FABER MAUNSELL | AECOM

Extension to Carpenter Ltd, Glossop
Noise & Vibration Assessment

Carpenter Ltd
February 2009

Prepared by: .... Approved by: ....

Debbie Ward
Environmental Scientist

Mike Hewett
Regional Director

Extension to Carpenter

Rev No	Comments	Date
1	Draft	August 2008
2	Final	February 2009

Lynnfield House, Church Street , Altrincham, Cheshire, WA14 4DZ
Telephone: 0161 927 8200 Fax: 0161 927 8499 Website: http://www.fabermaunsell.com

Job No 60045681 Reference Date Created February 2009

f:\projects\environmental management & development - carpenters site, glossop\carpenter noise\report\final carpenter noise report feb 2009.doc

Table of Contents

FABER MAUNSELL | AECOM

Noise and Vibration Assessment

1 Introduction

1.1 This report presents the findings of a noise impact assessment for the proposed expansion of a mattress manufacturing site operated by Carpenter Ltd, Dinting Lodge Industrial Estate, Glossop.

1.2 Noise monitoring has been carried out to determine the existing acoustic climate at the nearest noise sensitive receptor location. The most significant noise sources that contribute to the existing ambient noise environment at this location are road traffic noise and commercial operations on the existing Carpenter Ltd site.

1.3 The potential impacts of construction noise and vibration have been assessed in accordance with relevant guidance methodologies.

1.4 Mitigation measures are discussed to prevent excessive sound transmission from the proposed extension.

1.5 The following sections of this report contain the measurement work undertaken, the results and a discussion of the relevant guidance. A glossary of acoustic terminology is provided in Appendix B.

2 Site Description

2.1 Carpenter Ltd is located on Dinting Lodge Industrial Estate, which is located on the western outskirts of Glossop, Derbyshire. The premises are used for the manufacture and distribution of polyurethane foam, processed polyester fibre and related products.

2.2 It is proposed that the factory/distribution building will be extended to the southeast, including a loading area to the south, and a new 0.77 ha truck park to the southeast. The height of the proposed building extension will be in keeping with the existing factory building.

2.3 Dinting Lodge is approximately 20 hectares in area comprising a mixture of commercial and industrial land use. Carpenters Ltd currently employs 196 full time staff consisting of unskilled, semi-skilled, skilled, administration and managerial positions. The buildings contain a variety of commercial uses including storage, workshops and offices.

2.4 The redevelopment of Carpenters Ltd would provide an additional 8,775 m² gross floor area of industrial use to the east and a service yard for HGVs to park in. This service yard will introduce a formal parking structure for the HGVs. The truck park will continue to be used

2.5 A designated staff car park is also to be located to the east of the main building.

2.6 The closest Noise Sensitive Receptors (NSR) are existing residential dwellings on Shaw Lane, approximately 95 m, and Shawfield Road, approximately 110 m, to the northeast of the proposed factory building extension

2.7 Figure 1.1 below illustrates the geographical location of Carpenter Ltd.

Figure 1.1 Location of Carpenter Ltd.

3 Assessment Methodology

3.1 Noise Perception and Terminology

3.1.1 Between the quietest audible sound and the loudest tolerable sound, there is a ten million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range, a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

3.1.2 The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB L_A

Table 3.1 Sound Pressure Level in dB L_A for Common Situations.

Typical Noise Level, dB L_A	***Example***
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2m
50	Quiet office, no machinery Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m Vacuum cleaner at 3m
80	General factory noise level
90	Heavy goods vehicle from pavement Powered lawnmower, operator's ear
100	Pneumatic drill at 5m
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

3.1.3 The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB, whereas in a suburban area this may increase up to 40 dB or more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

3.1.4 An indicator that is widely accepted as reflecting the underlying background noise level is the L_{A90} index. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a 1-hour period, the L_{A90} will be the noise level exceeded for 54 minutes.

3.1.5 The equivalent continuous A-weighted sound pressure level, L_{Aeq}, is the single number that represents the average sound energy measured over a period. L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to describe environmental noise from individual sources that vary in level over their operational cycle.

3.1.6 The $L_{AFmax,}$ measurement indicator is the maximum instantaneous sound pressure level attained during the measurement period, measured with the 'Fast' response setting of the sound level meter. It is most commonly used to assess potential night-time sleep disturbance.

3.1.7 The index historically adopted by the government since the early 1970s to assess road traffic noise is the $L_{A10,1hr}$. This is the noise level exceeded for 10% of the measurement time, over a 1-hour period the L_{A10} will be the noise level exceeded for 6 minutes. However, the L_{Aeq} level is widely used in Europe for road traffic noise assessment and is consequently becoming more commonly used in the UK.

3.1.8 Time weighting determines how quickly the sound level meter responds to changes in noise level. The 'Fast' time weighting effectively averages the measured level over an eighth of a second, whereas the 'slow' weighting averages over 1 second. The 'Fast' time weighting most closely follows the response of the human ear to sound level changes and is most commonly specified for environmental noise measurement purposes (including the L_{AF10}, L_{AF90} and L_{AFmax} statistical indices).

3.1.9 Most environmental noise measurements and assessments are undertaken in the 'free-field', away from any existing reflecting surfaces (other than the ground). However, it is sometimes necessary to consider noise levels immediately external to a facade when considering the impact on residents inside properties and this normally requires the addition of up to 3 dB to the predicted (or measured) free-field level due to noise reflection from the facade.

3.1.10 Human subjects, under laboratory conditions, are generally only capable of noticing changes in steady levels greater than 3 dB. It is generally accepted that a change of 10 dB in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient, non-steady or intermittent noise sources).

3.2 Terms of Reference

3.2.1 Assessment of noise impacts primarily involves the identification of potential sensitive receptors, including residences, educational establishments and hospitals and existing noise and vibration sources, together with consideration of the relevant national legislation and local planning issues. The following documents have been consulted:

- SODD Circular 10/1999 Planning and Noise
- BS 4142: 1997 'Method for - Rating industrial noise affecting mixed residential and industrial areas'
- Planning Policy Guidance PPG 24, 'Planning and Noise'
- BS 8233 : 1999 .'Sound insulation and noise reduction for buildings – Code of Practice'
- BS 5228 : 1997 'Noise and vibration control on construction and open sites' which has been superseded by BS 5228: 2009 ' Code of practice for noise and vibration on construction and open sites'
- 'Guidelines for Community Noise' World Health Organization, Geneva, 2000.
- CRTN- Calculation of Road Traffic Noise
- DMRB Volume 11 Section 3 Part 7, HA 213/08, 2008 'Noise and Vibration'

3.3 Construction Noise Assessment Methods

3.3.1 Noise levels generated by demolition and construction activities are regulated by guidelines and subject to local authority control. Advice is contained within British Standard BS 5228. A new version of BS 5228(2) came into force on 1st January 2009. At the moment the existing 1997 version is still officially approved under section 71 of the COPA'74 via The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2002.

3.3.2 BS 5228-1: 2009 'Code of practice for noise and vibration on construction and open sites'(2) contains an updated database on the noise emission from individual items of equipment and activities and routines to predict noise from demolition and construction methods to identified receptors. The prediction method gives guidance on the effects of different types of ground, barrier attenuation and how to assess the impact of fixed and mobile plant.

3.3.3 Construction noise levels have been estimated using published methodologies. Although short-term peak events may occur during construction, calculated noise has been presented as the continuous equivalent noise level over 10 hours during the working day (denoted as $L_{Aeq,10hr}$), to allow comparison against the ambient levels.

3.3.4 Construction work of any type that involves heavy plant activities generates a significant amount of noise and can lead to high levels of complaint if sensitive scheduling and control is not exercised. The effects on a neighbourhood of construction of the proposed development will depend on the specific construction activity and the proximity of local residents. Disturbance due to construction noise from a scheme of this sort, although it may be significant, is usually short-term since the period of construction is limited.

3.3.5 Construction noise can be assigned a descriptive impact in bands of noise levels.

Negligible: Generation of daytime facade noise levels that are below 55 dB $L_{Aeq,10hr}$.

Slight: Generation of daytime facade noise levels that are in the range of 55 to 65 dB $L_{Aeq,10hr.}$

Moderate: Generation of daytime facade noise levels that are in the range of 65 to 75 dB $L_{Aeq,10hr}$

Major: Generation of daytime facade noise levels in excess of 75 dB $L_{Aeq,10hr.}$

3.3.6 Some excavations and site levelling to provide for proposed building foundations and truck park will be undertaken. Assumptions have been made on likely plant and vehicles that would be used for such activities and the methodology prescribed within BS 5228 has been used to predict levels of construction noise at the nearest existing residential dwelling.

3.4 Operational Noise Assessment Methods

3.4.1 PPG 24 Noise Exposure Category

3.4.1.1 Planning Policy Guidance PPG 24 ‘Planning and Noise’ [3] was introduced by the Department of the Environment in 1994. Paragraph 1 on page 1 of PPG 24 indicates that it was issued to:

> ‘…*provide advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business … It outlines some of the main considerations which local planning authorities should take into account in drawing up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources’*

3.4.2 World Health Organization

3.4.2.1 The World Health Organization’s (WHO) ‘Guidelines for Community Noise’ [4] report for external daytime environmental noise levels (in a garden, for example) that;

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

3.4.2.2 For night-time noise sources the WHO guidelines recommend a night-time (23.00-07.00) noise level of 45 dB $L_{Aeq,8h}$ ‘outside bedroom windows’ (for a reasonably steady noise source) and on a sleep disturbance basis (for impact-type noise) the guidelines state in Section 3.3 that:

> *‘For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night……*’

3.4.2.3 This bedroom internal impact-type noise limit is confirmed in BS 8233:1999[5] and the WHO guidelines go on to further convert the internal limit to an external facade limit of 60 dB L_{AFmax} for ‘Outside bedrooms, sleep disturbance, window open, outdoor values’. (This follows since an open window will provide an insertion loss of approximately 15 dB and consequently a noise level of 60 dB L_{AFmax} external to an open bedroom window would lead to a resulting internal level of 45 dB L_{AFmax}).

3.4.2.4 It should be noted that this advice is merely a guideline for assessing likelihood of environmental annoyance; the most recent National Noise Incidence survey found that 55% of the population of the UK currently live in dwellings exposed to daytime noise levels above 55 dB L_{Aeq} and 68% to night-time noise levels above 45 dB L_{Aeq}.

3.4.3 Fixed Mechanical and Electrical Plant & HGV Movements

3.4.3.1 BS 4142:1997 - *Method for - Rating industrial noise affecting mixed residential and industrial areas* provides guidance on the assessment of the likelihood of complaints relating to noise from building services equipment. The standard presents a method of rating noise levels by comparing the noise level of the new source (the Rating Level) with the existing background noise level in the area in the absence of the building services noise (the Background Noise Level).

3.4.3.2 The rating method according to BS 4142:1997 accounts for unusual acoustic features such as a whine, hiss, impulsive or irregular noise by the addition of a single 5 dB correction to the actual specific noise level of the source. The corrected Specific Noise Level is the Rating Level.

3.4.3.3 The BS 4142:1997 rating is determined by arithmetically subtracting the Background Noise Level from the Rating Level. A difference of around +10 dB or more indicates that complaints about noise are likely. A difference of +5 dB is said to be of marginal significance. If the Rating Level is more than 10 dB below the Background Noise Level it is a positive indication that complaints are unlikely.

3.4.3.4 It should be noted however that the standard is not suitable for use where both the Background Noise Level and the Rating Level are very low. For the purpose of the standard, Background Noise Levels below about 30 dB and Rating Levels below about 35 dB are considered to be very low. In these instances a different assessment methodology is typically deemed to be more appropriate.

3.4.3.5 The background noise varies throughout the day and night. For new plant that may operate on a 24-hour basis, it is appropriate to measure the representative Background Noise Level (which would normally occur in the early hours of the morning) at the nearest residential property and to use this value for comparison against the predicted Rating Level from the new plant. If it can be shown that the Rating Level from the proposed new fixed plant would not exceed the Background Noise Level by more than 5 dB for the quietest period of the night, then it follows the impact will be lower at all other times throughout a 24-hour period.

3.4.4 Road Traffic Noise

3.4.4.1 The Design Manual for Road and Bridges (DMRB) Volume 11 Section 3 Part 7 HA 312/08 'Noise and Vibration' 2008 (8) provides a method of evaluating both the immediate and long term impact of abrupt changes in the 18-hour traffic flow (06.00-24.00) in terms of the effects on people and, principally, occupiers of residential property.

3.4.4.2 Individuals vary widely in their response to traffic noise, although the average or community response from a large number of people to the same level of traffic noise is fairly stable.

3.4.4.3 Consequently, a community average degree of annoyance can be related to the $L_{10,18h}$ traffic noise level. The annoyance caused by the existing traffic noise and the predicted future traffic noise is calculated, enabling the increase, or decrease in the percentage of people likely to be annoyed to be determined.

3.4.4.4 DMRB requires that an assessment is undertaken where an increase in a road traffic flow of 25% or greater is predicted (equivalent to an increase or decrease in road traffic noise of approximately 1 dB). This implies that road traffic flow increases of up to 25% offer no significant impact in environmental noise terms.

3.4.4.5 It is generally accepted that changes in road traffic noise levels of up to 3 dB are not widely perceptible, confirmed in Department for Transport document Transport Analysis Guidance Unit 3.3.2 [8]:

> *"For freely flowing traffic, a difference of about 3dB in noise level is required before there is a statistically significant change in the average assessment of nuisance. The assessment of nuisance however could still be affected even if there is only a 1dB change in the noise level if the change is associated with changes in the view of traffic, or if the change occurs suddenly."*

3.4.4.6 In order to assess the level of community disturbance from potential changes in local road traffic characteristics as a result of the proposed development, the following definitions of noise impact criteria have therefore been adopted, based on Table 3.1 in DMRB[8]. The change can be an increase or decrease of noise.

Table 3.3 Classification of Magnitude of Noise Impacts

Noise Change $L_{A10,18h}$	Magnitude of Impact
0	No change
0.1 - 0.9	Negligible
1.0 - 2.9	Minor
3.0 -4.9	Moderate
5.0+	Major

3.5 Vibration Assessment Methods

3.5.1 After the construction works are complete it is not expected that there will be any significant sources of vibration associated with the development. Appropriate conditions should be imposed if any vibration generating plant is to be installed as part of the proposed extension.

3.5.2 The propagation of ground-borne vibration is very complex. There are no nationally accepted methods for prediction of passage of vibration through ground due to the varying effects of non-uniform ground conditions, although some empirical formulae have been proposed for known ground conditions based on previously measured data.

3.5.3 In this instance, vibration due to excavation and construction has been calculated using measured source data and the propagation relationship taken from the British Standard BS 5228: 1992: Part 4 [9] and data included in the British Steel document 'Control of Vibration and Noise During Piling' [10]. The standard suggests that attenuation with distance should be calculated as the reciprocal of the source-receiver distance.

3.6 Application to this Development

3.6.1 Noise

3.6.1.1 For short-term daytime site preparation and construction noise, a limit of 75 dB $L_{Aeq,10h}$ (free-field) is recommended in the vicinity of the nearest residential property, which should prove acceptable for a total of up to 8 weeks per year throughout the course of the site's development. For longer term demolition and construction activities, a limit of 65 dB $L_{Aeq,10h}$ (free field) is recommended.

3.6.1.2 For any potential increase in local road traffic as a consequence of the development, an increase of up to 1 dB, (equivalent to an increase in road traffic of approximately 25% on roads local to the development) is not significant.

3.6.1.3 Noise from fixed plant associated with the proposed expansion (e.g. boilers, HVAC equipment, or refrigeration plant) should be limited to a BS 4142 Rating Level no more than 5 dB above the existing Background Noise Level at any noise sensitive receptor. On the basis that such plant could operate on a 24-hour basis, comparison of predicted levels with the minimum existing Background Noise Level throughout a 24-hour period measured at local existing and proposed residential property is considered appropriate. a limit of up to 5 dB in excess of the existing ambient environmental background noise level is recommended. On the basis that such plant could operate on a 24-hour basis, comparison of predicted levels with the minimum existing ambient background noise level throughout a 24-hour period measured at local existing and proposed residential property is considered appropriate.

3.6.2 Vibration

3.6.2.1 It is proposed, on structural damage grounds, that ground-borne peak particle velocity (ppv.) (for continual vibration) at the base of existing local residential properties should not exceed the limit of 5 mm/s ppv, stipulated in British Standard BS 5228: 1992 Part 4 (9).

4 Baseline Situation

4.1 Ambient Noise Monitoring

4.1.1.1 Measurement of the existing background noise levels at the nearest noise sensitive receptor has been undertaken in accordance with BS4142:1997 (6). This was carried out at a location representative of the nearest residential properties on Shaw Lane, as identified in Figure 4.1.. As no suitable location was identified north of Shaw Lane, monitoring was carried out at a point south of Shaw Lane, at a similar distance from the carriageway. The survey was undertaken on the afternoon of Monday 17th March and in the early hours of Tuesday 18th March 2008.

4.1.1.2 At this location, and at the nearest residential dwellings, the predominant noise sources that contribute to the existing acoustic environment include road traffic, birdsong and overhead aircraft in and out of Manchester Airport. Although operations were ongoing at the Carpenter Ltd site, its associated activities were not audibly perceived during either the day or night-time attended survey.

4.1.2 Indicators

4.1.2.1 The noise monitoring survey was undertaken in compliance with BS 7445: 2003 (11) 'Description and measurement of environmental noise', using the following equipment:

- Brüel & Kjær 2238 Type 1 Integrating sound level meter s/n 2106193
- Brüel & Kjær 4231 Sound level calibrator s/n 2326978

4.1.2.2 Various A-weighted noise indicators were measured including the equivalent continuous noise level (L_{Aeq}) and statistical indices such as Background Noise Level (L_{AF90})). The sound level meter was set to the 'fast' time response.

4.1.2.3 The calibration of the equipment was checked before and after each set of measurements and found to be within specified limits. All staff involved with noise measurements were competent to do so, either being Members of the Institute of Acoustics or holding a Certificate of Competence in Environmental Noise Measurement.

4.1.3 Meteorological Conditions

4.1.3.1 Weather conditions during the monitoring period were conducive to environmental noise measurements, with generally fair, dry conditions and low wind speeds (NNE direction)

4.1.4 Measurement Location

4.1.4.1 Figure 4.1 below shows the background noise monitoring location and other surrounding NSRs.

Figure 4.1Noise Monitoring Location

4.1.5 Noise Monitoring Results

4.1.5.1 The survey results are summarised in Table 4.1 below.

Table 4.1 Attended Measurement Data

Period	**Measurement Period**	**Measurement Duration, T**	**Sound Pressure Level, dB**		
			$L_{Aeq,T}$	$L_{AF90,T}$	$L_{AFmax,T}$
Day (17/03/08)	13:56 – 14:56	1 hr	64	44	85
	14:56 – 15:56	1 hr	66	48	86
	15:56 – 16:56	1 hr	66	48	84
Night (18/03/08)	01:56 – 02:01	5 min	40	34	65
	02:01 – 02:06	5 min	36	34	43
	02:06 – 02:11	5 min	35	33	43
	02:11 – 02:16	5 min	35	33	43

Notes:-

All values are in dB re 20 µPa, Free-field, with 'fast' time-weighting

4.2 Ambient Vibration Monitoring

4.2.1 There are currently no significant sources of vibration to the area. Consequently, ambient vibration monitoring has not been undertaken. It should be noted that annoyance due to vibration is not related to comparison of pre and post-development vibration levels, and pre-development vibration levels are not usually necessary to assess the likelihood of vibration damage or annoyance from any new vibration sources to be introduced to an area.

5 Construction Impacts

5.1 Construction Phase Noise

5.1.1 In order to evaluate the noise during the developments site preparation and construction phase it is necessary to define the various activities that will be undertaken. Construction contractors may use different working methods and plant to achieve the same ends, so an accurate demolition and construction noise and vibration impact assessment is not normally possible until appointment of the approved contractor. Consequently, at this stage of a project it is normally only possible to undertake a generic demolition and construction noise and vibration impact assessment based on expected methods of working gained from experience with previous similar developments.

5.1.2 For the purpose of predicting demolition and construction noise levels a series of typical activities have been assessed, based on likely closest approach and typical plant working.

5.1.3 The nearest Noise Sensitive Receptors (NSRs) are existing residential properties on Shaw Lane and Shawfield Road to north east. The distance of these properties from proposed expansion and truck park will vary considerably throughout the construction programme. Predictions of construction noise levels have therefore been undertaken at these and further locations, which vary from 95 – 200 m from construction activities.

5.1.4 Typical construction plant that are likely to be used on site include the following:

- Excavators;
- Cranes;
- Earthmoving plant;
- Compressors;
- Generators;
- Road-going lorries removing spoils and delivering material;
- Hand held tools such as disc cutters, grinders and nut runners; and
- Piling plant.

5.1.5 Typical road construction plant (truck park area) that are likely to be used on site include the following:

- Backhoe Excavator;
- 360º Excavator;
- Dozers;
- Breakers;
- Vibrating Rollers;
- Water Pumps;
- Generators; and
- Paver

5.1.6 A full list of assumed plant, associated sound power levels (SWL) and prediction routines, to the requirements of BS 5228 (1), is included in the tables in Appendix C. The sound power levels of the various plant items were taken from Annex C of BS 5228-1:2009(2)

5.1.7 For the purposes of this assessment, heavy plant construction activities have been assumed to take place during normal working hours, namely Monday to Friday, between 08:00 and 17:30 and on Saturdays between 08:00 and 13:00.

5.1.8 The BS 5228(1) prediction method uses the shortest distance from the receptor to the construction activities. The nearest edge of the relevant construction site has been used as the calculation point for equipment/plant classed as 'mobile' (loaders, excavators etc.) and similarly the edge of the site has been used as the calculation point for equipment/plant classed as 'fixed' (generators, compressors etc.).

5.1.9 Predicted noise levels therefore represent a worst-case scenario and in practice the actual noise levels are unlikely to reach those predicted.

5.1.10 Detailed calculations are presented in Appendix C and are summarised in Tables 5.1 and 5.2 below.

Table 5.1 Summary of Worst-case Predicted Demolition and Construction noise levels

NSR Distance	Predicted worst case 1-hour noise levels, closest approach dB $L_{Aeq,1h}$			
	Earthworks and site preparation	Piling *(if required*	Slab construction	Building construction
Shaw Lane (95 m)	65	64	62	59
Shawfield Road (110 m)	64	63	61	58
200 m	57	56	54	51

Table 5.2 Summary of Worst-case Predicted Road Construction Noise Levels

Distance to works	Predicted worst case 1-hour noise levels, closest approach dB $L_{Aeq,1h}$	
	Site preparation	Road construction
Shaw Lane	56	55
Shawfield Road	55	55
200m	53	52

5.1.11 From the tables above, it can be seen that predicted demolition and construction noise levels will not exceed the adopted criterion of 75 dB $L_{Aeq,10h}$ proposed for nearest existing residential properties

5.1.12 When compared with the significance criteria detailed in Section 3.3, at worst-case, slight impacts are predicted during truck park construction activities at the nearest residential dwellings. In practice, the worst-case nature of the assessment (with all plant working at its closest approach) means that the actual levels are likely to be lower and, furthermore, these levels would not exist throughout the duration of a working day due to mobility of working.

5.1.13 The nature of demolition and construction work means that the worst-case situation with the plant working at closest approach may exist for only a matter of days or even hours and there would be regular periods, even during the course of a single day, when the assumed noise plant would not be in operation during breaks or changes of working routine. However, until the contractor is appointed and the actual (rather than assumed) method of working is specified, detailed recommendations to reduce the predicted worst-case construction noise to the closest residential and other noise sensitive buildings cannot be undertaken.

5.2 Construction Phase Vibration

5.2.1 Surface plant such as cranes, compressors and generators are not recognised as sources of high levels of environmental vibration. Reference to Figure C2 of ‘Control of Vibration and Noise During Piling’ [(10)] confirms that ppv significantly less than 5 mm/s are generated by such machinery, even at a closest distance of 10 m. For example, the indication is that a bulldozer would generate a ppv of approximately 0.6 mm/s and a ‘heavy lorry on poor road surface’ a ppv of less than 0.1 mm/s at 10 m. These values are well below limits at which even cosmetic building damage becomes likely (5 mm/s).

5.2.2 The nature of any necessary piling work to establish foundations for proposed buildings has not yet been specified, and indeed may not be necessary. The final choice of piling will take into account design loads, geotechnical soil conditions and specific requirements emerging from the potential to take into account the floodplain. The financial cost of such works will also be a factor in determining piling methodology, but rotary bored piling would result in generally lower noise and vibration levels and is to be preferred. There are various other low noise and low vibration piling options that could also be considered.

5.2.3 It is generally accepted that, without a highly detailed understanding of the media, waveform, and frequency distribution, ground-borne vibration prediction methods are "*beset with complexities and uncertainties*" (12). However, it is unlikely that typical construction and demolition working routines would generate levels of vibration at local receptors above which cosmetic damage would be expected to be sustained.

6 Operational Impacts

6.1 Fixed Plant Noise

6.1.1 Predicted noise levels from fixed plant are calculated from basic acoustic formulae using various factors not dissimilar to the BS 5228 method used for demolition and construction noise. The sound power level of the source (i.e. compressor, generator, pump house, refrigeration condensers, roof mounted fans etc.), the directivity, distance to receiver, shielding effect of any barriers, and ground surface absorption are used to calculate the sound pressure level at the receptor. It is usual to predict noise from fixed plant as a 1-hour L_{Aeq} in the daytime and a 5-minute L_{Aeq} night-time level, as per the requirements of BS 4142 [(6).]

6.1.2 There may be fixed plant associated the extended building, likely to principally include ventilation, heating and refrigeration plant. Most of this plant will be capable of operating on a 24-hour basis or at least during periods considered to be night and day

6.1.3 At this stage the location and full complement of all fixed plant associated with the expansion is not available and would only normally be made available by the Mechanical & Electrical Design subcontractors upon finalisation of each building's detailed specification.

6.1.4 Fixed plant is relatively easy to attenuate, more so at the design stage. For example, breakout noise from refrigeration plant contained within plant rooms can be silenced using acoustic ventilation louvres, fans contained within units with ducted intakes, exhausts can be silenced using in-duct attenuators, and noise from boiler flue fans can be silenced by atmospheric-side boiler flue attenuators. This can be controlled through the application of standard conditions on the planning permission.

6.1.5 There is no reason why noise from fixed plant should prove problematical for this development and noise impact prediction routines undertaken at a later date will enable identification of any necessary noise mitigation measures.

6.2 HGV Movements in Proposed Truck Park and Proposed Loading Area

6.2.1 The proposed extension of the factory will provide sufficient screening attenuation from the proposed loading area to protect the residential dwellings on Shaw Lane. It is therefore considered that the associated noise impacts resulting from the proposed scheme will be negligible.

6.3 Noise from Local Roads

6.3.1 The Transport Assessment (TA) completed by Faber Maunsell predicts that in 2010, in comparison with the do-nothing scenario, the proposed development will result in the percentage changes in peak hour flow, summarised in Table 6.1.

Table 6.1 Summary of Traffic Generation Predictions

Location	% Change in Traffic Flow 2010	
	AM Peak	PM Peak
Shaw Lane	+6.6	+4.8
Cottage lane	0.0	0.0
A57 Hyde	+1.4	+1.2
A57 Glossop	+2.0	+1.7

Table 6.2 Predicted Changes in Traffic Noise 2010

Location	dB Change		Impact
	AM Peak	PM Peak	
Shaw Lane	+0.3	+0.2	Negligible
Cottage lane	0.0	0.0	Neutral
A57 Hyde	+0.1	+0.1	Negligible
A57 Glossop	+0.1	+0.1	Negligible

6.3.2 The summary above indicates there will be a slight increase in traffic flows on local roads with the proposed expansion. This increase in traffic flow will have a negligible impact on existing noise sensitive receptors. It should be noted that the traffic predictions above are based on peak hour traffic flow, during other times the traffic flow will be minimal The predicted change in traffic flow is less than 25% and is therefore likely to pass unnoticed by local receptors. It is generally accepted that changes in road traffic noise levels of up to 3 dB are not widely perceptible, confirmed in Department for Transport Analysis Guidance [(8)].

6.4 Operational Vibration

6.4.1 Vibration during operation is not likely to cause any significant disturbance to occupiers of existing or proposed properties. Proposed residential traffic and delivery vehicles may cause occasional airborne resonance of loose fittings within dwellings. However, DMRB [(7)] states:

> *'Normal use of a building such as closing doors, walking on suspended wooden floors and operating domestic appliances can generate similar levels of vibration to that from traffic* '

6.4.2 It is therefore considered that vibration from operational traffic associated with the proposed development will have a negligible adverse impact on existing sensitive receptors.

7 Mitigation

7.1 Construction Phase

7.1.1 Agreement on methods of working should be sought from Officers of High Peak Borough Council to limit the impacts of construction noise. British Standard 5228(1)(2) gives detailed advice on methods of minimising nuisance from construction noise. This can take the form of reduction at source, control of noise spread and in areas of very high noise levels, insulation at receptors. It is likely to be a requirement of any construction contract that the constructors comply with the recommendations in this standard, in order to achieve specific noise limit criteria for each site.

7.1.2 Mitigation measures could be the subject of control through the use of planning conditions and could include the following provisions:

- Construction sites to be surrounded with industry standard hoardings or other barriers, where appropriate.
- Continuous noisy plant to be housed in acoustic enclosures;
- Use of electrical items of plant instead of diesel plant in especially sensitive locations;
- Exhaust silencing and plant muffling equipment to be maintained in good working order;
- Night time working to be kept to an absolute minimum and the normal working day to be used wherever possible, and
- Loading/unloading sites to be located away from residential properties and shielded from those properties where practicable.
- Ensure modern plant is used, complying with the latest EC noise emission requirements
- Idling of machines between work periods and revving of engines should be avoided
- Keep internal routes well maintained and avoid steep gradients
- Use rubber linings in, for example, chutes and dumpers to reduce impact noise
- Arrange the site operations and vehicles routes to minimise the need for reversing movements.

7.1.3 In general, good public relations and extensive consultation with local authorities will be essential to help to minimise the impact of construction work. Local residents in particular will need to be persuaded that any higher levels of noise will only be for a short period of time and so it will be necessary to publicise and adhere to a stated works schedule.

7.1.4 Until the contractor is appointed and the actual (rather than assumed) method of working is specified, detailed recommendations to reduce the predicted worst-case demolition and construction noise to the closest residential and other noise sensitive buildings cannot be developed.

7.2 Operational Phase

7.2.1 Fixed Plant

7.2.1.1 The fixed plant associated with the proposed expansion may be capable of operating on a 24-hour basis and has the potential to generate noise. However at this early stage of the development the final details of the plant is not available.

7.2.1.2 The ambient background levels at nearest residential dwelling are 47 dB $L_{A90,1hr}$ during the day and 33 dB $L_{A90,5min}$ during the night. Therefore it is appropriate to specify suitable noise limits that any such plant operations should conform to. These limits should include any corrections for acoustic characteristics

7.2.1.3 Consequently, a total predicted noise level criterion of 52 dB $L_{Aeq,1hrr}$ is recommended for the sum of all fixed plant noise associated with the development, at the nearest proposed noise sensitive property for daytime operation.

7.2.1.4 For any plant that would potentially operate at night, a fixed plant noise level criterion of 38 dB $L_{Aeq,5min}$ is recommended at the nearest proposed noise-sensitive property Noise limits have been proposed to aid in the control of noise from any proposed fixed plant items, or commercial activities to be undertaken at the site. These limits have been proposed based on the guidance contained in BS 4142: 1997 'Method for rating industrial noise affecting mixed residential and industrial areas' (6), and the results of the environmental noise survey.

7.2.1.5 BS 4142(6) states that a Rating Level of +5 dB above the Background Noise Level is of 'marginal significance when assessing the likelihood of complaints. Consequently, it is recommenced that the total noise from all external plant to be incorporated in the proposal should be specified to meet this criterion at the closest noise sensitive receptors during both the daytime and night-time periods.

7.2.1.6 The above limits apply to the total noise emission from all new plant. Individual plant items must, therefore, be designed to lower levels than stated above where more than one plant item contributes to the overall noise emission in a particular area. This issue is best addressed during the detailed design stage.

7.2.1.7 Fixed plant is relatively easy to attenuate, more so at the design stage. For example, breakout noise from refrigeration plant contained within plant rooms can be silenced using acoustic ventilation louvers, fans contained within units ducted intakes, exhausts can be silenced using in-duct attenuators and noise from boiler flue fans can be silenced by atmospheric-side boiler flue attenuators.

7.2.1.8 Provided the design, location and installation of any fixed plant and the nature of future commercial operations are such that the specified noise limits are achieved, the significance of any adverse impacts will be minor.

7.2.2 HGV Movements in Proposed Truck Park

7.2.2.1 The proposed extension of the factory will provide sufficient screening attenuation of the proposed loading area to protect the residential dwellings on Shaw Lane. Therefore, additional mitigation measures are not required.

7.3 Existing Sensitive Receptors

7.3.1 No mitigation is required to reduce the potential road traffic noise.

7.3.2 The proposed noise limits for the commercial areas and fixed plant given above would be considered to be of less than 'marginal significance' by BS 4142 methodology Therefore, residual impacts are considered to be of minor significance.

8 Residual Impacts

Table 8.1 Residual Impact Summary Table

Development Phase	Description of Potential Impact	Classification of Potential Impact	Assessment of Significance Without Mitigation	Proposed and Recommended Mitigation Measures	Residual Impact
Construction	Noise from construction activities on site	Temporary Short-term	Slight /adverse	Code of construction practice, location of equipment, strict site management, restriction of operational hours.	Negligible to Slight/ adverse
	Vibration from construction activities on site	Temporary Short-term	Negligible/adverse		Negligible/adverse
	Noise from heavy construction vehicles	Temporary Short-term	Negligible/adverse		Negligible/adverse
	Vibration from heavy construction vehicles	Temporary Short-term	Negligible/adverse		Negligible/adverse
Occupation	Traffic noise on local roads	Permanent Long- Term	Negligible/adverse	None	Negligible/adverse
	Vibration from vehicles on local roads	Permanent Long-term	Negligible/adverse	None	Negligible/adverse
	Noise from vehicles on proposed site roads	Permanent Long term	Negligible/adverse	None	Negligible/adverse
	Vibration from vehicles on proposed site roads	Permanent Long-term	Negligible/adverse	None	Negligible/adverse
	Noise from fixed M&E plant	Permanent Long-term	Negligible/adverse	Appropriate M&E plant selection, sensitive locating of plant, attenuation and isolation where required	Negligible/adverse
	Vibration from fixed M&E plant	Permanent Long-term	Negligible/adverse		Negligible/adverse

9 Conclusion and Summary

9.1 Construction Phase

9.1.1 In general, it is predicted that the site preparation and construction activities will generate negligible to slight short-term residual impacts at the nearest residential properties with the recommended mitigation measures in place.

9.1.2 Based on likely working methods and duration, residual vibration impacts resulting from short-term site clearance and construction activities would be negligible.

9.2 Operational Phase

9.2.1 Design and attenuation measures can be employed to ensure that any required mechanical and electrical plant associated with the proposed expansion will have a negligible impact at existing and proposed residential dwellings.

9.2.2 The proposed extension of the factory will provide sufficient screening attenuation from the proposed loading area to protect the residential dwellings on Shaw Lane.

9.2.3 The slight increase in traffic flow on local roads will have a negligible impact and is unlikely to be perceptible at existing sensitive receptors.

9.2.4 Vibration impacts once the development is fully occupied will be negligible.

9.3 Post Development Monitoring

9.3.1 It is not considered necessary to undertake routine monitoring once the development is completed. However, if it is found that construction methods differ significantly from those described above, further noise predictions will need to be undertaken to ensure the potential impact of the construction phase is not increased

References

1. British Standard BS 5228: 1997 'Noise and vibration control on construction and open sites. Part 1. Code of practice for basic information and procedures for noise and vibration control''. British Standards Institution, 1997. ISBN 0 580 26845 4.

2. British Standard BS5228-1:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites

3. Planning Policy Guidance: Planning and Noise PPG 24, September 1994, Department of the Environment

4. Guidelines for Community Noise, World Health Organisation, 1999

5. British Standard BS 8233: 1999 'Sound insulation and noise reduction for buildings – Code of practice' British Standards Institution, 1999. ISBN 0 580 33009 5.

6. British Standard BS 4142: 1997 'Rating industrial noise affecting mixed residential and industrial areas'. British Standards Institution, 1997. ISBN 0 580 28300 3

7. Design Manual for Roads and Bridges Volume 11 Section 3 part 7, 1994. The Department of Transport.

8. Transport Analysis Guidance. Department for Transport. Update February 2007

9. British Standard BS 5228: 1992 Part 4 'Code of practice for noise and vibration control applicable to piling operations. Part 4. Code of practice for noise and vibration control applicable to piling operations''. British Standards Institution, 1992. ISBN 0 580 20381 6.

10. .British Steel, 1998. 'Control of Vibration and Noise During Piling'.

11. BS7445: 2003 'Description and measurement of environmental noise, Part 1: Guide to quantities and procedures'. British Standards Institution, 2003. ISBN 0 580 43032 4.

12. Thornley-Taylor, R.M., 'Ground Vibration Prediction and Assessment'.

13. Calculation of Road Traffic Noise, The Department of Transport and The Welsh Office, 1975 and 1988. ISBN 0 11 550847 3.

Appendix A Abbreviations

AADT	Annual average daily traffic
BS	British Standards
CRTN	Calculation of Road Traffic Noise
dB	Decibel
DMRB	Design Manual for Roads and Bridges
EHO	Environmental Health Officer
EMP	Environmental Management Plan
eVDV	Estimated Vibration Dose Value
HGV	Heavy Goods Vehicle
HVAC	Heating, ventilation and air-conditioning
Hz	Hertz
ISO	International Organisation for Standardisation
NEC	Noise Exposure Category
NSR	Noise Sensitive Receptor
Pa	Pascal
PPG	Planning Policy Guidance
ppv	Peak particle velocity
rms	Root mean square
TA	Transport Assessment
VDV	Vibration dose value
WHO	World Health Organisation

Appendix B – Glossary of Acoustic Terms

dB	Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise i.e. whether is it high pitched, low pitched or with no distinct tonal character. These measurements are usually undertaken in octave or 1/3 octave frequency bands. If these values are logarithmically summed a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.
dB L_A	Instead, the dB L_A figure is used, as this is found to relate better to the loudness of the sound heard. The dB L_A figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or 1/3 octave band values, before logarithmically summing them. As a result the single dB L_A value provides a good representation of how loud a sound is. It is common to se the A-weighted value identified by dB(A). This is an old description and should be avoided as it now conflicts with other SI unit nomenclature.
L_{Aeq}	As almost all sounds vary or fluctuate with time it is helpful instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The $L_{Aeq,\ 07:00\text{-}19:00}$ for example, describes the equivalent continuous noise level over the 12 hour period between 7am and 7pm. During this time period the L_{pA} at any particular time is likely to have been either greater or lower than the $L_{Aeq,\ 07:00\text{-}19:00}$
L_{Amax}	The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.
L_{An}	Another method of describing with a single value a noise level which varies over a given time period, is instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceed for say 6 minutes within one hour, that level can be described as being exceeded for 10% of the measurement period. This is denoted as the $L_{A10,1hr}$ = x dB. The L_{A10} index is often used to describe road traffic noise whilst the L_{A90}, the noise level exceeded for 90% of the time, is the usual descriptor of the underlying background noise. L_{A1} in addition to L_{Amax} are common descriptors of construction noise.
P.P.V	The Peak Particle Velocity is the maximum velocity which is recorded during a particular event and can refer to a particular orientation (vertical or horizontal) or to the maximum (units: mm/s).
VDV	Vibration Dose Value is a measure of vibration exposure; the fourth route of the integral, over the measurement period, of the fourth power of the frequency weighted time-varying acceleration (units: m/s)

Appendix C – BS 5228 Construction Noise Calculations

Faber Maunsell Limited

Carpenter Ltd

Typical Demolition and Construction Noise Prediction at Shaw Lane

Calculations to BS 5228

Plant Type	SWL dB(A)	Dist. (m)	Dist. Attn.	Barrier Attn	Grnd Attn	Total Attn	Result SPL	trav'se dist. ltr	Min. dist. dmin	Dist. Ratio ltr/dmin	Corrn Factor F (manual)	Act'vty Dur. Tt	Corr Ontime tc	Noise Level
Operation:	**Earthworks and Site Preparation**													
excavator	114	95	47.6	0	2.9	50.4	63.6	20	95	0.2	1.00	0.80	0.80	62.59
dumper	104	95	47.6	0	2.9	50.4	53.6	20	95	0.2	1.00	0.80	0.80	52.59
dozer	109	95	47.6	0	2.9	50.4	53.6	20	95	0.2	1.00	0.80	0.80	52.59
breaker	120	95	47.6	0	2.9	50.4	58.6	20	95	0.2	1.00	0.80	0.80	57.59
loader	108	95	47.6	0	2.9	50.4	57.6	20	95	0.2	1.00	0.80	0.80	56.59
vibratory plate	108	95	47.6	0	2.9	50.4	57.6	20	95	0.2	1.00	0.80	0.80	56.59
													Total	**65.4**
Operation:	**Piling (if required)**													
crane mounted auger (two)	110	95	47.55	0	2.9	50.44	59.56	5	95	0.1	1.00	0.50	0.50	56.5
electric water pumps (four)	113	95	47.55	0	2.9	50.44	62.56	5	95	0.1	1.00	0.83	0.83	61.7
concrete pump (one)	106	95	47.55	0	2.9	50.44	55.56	5	95	0.1	1.00	0.83	0.83	54.7
concrete poker (one)	106	95	47.55	0	2.9	50.44	55.56	5	95	0.1	1.00	0.83	0.83	54.7
													Total	**64.1**
Operation:	**Slab construction**													
compactor (six)	113	95	47.55	0	2.9	50.44	62.56	10	95	0.1	1.00	0.83	0.83	61.7
excavator (one)	94	95	47.55	0	2.9	50.44	43.56	10	95	0.1	1.00	0.83	0.83	42.7
tower crane (one)	104	95	47.55	0	2.9	50.44	53.56	10	95	0.1	1.00	0.50	0.50	50.5
concrete pump (one)	95	95	47.55	0	2.9	50.44	44.56	10	95	0.1	1.00	0.83	0.83	43.7
diesel water pump	96	95	47.55	0	2.9	50.44	45.56	10	95	0.1	1.00	0.83	0.83	44.7
													Total	**62.3**
Operation:	**Building construction**													
electric bolters (three)	110	95	47.55	0	2.9	50.44	59.56	20	95	0.2	1.00	0.75	0.75	58.3
cranes (two)	101	95	47.55	0	2.9	50.44	50.56	20	95	0.2	1.00	0.50	0.50	47.5
hand nail gun	101	95	47.55	0	2.9	50.44	50.56	8	95	0.1	1.00	0.80	0.80	49.6
													Total	**59.2**
Operation:	**Road construction - Site preparation**													
Breaking concrete	110	150	51.52	0	4	55.40	54.60	30	150	0.2	1.00	0.50	0.50	51.6
road planer	110	150	51.52	0	4	55.40	54.60	1	150	0.0	1.00	0.50	0.50	51.6
bulldozer	105	150	51.52	0	4	55.40	49.60	30	150	0.2	1.00	0.83	0.83	48.8
wheeled excavator	101	150	51.52	0	4	55.40	45.60	30	150	0.2	1.00	0.83	0.83	44.8
													Total	**56.0**
Operation:	**Road construction**													
paving machine	103	150	51.5	0	3.9	55.4	47.6	25	150	0.2	1.00	0.50	0.50	44.59
vibrating roller	103	150	51.5	0	3.9	55.4	47.6	25	150	0.2	1.00	1.00	1.00	47.60
road roller	108	150	51.5	0	3.9	55.4	52.6	25	150	0.2	1.00	1.00	1.00	52.60
asphalt paver	103	150	51.5	0	3.9	55.4	47.6	25	150	0.2	1.00	0.83	0.83	46.79
compressor	93	150	51.5	0	3.9	55.4	37.6	1	150	0.0	1.00	1.00	1.00	37.60
generator	97	150	51.5	0	3.9	55.4	41.6	1	150	0.0	1.00	1.00	1.00	41.60
water pump	96	150	51.5	0	3.9	55.4	40.6	1	150	0.0	1.00	1.00	1.00	40.60
													Total	**55.4**

Faber Maunsell Limited

Carpenter Ltd

Typical Demolition and Construction Noise Prediction at Shawfield Road

Calculations to BS 5228

Plant Type	**SWL dB(A)**	**Dist. (m)**	**Dist. Attn.**	**Barrier Attn**	**Grnd Attn**	**Total Attn**	**Result SPL**	**trav'se dist.** ltr	**Min. dist.** dmin	**Dist. Ratio** ltr/dmin	**Corrn Factor** F (manual)	**Act'vty Dur.** Tt	**Corr Ontime** tc	**Noise Level**
Operation:	**Earthworks and Site Preparation**													
excavator	114	110	48.8	0	3.2	52.0	62.0	20	110	0.2	1.00	0.80	0.80	61.00
dumper	104	110	48.8	0	3.2	52.0	52.0	20	110	0.2	1.00	0.80	0.80	51.00
dozer	109	110	48.8	0	3.2	52.0	52.0	20	110	0.2	1.00	0.80	0.80	51.00
breaker	120	110	48.8	0	3.2	52.0	57.0	20	110	0.2	1.00	0.80	0.80	56.00
loader	108	110	48.8	0	3.2	52.0	56.0	20	110	0.2	1.00	0.80	0.80	55.00
vibratory plate	108	110	48.8	0	3.2	52.0	56.0	20	110	0.2	1.00	0.80	0.80	55.00
													Total	**63.8**
Operation:	**Piling (if required)**													
crane mounted auger (two)	110	110	48.83	0	3.2	52.03	57.97	5	110	0.0	1.00	0.50	0.50	55.0
electric water pumps (four)	113	110	48.83	0	3.2	52.03	60.97	5	110	0.0	1.00	0.83	0.83	60.2
concrete pump (one)	106	110	48.83	0	3.2	52.03	53.97	5	110	0.0	1.00	0.83	0.83	53.2
concrete poker (one)	106	110	48.83	0	3.2	52.03	53.97	5	110	0.0	1.00	0.83	0.83	53.2
													Total	**62.5**
Operation:	**Slab construction**													
compactor (six)	113	110	48.83	0	3.2	52.03	60.97	10	110	0.1	1.00	0.83	0.83	60.2
excavator (one)	94	110	48.83	0	3.2	52.03	41.97	10	110	0.1	1.00	0.83	0.83	41.2
tower crane (one)	104	110	48.83	0	3.2	52.03	51.97	10	110	0.1	1.00	0.50	0.50	49.0
concrete pump (one)	95	110	48.83	0	3.2	52.03	42.97	10	110	0.1	1.00	0.83	0.83	42.2
diesel water pump	96	110	48.83	0	3.2	52.03	43.97	10	110	0.1	1.00	0.83	0.83	43.2
													Total	**60.7**
Operation:	**Building construction**													
electric bolters (three)	110	110	48.83	0	3.2	52.03	57.97	20	110	0.2	1.00	0.75	0.75	56.7
cranes (two)	101	110	48.83	0	3.2	52.03	48.97	20	110	0.2	1.00	0.50	0.50	46.0
hand nail gun	101	110	48.83	0	3.2	52.03	48.97	8	110	0.1	1.00	0.80	0.80	48.0
													Total	**57.6**
Operation:	**Road construction - Site preparation**													
Breaking concrete	110	165	52.35	0	4	56.44	53.56	30	165	0.2	1.00	0.50	0.50	50.6
road planer	110	165	52.35	0	4	56.44	53.56	1	165	0.0	1.00	0.50	0.50	50.6
bulldozer	105	165	52.35	0	4	56.44	48.56	30	165	0.2	1.00	0.83	0.83	47.8
wheeled excavator	101	165	52.35	0	4	56.44	44.56	30	165	0.2	1.00	0.83	0.83	43.8
													Total	**54.9**
Operation:	**Road construction**													
paving machine	103	165	52.3	0	4.1	56.4	46.6	25	165	0.2	1.00	0.50	0.50	43.55
vibrating roller	103	165	52.3	0	4.1	56.4	46.6	25	165	0.2	1.00	1.00	1.00	46.56
road roller	108	165	52.3	0	4.1	56.4	51.6	25	165	0.2	1.00	1.00	1.00	51.56
asphalt paver	103	165	52.3	0	4.1	56.4	46.6	25	165	0.2	1.00	0.83	0.83	45.75
compressor	93	165	52.3	0	4.1	56.4	36.6	1	165	0.0	1.00	1.00	1.00	36.56
generator	97	165	52.3	0	4.1	56.4	40.6	1	165	0.0	1.00	1.00	1.00	40.56
water pump	96	165	52.3	0	4.1	56.4	39.6	1	165	0.0	1.00	1.00	1.00	39.56
													Total	**54.4**

Faber Maunsell Limited

Carpenter Ltd

Typical Demolition and Construction Noise Prediction at 200m

Calculations to BS 5228

Plant Type	**SWL dB(A)**	**Dist. (m)**	**Dist. Attn.**	**Barrier Attn**	**Grnd Attn**	**Total Attn**	**Result SPL**	**trav'se dist.** ltr	**Min. dist.** dmin	**Dist. Ratio** ltr/dmin	**Corrn Factor** F (manual)	**Act'vty Dur.** Tt	**Corr Ontime** tc	**Noise Level**
Operation:	**Earthworks and Site Preparation**													
excavator	114	200	54.0	0	4.5	58.5	55.5	20	200	0.1	1.00	0.80	0.80	54.51
dumper	104	200	54.0	0	4.5	58.5	45.5	20	200	0.1	1.00	0.80	0.80	44.51
dozer	109	200	54.0	0	4.5	58.5	45.5	20	200	0.1	1.00	0.80	0.80	44.51
breaker	120	200	54.0	0	4.5	58.5	50.5	20	200	0.1	1.00	0.80	0.80	49.51
loader	108	200	54.0	0	4.5	58.5	49.5	20	200	0.1	1.00	0.80	0.80	48.51
vibratory plate	108	200	54.0	0	4.5	58.5	49.5	20	200	0.1	1.00	0.80	0.80	48.51
													Total	**57.3**
Operation:	**Piling (if required)**													
crane mounted auger (two)	110	200	54.02	0	4.5	58.53	51.47	5	200	0.0	1.00	0.50	0.50	48.5
electric water pumps (four)	113	200	54.02	0	4.5	58.53	54.47	5	200	0.0	1.00	0.83	0.83	53.7
concrete pump (one)	106	200	54.02	0	4.5	58.53	47.47	5	200	0.0	1.00	0.83	0.83	46.7
concrete poker (one)	106	200	54.02	0	4.5	58.53	47.47	5	200	0.0	1.00	0.83	0.83	46.7
													Total	**56.0**
Operation:	**Slab construction**													
compactor (six)	113	200	54.02	0	4.5	58.53	54.47	10	200	0.1	1.00	0.83	0.83	53.7
excavator (one)	94	200	54.02	0	4.5	58.53	35.47	10	200	0.1	1.00	0.83	0.83	34.7
tower crane (one)	104	200	54.02	0	4.5	58.53	45.47	10	200	0.1	1.00	0.50	0.50	42.5
concrete pump (one)	95	200	54.02	0	4.5	58.53	36.47	10	200	0.1	1.00	0.83	0.83	35.7
diesel water pump	96	200	54.02	0	4.5	58.53	37.47	10	200	0.1	1.00	0.83	0.83	36.7
													Total	**54.2**
Operation:	**Building construction**													
electric bolters (three)	110	200	54.02	0	4.5	58.53	51.47	20	200	0.1	1.00	0.75	0.75	50.2
cranes (two)	101	200	54.02	0	4.5	58.53	42.47	20	200	0.1	1.00	0.50	0.50	39.5
hand nail gun	101	200	54.02	0	4.5	58.53	42.47	8	200	0.0	1.00	0.80	0.80	41.5
													Total	**51.1**
Operation:	**Road construction - Site preparation**													
Breaking concrete	110	200	54.02	0	5	58.53	51.47	30	200	0.2	1.00	0.50	0.50	48.5
road planer	110	200	54.02	0	5	58.53	51.47	1	200	0.0	1.00	0.50	0.50	48.5
bulldozer	105	200	54.02	0	5	58.53	46.47	30	200	0.2	1.00	0.83	0.83	45.7
wheeled excavator	101	200	54.02	0	5	58.53	42.47	30	200	0.2	1.00	0.83	0.83	41.7
													Total	**52.8**
Operation:	**Road construction**													
paving machine	103	200	54.0	0	4.5	58.5	44.5	25	200	0.1	1.00	0.50	0.50	41.46
vibrating roller	103	200	54.0	0	4.5	58.5	44.5	25	200	0.1	1.00	1.00	1.00	44.47
road roller	108	200	54.0	0	4.5	58.5	49.5	25	200	0.1	1.00	1.00	1.00	49.47
asphalt paver	103	200	54.0	0	4.5	58.5	44.5	25	200	0.1	1.00	0.83	0.83	43.67
compressor	93	200	54.0	0	4.5	58.5	34.5	1	200	0.0	1.00	1.00	1.00	34.47
generator	97	200	54.0	0	4.5	58.5	38.5	1	200	0.0	1.00	1.00	1.00	38.47
water pump	96	200	54.0	0	4.5	58.5	37.5	1	200	0.0	1.00	1.00	1.00	37.47
													Total	**52.3**