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Ref: P2643/L01/AGB (email attachment) 8 November 2017

To:	Lee Williams	of:	Kier
Cc:	As per email		

Dear Lee

11 York Street Manchester – Construction Noise and Vibration

Further to our recent conversation, I am providing AEC's assessment in relation to construction noise and vibration associated with the above development.

1.0 INTRODUCTION

1.1 Acoustic and Engineering Consultants Limited (AEC) has been appointed by Kier Property Services to undertake an assessment of demolition and construction noise associated with the 11 York Street, Manchester.

1.2 The development consists of the demolition of the existing 5 storey building down to basement level and construction of a new multi-storey office block.

1.3 This report provides an assessment of the likely worst-case demolition and construction noise activity with reference to relevant guidance.

2.0 METHODOLOGY

Noise

2.1 The potential impact from construction site noise can be assessed with reference to BS5228-1: 2009 '*Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*' The standard provides recommendations regarding the procedures for the establishment of effective liaison between developers, site operators and Local Authorities. In addition to this, guidance is provided concerning measuring noise and assessing its impact on those exposed to it.

2.2 Section 8.4 of the document states: *'All reasonably practicable means should be employed to ensure the protection of local communities and of people on construction sites, from detrimental effects of the noise generated by construction operations. The means employed should be determined by local circumstances and can include the methods described in 8.2 and 8.3'* [Sections 8.2 and 8.3 include various suggested methods for controlling noise].

2.3 With regard to assessing the significance of noise impacts and providing criteria, different methods are proposed in Annex E of the document.

2.4 Section E2 discusses the significance of impacts based on fixed noise limits, as included in the Wilson Committee's advisory leaflet 72, where construction noise levels outside the nearest window of an occupied living room or office closest to the site boundary should not exceed:

- 70dBA in rural, suburban and urban areas away from main roads and industrial noise;
- 75dBA in urban areas near main roads in heavy industrial areas.

2.5 Section E.3.2 provides an assessment method for the threshold of significant affect based on comparing the total noise level, to a listed value. In short, a significant effect has been deemed to occur if the total noise level (dBL_{Aeq}) including construction noise exceeds the threshold level. The table included in section E3 of BS5228 is reproduced below as Table 1 below.

2.6 It is important to note that BS5228 indicates that the assessment criteria presented below are relevant for residential receptors only, as indicated in Note 3 of the Table below.

Table 1 – Copy of Table E1 from BS5228 Pt 1: Example Threshold of Significant Effect

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.

2.7 Paragraph E.3.3 suggests an assessment based on a 5dB change in noise levels and states: *'Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values of 65dB, 55dB and 45dBL_{Aeq}, from construction noise alone, for the daytime, evening and night time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact.'*

2.8 However, again, the document notes that the above criteria are generally applicable to dwellings, hotels, healthcare and school buildings. There is no mention of commercial buildings in relation to the standards.

2.9 Further to the above, it is worth noting that the noise levels measured by AEC around the development site, as presented in the AEC report P2643/R1C/BT, dated 16 July 2015, were would be between 62 and 70$dBL_{Aeq,\ 2\ hours}$ during typical office hours.

2.10 Considering the above and that the site is surrounded by commercial properties, it is considered that an external daytime noise limit of no greater than 70-75dBL_{Aeq} would be appropriate over the entire 0700 to 1900h period. It is important to note that, as identified in BS5228, these limits should not be considered limiting criteria but only a guidance limit.

Vibration

2.11 The potential impact from vibration associated with construction sites can be assessed with reference to BS5228-2: 2009 '*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*' The standard provides recommendations regarding the procedures for the establishment of effective liaison between developers, site operators and Local Authorities. In addition to this, guidance is provided concerning measuring vibration and assessing its impact on those exposed to it.

2.12 As stated in BS5228, even vibrations of low magnitude can be perceptible to people Vibration nuisance is frequently associated with the assumption that, if vibrations can be felt, then damage is inevitable; however, considerably greater levels of vibration are required to cause damage to buildings and structures or to cause computers and similar electronic equipment to malfunction.

2.13 With regard to suggested vibration limits for the construction activities, these are presented in Table 2, below, in terms of peak particle velocity (PPV) where human perception and disturbance are likely. This table is a reproduction of Table B.1 of BS5225 Pt. 2.

Table 2 – Guidance on Effects of Vibration Levels

Vibration level (PPV)	Effect
0.14mm/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.
0.3mm/s	Vibration might be just perceptible in residential environments.
1.0mm/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.
10mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level

2.14 In addition to providing limits for human perception, BS5228 discussed the potential for damage to buildings with guide values stated. These are presented in Table 3 below. Table 3 is a reproduction of BS5228 Pt. 2. Table B.2

Table 3 – Transient Vibration Guide Values for Cosmetic Damage

Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50mm/s at 4Hz and above	50mm/s at 4Hz and above
2	Unreinforced or light framed structures Residential or light commercial buildings	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above

Note 1 – Values referred to are at the base of the building
Note 2 – For line 2, at frequencies below 4Hz, a maximum displacement of 0.6mm (zero to peak) is not to be exceeded.

2.15 Based on the above, it is considered that provided that the vibration levels are <10mm/s and the occupants of buildings around the site are kept updated about activities with potentially high levels of vibration, this should be deemed acceptable.

2.16 Where vibration levels are likely to potentially exceed 10mm/s, provided that the surrounding occupants are kept informed as to the duration of the activities and that agreed time limits are adhered to, this should be acceptable up to around 50mm/s for transient events.

3.0 ASSESSMENT

Activities

3.1 The main construction activities that have been identified by Kier will be as follows;

1. Internal soft strip and asbestos removal.
2. Demolition of the existing 5 storey concrete structure into the existing basement.
3. CFA piling along Fountain Street and Milk Street at existing road level.
4. Removal of demolition arisings from the basement.
5. Excavation and removal of concrete basement slab and below slab foundations.
6. Basement level CFA piling.
7. Basement concrete walls and slab.
8. Steel frame erection.
9. Concrete floor works.
10. Façade and internal fit out works.

Noise

3.1 With regard to assessing the potential impact from construction, the typical noise levels associated 'worst case' activities have been considered. The worst-case distance between the site and surrounding offices is on the corner of Milk-Street and York Street, where the nearest buildings will be 6m away, for the significant majority of the time any noisy activities will be at least 10m away, hence this has been used in the assessment.

3.2 Based on the above, noise levels obtained from BS5228 the anticipated noise from construction activities are presented in Table 4, below. It should be noted that in terms of screening, it is assumed that -10dB screening can be provided to smaller items and -5dB screening can be provided to larger stationary items. For items such as tracked excavators, it is assumed that no screening can be provided.

Table 4 – Anticipated Noise Levels

Activity / Equipment	Anticipated Noise Level, dBL_{Aeq} @ 10m	Details	Potential Noise Level After Screening, dBL_{Aeq} @ 10m
Demolition			
Handheld pneumatic breaker	85	Breaking concrete	75
Tracked breaker	93	Breaking concrete foundation	83
Tracked excavator	85	Loading dump truck	85 (no screening)
Tracked excavator (22t)	75	Prepping site - 14t could be 5dB quieter	75 (no screening)
Stihl saw	85	Cutting concrete	75
Dumper	75	3t to 9t	75 (no screening)
Breaker on wheeled backhoe	92	5228 – Levels don't change for different sizes	82
Construction			
Continuous Flight Auger Piling	80	- -	75 (assuming line of sight screening)
Concrete Pump	80	Pumping piles and upper floors	75 (assuming line of sight screening)
Angle grinder	80	Grinding Steel	70
Stihl saw	85	Cutting concrete	75

2.17 Based on the above, it would appear that the large proportion of construction activities can be controlled to be in line with the suggested noise limit of $75dBL_{Aeq}$. However, this assumes that appropriate screening in line with suggestions in BS5228 can be used and this will require development.

2.18 In terms of the activities where the noise level could exceed the suggested guidance limit, if Kier is aware that these activities will occur, consideration should be given to reducing the noise / potential impact via, for example:

- using quieter alternatives;
- reduction of noise at source;
- local screening;
- neighbourhood liaison;
- limiting the times these activities can occur to set periods.

2.19 In general, the construction methods employed must take practical noise control measures into account. It will be necessary for the contractor to liaise with the Local Authority about the operations and agree limits to be achieved at the nearest residences based on the above guidance. In addition, the contractor should agree to

keeping the local residents informed of when the noisier activities will occur, including the likely period these particular works will occur for.

Vibration

2.20 Vibration during construction work may arise from activities such as piling (e.g. for building foundations), ground improvement and road construction. Selection of plant and methods will need to consider the possible effects of vibration on nearby buildings and their occupants.

2.21 Groundborne vibration from construction work has broadly two potential impacts; human sensitivity and structural / cosmetic.

2.22 In terms of the impact on humans, perceptible vibration can give rise to complaints of disturbance over a wider area from the works. Depending on details of any proposed vibration causing activities, it is possible that certain activities such as piling / compacting, occurring close to the existing residential buildings, could give rise to perceptible vibration.

2.23 However, this is likely to be short in duration and hence the severity of any effects are likely to be minor (given appropriate good practice and notification).

2.24 It is not possible to provide any detailed vibration assessment without full details of the plant and methods to be used. However, an indicative assessment, based on guidance in BS5228, is provided in Table 5, below. The above is based on a distance of approximately 7m.

Table 5 – Assessment of Potential Vibration Impact During Construction

Activity	Estimated Vibration Level at Receptor, mm/s
Piling (CFA)	0.6
Compacting	1.8

2.25 In terms of the above, based on continuous flight auger (CFA) piling the vibration levels are such where it may be perceptible but should not be considered significant. With regard to the potential compacting, again the vibration levels should not be classed as significant but are at such a level were occupants of the surrounding buildings should be kept up to date in relation to site activities.

2.26 Structural damage to buildings by vibration is extremely rare and, if at all, only occurs when receiving buildings or structures are located very close (e.g. at least within around 10m) to very intensive vibration generating activities and/or are vulnerable due to their structural condition.

2.27 However, based on the above preliminary assessment, it is highly improbable that the vibration levels would be high enough to cause cosmetic damage to the surrounding buildings.

Yours sincerely



Andrew Burke