Appendix 2.3

Site suitability assessment

Introduction

This appendix provides an assessment in noise terms of the suitability of the site for residential development. The assessment has been undertaken with reference to the government's Planning Practice Guidance – Noise (PPG-N). Importantly PPG-N does not provide numerical values for the different effect levels, instead recognising that *"The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation"*.

It therefore remains for professional practitioners to carefully consider the PPG noise exposure hierarchy and seek to align it with significance criteria, having regard to British Standards, World Health Organization guidance, and other relevant sources of information.

This section therefore considers the effects of baseline noise by reference to absolute noise criteria advised in BS8233:2014: Sound Insulation and noise reduction for buildings – Code of practice and World Health Organization (WHO) Guidelines for Community Noise (1999).

Noise criteria

Absolute thresholds

Noise effects upon the proposed new residential dwellings have been considered by reference to criteria predominantly from BS8233:2014, which are based on the WHO Guidelines for Community Noise, summarised in Table C1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	$35dBL_{Aeq,16hour}$	-
Dining	Dining room / area	$40dBL_{Aeq,16hour}$	-
Sleeping	Bedroom	$35dBL_{Aeq,16hour}$	$30dBL_{Aeq,8hour}$
Outdoor living / amenity areas		$50 – 55dBL_{Aeq,16hour}$	-

Table C1: Ambient noise level criteria for proposed new residential development

BS8233:2014 does not suggest maximum noise level limits for bedrooms at night. WHO: 1999 however advises that L_{Amax} noise levels should not exceed 45dB more than 10-15 times per night.

For this assessment, these criteria are considered to represent the Lowest Observed Adverse Effect Level. PPG-N advises that, at these levels, sound can be heard, but would not cause any change in behaviour or attitude, so no additional mitigation measures would be required.

Baseline noise survey

Full baseline noise survey results are presented in Appendix 2.2. All measurements pertinent to the assessment of site suitability are presented in this section with irrelevant data discounted. Measurement locations are shown in Figure C1.

Figure C1: Site plan and noise measurement locations. Imagery ©2016 Google, map data ©2016 Google

Baseline noise results

The baseline noise levels are summarised in Table C2 to Table C4.

For L_{Aeq} noise levels, the values presented in the tables are a logarithmic average of measured data. For L_{A90} and L_{A10} values, the arithmetic averages of measured data are presented, and for $L_{Amax,F}$, the maxima of measured data are presented.

Measurement Location (see Figure C1)	Sound pressure level, dB re. 20µPa			
	$dBL_{A90,T}$	$dBL_{Aeq,T}$	$dBL_{A10,T}$	$dBL_{AMax,F}$
3	60	75	79	90
4	55	60	62	72
8	66	77	81	89

Table C2: Summary of measured daytime noise levels

Measurement Location (see Figure C1)	Sound pressure level, dB re. 20µPa			
	$dBL_{A90,T}$	$dBL_{Aeq,T}$	$dBL_{A10,T}$	$dBL_{AMax,F}$
3	57	74	79	92
4	55	58	61	66
8	61	76	81	91

Table C3: Summary of measured evening noise levels

Measurement Location (see Figure C1)	Sound pressure level, dB re. 20µPa			
	$dBL_{A90,T}$	$dBL_{Aeq,T}$	$dBL_{A10,T}$	$dBL_{AMax,F}$
3	50	64	65	80
4	46	53	56	67
8	53	69	71	86

Table C4: Summary of measured night time noise levels

C4 Noise assessment

This section sets out the adopted methodology for selecting representative noise levels for the development site. These levels are then used for the assessment of noise on site and identification of the need for and the development of outline mitigation measures.

The most significant noise sources affecting the proposed development site is road traffic from the A5052/New Quay Road and Bath Street, both of which lie to the east of the site.

In order to fully understand the distribution of noise, the measured data has been used to calibrate a noise model. The noise model in turn has been used to create façade noise maps for the purposes of assessing façade sound insulation requirements.

C4.1 Daytime noise results

The daytime noise levels at Locations 3 (Bath Street) and 8 (New Quay Road) have been calculated from three individual noise measurements, based upon the principles of the '*shortened measurement procedure*' described at Section 43 of Calculation of Road Traffic Noise (CRTN). These two roads are the primary noise sources affecting the development site.

This method has been used to calculate a noise level in terms of $L_{A10,(18\text{-hour})}$. A further correction has been applied in accordance with Section 9 of Annex 1 of the now superseded PPG24 to convert the noise levels to $L_{Aeq,16\ hour}$. This process is summarised below.

$$L_{A10}\ (18\text{-hour}) = L_{A10}\ (3\text{-hour}) - 1\text{dB(A)} \qquad \text{(CRTN)}$$

$$L_{Aeq,16\ hour} \approx L_{A10}\ (18\text{-hour}) - 2\text{dB(A)} \qquad \text{(PPG24)}$$

$$L_{Aeq,16\ hour} \approx L_{A10}\ (3\text{-hour}) - 3\text{dB(A)}$$

The resultant daytime noise levels alongside the main sources of road traffic noise have therefore been taken as follows:

- Location 3 - 76dB$L_{Aeq,16h}$
- Location 8 - 78dB$L_{Aeq,16h}$

The octave band frequency spectra have been logarithmically averaged from measured data to determine the spectra used in the assessments, which are shown in Table C5.

Measurement Location (see Figure C1)	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
3	68.7	64.7	65.2	64.5	67.1	60.8	52.3	46.8
8	71.7	66.3	66.5	65.5	69.8	61.1	51.4	46.6

Table C5: Daytime octave band noise spectra ($L_{eq,T}$)

Night time noise results

$L_{Aeq,T}$ levels

Noise measurements to inform the façade sound insulation requirements were taken during the typically noisiest part of the night period (23:00 – 02:00). The logarithmic average of all recorded night time noise levels is considered to be a representative assessment given that measurements were conducted during the loudest part of the night time period.

The night time noise levels used in the assessment have therefore been taken as:

- Location 3 - 64dB$L_{Aeq,8h}$
- Location 8 - 69dB$L_{Aeq,8h}$

The octave band frequency spectra have been logarithmically averaged from measured data to determine the spectra used in the assessments, which are shown in Table C6.

Measurement Location (see Figure C1)	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
3	62.4	61.8	59.4	58.3	63.0	58.0	47.3	37.8
8	69.6	65.1	63.8	64.3	68.1	61.9	51.6	43.2

Table C6: Night time octave band noise spectrum ($L_{eq,T}$)

$L_{Amax,F}$ levels

For the purposes of developing mitigation measures it would be inappropriate to base calculations on the single highest measured $L_{Amax,F}$ value. It is therefore necessary to remove outlying results. However, there is no formal guidance or consensus on how to select an appropriate value. The following method has therefore been adopted.

Noise measurements at night were conducted within one hour during the loudest part of the night time period. This period is considered to be representative of 1/8th of the 8 hour night time period. Therefore by excluding the two highest $L_{Amax,F}$ values the single highest of the remaining values is considered to represent a value which is not exceeded more than 15 times per night.

The resultant night time noise levels have therefore been taken as follows:

- Location 3 - 85dB$L_{Amax,F}$
- Location 4 - 69dB$L_{Amax,F}$
- Location 8 - 87dB$L_{Amax,F}$

The octave band frequency spectra have been logarithmically averaged from measured data to determine the spectra used in the assessments, which are shown in Table C7.

Measurement Location (see Figure C1)	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
3	78.2	77.8	77.3	77.6	82.5	78.1	70.4	62.7
4	85.3	78.5	78.3	79.3	82.0	76.5	70.0	62.4
8	89.8	81.6	81.5	82.7	84.4	78.1	72.5	65.0

Table C7: Night time octave band noise spectrum ($L_{max,F}$)

Noise mapping

Noise mapping has been conducted using SoundPLAN noise mapping software, calibrated using the measured noise levels. SoundPLAN calculates noise levels in accordance with ISO 9613 – Acoustics – Attenuation of Sound During Propagation Outdoors: Part 2: General Method of Calculation (1996). It also account for topography, ground cover and screening and reflections caused by buildings and other features.

The calibration and prediction of $L_{Aeq,T}$ noise levels is based upon nearby roads being treated as line sources. The calibration and prediction of $L_{Amax,F}$ noise levels is based upon the source being treated as a point source located at the nearest part of the road to the building envelope.

The following Figure C2 to Figure C4 show the predicted results as façade noise maps.

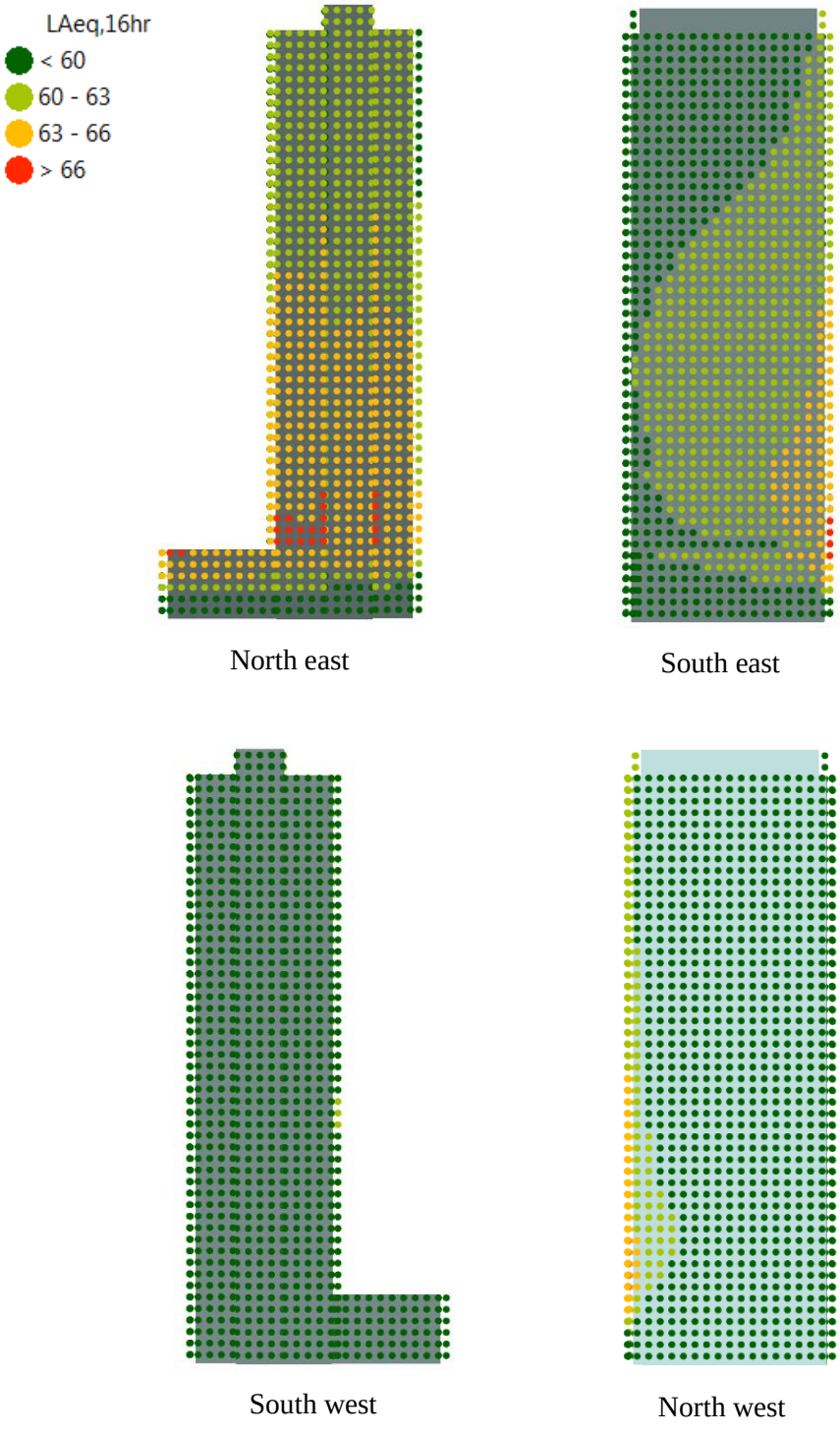

Figure C2: Daytime noise maps, free field levels ($L_{Aeq,16h}$)

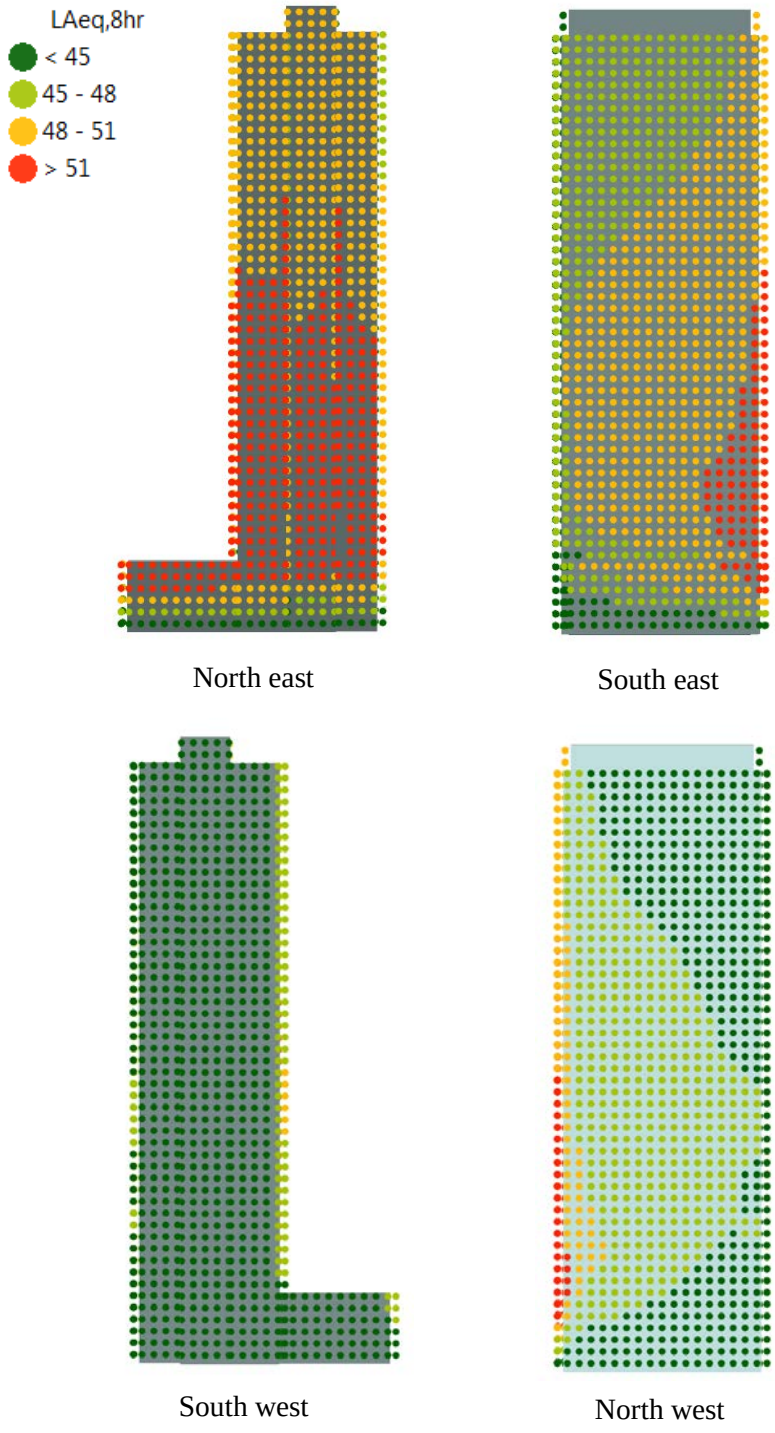

Figure C3: Night time noise maps, free field levels ($L_{Aeq,8h}$)

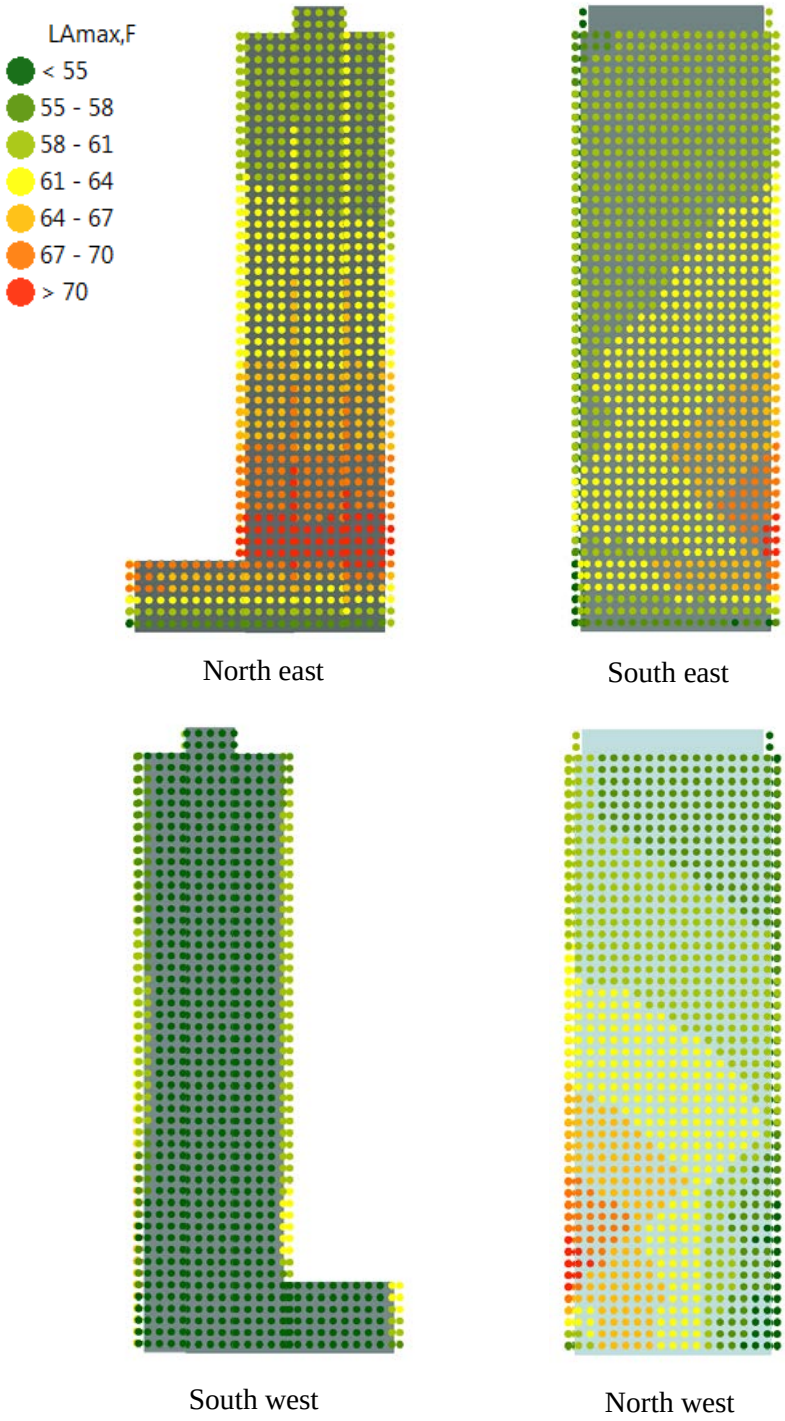

Figure C4: Night time noise maps, free field levels ($L_{Amax,F}$)

C4.4 Building envelope sound insulation

Sound insulation requirements of the façade are determined by the external noise levels and the required internal noise limits. Requirements have been calculated below for the most exposed elements of the building elevations to illustrate that the site can be developed appropriately for residential use. Lower specification glazing may be sufficient in quieter locations and can be determined later in the design process using façade noise maps as illustrated above. The worst case external free-field noise levels are presented in Table C8.

Elevation	Daytime $dBL_{Aeq,16h}$	Night time $dBL_{Aeq,T}$ peak period	Night time $dBL_{Amax,F}$
North east	66	54	72
South east	65	53	70
South west	53	41	52
North west	63	50	70

Table C8: Noise levels used to define façade sound insulation performance

Glazing and ventilation acoustic performance requirements are presented in Table C9 and Table C10. Predictions for living rooms are based upon a $9m^2$ glazed area and room volume of $45m^3$. Predictions for bedrooms are based upon a $7m^2$ glazed area and room volume of $31m^3$. All predictions are based on a 0.5s mid frequency reverberation time within rooms. The external walls / cladding are assumed to provide a performance of R_w50 or more.

Elevation	Glazing (R_w) and indicative glazing configuration	Ventilation ($D_{n,e,w}$)
North east	R_w42 (10mm / 12mm cavity / 16mm PVB laminate)	42
South east	R_w42 (10mm / 12mm cavity / 16mm PVB laminate)	42
South west	R_w33 (6mm / 12mm cavity / 6mm)	33
North west	R_w42 (10mm / 12mm cavity / 16mm PVB laminate)	42

Table C9: Façade sound insulation requirements (daytime – living rooms)

Elevation	Glazing (R_w) and indicative glazing configuration	Ventilation ($D_{n,ew}$)
Northeast	R_w38 (10mm / 12mm cavity / 6mm)	38
Southeast	R_w33 (6mm / 12mm cavity / 6mm)	33
Southwest	R_w38 (10mm / 12mm cavity / 6mm)	38
Northwest	R_w38 (10mm / 12mm cavity / 6mm)	38

Table C10: Façade sound insulation calculations (night time – bedrooms)

Importantly the required glazing specification can be traded off against the ventilation performance. Also the overall performance requirements can be reduced in areas where noise levels are reduced, such as lower levels of the building benefitting from the barrier effect provided by the Dock Wall or locations higher up the building benefitting from distance attenuation (see Figure C2 to Figure C4). Calculations will need to be revisited during the detailed design process to optimise the façade design.

C4.4.1 'Whole building' and 'extract' ventilation

It is anticipated that 'whole building' and 'extract' ventilation requirements of Building Regulations Approved Document F – Ventilation (ADF) would be achieved by way of continuous mechanical extract.

Whole house continuous mechanical extract is not unusual for dwellings, driven by revisions to Building Regulations Approved Document F – Ventilation (ADF) as well as Part L - Conservation of fuel and power (ADL).

C4.4.2 Purge ventilation

ADF advises that "purge ventilation" is required *"to aid the removal of high concentrations of pollutants and water vapour released from occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water. "Purge ventilation" is intermittent i.e. required only when such occasional activities occur.*

A continuous mechanical extract system would usually only provide "extract ventilation" and "whole building ventilation". Such a system would not usually be adequate to provide "purge ventilation" rates (approximately 4 air changes an hour) as also required by ADF. "Purge ventilation" would therefore need to be provided by an openable window.

C5 Conclusion

A noise impact assessment has been conducted for the proposed re-development which considers the suitability of the location for residential use.

Consideration has been given to the National Planning Policy Framework (NPPF), Planning Practice Guidance – Noise (PPG-N) and consultation with Liverpool City Council. A noise survey has been conducted to identify noise sources within the local area and to evaluate the baseline noise environment. Calibrated noise modelling has been employed to define façade sound insulation requirements.

External noise levels affecting the north-eastern elevation of the development are elevated, commensurate with the proximity to nearby roads.

Outline noise mitigation has been developed for the building envelope to ensure that internal noise levels achieve recognised standards. Calculations suggest that high specification glazing will be necessary in certain locations with the ventilation system being acoustically enhanced where necessary.

Therefore, subject to provision of enhanced façade sound insulation, the proposed development site is suitable for residential use. Importantly the area has significant existing precedence of residential uses.

Mitigation will need to be developed further during detailed design. Mitigation measures can be secured by a suitably worded planning condition.