADNA noise modelling software has been used (as shown in Figure 3.1). This model is based on the Department of Transport Calculation of Road Traffic Noise (CRTN) and ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken for large numbers of receptor points and different noise emission scenarios both horizontally and vertically.

Figure 3.1 CADNA Noise Model



The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data, assumptions and model settings as given in the table below have been used.

Table 3.1 Modelling Parameters Sources and Assumptions

Parameter	Source	Details
Horizontal distances – around site	Ordnance Survey	Ordnance Survey
Ground levels – around site	Ordnance Survey	Ordnance Survey
Ground levels – other areas	Site Observations and Ordnance Survey	OS 1:25,000 contours and OS 1:10,000 spot heights.
Traffic data, main surrounding roads	WYGE	Traffic flows for local roads based on WYGE observations and experience.
Traffic data – local roads	WYGE	Traffic flows for local roads based on WYGE observations and experience.
Building heights – around site	WYGE Observations	8 m height for two storey residential properties, and 4 m for Bungalows
Barrier heights	WYGE Observations	All existing barriers at 1.0 m with the exception of hedges and trees which are assumed to offer no noise protection.
Receptor positions	WYGE	1 m from façade, height of 1.5 m for ground floor, 4 m for first floor properties with ground floor or bungalow dormer windows. 7 m for dormer windows on two storey properties. 1.5 m height for model grid and monitoring locations for validation.
Reflections	WYGE	First order reflections have been applied based on mirror image sources
Absorbent Ground	CADNA	Frequency dependant ground absorption has been applied based on values specified in VDI 2714/16 clause 6.3.
Façade Correction	CADNA	Façade corrections have been incorporated into the modelling
Gradient	CADNA	Gradient for each road has been calculated from the height information using the 'calc slope of roads' tool
Plans	Persimmon	Drawing Title: Site Layout – COLOUR - 46 units Drawing No.: 544_PL_101 Rev J Dated: January 2020

It is acknowledged that a number of these assumptions will affect the overall noise levels presented in this report. However it should be noted that certain assumptions made, as identified above, are worst case.

3.2 Model Input Data

3.2.1 Model Verification

The model was verified by modelling the monitoring locations for the 'existing' weekday scenario. Daytime and night-time L_{Aeq} and night-time L_{Amax} scenarios have been verified. The comparison between the monitoring and modelling results (including contributions from local roads) are shown in the tables below.

Table 3.2 Modelled vs. Monitored Results L_{Aeq} ; daytime 07:00 – 23:00

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
LT1	68.0	68.1	0.1
LT2	60.9	61.5	0.6
LT3	66.0	65.8	-0.2
ST1	70.7	70.7	0.0
ST2	53.1	54.3	1.2
ST3	62.9	63.4	0.5
ST4	55.7	56.1	0.4
ST5	77.0	76.7	-0.3
ST6	82.1	82.1	0.0

All values are sound pressure levels in dB re: 2×10^{-5} Pa

Table 3.3 Modelled vs. Monitored Results L_{Aeq} ; night-time 23:00– 07:00

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
LT1	62.7	62.7	0.0
LT2	56.8	56.2	-0.6
LT3	59.8	61.3	1.5
ST1	64.2	65.2	1.0
ST2	38.9	42.8	3.9
ST3	39.0	56.3	17.3
ST4	45.4	54.8	9.4
ST5	71.1	71.6	0.5
ST6	77.4	77.6	0.2

All values are sound pressure levels in dB re: 2×10^{-5} Pa

Table 3.4 Modelled vs. Monitored Results L_{Amax} ; night-time 23:00– 07:00

Location	Monitored L_{Amax}	Modelled L_{Amax}	Difference between Monitored and Modelled Results
LT1	84.5	84.4	-0.1
LT2	89.4	89.2	-0.2
LT3	92.9	91.5	-1.4
ST1	81.0	86.5	5.5
ST2	50.2	62.7	12.5
ST3	84.2	83.3	-0.9
ST4	67.0	69.9	2.9

Location	Monitored L_{Amax}	Modelled L_{Amax}	Difference between Monitored and Modelled Results
ST5	90.5	88.7	-1.8
ST6	96.3	96.0	-0.3

All values are sound pressure levels in dB re: 2×10^{-5} Pa

The verification points show a divergence between monitored and modelled results of no more than 3 dB with the exception of locations ST2 - ST4 during the night-time L_{Aeq} scenarios and ST1 and ST2 for the night-time L_{Amax} scenarios where the model is predicting a higher level than was recorded during short term measurements, probably due to the low number of cars passing during the short-term 15 minute measurements. Accordingly, Toddington Lane immediately south of the site has been modelled based upon the predicted traffic flows included in Table 3.5 below with a night-time correction applied.

3.2.2 Traffic Noise Data

All roads expected to make a significant contribution have been included within this assessment. Traffic flows and HGV percentages for the proposed Lyminster Bypass and Toddington Lane have been based on traffic data provided by Mayer Brown. Estimates of the vehicle speeds have been made based upon the speed restrictions currently in force in the area.

Table 3.5 Lyminster Bypass Traffic Data

Road	18hr AAWT	HGV %	Speed (kmph)
Lyminster Bypass	15092	05	48
Toddington Lane	10210	08	48
Development Link Road East	7882	05	48

A correction has been applied to covert the predicted 18 hour L_{A10} traffic noise levels to 16 hour L_{Aeq} noise levels using the following formula, as provided within PPG 24:

$$L_{Aeq}(16\text{hour}) = L_{A10}(18\text{hour}) - 2\text{dB}$$

During the night-time period, a correction of $0.9 \times L_{A10,18\text{hours}} - 3.77$ has been applied to each link within the $L_{A10,18\text{hours}}$ noise model to derive the $L_{Aeq,8\text{hours}}$ which follows the guidance provided within DMRB.

3.2.3 Sensitive Receptors

Existing noise levels have been assessed at properties across the site with respect to direct noise from the existing ambient noise climate surrounding the site. The locations of the proposed receptors are shown in SK02 of Appendix B.

Table 3.6 Residential Receptor Locations

Ref.	Description	Closest Source	Approximate Distance To Source (m)	Height (m)
R01	Southwest of Site	Railway	22.0	1.5/4.0
R02	Southwest of Site	Railway	21.0	1.5/4.0
R03	Southwest of Site	Railway	22.0	1.5/4.0
R04	South of Site	Railway	21.0	1.5/4.0
R05	South of Site	Railway	20.0	1.5/4.0
R06	South of Site	Railway	22.0	1.5/4.0
R07	South of Site	Railway	22.0	1.5/4.0
R08	South of Site	Railway	22.0	1.5/4.0
R09	South of Site	New Link Road	24.0	1.5/4.0
R10	South of Site	New Link Road	24.0	1.5/4.0
R11	South of Site	New Link Road	32.0	1.5/4.0
R12	South of Site	Railway	32.0	1.5/4.0
R13	Southeast of Site	New Link Road	22.0	1.5/4.0
R14	Southeast of Site	New Link Road	28.0	1.5/4.0
R15	Southeast of Site	Railway	22.0	1.5/4.0
R16	Northeast of Site	Toddington Lane	27.0	1.5/4.0
R17	Northeast of Site	Toddington Lane	18.0	1.5/4.0
R18	Northeast of Site	Toddington Lane	7.0	1.5/4.0
R19	Northeast of Site	Toddington Lane	12.0	1.5/4.0
R20	Centre of Site	Toddington Lane	16.0	1.5/4.0
R21	North of Site	Toddington Lane	2.0	1.5/4.0
R22	Centre of Site	Toddington Lane	22.0	1.5/4.0
R23	West of Site	Toddington Lane	23.0	1.5/4.0
R24	West of Site	Toddington Lane	23.0	1.5/4.0
R25	Centre of Site	Railway	30.0	1.5/4.0

Table 3.7 Private External Amenity Area Receptor Locations

Ref.	Description	Closest Source	Approximate Distance To Source (m)	Height (m)
G01	West of Site	Toddington Lane	26.8	1.2
G02	Southwest of Site	Railway	19.8	1.2
G03	Southwest of Site	Railway	15.9	1.2
G04	South of Site	Railway	16.1	1.2
G05	South of Site	Railway	14.5	1.2
G06	South of Site	Railway	15.5	1.2
G07	Southeast of site	Railway	14.7	1.2
G08	Southeast of site	Railway	16.4	1.2
G09	Centre of Site	New Link Road	52.8	1.2
G10	Centre of Site	Toddington Lane	10.1	1.2
G11	West of Site	Toddington Lane	25.4	1.2

4.0 Noise Survey

4.1 Noise Survey Methodology

A monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on the site and to establish the relative local background and traffic noise levels.

Equipment used during the survey included:

B&K 2260	Environmental Noise Analyser (WYG1)	s/n	2361273
B&K 4231	Calibrator	s/n	2176211
Rion NL-52	Environmental Noise Analyser (WYG13)	s/n	620858
Rion NL-52	Environmental Noise Analyser (WYG14)	s/n	610212
Rion NL-52	Environmental Noise Analyser (WYG15)	s/n	1221575

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice and no drift was observed. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline monitoring survey was undertaken at nine locations (as specified in the following table and shown in SK01 of Appendix B) from Wednesday 8th October 2014 to Tuesday 14th October 2014. Attended short term measurements were undertaken at six locations during the day, evening and night-time periods with three additional locations being measured unattended over a 115 hour period. The raw data collected from the long term monitoring is available upon request.

Measurements were taken in general accordance with BS 7445-1:2003 *The Description and Measurement of Environmental Noise: Guide to quantities and procedures*. Weather conditions during the survey period were observed as being dry with scattered showers. Anemometer readings confirmed that wind speeds were less than 5 ms⁻¹ at all times during the survey with a predominant westerly wind direction.

Table 4.1 Noise Monitoring Locations

Ref	Description
LT1	Junction of Lyminster Road and Mill Lane
LT2	Land behind Empress Close along the rail line
LT3	Land north of Sunflower Close, along the rail line.
ST1	Junction of Lyminster Road and Mill Lane
ST2	On Fuller's Walk, next to play area.
ST3	Along Toddington Lane behind garden centre.
ST4	At the junction of Empress Close and Hearnfield Road.
ST5	At the junction of Worthing Road and Landsdowne Road.
ST6	Along Norway Lane adjacent to the A259.

4.2 Noise Survey Results

Existing ambient noise levels around the site are dominated by road traffic noise from the A259 (Worthing Road) and the West Coastway railway line.

Ambient and background noise levels are usually described using the L_{Aeq} index (a form of energy average) and the L_{A90} index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the L_{A10} index (i.e. the level exceeded for 10% of the measurement period).

The results of the statistical measurements and frequency measurements conducted during the survey are summarised in the following table. All values are sound pressure levels in dB (re: 2×10^{-5} Pa).

Table 4.2 Results of Baseline Noise Monitoring Survey (Average Levels)

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Daytime 07:00 - 23:00	44 hours	08/10/2014 - 13/10/2014 07:00 - 23:00	LT1	68.0	101.7	36.3	71.2	53.0
Night-time 23:00 - 07:00	24 hours	08/10/2014 - 13/10/2014 23:00 - 07:00		62.7	84.5	28.9	60.5	43.9
Weekend Daytime 07:00 - 23:00	32 hours	11/10/2014 - 12/10/2014 07:00 - 23:00		67.1	103.6	36.1	70.6	49.7
Weekend Night-time 23:00 - 07:00	16 hours	11/10/2014 - 12/10/2014 23:00 - 07:00		60.0	84.3	25.6	58.3	36.6
Daytime 07:00 - 23:00	44 hours	08/10/2014 - 13/10/2014 07:00 - 23:00	LT2	60.9	96.5	34.7	55.7	47.3
Night-time 23:00 - 07:00	24 hours	08/10/2014 - 13/10/2014 23:00 - 07:00		56.8	85.0	26.5	51.2	42.9
Weekend Daytime 07:00 - 23:00	32 hours	11/10/2014 - 12/10/2014 07:00 - 23:00		60.3	89.4	33.7	53.0	45.0
Weekend Night-time 23:00 - 07:00	16 hours	11/10/2014 - 12/10/2014 23:00 - 07:00		55.8	89.3	23.4	43.9	34.8
Daytime 07:00 - 23:00	44 hours	08/10/2014 - 13/10/2014 07:00 - 23:00	LT3	66.0	108.9	36.0	62.4	55.4
Night-time 23:00 - 07:00	24 hours	08/10/2014 - 13/10/2014 23:00 - 07:00		59.8	94.1	28.3	55.7	44.8
Weekend Daytime 07:00 - 23:00	32 hours	11/10/2014 - 12/10/2014 07:00 - 23:00		65.9	102.2	35.6	60.9	53.1
Weekend Night-time 23:00 - 07:00	16 hours	11/10/2014 - 12/10/2014 23:00 - 07:00		59.8	90.6	24.5	53.5	37.9
Daytime 07:00 - 19:00	15 Mins	14/10/2014 11:28	ST1	70.7	91.8	42.6	73.9	52.5
	15 Mins	14/10/2014 11:48	ST2	53.1	74.2	38.6	54.6	42.1
	15 Mins	14/10/2014 12:07	ST3	62.9	84.2	39.0	63.0	41.8
	15 Mins	14/10/2014 12:26	ST4	55.7	74.0	40.3	55.3	42.7
	15 Mins	14/10/2014 13:09	ST5	77.0	92.3	54.3	80.5	67.7
	15 Mins	14/10/2014 10:38	ST6	82.1	93.6	59.7	86.8	68.6

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Evening 19:00 - 23:00	15 Mins	13/10/2014 21:05	ST1	70.0	85.7	35.4	74.2	42.2
	15 Mins	13/10/2014 21:26	ST2	45.4	62.7	36.8	46.6	40.7
	15 Mins	13/10/2014 21:48	ST3	63.2	83.5	37.1	57.5	39.6
	15 Mins	13/10/2014 22:09	ST4	52.4	75.6	37.7	47.4	40.6
	15 Mins	13/10/2014 20:44	ST5	74.4	89.5	43.7	78.8	53.1
	15 Mins	13/10/2014 20:21	ST6	77.5	94.2	46.4	80.8	55.7
Night-time 23:00 - 07:00	15 Mins	13/10/2014 23:52	ST1	64.2	81.0	35.5	67.9	41.6
	15 Mins	14/10/2014 00:12	ST2	38.9	50.2	32.1	41.3	34.8
	15 Mins	14/10/2014 00:31	ST3	39.0	53.7	31.7	41.4	35.1
	15 Mins	14/10/2014 00:50	ST4	45.4	67.0	34.7	43.7	36.9
	15 Mins	13/10/2014 23:30	ST5	71.1	90.5	35.9	74.0	41.5
	15 Mins	13/10/2014 23:05	ST6	77.4	96.3	41.7	80.2	46.6

All values are sound pressure levels in dB re: 2×10^{-5} Pa

5.0 Assessment of Key Effects

5.1 Noise Intrusion Assessment

Internal noise levels within potential dwellings have been assessed both with windows open, where a reduction from a partially open window of 10 dB has been used, and with windows closed where an assumption of glazing with specification R_w 30 dB (e.g 6/12/6mm double glazing or equivalent) has been used. These assessments include noise from existing roads, the proposed link roads and the railway line directly south.

The results presented in Tables 5.1 – 5.3 below show the predicted noise intrusion levels at properties across the site. The recommended WHO/BS 8233 internal noise levels are met across the site during the night-time, assuming a windows-closed scenario, however the majority of façades are predicted to exceed the relevant criteria (L_{Aeq} , L_{Amax}) with windows open during the both daytime and night-time periods. In order to achieve the recommended internal noise criteria, a range of mitigation measures are outlined in Section 6.1 of this report; SK05 in Appendix B shows the glazing requirements for the proposed development.

Table 5.1 Daytime Noise Intrusion Levels L_{Aeq} 16 hour

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
R01	50.8	40.8	20.8	35
R02	55.0	45.0	25.0	35
R03	53.6	43.6	23.6	35
R04	53.6	43.6	23.6	35
R05	55.6	45.6	25.6	35
R06	55.2	45.2	25.2	35
R07	56.2	46.2	26.2	35
R08	60.7	50.7	30.7	35
R09	62.4	52.4	32.4	35
R10	62.3	52.3	32.3	35
R11	60.4	50.4	30.4	35
R12	56.5	46.5	26.5	35
R13	59.6	49.6	29.6	35
R14	57.8	47.8	27.8	35
R15	55.5	45.5	25.5	35
R16	57.3	47.3	27.3	35
R17	59.9	49.9	29.9	35
R18	64.3	54.3	34.3	35
R19	62.5	52.5	32.5	35
R20	61.3	51.3	31.3	35
R21	65.1	55.1	35.1	35
R22	51.0	41.0	21.0	35
R23	56.2	46.2	26.2	35
R24	51.5	41.5	21.5	35

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
R25	55.6	45.6	25.6	35

Table 5.2 Night-time Noise Intrusion Levels L_{Aeq} 8 hour

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
R01	48.2	38.2	18.2	30
R02	50.4	40.4	20.4	30
R03	49.7	39.7	19.7	30
R04	49.6	39.6	19.6	30
R05	50.8	40.8	20.8	30
R06	50.4	40.4	20.4	30
R07	50.9	40.9	20.9	30
R08	56.9	46.9	26.9	30
R09	57.1	47.1	27.1	30
R10	56.0	46.0	26.0	30
R11	51.2	41.2	21.2	30
R12	53.1	43.1	23.1	30
R13	54.8	44.8	24.8	30
R14	49.1	39.1	19.1	30
R15	49.8	39.8	19.8	30
R16	53.1	43.1	23.1	30
R17	53.3	43.3	23.3	30
R18	56.2	46.2	26.2	30
R19	52.8	42.8	22.8	30
R20	52.1	42.1	22.1	30
R21	54.6	44.6	24.6	30
R22	46.2	36.2	16.2	30
R23	49.1	39.1	19.1	30
R24	48.1	38.1	18.1	30
R25	46.3	36.3	16.3	30

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

Table 5.3 Night-time Noise Intrusion Levels L_{Amax}

Location	External L_{Amax} at 1m from facade	Internal L_{Amax} with windows open	Internal L_{Amax} with windows closed	Criteria Internal L_{Amax}
R01	74.8	64.8	44.8	45
R02	76.8	66.8	46.8	45
R03	82.9	72.9	52.9	45
R04	75.5	65.5	45.5	45
R05	76.3	66.3	46.3	45
R06	76.1	66.1	46.1	45
R07	76.5	66.5	46.5	45
R08	84.0	74.0	54.0	45
R09	84.9	74.9	54.9	45
R10	83.4	73.4	53.4	45
R11	78.5	68.5	48.5	45

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
R12	81.3	71.3	51.3	45
R13	82.9	72.9	52.9	45
R14	76.0	66.0	46.0	45
R15	75.1	65.1	45.1	45
R16	80.2	70.2	50.2	45
R17	80.7	70.7	50.7	45
R18	83.9	73.9	53.9	45
R19	82.4	72.4	52.4	45
R20	80.3	70.3	50.3	45
R21	85.1	75.1	55.1	45
R22	70.7	60.7	40.7	45
R23	75.7	65.7	45.7	45
R24	73.2	63.2	43.2	45
R25	74.1	64.1	44.1	45

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

5.1.1 Private External Amenity Area Noise Levels

Daytime noise levels in gardens and private external spaces of the proposed development have been assessed in the table below. The location of the 'garden' receptor locations are shown on SK02 in Appendix B. The scheme proposals include the construction of barriers in the form of 1.8m high fences across the majority of the site, with 2.0-2.5m high garden fences along the southern boundary with the railway and 2.5m fences for gardens adjacent to the new link road. Full location details for garden fences are shown in SK05.

Table 5.4 Private External Amenity Area Noise Levels $L_{Aeq,16hr}$

Ref	External $L_{Aeq,16hr}$ Daytime	BS 8233 Upper Limit Criteria L_{Aeq}
G01	51.9	55.0
G02	51.0	55.0
G03	53.9	55.0
G04	54.7	55.0
G05	54.9	55.0
G06	54.7	55.0
G07	54.9	55.0
G08	54.4	55.0
G09	52.5	55.0
G10	52.3	55.0
G11	54.5	55.0

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

The results in the table above show that daytime L_{Aeq} noise levels within private external amenity areas are predicted to be within the BS 8233 Upper limit (55 dB) and therefore Condition 38 planning permission reference LU-47-11 can be discharged.

6.0 Noise Mitigation

6.1 Glazing and Ventilation Strategy

The mitigation measures below are sufficient to reduce the effects of any noticeable and disruptive noise from the surrounding environment by helping to prevent noise levels exceeding BS 8233 criteria for L_{Aeq} and L_{Amax} within all areas of the proposed development.

In accordance with the requirements of Condition 37 of planning permission ref LU-47-11, the glazing strategy provided in SK05 has been designed to achieve internal daytime L_{Aeq} of 35 dB, an internal night-time L_{Aeq} of 30 dB and an internal night-time L_{Amax} of 45 dB in habitable rooms of the proposed development. Throughout the proposed development, all façades would require alternative ventilation for noise sensitive rooms (bedrooms and living rooms) due to the proximity of the railway and proposed new link road running through the site. Alternative ventilation can be provided in several ways from acoustic trickle vents (which need to have a minimum sound reduction equal to or greater than the glazing) or other passive ventilation systems.

Glazing with a sound reduction between R_w 30 – R_w 42 will need to be provided for most facades within the proposed development, particularly those with facades facing the railway, the proposed link road and Toddington Lane. Facades which require glazing with a sound reduction of R_w 31 – R_w 34 will require passive ventilation with equivalent noise reduction properties to the glazing, an example of which is 'Titon SF Xtra Sound Attenuator – Standard Vent + C25.' Facades which require glazing with a sound reduction of R_w 35 – R_w 38 will require passive ventilation with equivalent noise reduction properties to the glazing, an example of which is 'Titon SF Xtra Sound Attenuator – V75 + Standard Canopy'. Facades which require glazing with a sound reduction of R_w 39 – R_w 42 will require wall-mounted ventilation with equivalent noise reduction properties to the glazing, an example of which is 'MA3051 Acoustic Wall Ventilator'. The full glazing and ventilation strategy is detailed in SK05 within Appendix B and Table C1 within Appendix C. Manufacturer's data for the proposed ventilation detailed above is presented within Appendix D.

Care will be taken to minimise the potential impact of noise via careful design of building layout with consideration being made to the appropriate positioning of living rooms and bedrooms with respect to the access road and railway. Within the buildings themselves, living rooms and bedrooms will ideally be located on shielded façades with non-sensitive spaces such as corridors, bathrooms, en-suite, utility rooms, window-less gable ends and kitchens should ideally be located on the road facing façades of residential properties.

Fences will be constructed from brick or solid timber panels with no gaps of a ship-lapped design and shall have a surface weight of no less than 15kg/m² and be a minimum of 1.8 metres high, with 2.0 – 2.5m fences required for those which lie adjacent to the railway and new link road to provide further protection to external private amenity spaces.

7.0 Conclusions

Conditions 37 and 38

In accordance with the requirements of Conditions 37 and 38 of planning permission ref LU-47-11, a glazing and ventilation strategy has been provided which achieves both ventilation and internal ambient noise level requirements of L_{Aeq} daytime 35 dB, L_{Aeq} night-time of 30 dB and L_{Amax} night-time of 45 dB in all residential bedroom and living spaces of the proposed development. The suggested glazing specifications outlined in Section 6.0 are achievable, with alternative ventilation required for habitable areas (living rooms and bedrooms) of all properties across the site and enhanced glazing required for most buildings within the site, in order to meet internal targets for noise levels.

All private external amenity area receptors are below the BS 8233 Upper Limit Criteria levels for L_{Aeq} with fences constructed from brick or solid timber panels with no gaps with a minimum height of 1.8 metres high across the site, with fence lines adjacent to the railway and new link road between 2.0 – 2.5 metres high (as specified in SK05).

With implementation of the mitigation measures outlined in Section 6, the requirements of Conditions 37 & 38 of planning permission reference LU-47-11 are met and the conditions can therefore be discharged.

Appendices

Appendix A – Acoustic Terminology and Abbreviations

Acoustic Terminology

- dB** Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise, i.e. whether it is high-pitched, low-pitched, or with no distinct tonal character. These measurements are usually undertaken in octave or third octave frequency bands. If these values are summed logarithmically, a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.
- dB(A)** Instead, the dBA figure is used, as this is found to relate better to the loudness of the sound heard. The dBA figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or third octave band values, before summing them logarithmically. As a result the single dBA value provides a good representation of how loud a sound is.
- L_{Aeq}** Since almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The L_{Aeq, 07:00 – 23:00} for example, describes the equivalent continuous noise level over the 12 hour period between 7 am and 11 pm. During this time period the L_{pA} at any particular time is likely to have been either greater or lower than the L_{Aeq, 07:00 – 23:00}.
- L_{Amin}** The L_{Amin} is the quietest instantaneous noise level. This is usually the quietest 125 milliseconds measured during any given period of time.
- L_{Amax}** The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.
- L_n** Another method of describing, with a single value, a noise level which varies over a given time period is, instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceeded for say 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the L_{A10, 1 hr} = x dB.
- The L_{A10} index is often used in the description of road traffic noise, whilst the L_{A90}, the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise. L_{A1} and L_{Amax} are common descriptors of construction noise.
- R_w** The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.

Abbreviations

CADNA – Computer Aided Noise Abatement

DMRB – Design Manual for Roads and Bridges

HGV – Heavy Goods Vehicle

PPG – Planning Practice Guidance

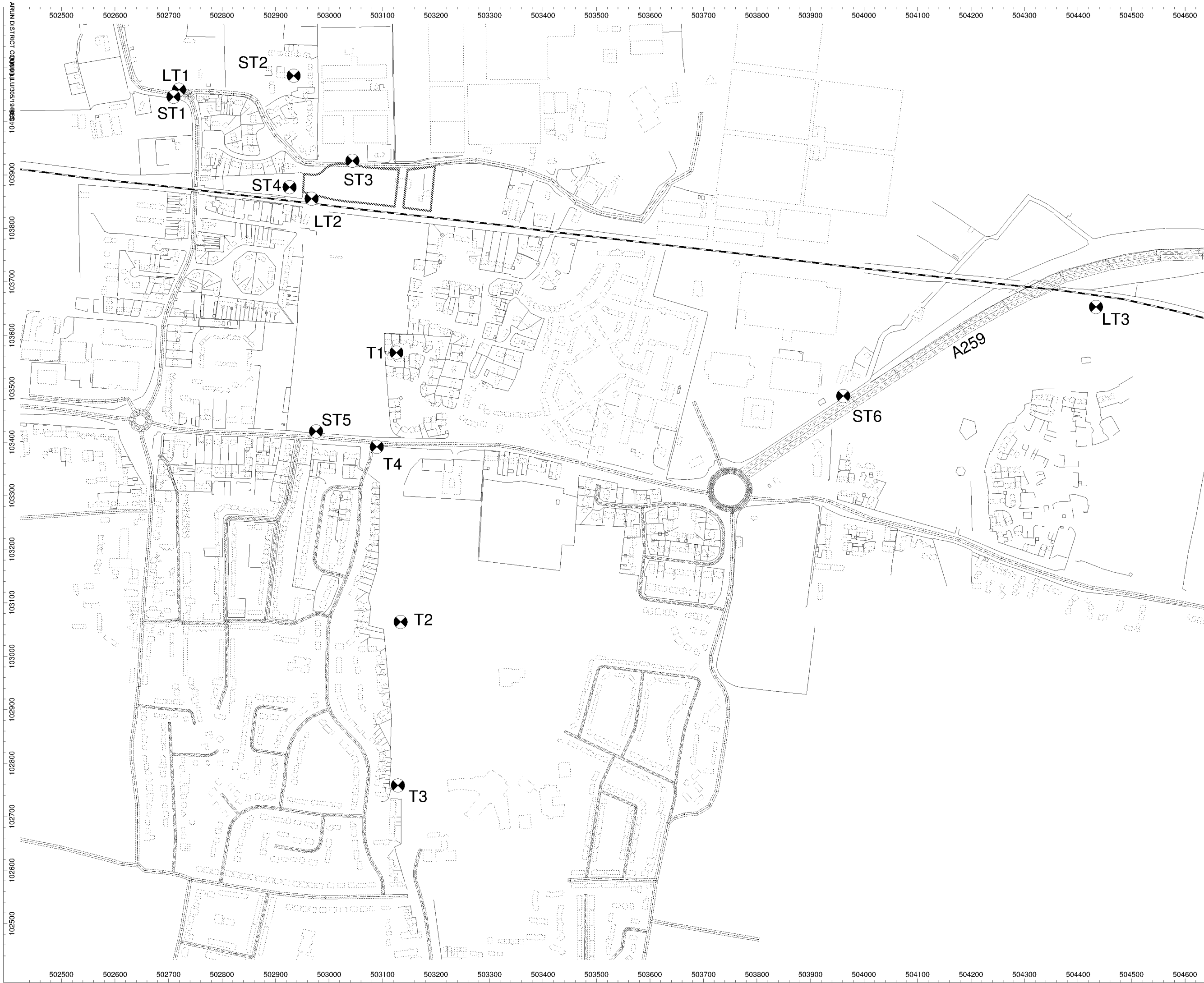
UDP – Unitary Development Plan

UKAS – United Kingdom Accreditation Service

WYGE – WYG Environment

Appendix B – Sketches

- SK01 Noise Monitoring Locations
- SK02 Site Layout and Receptor Locations
- SK03 Daytime $L_{Aeq,16hr}$
- SK04 Night-time $L_{Aeq,8hr}$
- SK05 Glazing and Ventilation Strategy



Client:
Persimmon Homes

Project:
Parcel A2 and B6
North Littlehampton

Project Number:
A100896-1

Drawing Title / Scenario:
Noise & Vibration
Monitoring Locations

Drawing Number:
SK01

Key:
Site Boundary: 

Scale : Not to scale

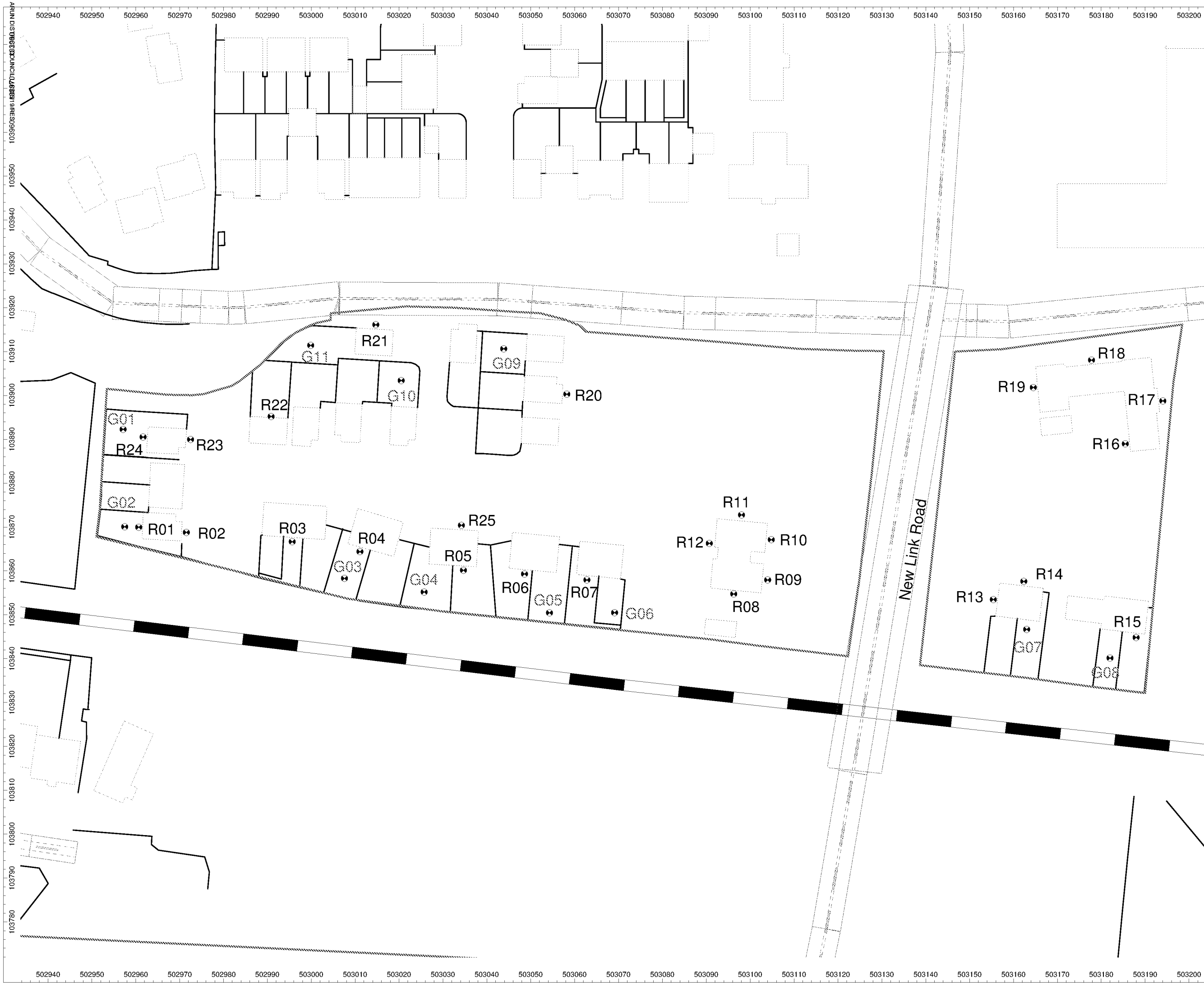
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Avalon Way
Anstley
Leicestershire
LE7 7GR
Tel 0116 234 8000

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Client:
Persimmon Homes

Project:
Parcel A2 and B6
North Littlehampton

Project Number:
A100896-1

Drawing Title / Scenario:
Site Layout and
Receptor Locations

Drawing Number:
SK02

Key:
Site Boundary: 

Scale : Not to scale

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Client:
Persimmon Homes

Project:
Parcel A2 and B6
North Littlehampton

Project Number:
A100896-1

Drawing Title / Scenario:
Daytime LAeq, 16hr
Noise Levels

Drawing Number:
SK03

Key:
Site Boundary: - - - - -

0.0 - 50.0 dB
50.0 - 60.0 dB
60.0 - 70.0 dB
> 70.0 dB

Scale : Not to scale

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Client:
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Project:
Parcel A2 and B6
North Littlehampton

Project Number:
A100896-1

Drawing Title / Scenario:
Night-time LAeq, 8hr
Noise Levels

Drawing Number:
SK04

Key:
Site Boundary: - - - - -

0.0 - 50.0 dB
50.0 - 60.0 dB
60.0 - 70.0 dB
> 70.0 dB

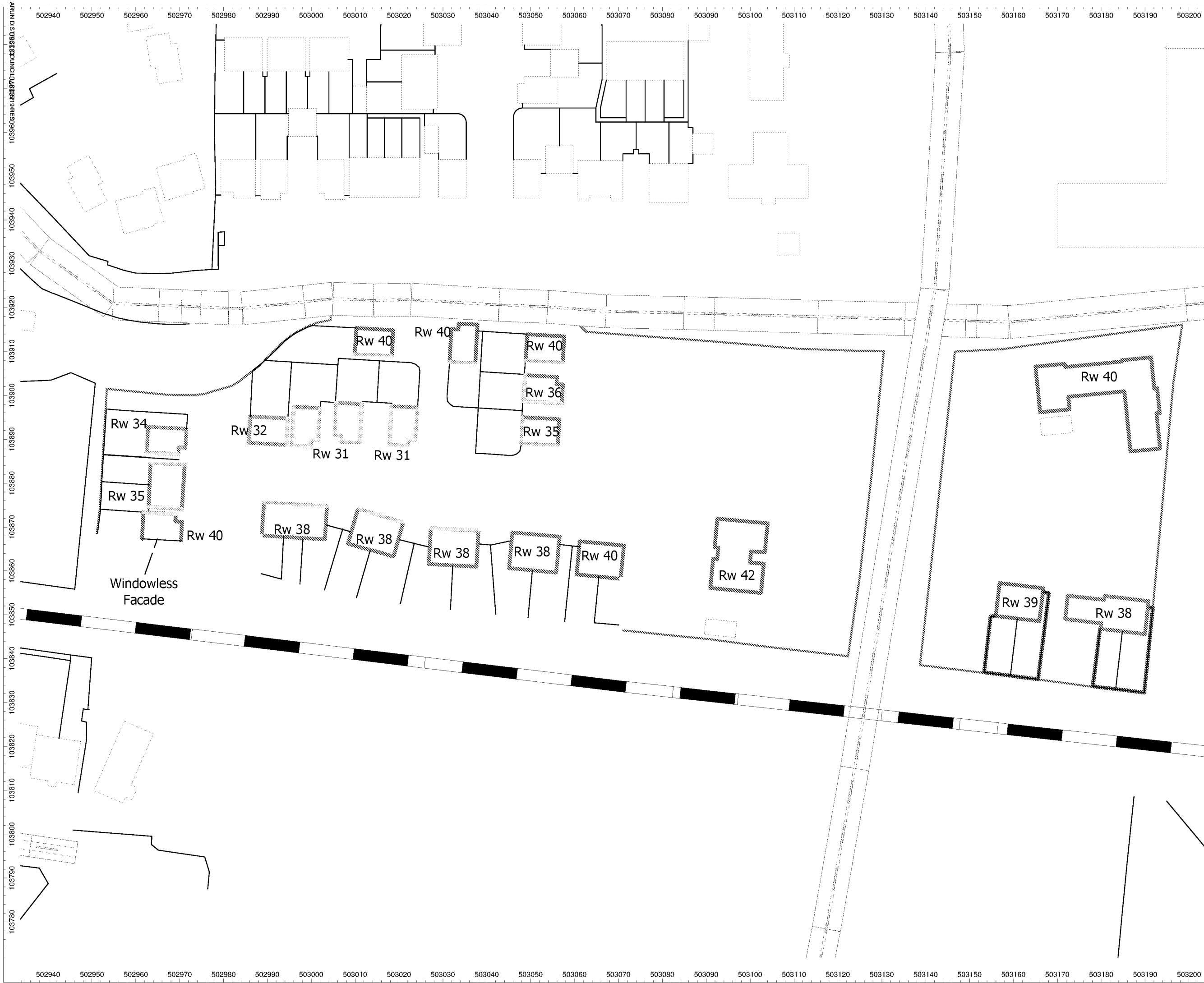
Scale : Not to scale

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Client:
Persimmon Homes

Project:
Parcel A2 and B6
North Littlehampton

Project Number:
A100896-1

Drawing Title / Scenario:
Mitigation Strategy

Drawing Number:
SK05

Key:

Site Boundary: - - - - -

Enhanced Glazing &
Passive Ventilation -
Titon Standard Vent + C25
Rw 31 - 34 dB: - - - - -

Enhanced Glazing &
Passive Ventilation -
Titon V75 + Standard Canopy
Rw 35 - 38 dB: - - - - -

Enhanced Glazing &
Wall Mounted Ventilation -
MA3051 Acoustic Wall Ventilator
Rw 39 - 42 dB: - - - - -

Standard Glazing &
Passive Ventilation -
Titon Standard Vent + C25
Rw 30: - - - - -

2.0m Fence: - - - - -

2.5m Fence: - - - - -

Windowless
Facade: - - - - -

Scale : Not to scale

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Appendix C – Noise Intrusion and Glazing/Ventilation Results

Table C1: Noise Intrusion Assessment Table

Receptor No.	Daytime External L_{eq}	Night-time External L_{eq}	Night-time External L_{max}	Glazing / Ventilation Specification ($R_w/D_{n,w}$) to Achieve BS 8233 L_{eq} and L_{max} 45 dB Target Levels	Alternative Ventilation Specification ($D_{n,w} + C_w$)
R01	53.2	57.5	84.2	40.0	40.0
R02	55.4	56.2	83.5	39.0	39.0
R03	54.3	55.4	82.9	38.0	38.0
R04	54.5	55.8	81.9	37.0	37.0
R05	55.9	56.8	82.9	38.0	38.0
R06	55.6	57.2	82.6	38.0	38.0
R07	56.6	57.9	83.0	38.0	38.0
R08	62.4	57.8	86.7	42.0	42.0
R09	63.3	58.2	84.8	40.0	40.0
R10	63.5	58.1	83.2	39.0	39.0
R11	61.0	53.6	78.2	34.0	34.0
R12	57.6	54.7	82.0	37.0	37.0
R13	58.9	55.9	83.5	39.0	39.0
R14	59.4	53.7	77.3	33.0	33.0
R15	55.5	59.8	82.7	38.0	38.0
R16	57.5	52.4	80.3	36.0	36.0
R17	64.1	59.7	80.6	36.0	36.0
R18	63.6	56.3	83.9	39.0	39.0
R19	62.3	52.6	82.4	38.0	38.0
R20	61.6	55.7	80.7	36.0	36.0
R21	65.1	57.5	84.7	40.0	40.0
R22	51.2	53.1	75.4	31.0	31.0
R23	56.3	51.8	77.4	33.0	33.0
R24	55.6	58.9	78.7	34.0	34.0
R25	55.3	47.4	74.4	30.0	30.0

Appendix D – Manufacturer's Data for Ventilation Suppliers

SF Xtra Sound Attenuator - Improved Sound Attenuation Performance

Fits on the window, passive.

Sizes: All combinations below offer 2500EA.

Ventilation Strategy:

System 1 (extract fans and background ventilators) or

System 3 (central mechanical extract with background ventilators).

This product can also be retrofitted to a property in place of standard background ventilators subject to space being available. Acoustic and ventilation performance will vary according to the size of the pre-existing slot in the window.

Sound Attenuation level:

	Open	Closed
V75 + C75	Dn,e,w (C,Ctr) = 44 (-2;-3)dB	Dn,e,w (C,Ctr) = 55 (-1;-5)dB
V75 + C50	Dn,e,w (C,Ctr) = 42 (-1;-2)dB	Dn,e,w (C,Ctr) = 55 (-2;-5)dB
V75 + standard canopy	Dn,e,w (C,Ctr) = 40 (-1;-2)dB	Dn,e,w (C,Ctr) = 53 (-1;-4)dB
V50 + C25	Dn,e,w (C,Ctr) = 39 (-1;-2)dB	Dn,e,w (C,Ctr) = 55 (-2;-5)dB
V50 + standard canopy	Dn,e,w (C,Ctr) = 38 (-1;-2)dB	Dn,e,w (C,Ctr) = 55 (-2;-5)dB
V25 + C25	Dn,e,w (C,Ctr) = 36 (-0;-2)dB	Dn,e,w (C,Ctr) = 55 (-1;-5)dB
V25 + standard canopy	Dn,e,w (C,Ctr) = 35 (-0;-1)dB	Dn,e,w (C,Ctr) = 54 (-1;-4)dB
Standard vent + C25	Dn,e,w (C,Ctr) = 35 (-0;-1)dB	Dn,e,w (C,Ctr) = 55 (-1;-5)dB
Standard vent + standard SF canopy	Dn,e,w (C,Ctr) = 32 (-1;-0)dB	Dn,e,w (C,Ctr) = 52 (-2;-4)dB
Standard vent + C25	Dn,e,w (C,Ctr) = 35 (-1;-2)dB	Dn,e,w (C,Ctr) = 54 (-2;-6)dB

AirCore & Airliner

Fits through the wall, passive.

Sizes: 9x3 or 9x6.

Ventilation Strategy:

System 1 (extract fans and background ventilators) or

System 3 (central mechanical extract with background ventilators).

Sound Attenuation level:

	EA	Open	Closed
9x3 acoustic AirLiner set with hit & miss ventilator	6300	Dn,e,w = 38dB	Dn,e,w = 39dB
9x6 acoustic AirLiner set with hit & miss ventilator	10500	Dn,e,w = 39dB	Dn,e,w = 40dB
9x3 cowled acoustic AirLiner set with hit & miss ventilator	6300	Dn,e,w = 39dB	Dn,e,w = 40dB
9x6 cowled acoustic AirLiner set with hit & miss ventilator	9800	Dn,e,w = 42dB	Dn,e,w = 42dB
Super acoustic controllable LookRyt® AirCore®	8500	Dn,e,w = 43dB	Dn,e,w = 50dB
Cowled super acoustic controllable LookRyt® AirCore®	8400	Dn,e,w = 45dB	Dn,e,w = 50dB
High rise super acoustic controllable LookRyt® AirCore®	7700	Dn,e,w = 44dB	Dn,e,w = 50dB

Sonair

Fits through the wall, mechanical supply with filter.

Ventilation Strategy:

System 1 (extract fans and background ventilators) or

System 3 (central mechanical extract with background ventilators).

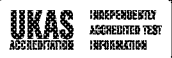
This product can also form part of a Sonair system, approved to comply with Part F of the building regulations.

Sound Attenuation level:

	Open
Sonair A+	Dn,e,w 52dB - (depending on filter)
Sonair F +	Dn,e,w 55/56dB - (depending on filter)

MA3051

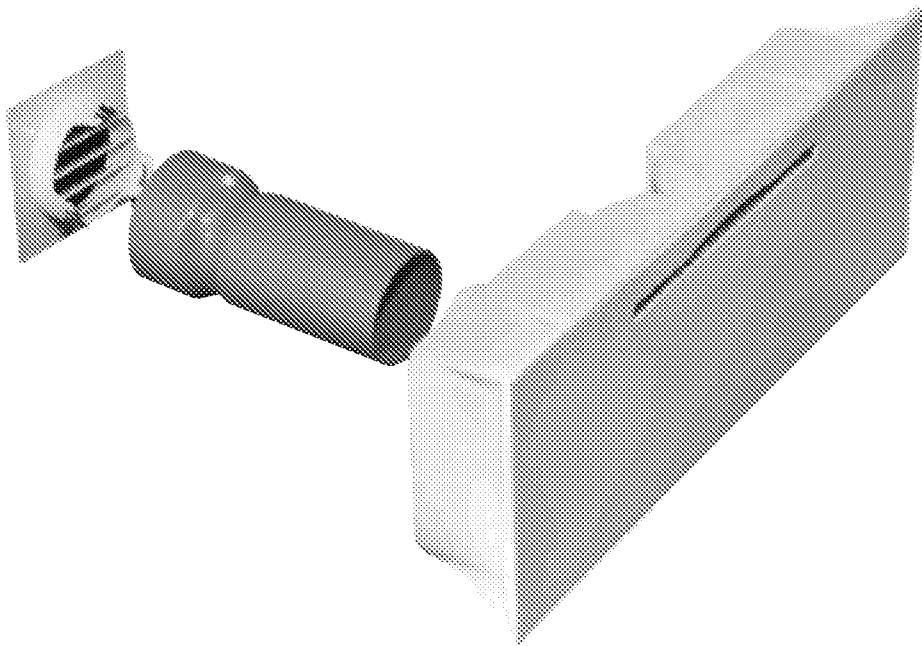
Acoustic wall ventilator



Physical specification

All measurements in millimetres

- Weight:** 2.65kg
- Materials:** PVC: Casing for wall vent, duct, external grille and internal ventilator. Acoustic lining and material inside wall vent



Features and benefits

Highest performing acoustic background ventilator.

Provides acoustic attenuation to $D_{n,e,w}$ 55dB(A).

2500mm² equivalent area performance.

Suitable for external wall thicknesses of 140mm and above.

Can be installed in internal wall constructions of between 100mm and 150mm.

Supplied with internal controllable vent and white/sand external grilles.

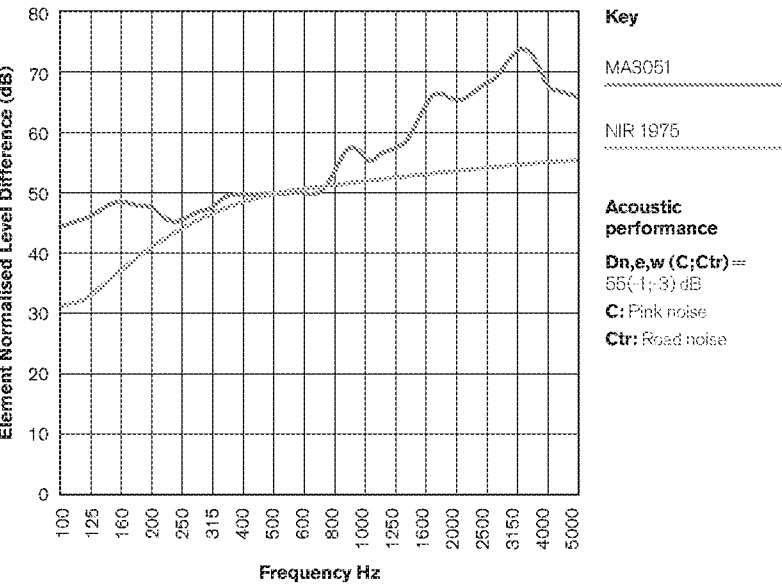
Conforms to acoustic requirements of Noise Insulation Regulations 1975, one of only a small number of products available in the UK.

Models and control options

Model	Operation
MA3051	Internal controllable trickle ventilator

Performance

Model	Acoustic performance $D_{n,e,w}$ (dB)	Equivalent area mm ²
MA3051	55	2500



Frequency	100	125	160	200	250	315	400	500
dB	45	48	47	44	46	49	49	49

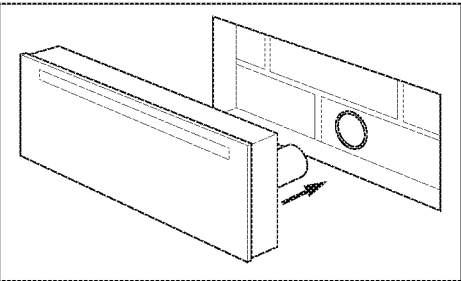
Frequency	630	800	1000	1250	1600	2000	2500	3150
dB	49	56	54	57	65	65	63	66

Installation

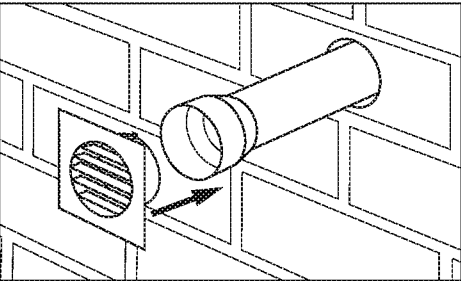
Instructions are provided with product including wall template for cut out.

Bonding compound is required to complete installation.

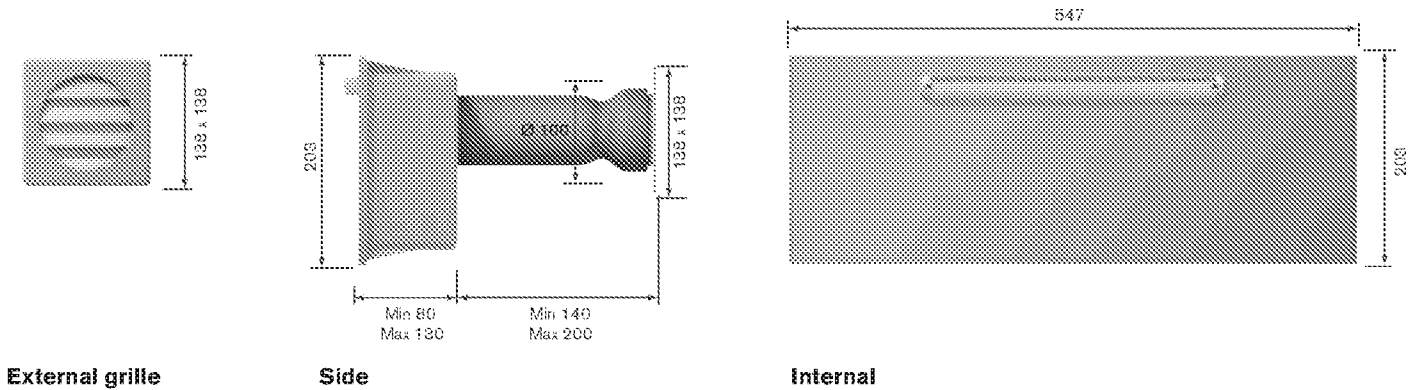
Protective strip to protect internal unit until decoration is complete within dwelling.



Push into cut out in wall



Push fit external grille



Appendix E – Report Conditions

This Report has been prepared using reasonable skill and care for the sole benefit of Persimmon Homes ("the Client") for the proposed uses stated in the report by WYG Environment Planning Transport Limited ("WYG"). WYG exclude all liability for any other uses and to any other party. The report must not be relied on or reproduced in whole or in part by any other party without the copyright holder's permission.

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The whole of the report must be read as other sections of the report may contain information which puts into context the findings in any executive summary.

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