Acoustic Associates Sussex Ltd

Transportation Noise Assessment (Residential Development)

Site: **Toddington Lane Littlehampton**
Client: **Wilmington Homes Ltd.**

Report by: George Orton BEng(Hons) MIOA

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1 Introduction

Acoustic Associates have been appointed to undertake an acoustic assessment of the proposed Toddington Lane, Littlehampton development (Phase 1 & Phase 2).

The purpose of this assessment is to assess transport noise levels and the associated internal/external noise levels for the proposed development.

It is understood that this document will form part of the planning application for the proposed development.

At the south of the site is the south coast railway therefore it will be necessary for rail noise to be measured and assessed. Noise levels from a proposed new road (which may or may not be built and which would pass 75m from the west boundary of the proposed development) have also been considered.

Rail noise has been measured on the empty site and noise propagation around the proposed development has been predicted using the computer program IMMI (Wolfel).

The rail noise levels for the day and the night time period have been assessed in terms of and following the guidelines of the documents listed below:

- Calculation of Rail Noise (CRN) 1995.
- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- BS8233 (Sound insulation and noise reduction for buildings) 1999
- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- Planning and Policy Guidance 24 (PPG 24 – now withdrawn see section 2.2)
- National Planning Policy Framework (NPPF) 2012

The rail noise survey and assessment shows that the worst case façade/s will fall into Noise Exposure Category “B” (This applies to Phase 1 and Phase 2)

The report concludes that planning permission should be granted, on noise grounds, so long as the noise mitigation measures detailed in this report are implemented. .

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2 Planning Policy, Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

The proposed development will be developed in two stages (all residential) on an area of land which previously has been used for commercial activities. Phase 1 (plots 1-48) is planned to be completed first. Phase 2 is smaller (Plots 49-61) and will be completed at a later stage.

At the south of the site is the south coast railway therefore it will be necessary for rail noise to be measured and assessed.

Noise levels from a proposed new road (which may or may not be built and which would pass 75m from the west boundary of the proposed development) have also been considered.

2.2 National Planning Policy Framework 2012

Previously planning policy guidance notes set out the Government's policies on different aspects of planning. Until recently, it was the case that Local Authorities must take their content into account in preparing their development plans. They may be material to decisions on individual planning applications and appeals. PPG24 (relating to noise) has recently been withdrawn following the introduction of the National Planning Policy Framework 2012 document (which is not meant to be a replacement for PPG24). This later document places the onus on Local Authorities to implement their own local noise criteria and assessment methodology.

It is understood that the Local Authorities are going to generate their own noise assessment guidelines and noise criteria (unless a nationwide PPG24 replacement is introduced first). At the time of completing this report a guidance document had not been published. Based upon discussions with the Local Authorities and the wording of the planning condition it is recommended in this case that appropriate criteria are provided by:

- BS8233 (Sound insulation and noise reduction for buildings) 1999
- World Health Organisation (WHO) - Guidelines for Community Noise 1999

Assessment methodology and calculations of noise propagation will follow the principles detailed within:

- Calculation of Rail Noise (CRN) 1995.
- ISO9613 (1996) Attenuation of sound during propagation outdoors
- Planning and Policy Guidance 24 (PPG 24 – now withdrawn as stated above)

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2.3 WHO Noise Criteria

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and are as follows:

Room Type	Target Maximum Internal Level - Leq dB (A)
Living rooms	35 (Daytime only)
Bedrooms	30 (Night)

The target maximum internal noise level for a bedroom during the night time corresponds to the threshold of sleep disturbance. WHO state that the noise level outside a bedroom window would be less than 45dB(A) this assumes that an open window provides 15dB attenuation.

With regard to outdoor amenity areas WHO states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

2.4 BS8233 Noise Criteria

Table 5 of BS8233 provides the following guideline values:

Criterion	Typical Situation	Design Range LAeq,T dB	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living Rooms	30	40
	Bedrooms	30	35

A footnote to this table states that “for a reasonable standard in bedrooms at night, individual noise events (measured with Fast time weighting) should not normally exceed 45dB LAmax”.

2.5 Rail Noise Measurement and Prediction Methodology

The noise levels for the day and night time periods have been predicted, using on site measurements, rather than measuring constantly for 24hrs or more. The predictions have been made using the following information:

- Current time table data which details the number of passenger trains that pass by the site (between Angmering and the Ford/Barnham junction).
- Train Sound Exposure levels were measured on site during the day time. These individual measurements were then grouped into train types based on train length.

The individual measurements have been averaged for each train type in order to create a “typical” sound exposure level for each train type.

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The above is in accordance with Calculation of Rail Noise 1995 which states the following in section 43 paragraph 2 and 3.

"In order to determine the LAeq,16h or LAeq,8h noise level it may be necessary to carry out SEL noise measurements of each train pass-by over the full time period of interest. Exceptions to this may occur when the train mix and speed of individual train types remain reasonably constant over the relevant time period. For this situation, it is acceptable to measure a representative sample of individual train pass bys of each train type running on each track and determine an arithmetic mean value for the SEL for each case."

In paragraph 3 CRN goes on to say that having established by measurement the mean values for the SELs of each train type operating on the railway, the day and the night time noise levels ($L_{Aeq,16hr}$ and $L_{Aeq,8h}$ should be calculated using a formula that is also stated in CRN. The SEL to $L_{Aeq,day/night}$ formula is detailed below and implemented in section 4.

For each train type: $\mathbf{L_{Aeq}}$ **= SEL – 10Log T + 10Log N**

- *N = no. of events in period (For each train type based upon timetable information*
- *T = no. of seconds in period (57600 seconds for the day and 28800 for the night)*

In order to sample all types of train that travel on the particular line the survey was deliberately conducted over a duration that covered a busy and a quiet period of train operation. Conducting the sampling in this way takes into account the fact that rail companies will try to match train type with demand.

It should be noted that a train SEL measured in the daytime is likely to be marginally higher than if an identical train SEL was measured at night time. This is due to the fact that in the daytime the background noise levels are generally higher than at night time and during the train SEL measurement background noise will be "captured" as well as the train noise.

The predicted day and night time noise levels at the survey position have been used to calibrate a noise model (section 5) which predicts noise levels around the whole of the proposed development

2.6 Non Passenger Train Activity

The effect of noise from night time freight train activity is sometimes difficult to assess due to irregularity of freight operations and the non-existence of any useful timetable information. However reference can be made to the Network Rail Business Plan 2009 for Brighton & Sussex which does not state that there would be freight traffic on the south coast line between Brighton and Portsmouth (There is likely to be some freight traffic on the Brighton to London mainline and between London and the channel tunnel)

In the past several freight train operators were contacted who confirmed that freight trains on this railway line would be very unlikely.

There may well be occasional leaf clearing or maintenance trains that operate during the day or night-time period. These trains will be seasonal/infrequent and it is very unlikely that there would be several in a week let alone more than one in any night time hour.

Because of infrequency of such events, it has not been possible to carry out measurements of the rail traffic noise associated with them

It should be borne in mind that such trains pass the site only on an occasional basis, as the need arises. Therefore, it would not normally be the case that Planning Decisions would hinge upon such irregular events.

3 Noise Survey Baseline Conditions

On the 15th January 2013 Rail Noise levels were monitored at one location on the empty site

3.1 Noise Survey Details

- Survey carried out by: George Orton BEng (Hons) MIOA
- Equipment used: Norsonic NOR140 - Type 1 Sound Level Meter
- Weather conditions: Dry, Wind speed average less than $3ms^{-1}$,

The meter was calibrated before commencing the noise measurements (@94dB). The calibration was re-checked at the end of the measurements to ensure that no calibration drift had occurred. After survey the calibration showed no significant drift (94dB)

All measurements were taken with the microphone 1.5m above ground level away from any reflecting surfaces. This means that all measurements are free-field measurements. All noise levels in this report will be free-field noise levels unless stated otherwise. The microphone position used during the noise survey is shown in the figure below:

Figure 1: Noise Survey Measurement Position (Plan)

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4 Railway Noise Level at Measurement Position

This section gives details of the noise survey measurements and details of how the day and night time period noise levels have been calculated.

4.1 Noise Survey Results

During the survey 24 measurements were taken (Sound Exposure Level (SEL)) of the train pass-by events. Ambient noise measurements were also taken. As the train noise measurements were at least 10dB greater than the ambient noise level, no correction has been applied. Taking the (arithmetic) averages of the SEL values for each train type (and direction) gave the following results:

Quantity		Operator	Train Notes	Average SEL - dB(A)	
East	West			East	West
7	8	Southern	4 Carriage Train	88	86
4	4	Southern	3 Carriage Train	90	87
1	-	Great Western	3 Carriage Train	82	80[1]

Table 1: Survey Noise Levels

4.2 Train Timetable

Train timetable information for trains operating between Angmering and the Ford/Barnham junction was viewed online (Southern Trains timetable was used which also includes Great Western train). Below is a summary of the timetable information (including trains which do not stop at Angmering station:

Train Type	Number of trains			
	East		West	
	Day	Night	Day	Night
Southern	37	6	37	5
Southern S/P[2]	33	5	36	3
Great Western	2	0	2	0
Total	**72**	**11**	**75**	**8**

Table 2: Train timetable info.

4.3 Converting Sound Exposure Levels (SEL) to L_{Aeq} Levels (measurement position)

In paragraph 3 CRN states that having established, by measurement, the mean values for the SELs of each train type operating on the railway, the day and the night time noise levels ($L_{Aeq,16hr}$ and $L_{Aeq,8h}$ can be calculated.

The day and the night time period noise level relating to each train type can be calculated using the following formula

Train Type $L_{Aeq,\ day/night}$ = SEL – 10Log T + 10Log N

- *N = no. of events in period (For each train type based upon timetable information*
- *Day = 07:00-:23:00hrs & Night = 23:00-07:00hrs*
- *T = no. of seconds in period (57600 seconds for the day and 28800 for the night)*

[1] Great Western westbound predicted as none were measured:
GW West = GW east train noise level minus east/west noise level difference

[2] The 3 carriage "Southern" trains travel to and from Southampton/Portsmouth (S/P)

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4.4 Train Type Day/Night Noise Levels

The table below shows the calculated results of the train type noise levels:

Train Type	$L_{Aeq,day/night}$ – dB(A)			
	East		West	
	Day	Night	Day	Night
Southern	56	51	54	48
Southern S/P	58	52	55	47
Great Western	38	0	35	0
Total	**60**	**55**	**58**	**51**

Table 3: Train Type Day/Night Noise levels

4.5 Total Noise Level at Measurement Position

The total noise levels detailed above can be added together to show the total day and night time noise level at the measurement position for all trains in both directions

Train Type	$L_{Aeq,day/night}$ – dB(A)	
	Day	Night
All Passenger Trains	**62.1**	**56.3**

Table 4: Total Noise Level Day/Night at measurement Position

5 Rail Noise Computer Model

5.1 Noise Model Methodology

In order to see how noise varies at different positions around the proposed development it is possible to produce a noise contour map.

A basic computer noise model has been completed using the computer package IMMI. The survey data and drawings of the proposed development have been used to complete the noise model.

The model displays the noise contours over the area of the site for both day and night time periods.

The noise model was calibrated first completing a noise contour model detailing the empty site and the measurement position. A rail track has been added as a line noise source (one for each direction). The noise source was adjusted until the reception point at the measurement position matched the measured noise levels detailed in the previous section (the difference factor between train directions was also built in to the model).

IMMI faithfully implements the propagation method of ISO-9613:1996; Acoustics – Attenuation of sound during propagation outdoors.

The figure in the appendix shows the proposed site layout and reception point:

Noise contours have been completed for the day time 1.5m above ground level and 4.5m above ground level. For the night time period a first floor (4.5m) plot has been produced. The day-time ground floor plot and the night-time 1st floor plot are shown on the following page (the day-time first floor plot can be found in the appendix):

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5.2 Noise Model Predicted Noise Levels

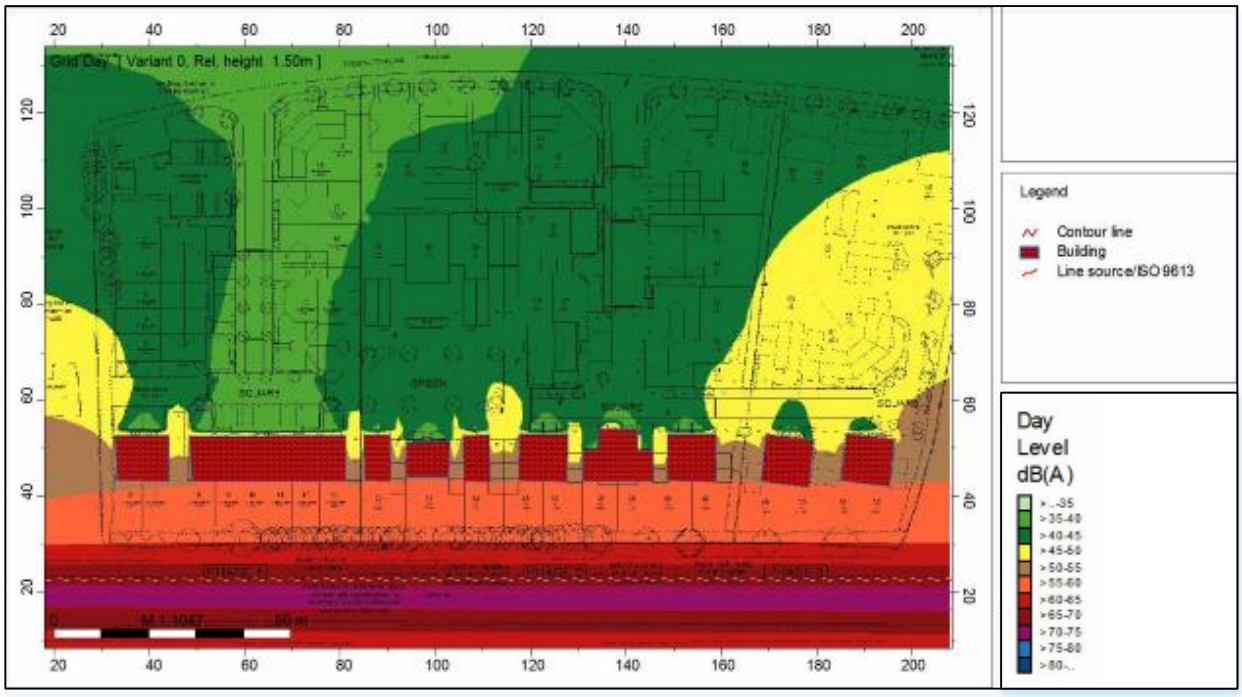

Figure 2: Day-time Noise Model 1.5m

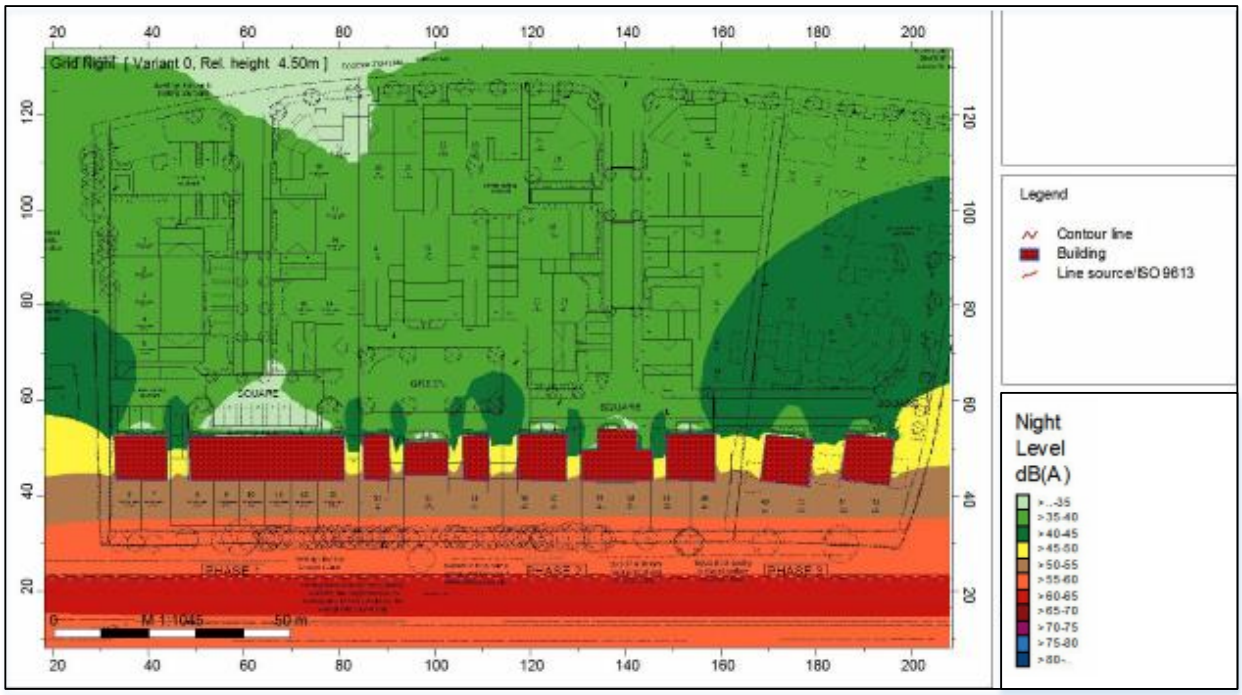

Figure 3: Night-time Noise Model 4.5m

6 Noise Exposure Category

Although PPG24 has been withdrawn it does not yet have a replacement. Until a replacement document is published it is understood that Local Authorities may still refer to the guidance laid out in PPG24.

With respect to "Noise Exposure Categories" (NECs) PPG 24 states that:

"When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NEC) 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:"

NEC	
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 a desirable level.***
B	***Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.***
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.***

Table 5: NEC Table

The following table taken from PPG24 shows the rail noise level ranges for the different NEC's:

Noise Levels Corresponding To The Noise Exposure Categories LAeq,T dB				
	Noise Exposure Category			
Rail Noise	**A**	**B**	**C**	**D**
07.00 - 23.00	<55	55 - 66	66 - 74	>74
23.00 - 07.00	<45	45 - 59	59 - 66	>66

Table 6: NEC Levels - Road Noise

The predicted noise levels and the above table have been used to determine that the (worst case) NEC, is NEC "B" for day time and night time periods. This applies to all houses[3], at the southern end of the development, which flank the railway line.

Based on the models (reading colour chart to ascertain noise level) in the previous section the worst case daytime noise level (Free field level outside most exposed façade) = 55dB(A) and worst case night-time noise level = 51dB(A)

All other plots will fall into NEC "A" for day time and night time periods

[3] Plots (inclusive): 6 to13, 32 to 40 & 49 to 52

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7 Noise Mitigation Measures

7.1 Noise Criteria

The more onerous BS8233 noise criteria (copied below) will be used to specify the noise mitigation measures relating to habitable areas. A footnote also states that "for a reasonable standard in bedrooms at night, individual noise events (measured with Fast time weighting) should not normally exceed 45dB LAmax".

Criterion	Typical Situation	Design Range LAeq,T dB	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living Rooms	30	40
	Bedrooms	30	35

7.2 Sound Insulation of Building Envelope

With respect to outside-to-inside attenuation of various transportation noise sources PPG24 (Annex 6, Para. 4) states the following:

"Because the sound insulation of a window (and other components of the building envelope) varies with the frequency (or pitch) of the sound, the overall noise reduction provided by a window will depend, among other factors, on the spectrum of the external noise. Table 1(copied below) shows typical reductions in noise levels from common sources which would be expected from various types of window installations fitted in brick/block walls in a dwelling. The insulation provided by any type of window when partially open will be in the region of 10-15 dB (A)"

Noise Source	Single Glazing	Thermal Double Glazing	Secondary Glazing
Road Traffic	28	33	34
Civil Aircraft	27	32	35
Military Aircraft	29	35	39
Diesel Train	28	32	35
Electric Train	30	36	41

It is understood that the proposed development is to be constructed using traditional masonry or timber frame construction. This type of wall construction should have a minimum R_w of 50dB(A). Normal thermal glazing (4mm/12mm/4mm) will provide R_w31dB and glazing that implements different thickness of glass such as 10mm/12mm/4mm will provide R_w35dB: source Pilkington Glass.

7.3 Maximum Noise Levels

Maximum noise levels were also measured at the survey position. The noise model predicts that the free-field noise level at the façade of the most exposed plots will be 5dB lower than at the survey position. The façade level is likely to be 3dB higher than the free-field level due to façade reflections. The survey data shows that the free field L_{Amax} levels resulting from train pass bys range from 75-86dB(A). Therefore façade L_{Amax} levels (at worst plots) will range from 73-84dB(A). For the survey period (just over 3hrs) 13 train pass by events would be higher than (façade noise level) L_{Amax} 81dB(A) Which equates to roughly every second train pass by triggering an L_{Amax} 81dB(A), or higher, façade level. (Based on table above façade/normal glazing will attenuate electric trains by 36dB. External L_{Amax} levels exceeding 81dB(A) façade level will give rise to internal levels higher than the 45dB BS83233 advisory level for the night time)

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7.4 Noise Mitigation for Maximum Noise Level

To reduce the maximum noise levels in the worst affected bedrooms it is recommended that the specified glazing should achieve a minimum of Rw=34 (10mm/12mm/4mm glazing would be suitable). Based on the table above, which takes into account the composite effect of both wall and glazing, a façade with Rw=31 glazing should attenuate electric trains by 36dB and therefore a façade with Rw=34 glazing should attenuate electric trains by 39dB. This level of attenuation will reduce the maximum noise levels in the bedrooms to 45dB(A) or less for all pass by events.

7.5 Glazing Specification

The noise model data and the fact that façade noise levels will be 3dB higher than the model predicted free-field levels demonstrates the following:

The worst case facade noise level (not including bedrooms see 7.4 above) outside the ground floor façade will be approximately 58dB(A) without the noise fence and at least 5dB lower with a 2m noise fence (see section 7.7)

With the exception of bedrooms in the worst affected railway facades all other areas should have glazing specified as a minimum of Rw=31dB so that levels in bedrooms and lounges will be below 30dB(A) for day time and night time periods. 58dB(A) external façade level and 36 dB wall/glazing attenuation level means the worst case internal noise level would be 22dB(A) (this level will actually be lower if the noise fence is built)

7.6 Ventilation

With respect to Noise Exposure Category “B” PPG24 states the following (Annex 2, Para 10):

“Because noise should be taken into account when determining planning applications in NEC B, it has been assumed that the minimum amelioration measure available to an occupant at night will be to close bedroom windows.”

If the Local Authority follow the guidelines above no acoustically treated mechanical ventilation system would be required.

However it is recommended that acoustic trickle ventilators, which are rated at least DnEw=34dB, are fitted to worst affected windows (railway façade of plots 5 to13, 36 to 45 & 62 to 63) (An alternative to this would be to use an attenuated ventilator fitted through the external wall DnEw should also be at least 34dB). Therefore background ventilation would be provided without allowing the ingress of excessive rail noise levels. An open window would allow for purge ventilation. For all other plots the noise criteria would be achieved even with an open window.

7.7 Noise fence

As mentioned in section 2 WHO states the following with regard to outdoor amenity areas:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

Without a noise fence the noise model predicts the rail level in the worst affected gardens will be 60dB(A) for the day time period. Timetable information and the CRN calculation have been used to calculate that a busy hour will be at a similar level. If a 2m noise fence is built in the location shown in the figure below the noise levels in the gardens will be at least 5dB lower (the figure also shows how the fence will be built in two sections for each phase of the development).

It is also worth noting that following research (detailed in PPG24) it was found that most people perceive railway noise to be less onerous than road noise at the same level. This is the reason that the PPG 24 NEC have different noise level ranges.

Figure 4: Noise Fence Figure

The fence should be constructed from 20mm treated timber. Cover strips should also be used to prevent noise escaping between gaps in the timber.

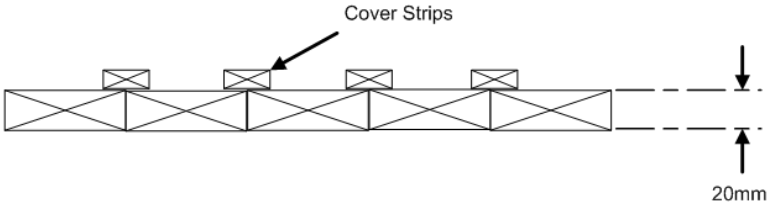

Figure 5: Noise Fence Construction

7.8 Noise Mitigation Measures Summary

The table below show the glazing and ventilation specifications for the development:

Plot/s	Facade	Mitigation Measures	Room	
			Bedroom	Lounge
5 to13	**Railway**	**Glazing with a minimum Rw:**	**34 dB**	**31 dB**
36 to 45	**Railway**	**Glazing with a minimum Rw:**	**34 dB**	**31 dB**
62&63	**Railway**	**Glazing with a minimum Rw:**	**34 dB**	**31 dB**
5 to13	**Front**	**Glazing with a minimum Rw:**	**31 dB**	**31 dB**
36 to 45	**Front**	**Glazing with a minimum Rw:**	**31 dB**	**31 dB**
62&63	**Front**	**Glazing with a minimum Rw:**	**31 dB**	**31 dB**
All other plots	**All**	**Glazing with a minimum Rw:**	**31 dB**	**31 dB**
5 to13	**Railway**	**Trickle vent minimum DnEw:**	**34 dB**	**31 dB**
36 to 45	**Railway**	**Trickle vent minimum DnEw:**	**34 dB**	**31 dB**
62&63	**Railway**	**Trickle vent minimum DnEw:**	**34 dB**	**31 dB**
5 to13	**Front**	**Trickle vent minimum DnEw:**	**31 dB**	**31 dB**
36 to 45	**Front**	**Trickle vent minimum DnEw:**	**31 dB**	**31 dB**
62&63	**Front**	**Trickle vent minimum DnEw:**	**31 dB**	**31 dB**
All other plots	**All**	**Trickle vent minimum DnEw:**	**31 dB**	**31 dB**

Table 7: Glazing/Ventilation Summary

A 2m noise fence should be built on the southern boundary of the site.

8 Proposed Fitzalan Link Road

A planning application has been submitted relating to a new link road and it is understood that the application has gained “outline consent” and will be subject to planning conditions relating to noise if it is eventually built. The new road is to replace the existing north/south Lyminster Road which crosses the railway line at a barrier type railway crossing. The new road also travels north to south and will be approximately 75m from the west boundary of the proposed development. The road will pass over the railway line on a new road bridge. As part of the planning application (ARUN DISTRICT COUNCIL LU/63/11/) a noise report was completed by Greencore Group. The report predicted that the day time noise level ($L_{Aeq,16hr}$) would be approximately 55dB(A) at a location that would approximate to a location on the west boundary of the proposed development

At 55dB(A) the road noise levels would be in NEC “B” and the mitigation measures detailed in section 7 would mean that internal noise levels would achieve the WHO noise criteria and BS8233 “Good” noise criteria.

9 Conclusion

If the noise mitigation measures detailed in section 7 are implemented the internal noise levels (relating to Road and Rail) would achieve the WHO noise criteria and BS8233 “Good” noise criteria. The southern boundary 2m high noise fence will mean that noise levels in outdoor amenity areas will be kept below a satisfactory level.

It is considered that, if all of the noise mitigation measures detailed in section 7 are implemented, there is no reason on noise grounds for planning consent to be withheld.

10 Appendix

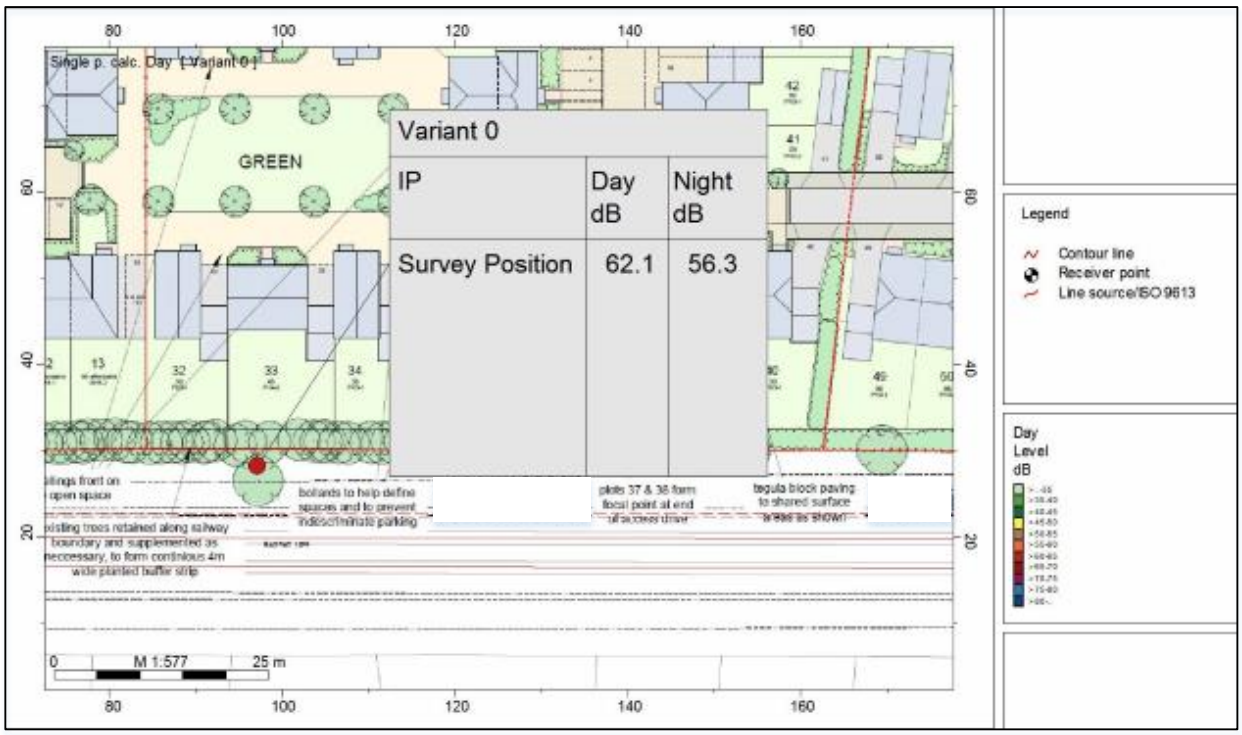

Figure 6: Survey Position Noise Model

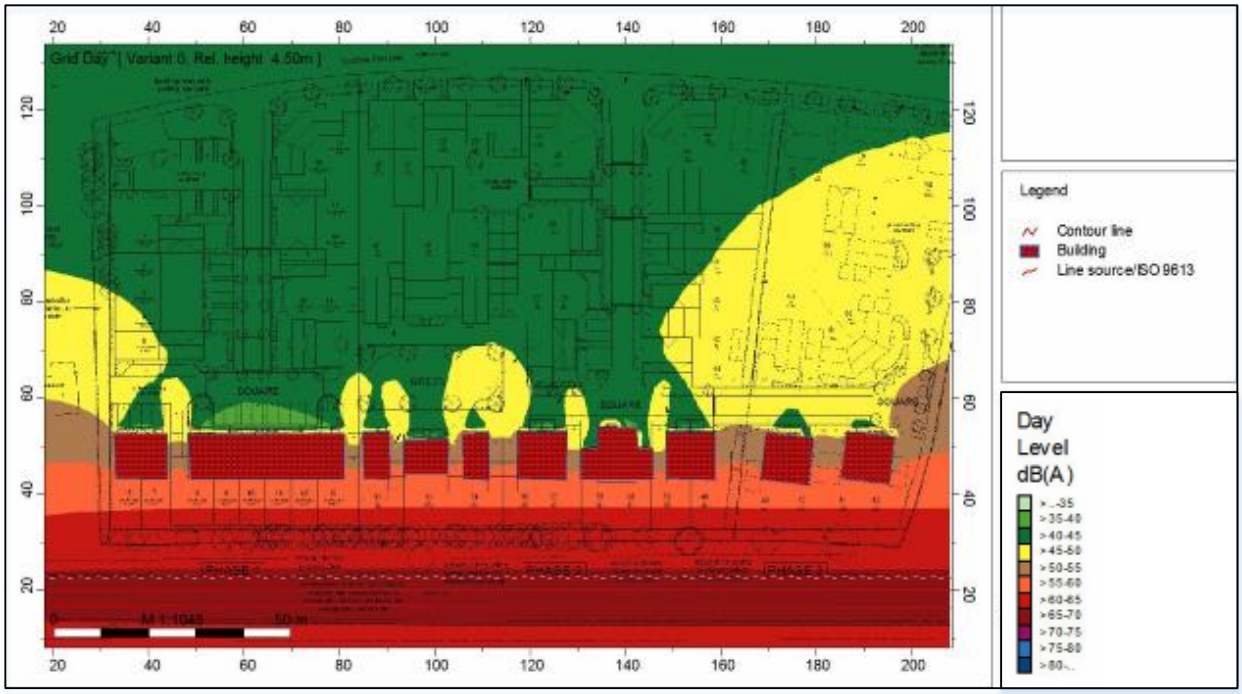

Figure 7: First Floor Day Time Model