NOISE ASSESSMENT

on behalf of

BARDEN MILL COMPANY LTD

for the site at

BARDEN MILL, BARDEN LANE, BURNLEY, BB12 0DX

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Summary

A noise assessment was undertaken to predict the potential impact of existing sources on a proposed development consisting of 35 residential dwellings at Barden Mill, Barden Lane, Burnley, BB12 0DX. This was requested by the Local Authority to support a planning application for the development. The significant noise sources in the vicinity of the development were Barden Lane and the Blackpool to Colne railway line.

Measurements were made at the location of the nearest proposed residential dwellings to the main noise sources in order to identify the existing ambient noise levels. This data was subsequently used to populate a computer noise model of the development which was utilised to predict the potential impact of noise on the proposed dwellings.

Recommendations have been made for mitigation measures in the form of acoustic double glazing and acoustically attenuated ventilators to provide commensurate levels of protection to future residents of the development from road and railway noise.

With the implementation of these measures, we can see no reason why planning permission for the development need be refused on the basis of noise.

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Signed		Signed	L Goodall
Date	10th June 2013	Date	10th June 2013

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1 Introduction

1.1 Miller Goodall Environmental Services Ltd (MGES) has, on behalf of Barden Mill Company Ltd of Barden Mill, Barden Lane, Burnley, BB12 0DX, undertaken a noise assessment in respect of the impact of noise from a nearby road and railway on a proposed residential development on the site of a former mill.

2 Site Description

2.1 The proposed development site is located on land to the north of Barden Lane, north east of Burnley town centre. The site is currently occupied by a single storey former mill and is bounded by the Leeds to Liverpool canal to the west and the Blackpool to Colne railway line to the east. The railway line is on an embankment approximately 6 m above the datum height of the site. The M65 motorway is located approximately 600 m to the west.

2.2 A second former mill is located to the immediate south of the site which is used for a variety of commercial – rather than industrial – uses, e.g. dance studio and wholesalers. Reedley Marina is located to the north with a car park and café accessed via the existing access road at the site's eastern boundary. Woodland and playing fields lie beyond the marina. The surrounding area is predominantly mixed residential and light industrial in nature.

3 Proposed Development

3.1 The proposal is to demolish the existing mill building and erect 35 new dwellings with the breakdown as follows:

- 4 storey apartment block with 14 no. 2 bed apartments
- 5 no. 2 and 3 storey blocks to provide a total of 21 no. 3 and 4 bed houses
- Associated parking spaces and external amenity areas.

3.2 The current master plan for the site is shown in Appendix 2.

3.3 This assessment seeks to address the potential impact of noise from Barden Lane and the railway on the proposed new dwellings.

4 Local Authority Requirements

4.1 Discussions were held with Steve Sylvester, an Environmental Health Officer at Burnley Borough Council (BCB), who agreed that the measurement and assessment methodology proposed by MGES was reasonable although no noise criteria were specified. Mr Sylvester advised that the railway was the

most significant source of concern in addition to any known industrial noise sources in the vicinity of the proposed development.

5 Policy Context

5.1 National Planning Policy and Guidance

5.1.1 The Noise Policy Statement for England (NPSE[1]), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are:

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

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

5.1.2 The National Planning Policy Framework (NPPF[2]) was published in March 2012. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise"[3].

5.1.3 Paragraph 109 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) "preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability".

5.1.4 The NPPF goes on to state in Paragraph 123 "planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including thorough use of conditions;
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land use since they were established, and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value".

5.1.5 The NPPF document does not refer to any other documents regarding noise other than NPSE.

[1] Noise Policy Statement for England, Defra, March 2010
[2] National Planning Policy Framework, DCLG, March 2012
[3] Planning Policy Guidance 24: Planning and Noise, DCLG, September 1994

5.2 Local Planning Policy

5.2.1 BCB's Planning and Environment Services provided a planning application information and validation document[4] which advises that noise sensitive developments such as new residential schemes should be supported by a noise impact assessment and should include any necessary mitigation measures, e.g. sound insulation.

5.2.2 The policy driver for this is Policy GP75 which states that when appropriate, all new development shall be examined to assess the potential for noise, light, air, water, groundwater and soil pollution. Development will be permitted when:

- it complies with the advice of the pollution control authorities;
- the location of the site in relation to other land uses, public transport, pedestrian and cycle links, would not lead to increased vehicle pollution;
- the risk and impact of any potential pollution on surrounding land uses, including to health, safety, amenity, and natural environment is minimised;
- there is no detrimental effect on the quality and sensitivity of the local environment, particularly Conservation Areas, Major Open Areas, Rural Areas, and sites with wildlife value;
- it would not have a detrimental effect on sensitive land uses such as housing and schools to any potential source of pollution; and
- it includes adequate provision for future restoration of the land for suitable after uses, when appropriate.

5.2.3 Development that would result in pollution that would lead to harm to the environment will not be permitted.

6 Acoustic Standards and Guidance

6.1 BS 8233:1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice

6.1.1 BS 8233:1999[6] gives recommended design criteria for internal noise levels for different types of rooms within residential dwellings. These design criteria are based on guidance contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999)[7]. The criteria for bedrooms and living rooms, which have been set to avoid sleep disturbance and ensure suitable living/resting conditions are shown in Table 1, below.

[4] Burnley Borough Council Planning and Environment Services Planning Application Information Requirements and Validation Checklists - Local Guidance, December 2010
[5] Burnley Local Plan Policy GP7 – New development and the control of pollution
[6] BS 8233:1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice
[7] World Health Organisation Guidelines for Community Noise, 1999

Table 1: BS 8233: 1999 recommended sound levels in habitable rooms

Room	Criteria	Reasonable ($L_{Aeq,T}$)	Good ($L_{Aeq,T}$)
Bedrooms	Sleeping	35	30
Living Rooms	Resting	40	30

6.1.2 In addition to the above, this document recommends that maximum noise levels (L_{Amax}) of individual noise events should not normally exceed 45 dB in bedrooms at night. BS 8233:1999 does not provide guidance on how this may be interpreted, however a criteria of between 10-15 times per night-time period has commonly been adopted, as referenced in the WHO guidelines.

6.2 World Health Organisation (WHO) Guidelines for Community Noise 1999

6.2.1 The WHO Guidelines 1999 recommends indoor night-time noise levels that are broadly in line with the 'good' levels described in BS 8233. There is an additional recommendation that external amenity areas should not be subjected to daytime averaged noise levels greater than L_{Aeq} 55 dB, and preferably below L_{Aeq} 50 dB.

7 Noise Survey

7.1 Description of Existing Noise Sources

7.1.1 The noise climate in the vicinity of the development is dominated by road traffic noise from Barden Lane to the south and the railway to the east. However, the contribution of noise from the railway is limited by the relatively small number of trains using the line.

7.1.2 The Northern Line service from Blackpool terminates at Colne and provides an hourly service in each direction, i.e. 2 train pass-bys per hour. The current timetable indicates the service runs hourly from 05:40 to around 23:00 Mondays to Saturdays and 2 hourly from around 09:15 to 23:15 on Sundays. This equates to a maximum of 7 trains overnight (between 23:00 and 07:00) on Friday night, 6 trains Monday to Thursday nights, 5 on Saturday and 1 on Sunday.

7.1.3 The only trains observed on the line during the survey were dual-carriage diesel multiple units (DMUs). Enquiries made with the station master at Burnley Central station indicated that no freight trains operated on this line.

7.1.4 A pressure group entitled Skipton-East Lancashire Rail Action Partnership (SELRAP[8]) has been lobbying to reinstate the East Lancashire Line between Colne and Skipton which would have the potential to increase the number of trains passing the proposed site. However, the projected cost of the construction work required to reinstate the line varies from £43 million (for a single-track line) to

[8] http://en.wikipedia.org/wiki/Skipton-East_Lancashire_Rail_Action_Partnership

£81 million (for a double-track line) and Network Rail has stated that it will not provide the necessary funds for the work. Although SELRAP are hoping to raise the funds by other means, the likelihood of this coming to fruition in the near future appears remote.

7.1.5 No significant noise sources were evident from the mill buildings opposite the development site on Barden Lane with only a small number of vehicles accessing the site after approximately 08:30, including cars and light goods vehicles (vans).

7.1.6 There is a small electrical substation located on the corner of Barden Lane and the site access road although this did not generate high levels of noise and was inaudible at measurement location P1.

7.2 Measurements of the Current Noise Climate

7.2.1 Noise measurements were undertaken at a location consistent with the proposed development in accordance with BS 7445-1: 2003[9] by Simon Faircloth of Miller Goodall Environmental Services Ltd. The calibration of the sound level meter was checked before and after measurements with negligible deviation (<0.1 dB). Details of the equipment used are shown in Table 2, below.

Table 2: Noise monitoring equipment

Equipment Description	Type Number	Manufacturer	Serial No.	Date Calibrated	Calibration Certification Number
Class 1 Integrating Real Time 1/3 Octave Sound Analyzer	Type 2260	Brüel & Kjær	2467009	15/09/11	C1107367
Microphone	Type 4189	Brüel & Kjær	2508884	15/09/11	C1107367
Calibrator	Type 4231	Brüel & Kjær	2478249	04/09/12	01010/1

7.2.2 Specific, background and ambient noise monitoring was undertaken at the times specified in Table 3, below.

Table 3: Dates, times and weather conditions during noise measurements

Measurement Locations	Date	Time	Weather conditions
P1 and P2	22/05/13	05:31 – 09:02	Overcast, dry, 10°C and a light westerly breeze with a speed of approximately 1 – 2 m/s.

7.2.3 Measurements were taken at times considered to be representative of the periods during which the proposed residential accommodation would be subject to the highest levels of ambient noise. Measurements were made under free-field conditions at a height of 1.2 m above the ground.

[9] BS 7445-1: 2003 Description and measurement of environmental noise - Part 1: Guide to quantities and procedures

7.2.4 The measurement locations and approximate redline boundary are detailed below and indicated on Figure 1; a photo from location P2 is provided in Figure 2.

- P1 approximately 15 m from the near roadside edge of Barden Lane.
- P2 approximately 13 m from the eastern boundary below the railway embankment and approximately 25 m laterally from the railway. This location was chosen to measure noise from train pass-bys in isolation.

Figure 1: Measurement locations

Figure 2: Measurement location P2 (during train pass-by)

7.3 Monitoring Results

7.3.1 A summary of the measurement data is provided in Table 4 below with full data in Appendix 2. All data are sound pressure levels in dB re 20 µPa.

Table 4: Summary of noise measurements

Measurement Location	Start Time	Elapsed Time (hr:min:sec)	$L_{Aeq,T}$ (dB)	Overall L_{ASmax} (dB)	Overall L_{AFmax} (dB)	95th% $L_{AFmax,10sec}$ (dB)	$L_{AF10,T}$ (dB)	$L_{AF90,T}$ (dB)
P1	05:31	0:15:00	52.9	69.7	72.0	68.0	52.3	41.1
P1	05:50	0:15:00	59.1	83.9	86.1	68.5	53.9	39.7
P1, inc. train	06:05	0:15:00	56.8	77.4	79.2	69.1	57.6	40.9
P1	06:20	0:15:00	55.5	68.0	70.0	68.3	59.4	40.9
P1	06:38	0:15:00	57.7	69.4	71.1	70.0	61.2	46.8
P2, inc. train	06:55	0:15:00	55.0	77.7	80.0	62.2	49.6	44.7
P2, inc. train	07:10	0:15:00	54.9	76.6	78.2	65.0	51.8	45.7
P1	07:31	0:24:51	62.1	73.2	75.3	70.9	66.5	49.0
P1, train only	07:58	0:00:11	67.0	71.7	73.1	73.1	72.0	51.9
P1, inc. train	08:00	0:30:00	62.8	78.4	80.1	71.5	66.1	51.8
P1, inc. train	08:32	0:30:00	63.1	75.6	80.6	74.3	66.5	51.7

7.3.2 Each measurement period consisted of sequential 10 second samples which therefore allowed the variation in noise level over time to be assessed. This data was used to determine a 'typical' L_{AFmax} noise level and octave band spectrum based on the 95th percentile of individual 10 second measurements. This data was subsequently utilised within the noise model.

7.3.3 The 10 second noise levels have not been presented in this report but are kept on file for future reference.

7.3.4 A time history of the 10 second L_{AFmax} samples measured at P1 and P2 is provided in Figures 3 and 4, respectively.

Figure 3: $L_{AFmax,10sec}$ time history for location P1 (night-time)

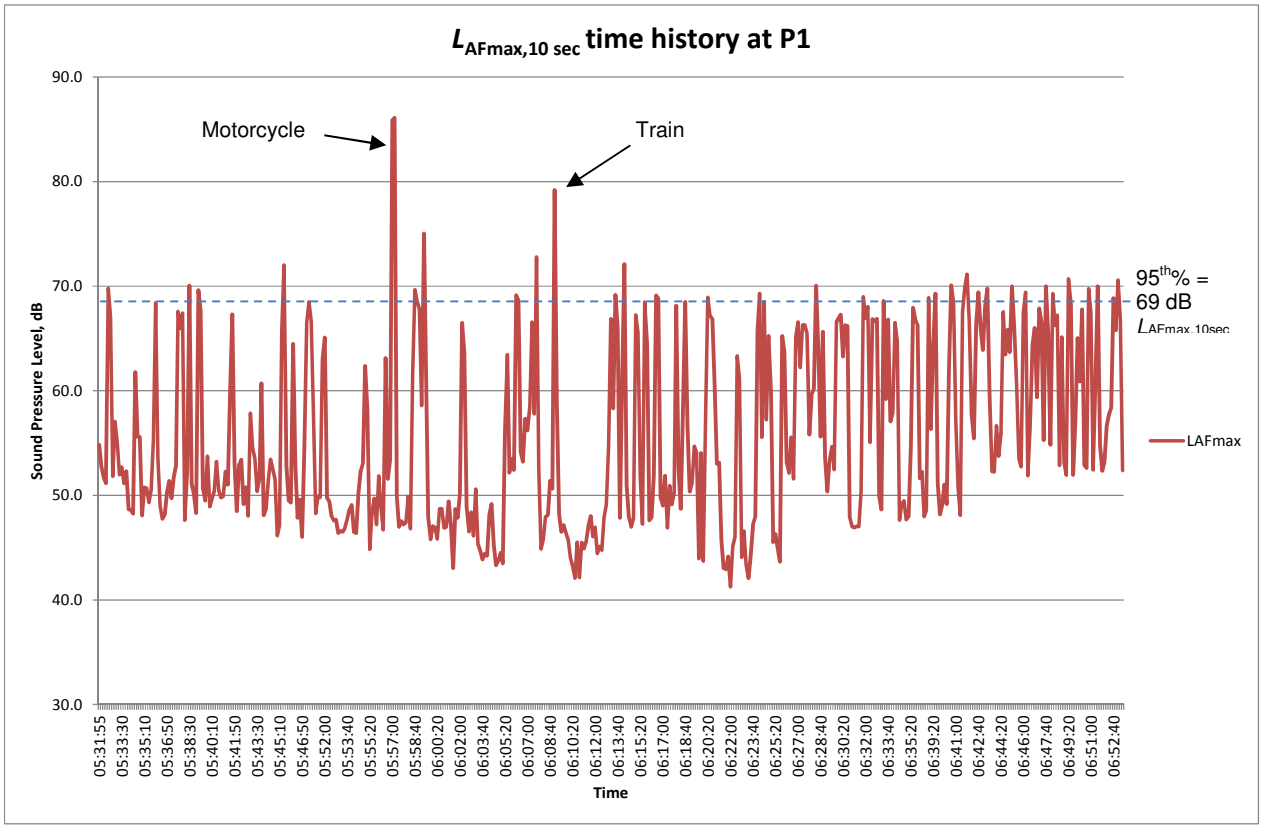
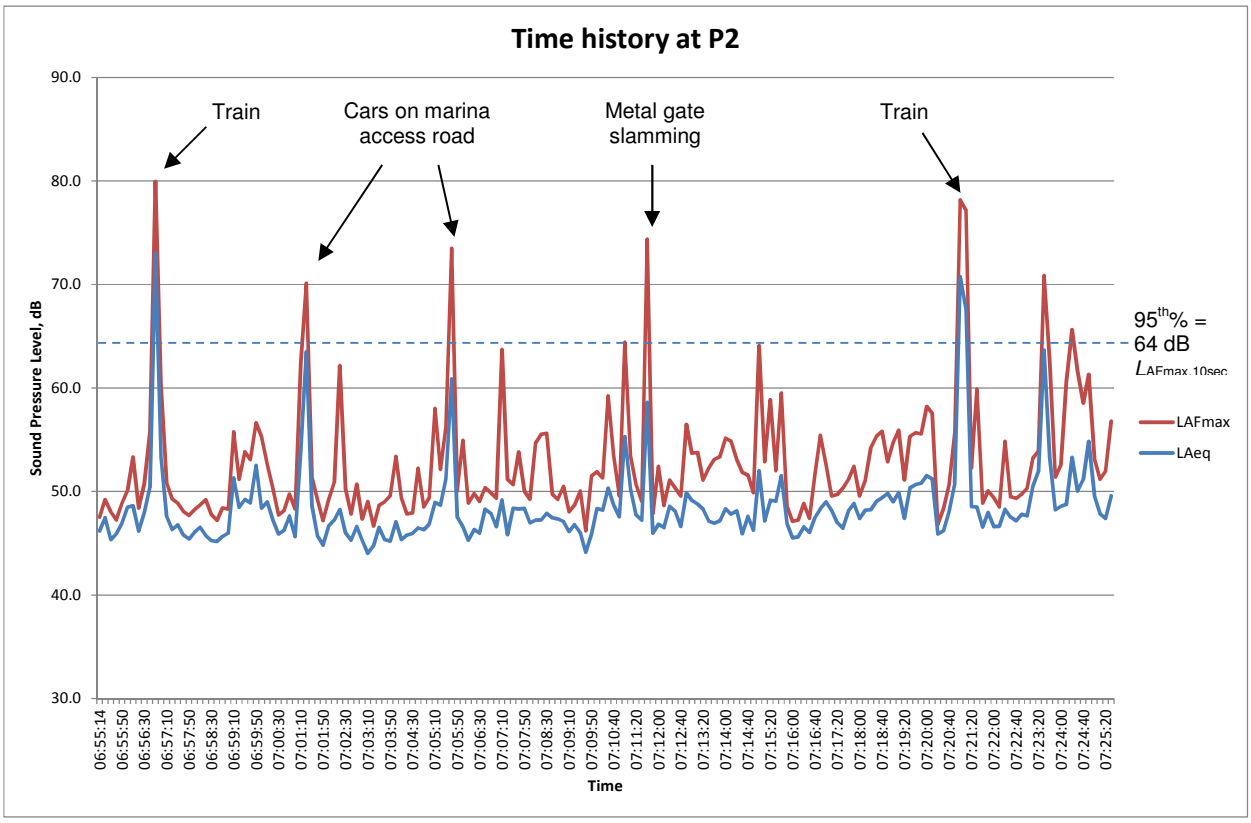


Figure 4: Time history for location P2



8 Impact of Existing Noise Sources on the Development

8.1 Computer Modelling

8.1.1 Predictions of existing noise levels on the site have also been undertaken using the CadnaA noise modelling package. Specific model parameters were applied as follows:

- Propagation of noise using algorithms within ISO 9613: 1993 *Acoustics - Attenuation of sound during propagation outdoors*. Roads were modeled as line sources at a height of 0.5 m above ground level and calibrated using spectral data measured during the survey.
- Default ground absorption G = 0.5 (equivalent to grassed areas and consistent with the dominant ground cover at the site). Hard areas (roads, concrete) set to G = 0 (acoustically reflecting).
- Ground attenuation: spectral all sources.
- No adverse meteorological effects.
- Two orders of reflection.

8.2 Validation of the Noise Model

8.2.1 Noise level receptor points were incorporated into the CadnaA model at the noise survey measurement locations to calibrate the model using the measured octave band L_{eq} and L_{Fmax} noise

levels. The modelled results agreed with the measured results to within around ± 2 dB for both L_{Aeq} and L_{AFmax}.

8.3 Noise Model Scenarios

8.3.1 Three scenarios were modelled using the indicative master plan provided: daytime L_{Aeq} noise levels affecting the site, night-time L_{Aeq} noise levels and night-time L_{AFmax} noise levels. Screen shots from each model are provided in Appendix 2.

8.3.2 The noise modelling demonstrates the fall-off in L_{Aeq} noise levels with increasing distance from Barden Lane, the most significant noise source affecting the average noise levels at the site.

8.3.3 L_{AFmax} noise levels varied considerably, depending on whether trains passed the site or not. In the absence of trains, L_{AFmax} levels were generally the result of vehicles on Barden Lane, the influence of which reduced with increasing distance from the road.

8.4 Predicted Internal Noise Levels

8.4.1 It is proposed that noise from the development is controlled to 30 dB L_{Aeq} in bedrooms at night and 35 dB L_{Aeq} in habitable rooms during the day. This is in line with the 'good' levels advised in BS 8233 for night-time noise and 'good' to 'reasonable' levels for daytime noise. The recommended criteria for maximum noise levels due to individual noise events such as vehicle pass-bys is 45 dB L_{AFmax}. WHO also recommends this level should not be exceeded more than 10 – 15 times per night.

8.4.2 The noise model suggests that external noise levels could reach levels of around 80 - 84 dB L_{AFmax} at the location of bedrooms facing the railway during train pass-bys. These events generally occur only twice between the hours of 23:00 and 00:00 and 4 times between 05:30 and 07:00 with no train movements during the middle of the night when background noise levels are at their lowest.

8.4.3 With the implementation of acoustic double glazing and acoustically attenuated trickle ventilators, L_{AFmax} noise levels within bedrooms facing the railway will, for the majority of the night, be significantly below the 45 dB level recommended by WHO but may exceed this level by up to 5 dB during train pass-bys.

8.4.4 However, there is research that suggests a higher noise limit for individual events may be appropriate where such noise events occur infrequently. A study in 1992 by Griefahn[10] reported the effect of less frequent noise events on sleep awakenings and showed that a higher noise threshold is possible if there are a lower number of noise events during the night. For intermittent or short duration noise events, the study found that there were no awakenings amongst 90% of the population if internal maximum noise levels were controlled to: 59.4 dB L_{Amax} for up to 2 noise events; 54.1 dB L_{Amax} for 10

[10] Acoustics Australia vol 20 No 2 August 1992 pp 43-47

noise events and 53.9 dB L_{Amax} for 30 noise events per night. Griefahn also noted that 53 dBA indoors was the absolute level below which no awakenings were observed in 90% of the population.

8.4.5 Based on this guidance it is considered that internal noise levels above 45 dB L_{AFmax} are acceptable for the low number of train pass-bys expected at the site, providing the level of 53 dB L_{AFmax} is not exceeded.

8.4.6 The generally accepted rule of thumb is that a window left open for ventilation provides 10 - 15 dB attenuation from external noise sources with the WHO Guidelines for Community Noise suggesting 15 dB. The DEFRA report NANR116: Open/Closed Window Research[11] suggests the figure to be between 12 and 18 dB for road and rail traffic. Where external noise levels are more than around 15 dB higher than the internal noise targets, openable windows should not be relied upon as the sole means of ventilation and some form of acoustically attenuated ventilation may be required.

8.4.7 The recommended sound insulation measures are discussed further in Section 9.

8.5 Predicted Noise Levels in Gardens

The model indicates that the predicted external noise levels within gardens fronting the canal vary from 53 dB to 58 dB L_{Aeq}, depending on the proximity to Barden Lane. The external noise level on the roof terrace of the apartment block is predicted to be 57 dB L_{Aeq}. It is to be appreciated that the model was validated based on early morning noise levels measured during the busiest time of the day for road traffic. Average noise levels for the daytime period as a whole will be lower and therefore the upper daytime level of 55 dB L_{Aeq} recommended by WHO for external amenity areas is predicted to be achieved.

9 Recommended Mitigation Measures

9.1.1 In order to assess the potential glazing and ventilation requirements for habitable rooms, noise ingress calculations were undertaken based on the methodology in BS EN 12354-3[12]. The following assumptions were made regarding the assessment rooms:

- Assessed within first floor bedrooms with an internal volume of 30 m^3
- 'Normal' internal surface finishes e.g. carpeted with curtains etc
- External walls were cavity masonry construction
- Glazed area of 1.5 m^2 per room.

[11] NANR116: 'Open/closed window research' Sound Insulation through ventilated open windows, Defra April 2007

[12] BS EN 12354-3:2000 Building acoustics. Estimation of acoustic performance in buildings from the performance of elements - Airborne sound insulation against outdoor sound

9.1.2 The areas of the proposed site where internal noise may exceed the standards are bedrooms on elevations closest to, and facing, Barden Lane and the railway lines. Night-time periods have been assessed as the standards are more onerous than for daytime periods. Based on the measured difference between daytime and night-time L_{Aeq} noise levels, if the night-time criteria can be demonstrated to have been met with at least 1 dB in hand, daytime criteria would also be met. It should also be appreciated that night-time noise has been assessed during the loudest part of the night and that the average level over the course of an 8 hour night-time period would be expected to be lower.

9.1.3 Due to the limited number of train movements, assessments have been undertaken with the effect of trains both taken into account and discounted to enable a comparison to be made.

9.1.4 An example noise ingress calculation is provided in Appendix 4 and other calcualtion sheets can be provided on request. A summary of the calculation results below in Table 5 (where the external L_{AFmax} is due to train pass-bys) and Table 6 (where the external L_{AFmax} is derived from the 95th percentile of the measured $L_{AFmax,10sec}$). Note that the external noise levels used within the assessment are the highest levels predicted by the Cadna noise model for each assessment location.

Table 5: Predicted internal night-time noise levels (including train pass-bys)

Description	External Noise Levels		Predicted Internal Noise Levels		Proposed Criteria		Exceedance of Criteria		Proposed Glazing and Ventilation
	dB L_{Aeq}	dB L_{AFmax}	dB L_{Aeq}	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	
Bedrooms in apartments facing Barden Lane	59	78	28	46	30	45	-2	+1	Acoustic double glazing; acoustic trickle vents
Bedrooms in houses facing the railway	57	84	24	50	30	45	-6	+5	Acoustic double glazing; acoustic trickle vents
Bedrooms in houses facing the canal	53	73	23	42	30	45	-7	-3	Thermal double glazing; acoustic trickle vents

Table 6: Predicted internal night-time noise levels (train pass-bys excluded from L_{AFmax})

Description	External Noise Levels		Predicted Internal Noise Levels		Proposed Criteria		Exceedance of Criteria		Proposed Glazing and Ventilation
	dB L_{Aeq}	dB L_{AFmax}	dB L_{Aeq}	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	
Bedrooms in apartments facing Barden Lane	59	71	28	40	30	45	-2	-5	Acoustic double glazing; acoustic trickle vents
Bedrooms in houses facing the railway	57	67	24	34	30	45	-6	-11	Acoustic double glazing; acoustic trickle vents
Bedrooms in houses facing the canal	53	65	23	34	30	45	-7	-11	Thermal double glazing; acoustic trickle vents

9.1.5 It is to be appreciated that the night-time L_{Aeq} noise levels were measured between 05:30 and 07:00 when noise from Barden Lane was dominant and increasing as the morning rush hour approached. When averaged over a typical 8 hr period, night-time noise levels would be expected to be lower than those reported.

9.1.6 It can be seen from Table 5 and Table 6 that rooms on the elevations facing the railway and Barden Lane are predicted to exceed the L_{AFmax} criteria by between 1 and 5 dB during train pass-bys, although the recommended absolute level of 53 dB L_{AFmax} is not exceeded at any time. In the absence of train noise, which is the majority of the night, predicted indoor noise levels are significantly below the recommended criteria.

9.1.7 In order to achieve these noise levels, the following sound insulation measures are recommended:

Table 7: Recommended sound insulation measures

Description	Glazing	Ventilation	Other
Habitable rooms in houses facing the railway	Acoustic double glazing with rating of 35 dB $R_w + C_{tr}$	Acoustic trickle vent with rating of 41 dB $D_{ne,w}$	All rooms on top floor to have enhanced ceiling
Habitable rooms in houses facing the canal	Standard double glazing with rating of 27 dB $R_w + C_{tr}$	Acoustic trickle vent with rating of 41 dB $D_{ne,w}$	All rooms on top floor to have enhanced ceiling
All habitable rooms in apartment block	Acoustic double glazing with rating of 35 dB $R_w + C_{tr}$	Acoustic trickle vent with rating of 41 dB $D_{ne,w}$	All rooms on top floor to have enhanced ceiling

9.1.8 Glazing with a minimum sound reduction index of 35 dB $R_w + C_{tr}$ could be achieved using double glazed units with a 10/12/6.4 (laminated) configuration. Glazing with a rating of 27 dB $R_w + C_{tr}$ could be achieved using standard thermal double glazing (e.g. 4/12/4).

9.1.9 In addition to the recommended glazing and ventilation options above, it is recommended that the ceilings within rooms on the top floor of all houses and the apartment block are enhanced to provide additional protection against traffic noise. All ceilings are to be constructed from at least 2 layers of 15 mm high density plasterboard each with a minimum mass of 12 kg/m^2, 150 mm cavity between the roof and the inner lining and filled with 100 mm mineral wool insulation with a minimum density of 40 kg/m3 (rigid insulation boards are not appropriate in this case).

9.1.10 Final proposals for glazing and ventilation options would need to be reviewed as the final master plan of the site is developed at the reserved matters stage.

10 Conclusions

10.1 A noise assessment was undertaken to predict the impact of existing road and rail noise sources on a proposed residential development in the vicinity of Barden Mill, Barden Lane, Burnley. Noise measurements were made in the vicinity of the proposed development and this data was used to populate a computer noise model of the site.

10.2 The results from the noise model have been used to predict the impact of existing noise sources on future occupants of the development. The assessment indicated that the noise climate in the vicinity of the proposed development levels was dominated by road traffic on Barden Lane and infrequent train movements on the adjacent Blackpool to Colne railway line.

10.3 Recommended glazing and ventilation specifications have been proposed to enable the recommended internal noise limits to be achieved. Due to the infrequent nature of train pass-bys and the fact that there are no train movements for the majority of the night, a lower L_{AFmax} noise limit has been proposed for trains with alternative guidance cited.

10.4 With the implementation of these recommendations, it is considered that a suitable and commensurate level of protection against noise will be provided to the occupants of the proposed accommodation. As such, we can see no reason why planning permission for the development need be refused on the basis of noise.

Glossary of Terms

Decibel (dB) The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 µPa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB(A) Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB (A) broadly agree with people's assessment of loudness. A change of 3 dB (A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 meter; heavy road traffic about 80 dB(A) at 10 meters; the level near a pneumatic drill about 100 dB(A).

$L_{A90,T}$ The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1990 it is used to define background noise level.

$L_{Aeq,T}$ The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax} The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

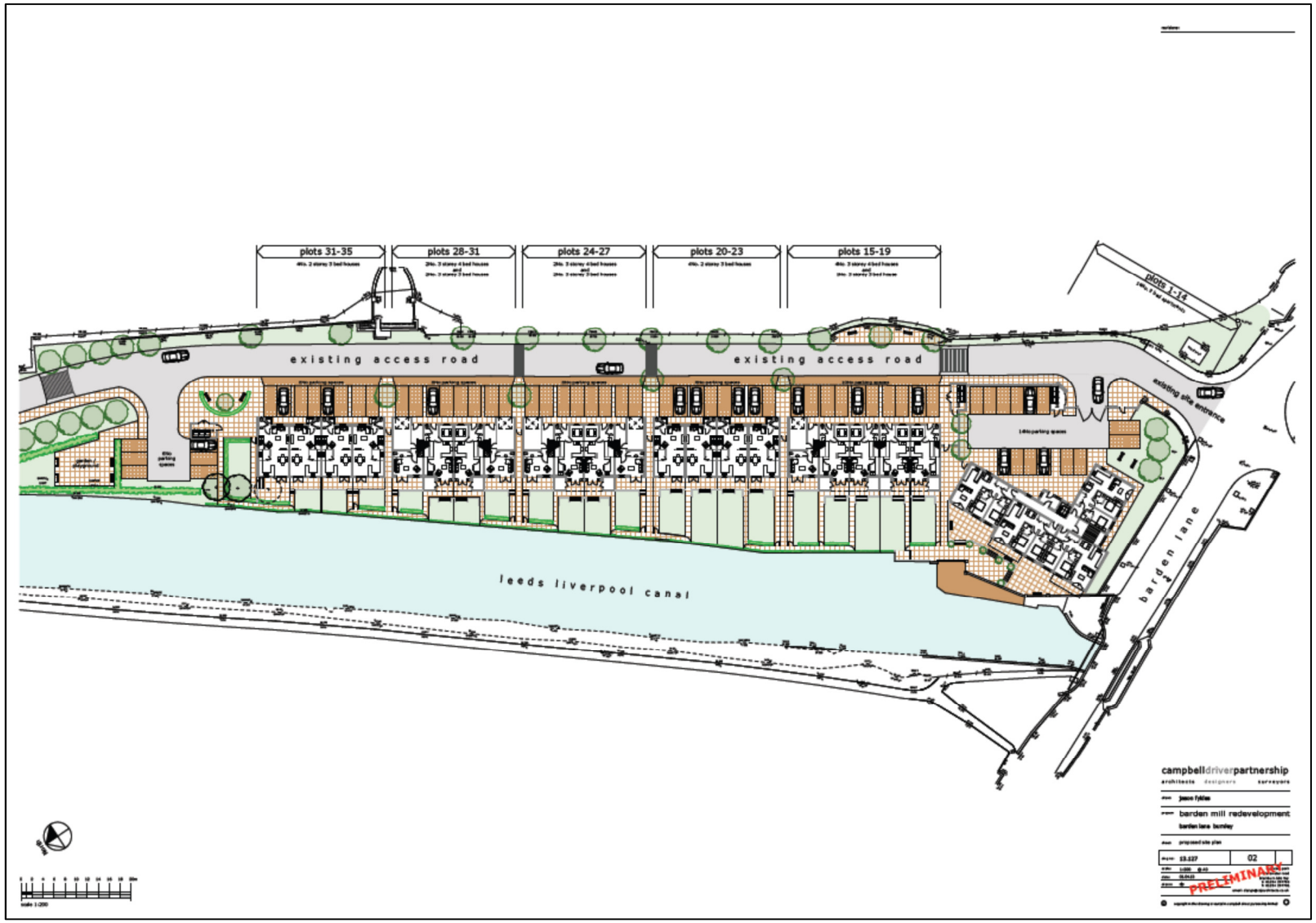
R_w Single number rating used to describe the sound insulation of building elements and is defined in BSEN ISO 140-3: 1995. It is derived by measurement under laboratory conditions and does not take into account the effects of flanking transmissions.

$D_{nT,w}$ The weighted standardized level difference is a single figure rating used to describe the sound insulation of a construction separating two rooms, for example a wall or floor, and is defined in BSEN ISO 140-4: 1998. It is derived by measurement of an in-situ construction and therefore takes into account the effects of flanking transmissions, workmanship etc.

$D_{ne,w}$ The weighted element-normalized level difference is a single figure rating used to describe the sound insulation of small elements within a larger construction and is defined in BSEN ISO 140-10: 1991. It is most often used to rate the sound insulation performance of ventilator units e.g. trickle vents.

C_{tr} A spectrum adaptation term used to characterise the sound insulation rating with respect to urban traffic.

Appendix 1: Proposed Site Plan



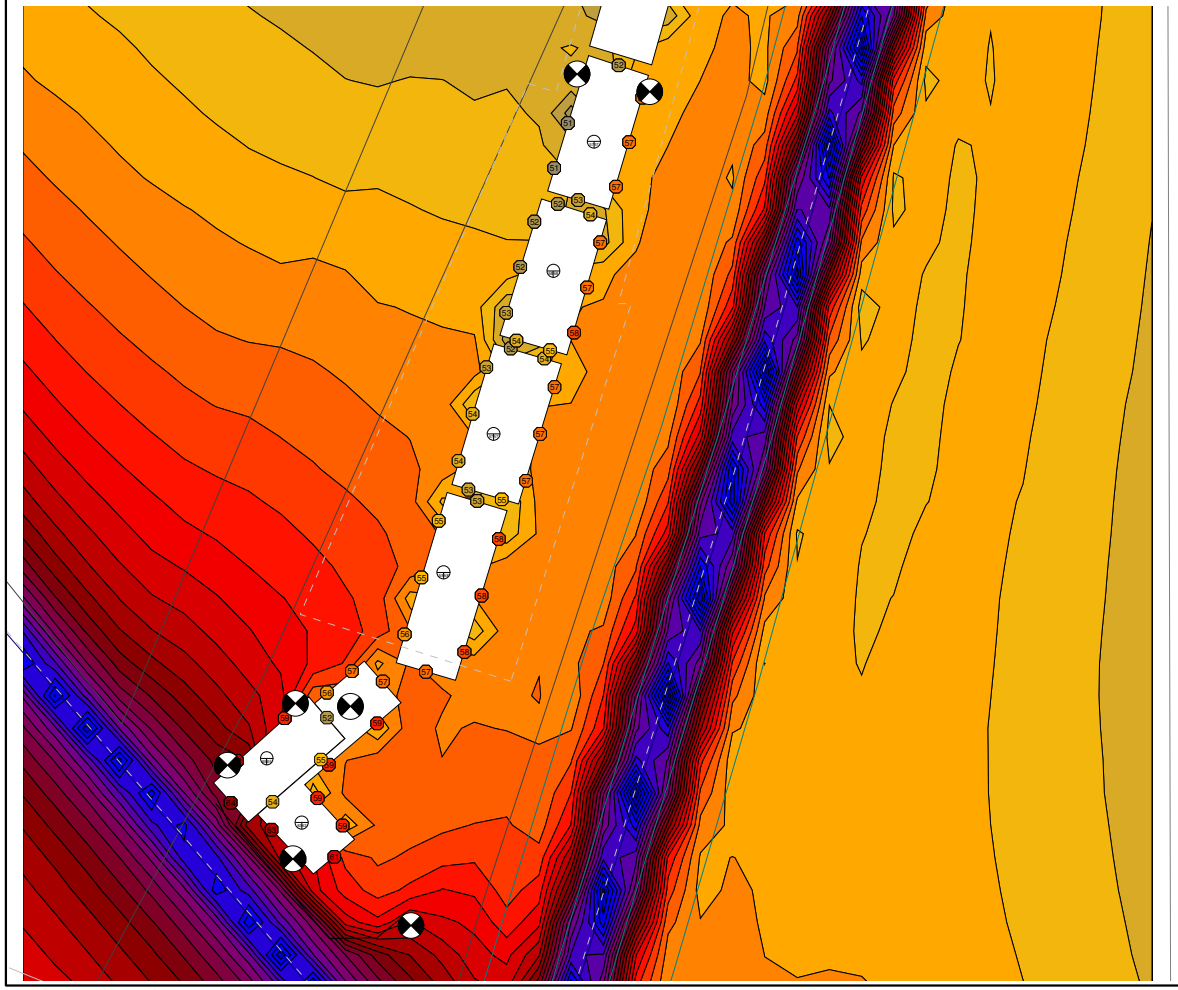
Appendix 2: Measurement Data, 22/05/13

Description	Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AF1} (dB)	L_{AF10} (dB)	L_{AF90} (dB)	L_{AF99} (dB)	L_{AFmin} (dB)
P1	05:31:55	15:00	52.9	72.0	66.6	52.3	41.1	39.1	37.4
P1	05:50:32	15:00	59.1	86.1	67.8	53.9	39.7	37.8	35.4
P1, inc. train	06:05:47	15:00	56.8	79.2	68.4	57.6	40.9	39.4	37.2
P1	06:20:51	15:00	55.5	70.0	66.7	59.4	40.9	38.6	37.2
P1	06:38:24	15:00	57.7	71.1	68.8	61.2	46.8	43.9	42.6
P2, inc. train	06:55:14	15:00	55.0	80.0	66.0	49.6	44.7	43.4	42.2
P2, inc. train	07:10:33	15:00	54.9	78.2	65.9	51.8	45.7	44.4	43.4
P1	07:31:45	24:51	62.1	75.3	69.5	66.5	49.0	45.9	44.2
P1, train only	07:58:08	00:11	67.0	73.1	72.8	72.0	51.9	49.3	51.2
P1, inc. train	08:00:17	30:00	62.8	80.1	70.0	66.1	51.8	47.5	44.7
P1, inc. train	08:32:05	30:00	63.1	80.6	71.5	66.5	51.7	48.4	46.2

Appendix 3a: Cadna – Daytime L_{Aeq} Noise Levels (with trains)

Barden Mill, Burnley

Daytime LAeq noise levels



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Key to Noise Contours

- > -99.0 dB
- > 35.0 dB
- > 40.0 dB
- > 45.0 dB
- > 50.0 dB
- > 55.0 dB
- > 60.0 dB
- > 65.0 dB
- > 70.0 dB
- > 75.0 dB
- > 80.0 dB
- > 85.0 dB

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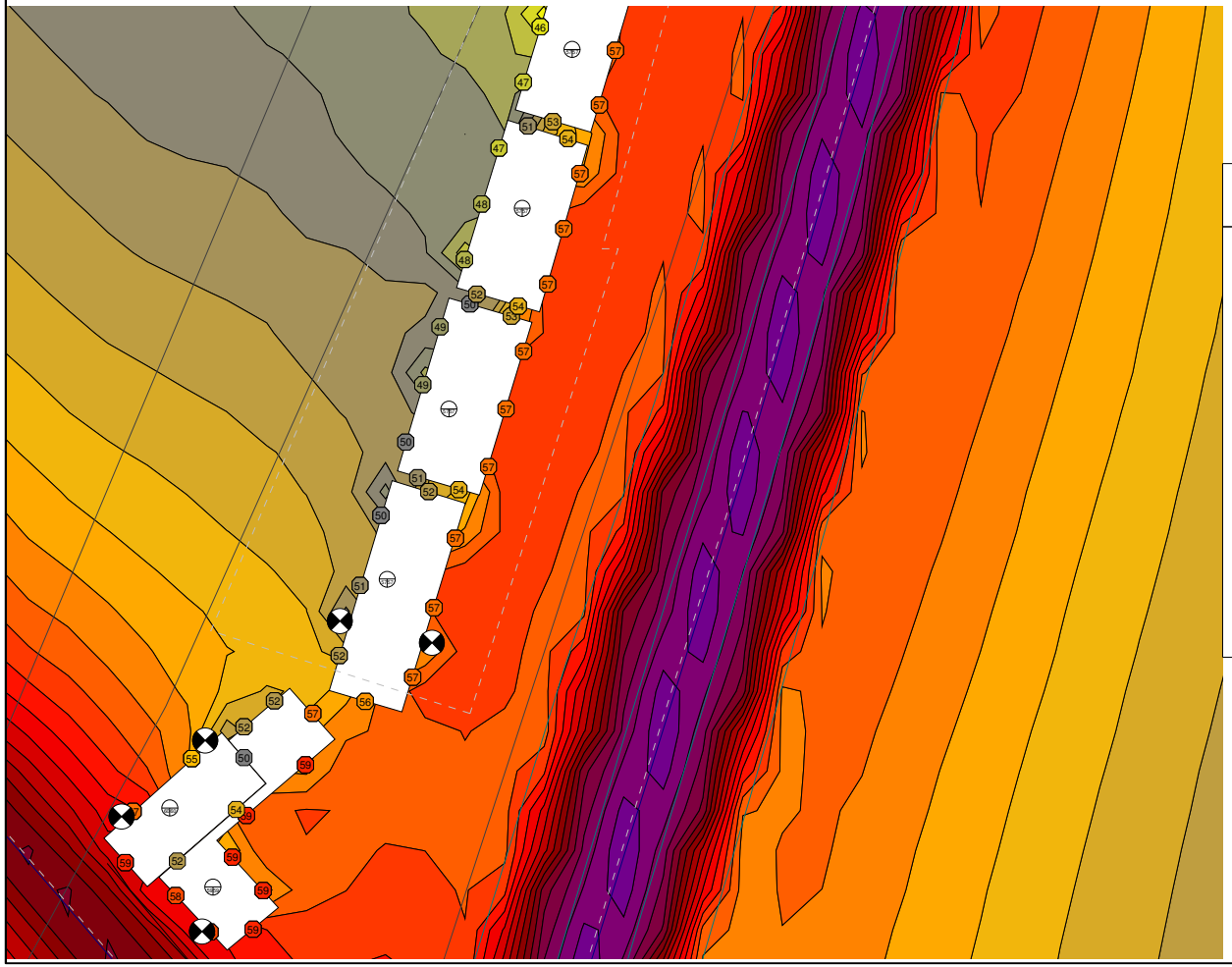
Appendix 3b: Cadna – Night-time LAeq Noise Levels (with trains)

Barden Mill, Burnley

Night-time LAeq noise levels



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- > 60.0 dB
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- > 70.0 dB
- > 75.0 dB
- > 80.0 dB
- > 85.0 dB

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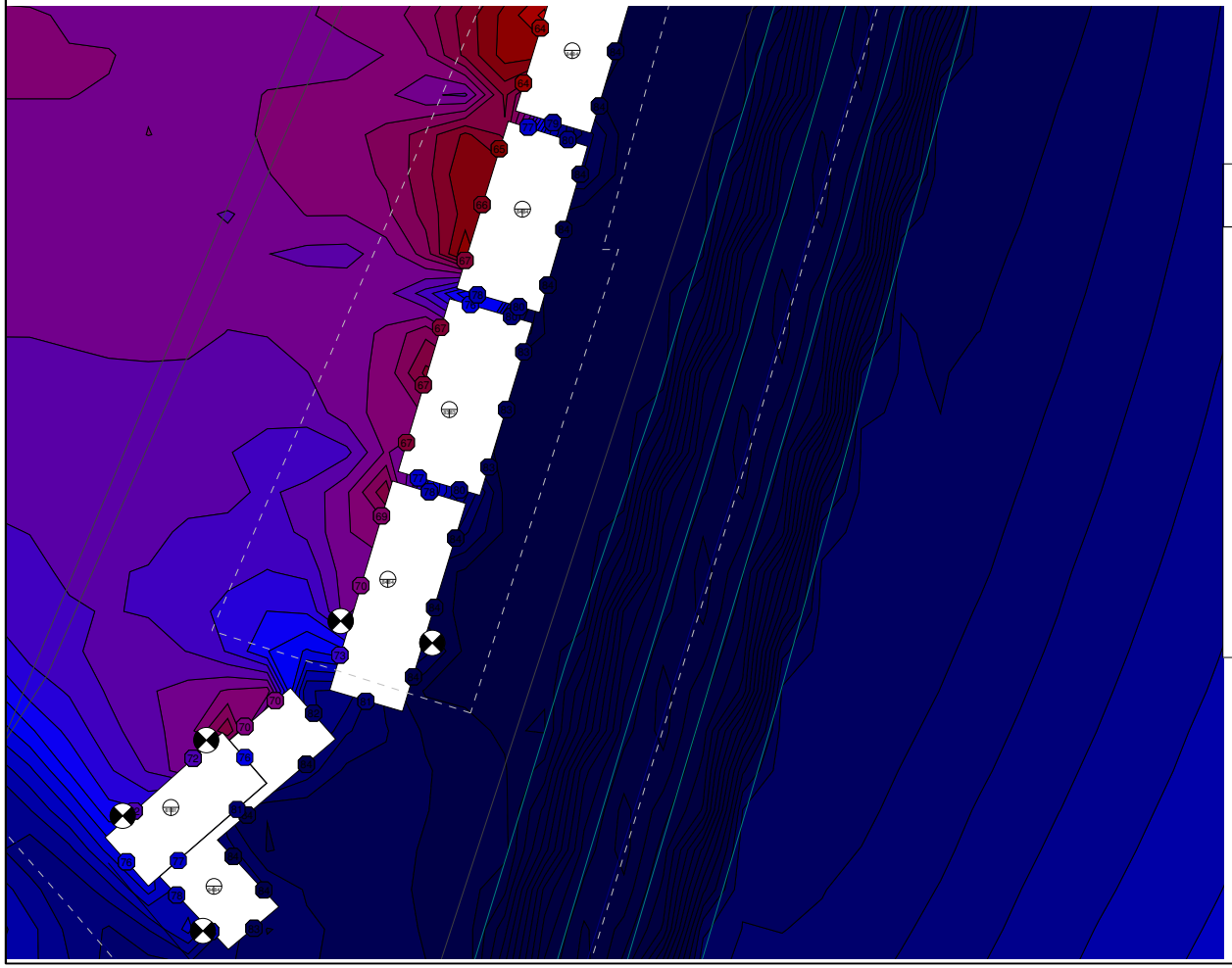
Appendix 3c: Cadna – Night-time L_{Amax} Noise Levels (with trains)

Barden Mill, Burnley

Night-time LAmax noise levels (with trains)



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- > 45.0 dB
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- > 55.0 dB
- > 60.0 dB
- > 65.0 dB
- > 70.0 dB
- > 75.0 dB
- > 80.0 dB
- > 85.0 dB

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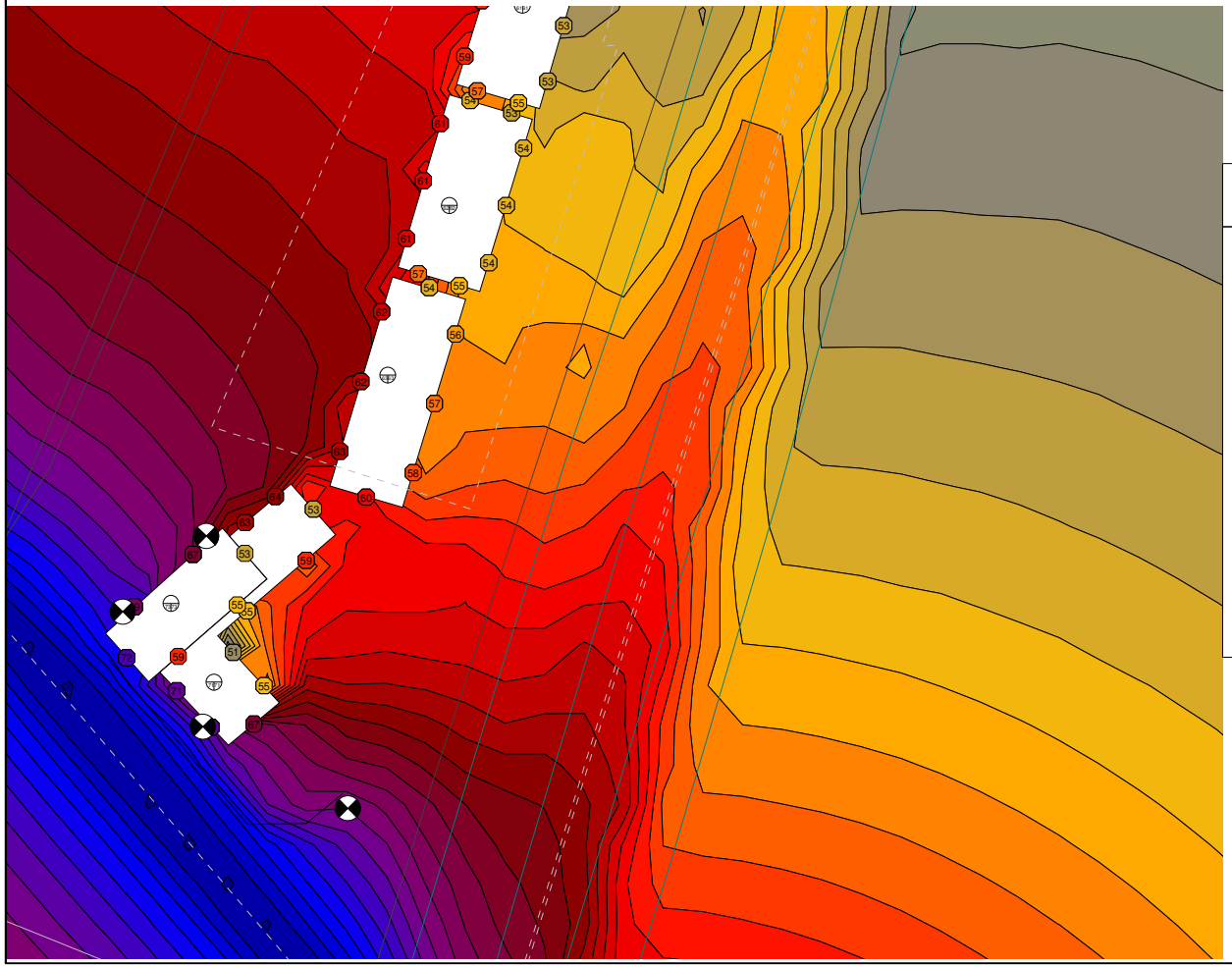
Appendix 3d: Cadna – Night-time 95th% L_{Amax} Noise Levels (without trains)

Barden Mill, Burnley

Night-time 95th% LAmax noise levels (without trains)



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- > 60.0 dB
- > 65.0 dB
- > 70.0 dB
- > 75.0 dB
- > 80.0 dB
- > 85.0 dB

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Appendix 4: Noise Ingress Calculation

Miller Goodall Environmental Services: Noise Ingress Calculation

Project:	Barden Mill	**Calcs By:**	SF
Description:	House at northern boundary	**Date:**	23/05/13
	Bedroom facing railway - NT - during train pass-by		

Calculation is based on methodology within BS 8233:1999 & BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A - C + 6$$

where A = 0.16V/T and C = 10 x log (cosθ), an angle of incidence correction varying from 0 (normal to axis) to -6 dB (for max. AOI).
This can be broken down further to:

$$L_{eq,2} = L_{eq,ff} + 10\log((A_0/S \times 10^{(-D_{n,e}/10)}) + (S_w/S \times 10^{(-R_w/10)}) + (S_{ew}/S \times 10^{(-R_{ew}/10)}) + (S_{rr}/S \times 10^{(-R_{rr}/10)})) + 10\log(S/A) - C + 6$$

The above terms are described below.

Description	Term	Value
Total facade area (m2)	S_f	7.5
Window area (m2)	S_{wi}	1.5
External wall area (Sf - Swi)	S_{ew}	6
Area of ceiling (m2)	S_{rr}	12
Total area of elements (Sf + Srr)	S	19.5
Volume of receiving room (m3)	V	32
Reference absorption area (m2)	A_0	10
Number of ventilators in facade:		1
Angle of incidence (degrees):	θ	30

	Octave band centre frequency, Hz												
	63	125	250	500	1k	2k	4k	8k	dBA	Rw	Ctr	Rw+ Ctr	Notes
External Leq, freefield (dB Leq,ff)	57	52	49	53	53	50	44	32	57	-	-	-	From Cadna
External Lmax, freefield (dB Lmax,ff)	80	69	72	82	79	75	72	59	84	-	-	-	From Cadna
Dne of each ventilator	27	31	33	42	43	39	44	44		41	-3	38	Renson AK38 acoustic trickle vent
Total Dne of all ventilators	27	31	33	42	43	39	44	44	-	41	-3	38	
SRI of window (Rwi)	21	27	29	36	41	42	52	52		39	-4	35	10/12/6.4
SRI of external wall (Rew)	35	37	42	52	60	63	68	68		54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall tie
SRI of roof and ceiling (Rrr)	25	31	37	43	48	52	58	58		47	-5	42	Tiles on felt, pitched roof with 270 mm wool on plasterbo
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					Habitable room ref Part E
All ventilators [eqn. B]	0	0	0	0	0	0	0	0					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/Sf x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/Sf x 10^(-Rew/10)
Ceiling [eqn. E]	0	0	0	0	0	0	0	0					Srr/Sf x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-29.7	-33.7	-35.6	-44.6	-46.1	-41.6	-47.1	-46.9					
Glazing [10 x log "C"]	-32.1	-38.1	-40.1	-47.1	-52.1	-53.1	-63.1	-63.1					
External wall [10 x log "D"]	-40.1	-42.1	-47.1	-57.1	-65.1	-68.1	-73.1	-73.1					
Ceiling [10 x log "E"]	-27.1	-33.1	-39.1	-45.1	-50.1	-54.1	-60.1	-60.1					
All elements combined [eqn. F]	-24.3	-29.5	-32.9	-40.6	-43.9	-41.1	-46.8	-46.6					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m²	10	10	10	10	10	10	10	10					
10 x log(S/A) [eqn. G]	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8					
10 x log(cos 0) [eqn. H]	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6					Maximum correction -6 dB

	63	125	250	500	1k	2k	4k	8k	dBA	Target	Exc.	
Internal Leq,2	41	31	24	21	17	17	5	-6	24	30	-6	Equations (A+F+G+H) +6 dB
Internal Lmax,2	64	48	47	50	44	42	33	20	50	45	5	Equations (A'+F+G+H) +6 dB