

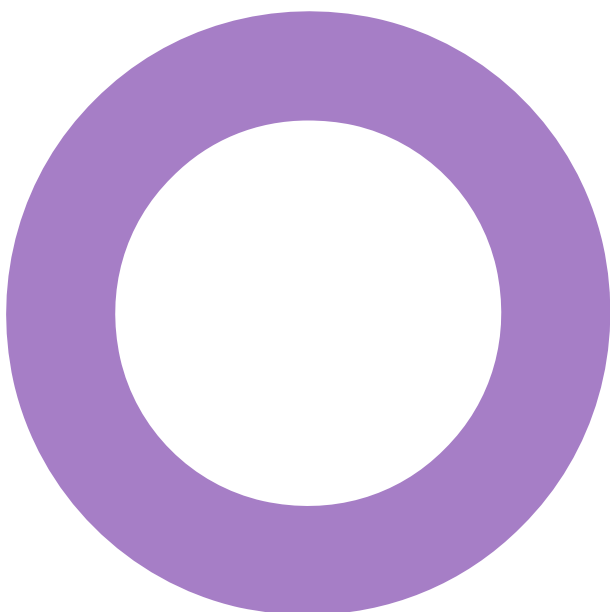
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Bond Bryan.

ACOUSTICS

CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

REVISION 01 – 13 FEBRUARY 2020



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
01	13/02/2020	Initial issue	AP	PM	PM

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Project number: 10/11030

Document reference: REP-1011030-5A-AP-20200212-Construction noise assessment-Rev00-F

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Executive summary.

Hoare Lea have been appointed to carry out an assessment of construction noise and vibration for the proposed The Manchester College City Centre Campus scheme in central Manchester.

A review of relevant assessment criteria is provided in line with the guidance given in British Standard BS 5228 *Code of practice for noise and vibration control on construction and open sites*. Based on this, effect categories are proposed to quantify the potential impact on nearby residents.

An assessment has been carried out to predict the noise levels at nearby receptors due to construction noise from key noise generating activities which are understood to be proposed.

From this assessment, the proposed ground remediation works are predicted to have a minor adverse impact at the nearby Beaumont residential building, with all other activities predicted to have a negligible impact.

At the nearby Travelodge, a moderate adverse impact is predicted when ground remediation and piling works are simultaneously taking place. A minor adverse impact is also predicted during some superstructure phase activities (ie, erecting the pre-cast concrete cores, erecting the steel frame and constructing the upper floors). However, given that the occupants of the Travelodge are only expected to reside there for short periods of time, the impact of the construction noise is expected to have a lesser impact on this receptor.

Some general mitigation measures are presented which represent good practice in terms of minimising noise impact on the surrounding areas during construction.

An assessment of vibration levels at nearby receptors due to piling works has been carried out which suggests that there will be a negligible impact on the residents during this activity.

1. Introduction.

Hoare Lea have been appointed to carry out an assessment of construction noise and vibration for the proposed The Manchester College City Centre Campus scheme in central Manchester.

This report provides an overview of relevant assessment criteria along with an assessment of predicted levels based on the proposed construction activities/programme.

2. Criteria.

2.1 Noise threshold - BS 5228-1.

Annex E of BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites (Part 1: Noise)* provides criteria for the threshold of significance effect due to construction noise based on the existing ambient noise level at a given receptor. The ABC method as per Annex E.3.2 is provided in Figure 1.

Table E.1 Example threshold of significant effect at dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23.00–07.00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

^{A)} Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

^{B)} Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

^{C)} Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

^{D)} 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Figure 1 Threshold of significance - ABC method

An environmental noise survey has previously been carried out at the site to establish the existing noise climate. Full details are provided in the Hoare Lea report *REP-1011030-RJ-20190424-Acoustic planning report-Rev03-F*. From the measurements results, the threshold limits to apply at the nearby receptors are set out in Table 1.

Table 1 Threshold value at nearby receptors

Receptor	Threshold value
Beaumont Building	75 dB (daytime) 65 dB (evenings and weekends) 55 dB (night-time)
Travelodge	65 dB (daytime) 55 dB (evenings and weekends) 45 dB (night-time)

It should be noted that the criteria do not represent mandatory limits but rather provide a basis to determine the significance effect of construction noise. The proposed determination of the effect category is provided in Table 2 which is based broadly on the guidance provided in BS 5228.

Table 2 Summary of effect categories for construction noise

Effect category	Construction noise level
Negligible	Lower than existing ambient L_{Aeq} , or greater than the existing ambient L_{Aeq} but less than the threshold noise level (dependent on existing ambient noise levels).
Minor adverse	Greater than existing ambient L_{Aeq} and between the threshold noise level and threshold noise level +5 dB (dependent on existing ambient noise levels).
Moderate adverse	Greater than the threshold noise level +5 dB but for no more than 10 days in any month.
Major adverse	Greater than the threshold noise level +5 dB for more than 10 days in any month.

2.2 Vibration threshold - BS 5228-2.

Annex B of BS 5228-2: 2009 *Code of practice for noise and vibration control on construction and open sites (Part 2: Vibration)* provides guidance limits for the significance effect from construction vibration levels. These are summarised in Table 3 with suggested significance effect categories based on these levels set out in Table 4.

Table 3 Effect from construction vibration

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level

Table 4 Summary of effect categories for construction vibration

Effect category	Vibration level
Negligible	PPV less than 0.14 mm/s
Minor adverse	PPV regularly exceeding 0.14 mm/s but less than 0.3 mm/s
Moderate adverse	PPV regularly exceeding 0.3 mm/s but less than 1 mm/s
Major adverse	PPV regularly exceeding 1 mm/s

3. Construction noise assessment.

3.1 Proposals.

The assessment of construction noise has been based on the Willmott Dixon construction programme *MC-WDC-XX-XX-PR-W-1000* dated 13 January 2020. The programme indicates an overall construction period of approximately 23 months.

For the purposes of the assessment, key noise generating activities have been considered for the various phases of construction. These are summarised in Table 5.

Table 5 Key noise generating activities

Phase	Activity	Programmed date	Assumed plant
Enabling works & piling	Ground remediation	02/03/2020 - 28/05/2020	2x Excavators, 2x Concrete breakers, 2x Dump trucks. All assumed to be operating for 80% of the working day.
	Form contiguous pile wall	23/03/2020 - 16/04/2020	1x CFA piling rig. Assumed 30 minute cycle time with 50% on time during each cycle.
	CFA piling	18/05/2020 - 30/06/2020	2x CFA piling rigs. Assumed 30 minute cycle time with 50% on time during each cycle.
Superstructure	Erect pre-cast concrete cores	16/06/2020 - 27/07/2020	2x Mobile cranes. Assumed to be operating for up to 50% of the working day and idling the remainder of the time.
	Erect steel frame	13/07/2020 - 30/11/2020	2x Mobile cranes. Assumed to be operating for up to 50% of the working day and idling the remainder of the time.
	Upper floors	26/05/2020 - 01/03/2021	3x Concrete pumps and 3x Poker vibrators. Assumed to be operating for up to 80% of the working day.
Building envelope	Installation of cladding	01/09/2020 - 13/08/2021	3x MEWPs and 3x Mobile cranes. Assumed to be operating for up to 50% of the working day and idling the remainder of the time.
Internal fit-out	General fit-out	24/11/2020 - 30/11/2021	No activities assessed due to screening provided by envelope.

3.2 Predicted noise levels.

Using the archive noise data available in BS 5228-1 for the assumed construction activities, predicted noise levels at the nearby sensitive receptors have been calculated.

The calculations consider distance attenuation to the sensitive receptors based on assumed locations for the construction activities. Generally, where a single item of plant has been used in the assessment, the location is assumed to be at the nearest area of the site to present a worst case scenario. Where multiple items of plant have been used in the assessment, these are assumed to be spread across the site.

The predicted noise levels during each of the construction activities identified in Section 3.1 are summarised in Table 6. Since activities are programmed to overlap, the combined noise level during simultaneous activities has also been predicted and is presented in Table 7.

Activities which result in an exceedance in the threshold value are highlighted and discussed further in Section 3.3.

Table 6 Predicted noise levels at sensitive receptors - single activities

Phase	Activity	Predicted noise level from individual activity, L _{Aeq}	
		Beaumont Building	Travelodge
Enabling works & piling	Ground remediation	76	70
	Form contiguous pile wall	67	60
	CFA piling	68	62
Superstructure	Erect pre-cast concrete cores	71	65
	Erect steel frame	71	65
	Upper floors	72	67
Building envelope	Installation of cladding	67	61

Table 7 Predicted noise levels at sensitive receptors - simultaneous activities

Phase	Activity	Predicted noise level from combined activity, L _{Aeq}	
		Beaumont Building	Travelodge
Enabling works & piling	Form contiguous pile wall	76	71
	Ground remediation		
	CFA piling	77	71
Superstructure	Erect pre-cast concrete cores	72	67
	Erect steel frame	74	68
	Upper floors	74	69
	Installation of cladding	73	68

3.3 Significance effect.

Table 8 provides a summary of the time periods when the threshold value as determined in Section 2.1 are predicted to be exceeded. This assumes that construction activities are to take place between 07:00-19:00 on weekdays and 07:00-13:00 on Saturdays only. A negligible significance impact is predicted for the activities which are not included in the table.

Table 8 Significance impact for activities which exceed threshold value at receptors

Activity	Significance impact	Programmed dates
Ground remediation	Beaumont Building - minor adverse Travelodge - minor adverse	02/03/2020 - 28/05/2020
Ground remediation and forming contiguous pile wall	Beaumont Building - minor adverse Travelodge - moderate adverse ¹	23/03/2020 - 16/04/2020
Ground remediation and CFA piling	Beaumont Building - minor adverse Travelodge - moderate adverse	18/05/2020 - 28/05/2020
CFA piling and erect pre-cast concrete cores	Beaumont Building - negligible Travelodge - minor adverse	16/06/2020 - 30/06/2020
Erect pre-cast concrete cores and erect steel frame	Beaumont Building - negligible Travelodge - minor adverse	13/07/2020 - 27/07/2020
Construct upper floors	Beaumont Building - negligible Travelodge - minor adverse	26/05/2020 - 01/03/2021

¹ Moderate adverse impact on the basis that occupants of the Travelodge are not expected to stay for more than 10 days a month.

At the Beaumont Building, where the existing ambient noise level is higher, a minor adverse impact is predicted during ground remediation works only. This lasts for an overall period of approximately 3 months.

At the Travelodge, a moderate adverse impact is predicted when ground remediation and piling works are simultaneously taking place. A minor adverse impact is also predicted during some superstructure phase activities. However, given that the occupants of the Travelodge are only expected to reside there for short periods of time, the impact of the construction noise is expected to have a lesser impact on this receptor.

3.4 Mitigation.

Based on guidance provided in BS 5228, the following mitigation measures are recommended to be adopted to ensure that the general noise impact is reduced as much as practicable:

- Industry standard hoardings to provide screening to the site boundary
- Use of acoustic enclosures for continuous plant
- Cutting activities to be carried out in defined areas with localised screening
- Use of electrical plant items rather than diesel plant wherever practicable
- Appropriate maintenance of exhaust silencing and plant muffling equipment
- Construction activities to be limited to take place during normal sociable hours
- Audible reversing warning systems on mobile plant and vehicles will be of the type which, whilst ensuring that they give proper warning, has a minimum noise impact on persons outside open sites.

In addition, BS 5228 notes that good community liaison and information distribution regarding noise impacts can help improve the attitude towards the contractor and reduce the impact from high noise levels. It is recommended that this be considered in particular where a minor/moderate adverse impact as predicted above.

4. Construction vibration assessment.

The vibration levels due to proposed construction works have been assessed using historic data. However due to the potential variation in ground conditions it is not possible to estimate the levels of vibration with accuracy. It may therefore be appropriate to undertake monitoring of the vibration levels during the construction phase.

Annex D of BS 5228-2:2009 provides summaries of case histories of vibration measured during rotary bored piling operations. Data indicates that particle peak velocities of 0.23 mm/s at a distance of 20 metres have been recorded during rotary bored piling of 1050 mm diameter piles, with soil conditions described as, 'Fill/dense ballast/clay'.

Calculations have been carried out based on the historic data to estimate the vibration levels during piling at the nearby noise sensitive premises. The calculations indicate the vibration levels set out in Table 9.

Table 9 Predicted vibration levels

Receptor	Predicted vibration level during piling	Significance impact
Beaumont Building	0.13 mm/s	Negligible
Travelodge	0.10 mm/s	Negligible

It can be seen that the impact on the nearby receptors due to vibration caused by construction activities is predicted to be negligible.



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