CHINA TOWN DEVELOPMENT LTD

NOISE ASSESSMENT

TRIBECA, PHASE 1
GREAT GEORGE STREET, LIVERPOOL

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1.0 INTRODUCTION

1.1 Acoustic & Engineering Consultants Limited (AEC) has been appointed by China Town Development Ltd, to assess the existing ambient and background noise levels at Phase 1 of the proposed Tribeca development on Great George Street, Liverpool. Phase 1 consists of a single seven storey mixed-use retail and residential block.

1.2 This report presents the results of the daytime and night-time noise level measurements undertaken on the site and an assessment of the potential impact on the acoustic design of the site taking into account relevant guidance and the Local Authority's requirements.

1.3 Acoustic terminology is described in brief in Appendix A.

2.0 BACKGROUND AND SITE DESCRIPTION

2.1 A scheme to redevelop existing vacant ground adjacent to Great George Street, Liverpool has been prepared by Blok Architects, as identified on Figure 1. The development will consist of 3 separate phases, however, this noise assessment only deals with noise breaking-in and breaking-out of the single block in Phase 1.

2.2 Great George Street makes up the eastern boundary of the development site. Adjacent to the site, on the opposite side of Great George Street, are existing residential blocks.

2.3 To the north is Hardy Street and further residential properties and to the south of the site will be Phase 2 of the development.

2.4 It is understood that the ground floor retail units will operate during the daytime period only.

3.0 NOISE MEASUREMENTS

3.1 Daytime noise levels were measured by AEC on Friday 10 July 2015 between 1000 and 1330h and night-time noise levels were measured on Tuesday 21 and Wednesday 22 July 2015 between 2300 and 0110h.

3.2 Measurements were undertaken at two locations identified as A and B on Figure 1. Full details of the noise surveys are presented in Appendix B with measured noise data presented in Tables B1 and B2, with a brief description provided below.

3.3 Location A was chosen to represent the elevations of the blocks overlooking Great George Street. During the daytime period the measured noise levels, due to road traffic on Great George Street was consistently around 64dB$L_{Aeq,\ 15minute}$ and 68dB$L_{A10,\ 15minute}$.

3.4 Similarly at night, there was little variation in the measured ambient noise level of 61dB$L_{Aeq,\ 10minute}$ and maximum noise levels ranged between 74 and 78dB$L_{Amax.}$

3.5 Location B was selected to measure the noise levels to the west of the site, which would represent the façade of the development facing away from Great George Street. The ambient noise level at this location during the day was 55dB$L_{Aeq,\ 15\ minutes}$ and 51dB$L_{Aeq,\ 10\ minutes}$ at night. The main noise source during both periods was due to road traffic noise on Great George Street, however, there was occasional car pass-bys on Cookson Street and the night-time maximum noise level from this source was around 67dBL_{Amax}.

3.6 The lowest background noise levels measured around the development site at locations representative of the existing properties on Hardy Street and Great George Street were 49dB$L_{A90,\ 15minutes}$ during the daytime period and 41dB$L_{A90,\ 10minutes}$ at night.

4.0 BASIS OF ASSESSMENT

Noise Ingress

4.1 Liverpool City Council (LCC) has generally adopted a requirement that the glazing used for residential accommodation in the city centre is as a minimum, 10mm glass/thermal cavity/6mm glass and that habitable rooms are provided with acoustically attenuated mechanical ventilation to remove the need to open windows.

4.2 These proposals are understood to be required to control internal noise levels in habitable rooms to typically no greater than those identified in the World Health Organisation (WHO) document '*Guidelines for Community Noise*'. WHO states that to avoid annoyance and sleep disturbance inside dwellings, the noise level should not exceed 30dB$L_{Aeq,\ 8\ hour}$ and 45dBL_{Amax} at night and 35dB$L_{Aeq,\ 16\ hour}$ during the day.

4.3 These levels are consistent with those presented in BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings'*, therefore, the internal levels identified by WHO would appear to be appropriate for this type of development.

4.4 Where these internal noise levels can be achieved with an alternative glazing and ventilation strategy than the one provided above by LCC, the suggested alternative scheme needs to be agreed with LCC.

Noise Egress

4.5 Following discussions with LCC, AEC has been informed that any items of plant associated with the proposed development should be assessed using BS4142: 2014 '*Methods for rating and assessing industrial and commercial sound*', and the 'rating' level should not exceed the existing background at the nearest noise sensitive residential property.

4.6 The noise levels from ground floor daytime activities would not only need to be controlled externally to no greater than the background at the nearest noise sensitive properties, but there would also be a need to control noise to the apartments above. Controlling noise levels in the apartments above to not exceed NR25L_{max} would be expected to be acceptable.

5.0 ASSESSMENT OF PROPOSED DEVELOPMENT

External Envelope Sound Insulation Requirements

5.1 Due to the constant nature of the road traffic on Great George Street it is possible to calculate the daytime ambient noise level, dB$L_{Aeq,\ 16h}$ using the shortened measurement procedure in CRTN. The measured $L_{A10,\ 3h}$ of 68dBis converted to a daytime average, $L_{A10,18h}$, by subtracting 1dB. To convert this to an ambient noise level, a further 2dB is subtracted, giving an overall level of 65dB$L_{Aeq,16h}$, which correlates well, but is marginally higher than, the average measured ambient noise level, 64dB$L_{Aeq,\ 15minutes}$, and hence the CRTN figure, has been used in our assessment calculations.

5.2 At night, although noise levels may reduce after 0100h until about 0500h, the average noise level, of 62dB$L_{Aeq,\ 10minutes}$, measured over the two hour period between 2300 and 0100h has been taken to be representative of the 8 hour period for the elevations facing Great George Street. In addition, the night-time maximum noise level has been based on the highest maximum noise level, due to road traffic, of 78dBL_{Amax} measured in the same period.

5.3 Regarding the western elevation of the proposed development, which will be fully screened from Great George Street, based on AEC measurements the daytime ambient noise level would be expected to be around 55dB$L_{Aeq,\ 15minutes}$, with night-time ambient noise levels around 51dB$L_{Aeq,\ 10minutes}$ and maximum noise levels of no greater than 67dBL_{Amax}.

Glazing and Ventilation Requirements

5.4 As identified above, LCC require that the glazing used for residential accommodation in the city centre is 10mm glass/thermal cavity/6mm glass and that habitable rooms are provided with acoustically attenuated mechanical ventilation to remove the need to open windows.

5.5 Calculations taking account of the measured external noise levels, the area of the windows (assumed to be around 40%) and assumed room dimensions, indicate that while the internal noise levels presented in BS8233 and WHO would be achieved on all elevations with LCCs required glazing and ventilation strategy, they would also be achieved with an alternative system.

5.6 On the eastern elevation, facing Great George Street, the daytime ambient and night-time ambient and maximum noise level limits suggested in BS8233 and WHO guidance could be achieved with 10/12/6 glazing and ventilation can be provided by a single acoustic ventilator with a sound insulation performance of 38dB$D_{n,e,w.}$ The level of ventilation would need to be confirmed with the supplier of the acoustic ventilator and agreed with LCC.

5.7 In regards to the elevations facing away from Great George Street, the internal daytime and night noise level limits can be achieved with standard double glazing, achieving a sound insulation performance of 31dBR_w (25R_w + C_{tr}), and ventilation can be provided by a single acoustic ventilator with a sound insulation performance of 33dB$D_{n,e,w.}$

5.8 Windows can be openable providing that they are effectively acoustically sealed when closed and it is important that any frames and seals do not downgrade the sound insulation performance of the glazing.

Other Façade Elements

5.9 With regards to the other façade elements these should be selected in order that the on-site sound insulation performance (dBR'_w) is at least 10dB higher than the sound insulation performances stated for the glazing and ventilation system. Therefore, on the Great George Street elevation the external envelope will need to achieve a sound insulation performance of at least 50dBR'_w and at least 43dB$'_w$ on the remaining elevations.

Noise Breakout from Other Building Uses

Noise Breakout Retail

5.10 Noise breakout from the building in terms of typical, L_{Amax}, levels should be controlled to not exceed the existing background noise levels in the area of about 49dBL_{A90} during the day and 41dBL_{A90} at night at the nearest residential accommodation which is located on Hardy Street to the north and Phase 2 of the proposed development scheme to the south.

5.11 It is understood that the retail units would be used for small commercial enterprises and potentially a small supermarket, therefore, the areas would not include music venues. Based on this, it is anticipated that the noise level within the retail units would not be expected to exceed the values stated in Table 1 below.

Table 1 – Typical Noise Levels in Retail Units

Retail Use	Maximum Noise Level, dBL_{max}							
	Overall A-weighted	Octave Band Centre Frequency, Hz						
		63	125	250	500	1k	2k	4k	8k
Typical Maximum Sound Level	Approx 85	75	75	80	80	80	80	75	75

5.12 The weakest element, acoustically, in the external envelope would typically be the glazing. Assuming that any curtain walling to the retail provides a sound insulation of at least $34dBR_w$, and $30dBR_w + C_{tr}$, then this construction would adequately control breakout noise externally. Therefore, there would be expected to be no impact due to noise breaking out of the retail units, even if the units were operating at night.

5.13 The noise levels from ground floor activities would not only need to be controlled externally, but there would also be a need to control noise to the adjacent apartments above. The party floor construction between the retail units and the apartments would need to achieve, as a minimum, the sound insulation value required to meet Approved Document E of The Building Regulations of $45dBD_{nT,w}+c_{tr}$. However, a higher sound insulation performance of around $55dBD_{nT,w}+c_{tr}$ is likely to be required to achieve below $NR25L_{max}$ in the apartment rooms. This will require further development once the floor construction has been confirmed.

5.14 If a music system for background entertainment purposes only were to be employed in any of the retail units, then a limiting device could be installed and set up, in conjunction with the Local Authority, to ensure that breakout levels are suitably controlled.

Basement Car Parking

5.15 It is understood that the floor between the carpark and the adjacent apartments will consist of a solid concrete floor slab at least 250mm thick. Based on normal weight concrete ($2400kg/m^2$), this should provide a sound insulation performance of at least $55dBR_w$.

5.16 Calculations have been based on previously measured noise levels for a car manoeuvring in a carpark of $65dBL_{Aeq}$ and $75\text{-}80dBL_{Amax}$, maximum noise levels of about $90dBL_{Amax}$ for a car door slamming and maximum noise levels of about $103dBL_{Amax}$ for a car alarm.

5.17 Based on the above levels and the assumed sound insulation of the floor, the noise levels breaking-in to the above apartments should be adequately controlled, however, this will need development when the final constructions are known.

Plant Noise

5.18 Although the amount, types or locations of any building services plant which may be installed on this development is not yet known, the 'rating' noise level from all plant should be designed to meet LCC requirements. Therefore, based on the measured background noise levels of $41dBL_{A90}$ during the night and $49dBL_{A90}$ during the day, external noise levels from all plant serving the proposed development should be controlled to $34dBL_{Aeq}$ during the night and $43dBL_{Aeq}$ during the day at the nearest noise sensitive property which could be either an existing residential property or part of the new development. This level allows for any acoustic character which could potentially be associated with the noise emitted from the plant.

5.19 This will require further development once the layout of the site and location of the plant has been finalised.

6.0 CONCLUSION

6.1 Acoustic and Engineering Consultants Limited has been appointed to undertake a noise assessment for Phase 1 of the proposed mixed-use development at Tribeca, Great George Street, Liverpool.

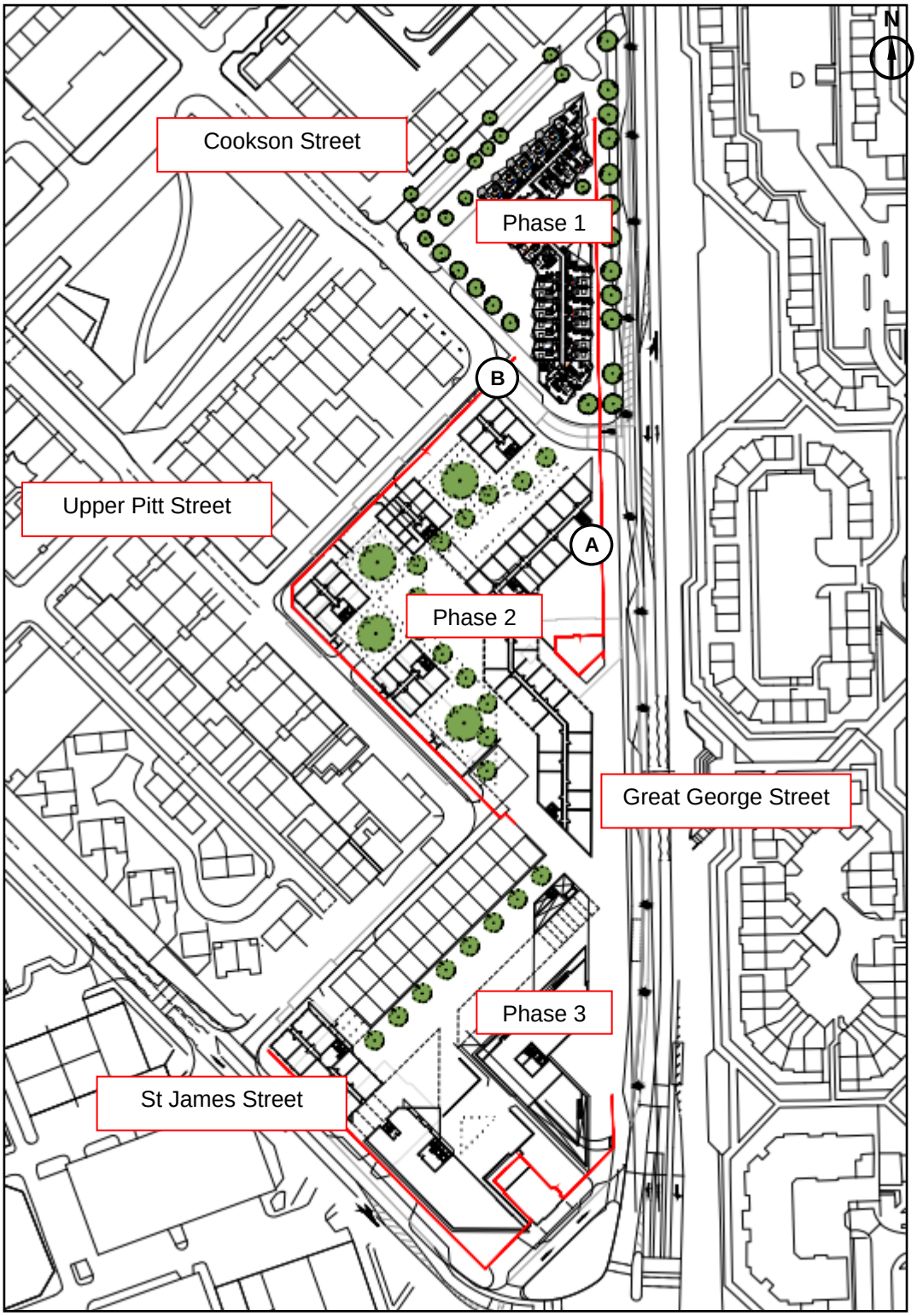
6.2 Based on the noise levels at the proposed development site, the sound insulation requirements to achieve appropriate internal noise levels based on BS8233 and WHO guidance has been determined and is presented in Section 4. Liverpool City Council currently request that all habitable rooms in residential properties in the city centre are provided with a glazing build-up of 10/12/6 and mechanical ventilation. This specification would control internal noise levels in all rooms to below the levels suggested in BS8233 and WHO guidance, however, on the elevation facing away from Great Georges Street a lower specification would achieve the required internal noise levels and this is presented in Section 5. The proposed alternative glazing and ventilation scheme would need to be agreed with LCC.

6.3 Total external noise levels from all future mechanical and electrical plant serving the proposed development should be controlled to 34dBL_{Aeq} at night, and 43dBL_{Aeq} during the day outside the nearest residential properties.

6.4 Noise levels at the proposed development have been assessed, and may be controlled through the use of an appropriate sound insulation scheme. Therefore, appropriate planning conditions can be applied to the proposed development to ensure reasonable internal noise levels in the proposed accommodation, and to control noise from any mechanical plant.

Paul Knowles

FIGURE 1 – Proposed Site Layout Identifying Monitoring Locations



APPENDIX A – Acoustic Terminology in Brief

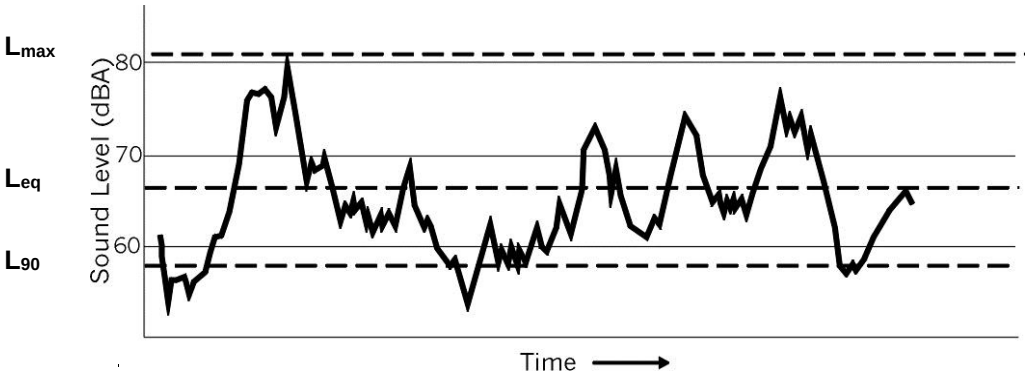
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz *(Hz)*, that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discreet frequency - a 'pure tone' - most noise is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA,* normally used to assess the effect of noise on people. The dBA weighting emphasises or reduces the importance of certain frequencies within the audible range.

Noise Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the noise.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of noise can be described by several different levels. The most common of these are described below.



Example of Sound Level Varying With Time

$L_{Aeq,T}$ The equivalent continuous (A-weighted) sound level may be considered as the "average" sound level over a given time, T. It is used for assessing noise from various sources including transportation, industrial and construction sources and can be considered as the "ambient" noise level.

L_{A90} The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value used to describe the "background" noise.

L_{Amax} The maximum (A-weighted) sound level during a measurement period.

Free-field Level This refers to the sound level measured outside, away from reflecting surfaces.

R_w Single number rating used to describe the airborne sound insulation properties of a material or building element over the frequency range of typically 100-3150Hz.

R_{tra} Single number rating used to describe the airborne sound insulation properties of a material or building element over the frequency range of typically 100-3150Hz, using a traffic noise spectrum as the source.

$D_{n,e,w}$ Weighted element-normalised level difference. Single number rating used to describe the performance of a ventilation unit.

APPENDIX B – Measurement Procedure

Dates & Times of Survey	Daytime: Friday 10 July 2015, 1000 to 1400h Night-Time: Tuesday/Wednesday 21/22 July 2015, 2300 to 0100h
Personnel Present	Paul Knowles (AEC)
Equipment Used	B&K 2260 Real Time Analyser (AEC Kit 1)
Weather Conditions	Daytime: Dry, 22°C, clear skies, calm Night-Time: Dry, 15°C, clear skies, 2m/s westerly breeze
Measurement Procedure	Ambient, background and maximum noise levels were measured at 5 locations, identified as Locations A to E on Figure 1 and described below. A - On the edge of the path, 12m from the edge of the carriageway of Great George Street. B - 5m from the edge of the carriageway of Cookson Street. All locations were selected to measure baseline noise levels, which were measured in terms of L_{Aeq}, L_{A10}, L_{A90} and L_{Amax} (fast response) typically over 5 to 15 minute periods. All the measurements were taken at a height of 1.5m above ground and all were free field measurements. The sound level analyser, which conforms to BS EN 61672-12003 *'Electro acoustics – sound level meters - Part1Specifications'* for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration. Calibration certificates are available on request.
Measured Data	A summary of the results are presented in Tables B1 and B2.

TABLE B1 – Measured Daytime Noise Levels

Location	Period, h	Noise Level, dB				Comments
		L_{Aeq}	L_{A10}	L_{A90}	$L_{Amax, F}$	
A	1001-1016	64.3	68.0	51.3	73.6	Road traffic on Great George Street
	1123-1138	64.0	67.8	51.1	74.8	
	1231-1246	63.6	67.2	49.0	73.3	
B	1018-1033	54.6	57.3	49.3	63.3	Road traffic on Great George Street and Cookson Street
	1144-1159	55.9	58.6	49.8	72.9	
	1247-1302	55.1	57.8	50.2	70.0	

TABLE B2 – Measured Night-Time Noise Levels

Location	Period, h	Noise Level, dB			Comments
		L_{Aeq}	L_{A90}	$L_{Amax, F}$	
A	2305-2315	61.0	43.9	78.5	Road traffic on Great George Street
	2356-0006	62.7	42.2	75.1	
B	2317-2327	51.0	42.5	67.2	Road traffic on Great George Street and Cookson Street
	0008-0018	51.7	40.5	67.1	