REC
Resource & Environmental Consultants Ltd

Noise & Vibration Impact Assessment

Proposed Residential Development
Vine Street
Gorton

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Prepared for:
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REC Acoustics

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QUALITY ASSURANCE

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EXECUTIVE SUMMARY

Noise and Vibration Surveys

A series of Noise and Vibration Surveys have been completed in order to measure the impact of rail traffic noise and vibration and industrial noise upon the proposed residential development.

Noise Impact Assessment

The Noise Impact Assessment has been completed with due regard to the requirements of Manchester City Council's Environmental Health Department.

The Noise and Vibration Impact Assessment has identified that the key sources of noise and vibration impacting upon the development is from rail traffic using the Gorton to Fairfield Railway Line to the north, industrial noise from units on Lees Street to the north west and potential commercial noise from any mechanical and electrical plant associated with the proposed care home to the north. Accordingly appropriate consideration has been given towards the mitigation measures required to ensure a commensurate level of protection against noise for future residents.

Recommended Mitigation Measures

This assessment has recommended the following mitigation measures in order to ensure an adequate level of protection from noise within external and internal areas:

- Through-frame window mounted trickle ventilators should be incorporated into the glazing unit for the habitable rooms located on the northern facades of dwellings which have direct line of sight to the Gorton to Fairfield Railway Line in order to control internal noise levels as an alternative to opening windows.

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1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Limited have been commissioned by Smith Planning Consultancy to undertake a Noise and Vibration Impact Assessment for a proposed residential development on land located off Vine Street in Gorton, to be referred to hereafter as 'the Site'.

This assessment has been undertaken to identify key noise and vibration sources in the vicinity of the Site which may have the potential to impact upon the proposed noise and vibration sensitive residential development.

This Noise and Vibration Impact Assessment has been completed with due regard to the requirements of Manchester City Council's (MCCs) Environmental Health Department.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

1.2 Site Location & Proposed Development

The Site comprises a parcel of land located off Vine Street in Gorton. The Site lies adjacent to residential properties to the east, west and south. The Site lies approximately 1.2km to the north east from the centre of Gorton.

The Site is bound by Vine Street to the east and a footpath to the south. Existing residential properties on Long Street bound the Site to the west and commercial buildings on Lees Street lie to the north west. Open land lies to the north which is part of a planning application for a proposed Care Home. The Gorton to Fairfield Railway Line lies beyond to the north running east to west.

The key sources of noise and vibration impacting upon the Site are rail traffic using the Gorton to Fairfield Railway Line and industrial noise associated with the commercial units on Lees Street. The potential noise impact associated with the proposed care home from mechanical and electrical (M&E) plant and deliveries has also been considered.

Proposals include for the construction of 46 residential units on the Site comprising of 2 and 3 bedroom semi-detached houses. This assessment has been undertaken with due regard to the following planning drawing:

- Proposed Site Plan (Drawing No. 12-91-F12), dated 21st November 2013, issued by Eden Building Design.

The Proposed Site Plan is shown in Figure 1 of Appendix III.

1.3 Limitations

The limitations of this report are presented in Appendix I.

1.4 Confidentiality

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2.0 ASSESSMENT CRITERIA

2.1 Local Authority Guidance and Criteria – Manchester City Council's Environmental Health Department

Consultation was undertaken with Rick Knightley at Manchester City Council on Monday 21st October 2013 who was in broad agreement with the proposed Noise and Vibration Survey methodology and assessment criteria for which the following were agreed:

- The maximum permissible average noise level in garden areas shall not exceed 55dB $L_{Aeq,16hr}$;
- The maximum permissible average noise level in living rooms shall not exceed the BS8233 internal target 'reasonable' criteria which is 40dB $L_{Aeq,16hr}$;
- The maximum permissible average noise level in bedrooms shall not exceed the BS8233 internal target 'good' criteria which is 30dB $L_{Aeq,8hr}$;
- The maximum permissible instantaneous noise level in bedrooms shall not exceed 45dB $L_{Amax,fast}$; and,
- The total noise rating level from any mechanical or electrical plant shall not exceed 5dB below the existing background noise level.

2.2 British Standard BS8233:1999: Sound Insulation and Noise Reduction for Buildings – Code of Practice

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

The standard suggests suitable internal noise levels within different types of buildings, including plots, as shown in Table 2.1.

Table 2.1: BS8233 Recommended Internal Target Noise Levels

Criterion	Typical Situation	Design Range $L_{Aeq,T}$ dB	
		Good	Reasonable
Suitable resting / sleeping conditions	Living Room	30	40
	Bedroom	30	35
For a reasonable standard in bedrooms at night, individual noise events (measured with fast time weighting) should not normally exceed 45dB L_{Amax}			

BS8233 goes on to recommend noise levels for gardens. According to BS8233, it is desirable that the steady noise level does not exceed $L_{Aeq,T}$ 50dB, and 55dB should be regarded as the upper limit.

2.3 World Health Organisation's (WHO) 'Guidelines for Community Noise'

As with 'good' and 'reasonable' criteria in BS 8233, the L_{AFmax} criterion is largely concordant with the WHO guidelines which states:

"For good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{AFmax} more than 10-15 times per night."

With regards to external noise levels in outdoor noise, the WHO states the following:

> *"During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55dB; or moderately annoyed with L_{Aeq} levels below 50dB."*

These external noise levels are widely adopted by Local Planning Authorities in the UK in order to protect external residential amenity which covers garden areas, balconies for residential apartments and communal garden areas.

2.4 British Standard BS4142: 1997: Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

This standard is intended to be used to assess where noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises is likely to give rise to complaints from people residing in nearby dwellings.

The procedure contained in BS4142 for assessing the likelihood of complaints is to compare the measured or predicted noise level from the source in question, the 'specific noise level' immediately outside the dwelling, with the background noise level. Where the noise contains a 'distinguishable discrete continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks, clatters or thumps), or if the noise is irregular enough to attract attention' then a correction of +5dB is added to the specific noise level to obtain the 'rating level'.

The likelihood of noise provoking complaints is assessed by subtracting the background noise level from the rating noise level. BS4142 states:

> *"A difference of around 10dB or higher indicates that complaints are likely. A difference of around 5dB is of marginal significance. A difference of -10dB is a positive indication that complaints are unlikely."*

For the daytime, this assessment is carried out over a 1-hour period, and over a 5-minute period at night. The day and night-time periods are not defined in the Standard but it states that night should cover the times when the general adult population are preparing for sleep or are actually sleeping. For the purposes of this assessment it is assumed that the day and night periods reflect those stated in the now revoked Planning Policy Guidance Note 24 (PPG24), i.e. day is 07:00 to 23:00 hours and night 23:00 to 07:00 hours.

The standard goes on to state:

> *"The method is not suitable for assessing the noise measured inside buildings or when the background and rating noise levels are both very low. For the purposes of this standard, background noise levels below about 30dB and rating noise levels below about 35dB are considered to be very low.*

2.5 British Standard BS6472: 2008: Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)

With respect to human exposure to building vibration, BS6472 provides guideline values of the vibration dose value (VDV) above which various degrees of adverse comment may be expected from the occupants of residential buildings. The VDV is defined mathematically as the fourth root of the time integral of the fourth power of the vibration acceleration, after it has been frequency weighted. The guideline values recommended by BS6472 are shown in Table 2.2 below.

Table 2.2: BS6472 Guideline Values

Place	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential Buildings (16 Hour Day)	0.2 – 0.4	0.4 – 0.8	0.8 – 1.6
Residential Buildings (8 Hour Night)	0.1 – 0.2	0.2 – 0.4	0.4 – 0.8

Where the vibration is intermittent rather than continuous in nature, BS6472 defines procedures for calculating the estimated Vibration Dose Value (eVDV), based on the number and duration of vibration events and the recorded value of the root mean square frequency weighted vibration acceleration. The frequency weighting takes into account the response of the human body to vibrations of different frequency and whether the person is lying down or standing. The eVDV can then be taken as the VDV for use in the assessment of human exposure to vibration in buildings.

The above guidance relates to vibration measured at the point of entry into the human body, which is usually taken to mean the ground surface or at a point mid-span of an upper storey floor, rather than the point of entry into the building (a foundation element).

3.0 NOISE AND VIBRATION SURVEYS

REC has conducted a number of Noise and Vibration Surveys at the Site which included:

- Rail Traffic Noise and Vibration Survey for the Gorton to Fairfield Railway Line that runs along the northern boundary;
- Industrial and Commercial Noise Survey for Commercial Units on Lees Street to the north west of the Site; and,
- Background Noise Survey.

The purpose of the Background Noise Survey was to establish the existing levels of background noise present at the proposed residential receptors in the absence of any commercial or industrial noise.

3.1 Rail Traffic Noise Survey

REC has conducted a Rail Traffic Noise Survey in order to measure the level of noise generated by the Gorton to Fairfield Railway Line. Both commuter and freight train movements have been assessed. The survey was carried out over the following time period:

- Thursday 24th October 2013 between 11:06 and 12:06.

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

- Noise Measurement Position 1 (NMP1): Located on the northern Site boundary, 25m from the centre of the track. The microphone was located 1.5m above ground level and in free-field conditions. Noise sources at this location consisted predominately of intermittent train pass-bys and industrial noise from the commercial units on Lees Street.

A summary of the measured sound pressure levels from the Rail Traffic Noise Survey are presented in Table 3.1 for Northern Rail Passenger Trains eastbound and westbound.

Table 3.1: Summary of Measured Noise Levels for NMP1 for Northern Rail

Date	Time	Direction	Measured Sound Pressure Level (dB)		Measurement Duration (seconds)	Measurement Distance (m)
			$L_{Aeq,t}$	$L_{Amax,fast}$		
24/10/2013	11:11	East	61.1	64.2	21	30
	11:12	West	57.3	62.7	13	30
	11:15	East	61.5	68.0	14	30
	11:16	West	55.9	67.2	22	30
	11:24	West	53.4	64.8	17	30
	11:24	East	60.1	65.0	12	30

	11:28	West	57.6	61.4	15	30
	11:31	East	57.9	68.9	22	30
	11:40	West	58.4	63.8	13	30
	11:41	East	59.3	64.2	26	30
	11:46	West	61.8	67.5	24	30
	11:53	East	59.9	63.6	9	30
	11:55	East	54.9	62.1	15	30
	11:56	West	57.0	61.4	14	30
	11:59	West	56.1	59.6	16	30
	12:01	East	62.5	67.5	13	30

The line is also used by freight movements during the night-time period. Source noise measurements were not taken on Site; however, the number of freight trains has been counted by using the noise level trace for the background noise survey. Previously measured library source noise data for freight trains has been considered representative of freight movements at this Site, and has been used in the assessment.

Table 3.2 details the library source noise data used to represent freight movements.

Table 3.2: Library Source Data for Freight Trains

Type	Measured Sound Pressure Level (dB)		Measurement Duration (seconds)	Measurement Distance (m)
	$L_{Aeq,t}$	$L_{Amax,fast}$		
Freight Train	62.4	68.2	94	25

3.2 Industrial & Commercial Noise Survey

REC has conducted an Industrial and Commercial Noise Survey of the commercial units on Lees Street to the north west of the Site. During the noise survey the operation of a grinder/drill was measured as well as a Heavy Goods Vehicle (HGV) delivery. It is understood that both operations will only be operational during normal daytime operating hours, i.e. 07:00 – 18:00.

The following noise measurement position was chosen for the Industrial and Commercial noise survey:

- Noise Measurement Position 1 (NMP1): Located on the northern Site boundary. The microphone was located 1.5m above ground level and in free-field conditions. Noise sources at this location consisted predominately of intermittent train pass-bys and

industrial noise from the commercial units on Lees Street.

The source noise measurements from the commercial activities are detailed in Table 3.3.

Table 3.3: Summary of Measured Source Noise Levels

Measured Operation	Measurement Duration (hh:mm:ss)	Measured Noise Level $L_{Aeq,t}$ (dB)	Measurement Distance (m)
Grinding/Drilling	00:12:00	46.5	35
HGV Delivery	00:02:27	49.3	45

The weather conditions during the noise surveys were conducive towards the measurement of environmental noise, being fine and dry with wind speeds of less than 5.0m/s.

3.3 Background Noise Survey

REC has conducted a Background Noise Survey at the Site in order to obtain the existing noise levels at the Site during the daytime and night time periods over a typical weekday and weekend period.

The Background Noise Survey was completed over the following period:

- Thursday 24th to Monday 28th October 2013 between 13:45 on the Thursday and 11:00 on the Monday.

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

- Noise Measurement Position 2 (NMP2): Located to the north west of the Site at the fence line with the industrial units on Lees Street. The microphone of the sound level meter was positioned at a height of 1.5m in free-field conditions. The measurement position was considered ideal as it is representative of the noise climate of the proposed residential dwellings facing the proposed care home and is considered worst case. The sound level meter logged continuously over the measurement period.

The weather conditions during the quietest daytime and night-time periods were conducive towards the measurement of environmental noise, being fine and dry with wind speeds of less than 5.0m/s.

A summary of the measured sound pressure levels are presented in Table 3.4.

Table 3.4: Summary of Measured Background Noise Levels

Period	Measurement Period	Measured Sound Pressure Level (dB)	
		$L_{Aeq,15mins}$	$L_{A90,15mins}$
Quiet Daytime	Sat 26th October 2013 07:00-07:15	42.8	35.9
	Sat 26th October 2013 07:15-07:30	41.6	37.0

	Sat 26th October 2013 22:00-22:15	41.2	39.4
	Sat 26th October 2013 22:15-22:30	38.7	37.3
	Sun 27th October 2013 07:00-07:15	44.4	39.9
	Sun 27th October 2013 07:15-07:30	45.1	39.8
Quiet Night-time	Mon 28th October 2013 03:15 – 03:30	34.8	32.4
	Mon 28th October 2013 03:15 – 03:30	33.9	31.5

The Noise Surveys were completed using the following specification noise measurement equipment shown in Table 3.5.

Table 3.5: Noise Measurement Equipment

Measurement Position	Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
NMP1 and NMP2	Sound Level Meter	01dB-Metravib Black Solo	65629	19th November 2014
	Pre-amplifier	01dB-Metravib PRE 21 S	166569	
	Microphone	01dB Metravib MCE212	16255	
	Calibrator	01dB-Metravib CAL-21	24924066	16th November 2013

The sound level meter has been calibrated to the manufacturer's traceable standard in November 2012 and the field calibrator has been calibrated to United Kingdom Calibration Service (UKAS) standards in November 2012. The sound level meter was field-calibrated on Site prior to and after noise measurements were taken. No significant drift was witnessed. Calibration certificates are available upon request.

3.4 Rail Traffic Vibration Survey

REC has conducted a Rail Traffic Vibration Survey in order to measure the level of vibration associated with the different train types which use the Gorton to Fairfield Railway Line. The survey was carried out over the following time period:

- Thursday 24th October 2013 between 11:06 and 12:06.

The following vibration measurement position was chosen for the Rail Traffic Vibration Survey:

- Vibration Measurement Position 1 (VMP1): The geophone of the Vibration Meter was located 30m from the centre of the railway line. The geophone was located on soft ground and was secured using spikes attached to the geophone to prevent movement.

The measured Peak Particle Velocity (PPV) vibration levels have been weighted in accordance with the guidance stated in BS6472, where the W_b weighting is applied to the vertical axis (z axis) and the W_d weighting is applied to the horizontal axes (x and y axes). A summary of the measured weighted vibration levels from the vibration survey are presented

in Table 3.6.

Table 3.6: Measured Peak Particle Velocity Vibration Levels for Northern Rail

Date	Time	Measured Vibration Level, by Axis (mm/s)		
		X Axis	Y Axis	Z Axis
Thursday 24th October 2013	11:12	0.127	0.127	0.127
	11:15	0.127	0.127	0.127
	11:16	0.127	0.127	0.127
	11:24	0.127	0.127	0.127
	11:28	0.127	0.127	0.127
	11:31	0.254	0.127	0.127
	11:40	0.127	0.127	0.127
	11:41	0.127	0.127	0.127
	11:46	0.127	0.127	0.127
	11:53	0.127	0.127	0.127
	11:55	0.127	0.127	0.127
	11:56	0.127	0.127	0.127
	11:59	0.127	0.127	0.127
	12:01	0.127	0.127	0.127

The Rail Traffic Vibration Survey was completed using the following specification vibration measurement equipment shown in Table 3.7.

Table 3.7: Vibration Measurement Equipment

Measurement Position	Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
VMP1	Vibration Meter	Instantel Blastmate III	BA18274	13th April 2015
	Tri-axial Geophone	Instantel Geophone	BG17363	

4.0 NOISE IMPACT ASSESSMENT

4.1 Rail Traffic Noise Impact Assessment

The measured noise levels for the train pass-bys, for each train type, have been converted to the 16-hour daytime noise level by using the following equation:

$L_{Aeq,16hr}$ = Average SEL – (10 x log (60 x 60 x 16) + 10 x log N

Where *Average SEL = Average Sound Event Level for Train Type / Provider*
60 x 60 x 16 = No. seconds in a 16-hour daytime period
N = No. Train pass-bys in a 16 hour daytime period

The measured noise levels for the train pass-bys, for each train type, have been converted to the 8-hour night-time noise level by using the following equation:

$L_{Aeq,8hr}$ = Average SEL – (10 x log (60 x 60 x 8) + 10 x log N

Where *Average SEL = Average Sound Event Level for Train Type / Provider*
60 x 60 x 8 = No. seconds in a 8-hour night-time period
N = No. Train pass-bys in a 8- hour night-time period

The total number of commuter train pass-bys has been obtained using internet-based train timetables and the number of freight train pass-bys has been obtained using the background noise survey data.

Table 4.1 details the calculated daytime and night-time noise levels for the Northern Rail passenger trains.

Table 4.1: Determination of Noise Levels – Northern Rail at 25m

Direction	Measured Sound Pressure Level $L_{Aeq,t}$ (dB)	Pass-by (Measurement) Duration (mm:ss)	Timetabled Movements		Calculated Average Noise Level $L_{Aeq,t}$ (dB)	
			Day	Night	Day	Night
East	61.1	00:21	54	4	46.5	38.3
East	61.5	00:14				
East	60.1	00:12				
East	63.4	00:22				
East	59.3	00:26				
East	59.9	00:09				
East	54.9	00:15				
East	62.5	00:13				
West	57.3	00:13	58	4	45.6	37.0

West	55.9	00:22				
West	53.4	00:17				
West	57.6	00:15				
West	58.4	00:13				
West	61.8	00:24				
West	57.0	00:14				
West	56.1	00:16				

Table 4.2 details the calculated daytime and night-time noise levels for the Freight trains.

Table 4.2: Determination of Noise Levels – Freight Trains at 25m

Direction	Measured Sound Pressure Level $L_{Aeq,t}$ (dB)	Pass-by (Measurement) Duration (mm:ss)	Timetabled Movements		Calculated Average Noise Level $L_{Aeq,t}$ (dB)	
			Day	Night	Day	Night
East	62.4	95	0	10	-	50.6
West	62.4	95	0	10	-	50.6

Table 4.3 summarises the calculated daytime and night-time noise levels for all trains.

Table 4.3: Determination of Daytime and Night-time Noise Levels – All Trains

Provider	Direction	Daytime Noise Level $L_{Aeq,16hr}$ (dB)	Night-time Noise Level $L_{Aeq,8hr}$ (dB)	Total Daytime Noise Level $L_{Aeq,16hr}$ (dB)	Total Night-time Noise Level $L_{Aeq,8hr}$ (dB)
Northern Rail	East	46.5	38.3	49.1	51.0
	West	45.6	37.0		
Freight Trains	East	-	50.6		
	West	-	50.6		

Table 4.4 summarises the calculated overall daytime and night-time noise levels for all trains.

Table 4.4: Determination of Daytime and Night-time Noise Levels – All Trains

Provider / Train Type	Total Daytime Noise Level $L_{Aeq,16hr}$ (dB)	Total Night-time Noise Level $L_{Aeq,8hr}$ (dB)	10th Highest $L_{Amax,fast}$ (dB)
All	49.1	51.0	66.2

4.1.1 External Noise Impact

Table 4.5 compares the predicted daytime noise levels in the garden areas with the external target noise level for garden areas. In determining the noise level within the closest garden areas, the calculation has used the middle point of the railway line which is 67m from the closest garden area which is Plot 36.

Table 4.5: Comparison of Predicted Garden Noise Levels with External Target Noise Level

Distance to Garden from Centre of Railway Line (m)	Calculated Daytime Noise Level $L_{Aeq,16hr}$ (dB)	External Target Noise Level (dB)	Difference +/- (dB)
67	44.8	55	-10.2

Table 4.5 indicates that the garden area of Plot 36 which lies closest to the railway line will fall below the external target noise level and as such no mitigation is required.

4.1.2 Internal Noise Impact

In order to accurately determine the noise level within habitable rooms, it has been necessary to calculate the external noise level immediately outside the façade. Accordingly calculation has allowed for the following:

1. Distance attenuation from the centre of the railway line to the façade by using the following formula:

   $$L_{Aeq,2} = L_{Aeq,1} - (10 \times \log (D_2/D_1)$$

   Where $L_{Aeq,2}$ = noise level under investigation
   $L_{Aeq,1}$ = measured noise level
   D_2 = distance under investigation (m)
   D_1 = measurement distance (m)

2. The following equation has been used to determine the resulting noise level from the night-time measured maximum noise level from the railway line:

   $$L_{Amax,fast,2} = L_{Amax,fast,1} - (20 \times \log (D_2/D_1)$$

   Where $L_{Amax,fast,2}$ = noise level under investigation
   $L_{Amax,fast,1}$ =measured noise level
   D_2 = distance under investigation (m)
   D_1 = measurement distance (m)

3. Angle of view correction at the façade by using the following formula:

   $$\text{Correction} = 10 \times \log (\theta / 180) \text{ dB(A)}$$

Table 4.6 calculates the noise level at the facades of the closest proposed residential dwellings.

Table 4.6: Calculation of Façade Noise Levels

Dwelling	Period	Measured Noise Level (dB)	Distance to the Façade (m)	Angle of View θ	Angle of View Correction (dB)	Calculated Façade Noise Level (dB)
35 & 36	Daytime Living Room (07:00–23:00)	49.1 $L_{Aeq,16hour}$	72	160	-0.5	44.0
	Night-time Bedroom (23:00–07:00)	51.0 $L_{Aeq,8hour}$				45.9
		66.2 $L_{Amax,fast}$				56.5
37 - 46	Daytime Living Room (07:00–23:00)	49.1 $L_{Aeq,16hour}$	72	100	-2.6	41.9
	Night-time Bedroom (23:00–07:00)	51.0 $L_{Aeq,8hour}$				43.8
		66.2 $L_{Amax,fast}$				54.4

In calculating the internal noise levels, the now revoked Planning Policy Guidance Note 24 (PPG24) states that standard thermal double glazing, when set into a brick-block wall, will attenuate noise levels from diesel trains by 32dB and this level has been used in the calculations.

Table 4.7 compares the predicted internal noise levels with internal target noise levels.

Table 4.7: Comparison of Predicted Internal Noise Levels with Internal Target Noise Level

Dwelling	Calculated Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
35 & 36	44.0 $L_{Aeq,16hour}$	32	12.0	40	-28.0
	45.9 $L_{Aeq,8hour}$		13.9	30	-16.1
	56.5 $L_{Amax,fast}$		24.5	45	-20.5
37 - 46	41.9 $L_{Aeq,16hour}$	32	9.9	40	-30.1
	43.8 $L_{Aeq,8hour}$		11.8	30	-18.2
	54.4 $L_{Amax,fast}$		22.4	45	-22.6

Table 4.7 indicates that the dwellings closest to the railway line meet the agreed internal target noise criteria for rail traffic and so no further consideration of mitigation is required.

During summer months it may be necessary to open windows in order to provide a supply of fresh air and Table 4.8 determines the internal noise levels for the dwellings closest to the railway line. BS8233 suggests that the sound reduction index of a partially open window will attenuate noise by approximately 12dB.

Table 4.8: Calculation of Internal Noise Levels – Windows Open

Dwelling	Calculated Noise Level at Façade (dB)	Attenuation Afforded by Open Window (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
35 & 36	44.0 $L_{Aeq,16hour}$	12	32.0	40	-8.0
	45.9 $L_{Aeq,8hour}$		33.9	30	+3.9
	56.5 $L_{Amax,fast}$		44.5	45	-0.5
37 - 46	41.9 $L_{Aeq,16hour}$	12	29.9	40	-10.1
	43.8 $L_{Aeq,8hour}$		31.8	30	+1.8
	54.4 $L_{Amax,fast}$		42.4	45	-2.6

Table 4.8 indicates that the internal target noise levels will be exceeded during the night-time period if windows are opened for the dwellings facing the railway line. Accordingly, Section 5.0 provides suitable mitigation measures.

4.2 Industrial & Commercial Noise Impact Assessment

Operations associated with the industrial units to the north west of the Site have been assessed in accordance with the guidance stated in BS4142. The main source of noise during the noise survey was from A and G Garages which consisted of the operation of handheld power tools and HGV deliveries.

A and G Garages operates during the daytime only and the measured noise levels have been extrapolated into the wider 1 hour daytime assessment noise level. As the noise measurements were taken to the north with direct line of sight with the noise sources, a correction of -10dB has been applied to the sources to allow for direct line of sight removal from the noise sources as a result of intervening buildings.

Table 4.9 determines the Calculated Noise Rating Level in the closest garden areas.

Table 4.9: BS4142 Assessment in Outdoor Amenity Areas during the Daytime Period

Source	Calculated Average $L_{Aeq,1hour}$ (dB)	$L_{Aeq,1hour}$ Plus Acoustic Feature Correction +5dB (dB)	$L_{Aeq,1hour}$ Plus Line of Sight Removal -10dB (dB)	Calculated Noise Rating Level $L_{A,r}$ In closest Garden (dB)
Hand Held Power Tools	29.3	34.3	24.3	21.6
HGV Delivery	37.6	37.6	27.6	22.8

Table 4.10 details the BS4142 assessment for operations associated with A and G Garages.

Table 4.10: BS4142 Assessment in Outdoor Amenity Areas during the Daytime Period

Source	Calculated Noise Rating Level $L_{A,r}$ In closest Garden (dB)	Background Noise Level prior to Operations Beginning (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
Hand Held Power Tools	21.6	36.9 $L_{A90,1hour}$	31.9	-10.3
HGV Delivery	22.8			-9.1

Table 4.10 indicates that the operation of hand held power tools and HGV deliveries results in a daytime noise level difference of -10.3dB and -9.1dB respectively below the required MCC criteria level. It is also important to consider the outdoor and internal noise criteria levels specified by MCC. Therefore, Table 4.11 compares the specific 1 hour noise level of the combined activities with the outdoor noise criteria of 55dB.

Table 4.11: Comparison of Specific Noise Level of Combined Activities with External Target Noise Level

Activity	Specific Noise Level $L_{Aeq,1hour}$ (dB)	Distance to Closest Proposed Dwelling (m)	Specific Noise Level of Combined Activities $L_{Aeq,1hour}$ (dB)	External Target Noise Level (dB)	Difference +/- (dB)
Hand Held Power Tools	29.3	15	43.2	55	-11.8
HGV Delivery	37.6	79			

Table 4.11 shows that the outdoor noise criteria level will not be exceeded in the garden areas of the closest proposed residential dwellings as a result of commercial and industrial noise from the north west. Therefore, no mitigation measures are required.

In calculating the internal noise levels, the now revoked Planning Policy Guidance Note 24 (PPG24) states that standard thermal double glazing, when set into a brick-block wall, will attenuate noise levels by 33dB and this level has been used in the calculations.

Table 4.12 compares the predicted internal noise levels with internal target noise levels.

Table 4.12: Comparison of Predicted Internal Noise Levels with Internal Target Noise Level

Calculated Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
38.2 $L_{Aeq,1hour}$	33	5.2	40	-34.8

Table 4.12 indicates that the dwellings closest to the industrial units meet the agreed internal target noise criteria and so no further consideration of mitigation is required.

During summer months it may be necessary to open windows in order to provide a supply of fresh air and Table 4.13 determines the internal noise levels for the dwellings closest to the

railway line. BS8233 suggests that the sound reduction index of a partially open window will attenuate noise by approximately 12dB.

Table 4.13: Calculation of Internal Noise Levels – Windows Open

Calculated Noise Level at Façade (dB)	Attenuation Afforded by Open Window (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
38.2 $L_{Aeq,16hour}$	12	26.2	40	-13.8

Table 4.13 indicates that the internal target noise levels will not be exceeded during the daytime period if windows are opened for the dwellings facing the industrial units. Therefore, no mitigation measures are required.

4.3 Rail Traffic Vibration Impact Assessment

The total VDV for the daytime period and night-time period, for passenger commuter trains has been calculated in accordance with the methodology presented in BS6472: 2008 using the appropriate weightings.

The total number of commuter trains has been obtained from train timetables published on the internet. The total number of freight trains has been obtained by using the noise level trace obtained during the background noise survey. Library source data of freight train vibration has been used.

Table 4.14 below summarises the results of the vibration assessment;

Table 4.14: Summary of Predicted Vibration Levels

Train Type	Timetabled Train Movements		Predicted Vibration Dose Value (m/s $^{1.75}$)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Passenger	112	8	0.018	0.009
Freight	0	20	-	0.102
		Total:	0.018	0.102

Comparing the predicted VDV levels at the Site boundary with the railway, and with the guideline values from BS6472:2008, it can be seen that there is less than a low probability of adverse comment likely, (see Table 2.2).

4.4 Calculation of Plant Noise Emission Limits for Future M&E Plant

MCC have stipulated that the total noise rating level for any new M&E plant shall not exceed the lowest measured 15-minute background noise level ($L_{A,r}$ = $L_{A90,15mins}$–5dB) when measured or calculated at the boundary of the closest residential property.

Plant noise emission limits have been derived for both daytime and night-time periods as detailed in Table 4.15.

Table 4.15: Calculation of Plant Noise Emission Limits

Period	Lowest Measured 15-minute Background Noise Level L_{A90} (dB)	Criteria	Derived Plant Noise Emission Limit L_{Ar} (dB)
Daytime (07:00 – 23:00)	35.9	L_{A90} - 5dB	30.9
Night-time (23:00 – 07:00)	31.5		26.5

Table 4.15 indicates the plant noise emission limits which should not be exceeded at the boundary of the closest residential property.

It should be noted that BS4142 is not applicable for use when rating noise levels fall below 35dB. As such it is recommended that in this instance the total noise rating level from any future M&E plant does not exceed 35dB $L_{A,r}$ at the closest receptor. This noise rating level will provide a sufficient level of protection for future residents without placing undue restrictions on development.

5.0 MITIGATION

5.1 Rail Traffic Noise Mitigation

The previous Section has indicated that the closest proposed residential dwellings to the railway line will benefit from sufficient sound insulation by using standard thermal double glazing, however with windows open, the sound insulation performance of the façade will not be sufficient in controlling external to internal noise break-in for all dwellings. Accordingly, it is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit of the northern facades of the habitable rooms so that fresh air can enter the room without having to open windows. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV) or Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

6.0 CONCLUSION

REC Limited have been commissioned by Smith Planning Consultancy to undertake a Noise Impact Assessment for a proposed residential development on land located off Vine Street in Gorton. This Noise Impact Assessment has been completed with due regard to the requirements of MCC's Environmental Health Department.

This assessment has been undertaken to identify key noise sources in the vicinity of the Site which may have the potential to impact upon the proposed noise-sensitive residential development.

This Noise Impact Assessment has identified that the key noise sources within the vicinity of the Site are train pass-bys using the Gorton to Fairfield Railway Line to the north, industrial noise from the commercial units to the north west on Lees Street and noise associated with the proposed care home to the north of the Site. Accordingly, appropriate consideration has been given towards the mitigation measures required to ensure a commensurate level of protection against noise for future occupants.

In the interests of controlling noise within habitable rooms whilst gaining a supply of fresh air with windows closed, this assessment has recommended the use of an alternative ventilation system for the northern facades of the dwellings along the northern Site boundary which have direct line of sight to the Gorton to Fairfield Railway Line.

It should be noted that all of the calculations performed in this assessment are based on worst-case assumptions and so the actual level of noise within external amenity areas and internal habitable rooms is likely to be lower than the calculated noise levels.

Subject to the incorporation of the identified mitigation measures, it is anticipated that a commensurate level of protection would be incorporated into the scheme for residential development

APPENDIX I LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Limited and the Client as indicated in Section 1.2.

2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

3. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man-made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.

4. REC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.

APPENDIX II GLOSSARY OF ACOUSTICAL TERMINOLOGY

Noise

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

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc, according to the parameter being measured.

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

An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A1: Typical Sound Pressure Levels

Sound Pressure Level dB(A)	Location
0	Threshold of hearing
20 - 30	Quiet bedroom at night
30 - 40	Living room during the day
40 - 50	Typical office
50 - 60	Inside a car
60 - 70	Typical high street
70 - 90	Inside factory
100 - 110	Burglar alarm at 1m away
110 - 130	Jet aircraft on take off
140	Threshold of pain

Acoustic Terminology

Table A2: Terminology

Descriptor	Explanation
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq, T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} & L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.

APPENDIX III FIGURES



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Figure 1

Site Location, NMP1, NMP2 and VMP1

APPENDIX IV SOUND PRESSURE LEVELS

Table A1: Measured Background, Ambient and Source Noise Levels at NMP2

Measurement Start Time	Measured Sound Pressure Level, freefield (dB)	
	$L_{Aeq,1hour}$	$L_{A90,1hour}$
24/10/2013 13:00	73.7	38.6
24/10/2013 14:00	44.6	38.5
24/10/2013 15:00	46.9	41.2
24/10/2013 16:00	47.3	42.8
24/10/2013 17:00	49.3	45.4
24/10/2013 18:00	51.2	49.5
24/10/2013 19:00	49.8	47.1
24/10/2013 20:00	47.6	45.9
24/10/2013 21:00	47.2	44.7
24/10/2013 22:00	45.8	43.2
24/10/2013 23:00	44.3	41.4
25/10/2013 00:00	43.1	39.3
25/10/2013 01:00	43.7	38.8
25/10/2013 02:00	44.6	39.3
25/10/2013 03:00	43.8	40.1
25/10/2013 04:00	42.5	40.3
25/10/2013 05:00	45.9	41.6
25/10/2013 06:00	52.3	47.9
25/10/2013 07:00	55.0	49.9
25/10/2013 08:00	50.4	48.3
25/10/2013 09:00	49.9	46.6
25/10/2013 10:00	48.7	45.1
25/10/2013 11:00	47.0	43.2
25/10/2013 12:00	48.7	41.9
25/10/2013 13:00	46.7	41.2
25/10/2013 14:00	47.3	40.2
25/10/2013 15:00	48.0	43.4
25/10/2013 16:00	53.1	44.7
25/10/2013 17:00	49.4	44.4
25/10/2013 18:00	50.3	45.7
25/10/2013 19:00	53.9	46.4
25/10/2013 20:00	47.2	43.0
25/10/2013 21:00	46.7	40.6
25/10/2013 22:00	43.6	40.1

25/10/2013 23:00	42.5	39.2
26/10/2013 00:00	41.6	37.5
26/10/2013 01:00	42.0	37.3
26/10/2013 02:00	40.7	36.4
26/10/2013 03:00	40.8	36.1
26/10/2013 04:00	40.1	35.2
26/10/2013 05:00	41.9	36.8
26/10/2013 06:00	42.6	35.6
26/10/2013 07:00	52.0	36.9
26/10/2013 08:00	49.8	45.1
26/10/2013 09:00	49.8	42.7
26/10/2013 10:00	43.7	39.7
26/10/2013 11:00	44.2	39.8
26/10/2013 12:00	44.6	41.0
26/10/2013 13:00	46.5	42.0
26/10/2013 14:00	45.6	41.0
26/10/2013 15:00	47.0	42.2
26/10/2013 16:00	49.5	42.5
26/10/2013 17:00	48.8	44.1
26/10/2013 18:00	48.8	44.4
26/10/2013 19:00	51.6	45.4
26/10/2013 20:00	53.3	44.1
26/10/2013 21:00	48.9	41.2
26/10/2013 22:00	40.9	38.1
26/10/2013 23:00	40.4	37.3
27/10/2013 00:00	42.4	38.0
27/10/2013 01:00	40.5	37.3
27/10/2013 01:00	39.9	36.9
27/10/2013 02:00	42.6	37.2
27/10/2013 03:00	47.3	39.4
27/10/2013 04:00	51.8	41.4
27/10/2013 05:00	38.9	35.6
27/10/2013 06:00	46.3	38.1
27/10/2013 07:00	45.3	40.1
27/10/2013 08:00	46.0	41.3
27/10/2013 09:00	52.9	43.0
27/10/2013 10:00	51.7	45.4
27/10/2013 11:00	52.4	46.2
27/10/2013 12:00	50.5	45.8

27/10/2013 13:00	53.7	44.8
27/10/2013 14:00	51.9	44.7
27/10/2013 15:00	53.9	45.8
27/10/2013 16:00	49.0	43.7
27/10/2013 17:00	50.3	44.4
27/10/2013 18:00	46.1	41.2
27/10/2013 19:00	45.0	38.6
27/10/2013 20:00	44.4	39.2
27/10/2013 21:00	43.6	39.2
27/10/2013 22:00	44.8	39.3
27/10/2013 23:00	47.4	43.2
28/10/2013 00:00	47.3	44.7
28/10/2013 01:00	44.4	37.3
28/10/2013 02:00	38.6	35.1
28/10/2013 03:00	35.7	32.4
28/10/2013 04:00	42.9	35.8
28/10/2013 05:00	51.1	47.6
28/10/2013 06:00	54.1	51.4

REC are a multi-disciplinary health, safety, environmental and energy consultancy. Our national coverage enables our local experts to provide cost effective and pragmatic consultancy services in an efficient and sustainable manner.

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