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**ZERUM CONSULT LIMITED**

**STRAND STREET, LIVERPOOL**

**NOISE AND VIBRATION ASSESSMENT REPORT**

**JULY 2016**

*your earth our world*



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**ZERUM CONSULT LIMITED**

**Strand Street, Liverpool**

**Noise Assessment Report**

**June 2016**

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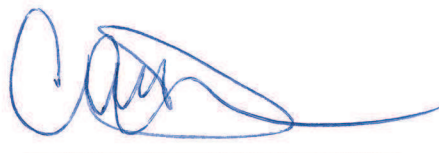
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## **CONTENTS**

1	INTRODUCTION	1
2	ASSESSMENT METHODOLOGY	2
3	NOISE SURVEY	13
4	NOISE IMPACT ASSESSMENT	13
5	NOISE ATTENUATION SCHEME	22
6	CONCLUSIONS	36

## **APPENDICES**

Appendix A	Noise Monitoring Results
Appendix B	Background Noise Levels
Appendix C	Noise Rating Curve Assessment
Appendix D	Break-in Calculations
Appendix E	The City of Liverpool Report – Noise Control Requirements for Residential and Other Developments in the City Centre.

## **DRAWINGS**

LE13526-001	Noise Monitoring Locations
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## **1 INTRODUCTION**

- 1.1.1 Wardell Armstrong LLP was commissioned to undertake a noise assessment for a proposed residential development at Strand Street, Liverpool.
- 1.1.2 The proposed development site is located to the west of Liverpool City Centre. To the north, the site is bordered by Red Cross Street, with commercial properties and Liverpool Street train station beyond. To the north east, the site is bordered by Liverpool Crown Court, with commercial areas beyond. To the south east, the site is bordered by commercial properties and car parking areas, with Chavasse Park beyond. To the south west, the site is bordered by the A5036 Strand Street, with Canning Dock and the River Mersey beyond.
- 1.1.3 The proposed development is residential in nature and will comprise approximately 395 apartments and approximately 50 car parking spaces. The location of the site is shown on drawing number LE13526-001.
- 1.1.4 This noise report has been prepared in support of the detailed planning application. It assesses the results of a noise survey carried out in accordance with current guidance and includes recommendations for noise mitigation as appropriate.

## **2 ASSESSMENT METHODOLOGY**

### **2.1 Consultation and Scope of Works**

2.1.1 The potential impacts of the proposed development and general principles of the assessment methodology were sent to Dr. Ian Rushworth, Senior Enforcement Officer at Liverpool City Council. Dr. Rushworth stated that our proposed methodology is acceptable but requested that reference be made to the City Centre Noise Policy, for acoustic insulation for proposed dwellings.

2.1.2 The scope of the noise assessment includes consideration of noise at sensitive areas of the proposed development, i.e. proposed residential areas, specifically in terms of the potential impact of existing transportation noise and any other noise sources, and is in line with current guidance.

### **2.2 Noise Survey**

2.2.1 As part of this assessment, Wardell Armstrong LLP has carried out an attended noise survey to assess the current noise levels at proposed receptor locations.

2.2.2 The main potential source of noise is road traffic on Strand Street, adjacent to the south western site boundary, and to a lesser extent Red Cross Street, adjacent to the north western site boundary, and the remainder of the local road network. In addition, noise from the commercial areas to the north west of the development site will also need to be considered.

### **2.3 Assessment Methodology**

2.3.1 An assessment is required to consider any potentially noise sensitive areas of the site. The potential impacts of the existing and future sources of noise on the proposed residential area of the development have been assessed with reference to;

- National Planning Policy Framework, 2012; (NPPF);
- Planning Practice Guidance – Noise, 2014;
- Noise Policy Statement for England 2010; (NPSE);
- World Health Organisation Guidelines For Community Noise 1999 (WHO, 1999);
- British Standard 8233: 2014 Guidance on sound insulation and noise reduction for buildings (BS8233, 2014);
- Department of Transport's memorandum, "Calculation of Road Traffic Noise" (CRTN), 1998;
- British Standard BS4142: 2014 Methods for rating and assessing industrial and commercial sound (BS4142);

- British Standard 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings (BS6472);
- British Standard 5228-1:2009 + Amendment 1 (2014) 'Code of practice for noise and vibration control on construction and open sites' Part 1: Noise;
- British Standard 5228-2:2009 + Amendment 1 (2014) 'Code of practice for noise and vibration control on construction and open sites' Part 2: Vibration; and,
- The City of Liverpool Report – Noise Control Requirements for Residential and Other Developments in the City Centre.

### **National Planning Policy Framework**

2.3.2 In March 2012 the 'National Planning Policy Framework' (NPPF) was introduced as the current planning policy guidance within England. Paragraph 123 of the NPPF states:

*'Planning policies and decisions should aim to:*

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

2.3.3 With regard to 'adverse impacts' the NPPF refers to the 'Noise Policy Statement for England' (NPSE), which defines three categories, as follows:

*'NOEL – No Observed Effect Level*

- This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*

*LOAEL – Lowest Observed Adverse Effect Level*

- This is the level above which adverse effects on health and quality of life can be detected.*

*SOAEL – Significant Observed Adverse Effect Level*



- *This is the level above which significant adverse effects on health and quality of life occur'.*

2.3.4 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided. The second aim refers to the situation where the impact lies somewhere between LOAEL and SOAEL, and it requires that all reasonable steps are taken to mitigate and minimise the adverse effects of noise. However the requirement to mitigate and minimise the adverse effects of noise does not mean that such adverse effects cannot occur.

2.3.5 The Planning Practice Guidance (PPG) provides further detail about how the effect levels can be recognised. Above the NOEL noise becomes noticeable, however it has no adverse effect as it does not cause any change in behaviour or attitude. Once noise crosses the LOAEL threshold it begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. Increasing noise exposure further might cause the SOAEL threshold to be crossed. If the exposure is above this level the planning process should be used to avoid the effect occurring by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused. At the highest extreme the situation should be prevented from occurring regardless of the benefits which might arise. Table 1 summarises the noise exposure hierarchy.

Table 1: National Planning Practice Guidance noise exposure hierarchy			
Perception	Examples of Outcomes	Increasing Effect Level	Action
<b>Not noticeable</b>	No Effect	No Observed Effect	No specific measures required
<b>Noticeable and not intrusive</b>	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
<b>Noticeable and intrusive</b>	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-	Observed Adverse Effect	Mitigate and reduce to a minimum

	awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.		
Significant Observed Adverse Effect Level			
<b>Noticeable and disruptive</b>	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
<b>Noticeable and very disruptive</b>	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

2.3.6 The Noise Policy Statement for England refers to the World Health Organisation (WHO) when discussing noise impacts. The WHO Guidelines for Community Noise 1999 suggest guideline values for internal noise exposure which take into consideration the identified health effects and are set, based on the lowest effect levels for general populations. Guideline values for annoyance which relate to external noise exposure are set at 50 or 55 dB(A), representing day time levels below which a majority of the adult population will be protected from becoming moderately or seriously annoyed respectively.

2.3.7 The following guideline values are suggested by WHO:

- 35 dB  $L_{Aeq}$  (16 hour) during the day time in noise sensitive rooms
- 30 dB  $L_{Aeq}$  (8 hour) during the night time in bedrooms
- 45 dB  $L_{Amax}$  (fast) during the night time in bedrooms
- 50 dB  $L_{Aeq}$  (16 hour) to protect majority of population from becoming moderately annoyed



- 55 dB  $L_{Aeq}$  (16 hour) to protect majority of population from becoming seriously annoyed

2.3.8 British Standard 8233 “Guidance on sound insulation and noise reduction for buildings” 2014 bases its advice on the WHO Guidelines. In addition, for internal noise levels it states;

*“Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.”*

2.3.9 In accordance with the requirements of VWHDC reference has also been made to British Standard 8233 (1999). BS8233 (1999) identifies a “good” standard of 30dB $L_{Aeq}$ <sub>16hour</sub> in living room areas.

2.3.10 With regard to external noise, BS8233, 2014 states;

*“For traditional external areas that are used for amenity space such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB  $L_{Aeq, T}$  with an upper guidance value of 55 dB  $L_{Aeq, T}$  which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited”.*

2.3.11 The PPG summarises the approach to be taken when assessing noise. It accepts that noise can override other planning concerns, but paragraph 002 of the noise guidance states:

*“Neither the Noise Policy Statement for England nor the National Planning Policy Framework (which reflects the Noise Policy Statement) expects noise to be considered in isolation, separate from the economic, social and other environmental dimensions of proposed development”.*

#### **Guidance on Assessment of Road Traffic Noise**

2.3.12 The Department of Transport's memorandum, "Calculation of Road Traffic Noise" (CRTN), 1998 defines a shortened measurement procedure which is used to calculate the  $L_{A10,18\text{Hour}}$  noise level from a measured 3 hour period. The method requires the measurement of noise over 3 consecutive hours between 1000 and 1700 hours.

2.3.13 From the measured 3 hour period, the arithmetic average of the three  $L_{A10,1\text{Hour}}$  measurements is taken. The  $L_{A10,18\text{Hour}}$  noise level is then determined using the following calculation method;

- $L_{A10,18\text{Hour}} = L_{A10,3\text{Hour}} - 1$

2.3.14 The document "*Converting the UK traffic noise index  $L_{A10,18h}$  to EU noise indices for noise mapping*" by P G Abbott and P M Nelson (The TRL Method) provides a calculation method to convert the calculated  $L_{A10,18\text{Hour}}$  into a daytime  $L_{Aeq}$  as described below.

- $L_{\text{day}} = 0.95 \times L_{A10,18\text{Hour}} + 1.44\text{dB}$

2.3.15 The calculation for the night-time period is shown below.

- $L_{\text{night}} = 0.90 \times L_{A10,18\text{Hour}} - 3.77$

***British Standard 5228 -1:2009+A12014 "Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise" (BS5228-1) <sup>1</sup>***

2.3.16 Guidance on the prediction and assessment of noise from development sites is given in British Standard 5228 -1:2009+A12014 "Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise" (BS5228-1).

2.3.17 Construction noise can have disturbing effects on the surrounding neighbourhood. The effects are varied and are complicated further by the nature of the site works, which will be characterised by noise sources which will change location throughout the construction period. The duration of site operations is also an important consideration. Higher noise levels may be acceptable if it is known that the levels will occur for a limited period.

2.3.18 For the purposes of this assessment, the occupants of residential properties in the vicinity of the site are considered to be the receptors most likely to be affected by the construction phases of the development. Details of the receptors are set out in Table 2, and shown on Drawing LE13526-001.

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<sup>1</sup> British Standards Institution (2009) *Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise* (BS5228-1) London: BSI

<b>Table 2: Existing Noise Sensitive Receptor Locations</b>			
<b>Receptor</b>	<b>Location</b>	<b>Bearing from Site</b>	<b>Approximate Distance to Site Boundary</b>
ESR 1	Travelodge, Liverpool Central, Strand Street	North West	10m

2.3.19 BS5228-1 provides guidance on significance criteria for assessing the potential noise impacts associated with the construction phase of large projects. For the purposes of this noise assessment, the noise likely to be generated by the earthworks and construction phase, have been assessed against significance criteria established, using the BS5228-1 ABC Method.

2.3.20 The ABC method for determining significance criteria requires the ambient noise levels at existing sensitive receptors to be determined. The ambient noise levels at each existing receptor location are then rounded to the nearest 5dB(A) to determine the appropriate threshold value in accordance with the category value, A B or C, as detailed in Table 3.

<b>Table 3: Thresholds of Significant Impact from Construction Noise at Residential Receptors in accordance with the ABC Method of BS5228-1</b>			
<b>Assessment Category and Threshold Value Period (L<sub>Aeq</sub>)</b>	<b>Threshold Value, in decibels (dB)</b>		
	<b>Category A *1</b>	<b>Category B *2</b>	<b>Category C *3</b>
Daytime (0700 to 1900 hours) and Saturdays (0700 to 1300 hours)	65	70	75
*1 Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than this value.			
*2 Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.			
*3 Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.			

2.3.21 The noise assessment for the construction phase details baseline daytime noise levels recorded at sensitive receptor locations and outlines the main construction activities that could give rise to noise impacts at receptors in the vicinity of the proposed development. It also sets out details of 'best practice' management and control measures to ensure that impacts are minimised as far as possible.

2.3.22 In addition to the earthworks and construction activities, vehicle movements to and from the proposed development have the potential to generate noise at existing sensitive receptors, in the immediate vicinity of the local road network.

2.3.23 At this stage, detailed traffic data relating to the likely numbers of construction vehicles are not available. However, the number of construction vehicles is not considered to be significant relative to the existing flows on the major road links within

and surrounding the development site. It is therefore considered that the level of road traffic noise at sensitive receptor locations will not change significantly, due to construction vehicles during the construction phases of the development, and this impact has not been considered further.

***British Standard 5228-2:2009+A12014 “Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration” (BS5228-2)<sup>2</sup>***

- 2.3.24 Guidance on the assessment of vibration from development sites is given in British Standard 5228 -2:2009+A1 2014 “Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration” (BS5228-2).
- 2.3.25 The sensitive receptors most likely to be affected by vibration generated by the earthworks and construction phase works of the development are detailed in Table 1.
- 2.3.26 It is not possible to mitigate vibration emissions from an open site. It is important therefore to examine the proposed working method to ascertain what, if any, operations would be likely to cause unacceptable levels of vibration at nearby sensitive locations. It is possible that these operations could be modified to reduce their vibration impacts.
- 2.3.27 BS5228-2 indicates that vibration can have disturbing effects on the surrounding neighbourhood; especially where particularly sensitive operations may be taking place. The significance of vibration levels which may be experienced adjacent to a site is dependent upon the nature of the source.
- 2.3.28 Human perception of vibration is extremely sensitive. People can detect and be annoyed by vibration before there is any risk of structural damage. Cases where damage to a building has been attributed to the effects of vibration alone are extremely rare; even when vibration has been considered to be intolerable by the occupants.
- 2.3.29 It is not possible to establish exact vibration damage thresholds that may be applied in all situations. The likelihood of vibration induced damage or nuisance will depend upon the nature of the source, the characteristics of the intervening solid and drift geology and the response pattern of the structures around the site. Most of these variables are too complex to quantify accurately and thresholds of damage, or nuisance, are therefore conservative estimates based on a knowledge of engineering.
- 2.3.30 Where ground vibration is of a relatively continuous nature, there is a greater

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<sup>2</sup>British Standards Institution (2009) *Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration* (BS5228-1) London: BSI

likelihood of structural damage occurring, compared to transient vibration; for example that caused by transiting vehicles.

- 2.3.31 BS5228-2 indicates that the threshold of perception is generally accepted to be between a peak particle velocity (PPV) of 0.14 and 0.3mm/sec. In an urban situation it is unlikely that such vibration levels would be noticed. The Highways Agency Research report No. 53 "Ground Vibration caused by Civil Engineering Works" 1986 suggests that, when vibration levels from an unusual source exceed the human threshold of perception, complaints may occur. The onset of complaints due to continuous vibration is probable when the PPV exceeds 3mm/sec.
- 2.3.32 British Standard BS6472: 2008 "Guide to Evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting" (BS6472-1) suggests that adverse comments or complaints due to continuous vibration are rare in residential situations below a PPV of 0.8mm/sec.
- 2.3.33 Continuous vibration is defined as "vibration which continues uninterrupted for either a daytime period of 16 hours or a night-time period of 8 hours". The proposed earthworks and construction works at the site will not cause continuous vibration as defined in BS6472-1.
- 2.3.34 BS5228-2 2009 suggests that the onset of cosmetic damage is 15mm/sec (15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz for residential or light commercial type buildings).
- 2.3.35 The vibration assessment for the construction phase outlines the main construction activities that could give rise to vibration impacts at receptors in the vicinity of the proposed development. It also sets out details of 'best practice' management and control measures to ensure that impacts are minimised as far as possible.

***British Standard 4142:2014 (BS4142), Methods for rating and assessing industrial and commercial sound:***

- 2.3.36 BS4142 is used to rate and assess sound of an industrial and/or commercial nature including:
- sound from industrial and manufacturing processes;
  - sound from fixed installations which comprise mechanical and electrical plant and equipment;
  - sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
  - sound from mobile plant and vehicles that is an intrinsic part of the overall sound

emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

2.3.37 The standard is applicable to the determination of the following levels at outdoor locations:

- rating levels for sources of sound of an industrial and/or commercial nature; and
- ambient, background and residual sound levels, for the purposes of:

1) Investigating complaints;

2) Assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and

3) Assessing sound at proposed new dwellings or premises used for residential purposes.

2.3.38 The purpose of the BS4142 assessment procedure is to assess the significance of sound of an industrial and/or commercial nature.

2.3.39 BS4142 refers to noise from the industrial source as the 'specific noise' and this is the term used in this report to refer to noise which is predicted to occur due to activities associated with Victoria House, Tesco Express, and Travelodge. The 'specific noise' levels, of the existing industrial premises that have been measured are detailed in Section 4 of this report.

2.3.40 BS4142 assesses the significance of impacts by comparing the specific noise level to the background noise level ( $L_{A90}$ ). Section 4 provides details of the background noise survey undertaken.

2.3.41 Certain acoustic features can increase the significance of impacts over that expected from a simple comparison between the specific noise level and the background noise level. In particular BS4142 identifies that the absolute level of sound, the character, and the residual sound and the sensitivity of receptor should all be taken into consideration. BS4142 includes allowances for a rating penalty to be added if it is found that the specific noise source contains a tone, impulse and/or other characteristic, or is expected to be present. The specific noise level along with any applicable correction is referred to as the 'rating level'.

2.3.42 The greater the increase between the rating level over the background noise level, the greater the magnitude of the impact. The assessment criteria given by BS4142 are as follows:

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.3.43 During the daytime, BS4142 requires that noise levels are assessed over 1-hour periods. However, during the night-time, noise levels are required to be assessed over 15-minute periods.

2.3.44 Where the initial estimate of the impact needs to be modified due to context, BS4142 states that all pertinent factors should be taken into consideration, including:

- The absolute level of sound;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

***The City of Liverpool Report – Noise Control Requirements for Residential and Other Developments in the City Centre***

2.3.45 Liverpool City Council have produced a document detailing the noise insulation requirements for proposed dwellings within the City Centre, to future proof any new development against potential noise sources. The policy document makes reference to Planning Policy Guidance and WHO guidelines.

2.3.46 The policy states the minimum required standard of glazing and ventilation to achieve appropriate internal noise level guideline values. The policy can be found in Appendix C.



### 3 NOISE SURVEY

- 3.1.1 On the 8<sup>th</sup> and 23<sup>rd</sup> June 2016, Wardell Armstrong LLP carried out a noise survey at the proposed development site.
- 3.1.2 Attended noise measurements were taken at three monitoring locations, which are considered to be representative of proposed residential receptors nearest to the dominant noise sources. The monitoring locations are as follows, and are shown on Drawing Number LE13526-001:
- Monitoring Location 1: In the south western part of the site, approximately 8m from Strand Street.
  - Monitoring Location 2: In the north western part of the site, approximately 4m from Red Cross Street.
  - Monitoring Location 3: In the north eastern part of the site, approximately 2m from the north eastern site boundary.
- 3.1.3 Noise monitoring was carried out between 1157 hours and 1457 hours on the 8<sup>th</sup> June, and between 0455 hours and 1005 hours on the 23<sup>rd</sup> June.
- 3.1.4 The measurement periods included the busiest times, with regard to road traffic, of the daytime and night-time periods. The measured noise levels therefore allow a robust assessment to be made of noise impact at the development site.
- 3.1.5 On the 8<sup>th</sup> June, the weather conditions during the survey were as follows:
- Low wind up to 3m/s;
  - Dry ground;
  - Temperature approximately +20°C; and
  - Approximately 40% cloud cover.
- 3.1.6 On the 23<sup>rd</sup> June, the weather conditions during the survey were as follows:
- No wind becoming low wind up to 2m/s throughout the survey;
  - Dry ground;
  - Temperature approximately +11°C rising to approximately +18°C; and
  - 20% cloud cover clearing to 5% cloud cover throughout the survey.
- 3.1.7 An additional noise survey was carried out on 29<sup>th</sup> and 30<sup>th</sup> June 2016, to assess noise from commercial buildings in the vicinity of the proposed development site. The monitoring locations are as follows and are shown on Drawing LE13526-001:

- Monitoring Location 4: At the southern façade of Victoria House. This location was chosen to measure external plant noise from Victoria House.
- Monitoring Location 5: Approximately 150m to the south of the proposed development site, on Salthouse Quay, approximately 30m from Strand Street. This monitoring location was selected to establish background noise levels within the vicinity of the proposed development and in the absence of local commercial noise sources adjacent to the development site. Monitoring was carried out between 2004 hours and 2304 hours on 29<sup>th</sup> June and between 0000 hours and 0300 hours on 30<sup>th</sup> June.

3.1.8 The weather conditions on the 29<sup>th</sup> and 30<sup>th</sup> June, during the noise survey were as follows:

- Low wind up to 3 m/s;
- Light shower between 2115 hours and 2123 hours;
- Temperature approximately 16°C at the start of the survey, dropping to approximately 14°C; and
- Approximately 70% cloud cover.

3.1.9 For the purpose of this assessment daytime hours are taken to be 0700 to 2300 hours and night-time hours to be 2300 to 0700 hours.

3.1.10 The noise measurements were made using a Class 1, integrating sound level meter. The microphone was mounted vertically on a tripod 1.2m above the ground. The sound level meter was calibrated to a reference level of 94dB at 1kHz both before, and on completion of, the noise survey. No drift in the calibration during the survey was noted.

3.1.11 A-weighted<sup>3</sup>  $L_{eq}$ <sup>4</sup> noise levels were measured to comply with the requirements of WHO, BS8233 and BS4142. A-weighted  $L_{90}$ <sup>5</sup> and  $L_{10}$ <sup>6</sup> noise levels, together with the maximum and minimum sound pressure levels, were also measured to provide additional information. The measured noise levels are set out in full in Appendix A.

3.1.12 Attended noise monitoring allows observations and detailed notes to be made of the

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<sup>3</sup> A' Weighting      An electronic filter in a sound level meter which mimics the human ear's response to sounds at different frequencies under defined conditions

<sup>4</sup>  $L_{eq}$       Equivalent continuous noise level; the steady sound pressure which contains an equivalent quantity of sound energy as the time-varying sound pressure levels.

<sup>5</sup>  $L_{90}$       The noise level which is exceeded for 90% of the measurement period.

<sup>6</sup>  $L_{10}$       The noise level which is exceeded for 10% of the measurement period.

significant noise sources which contribute to each of the measured levels. The observations identified the following:

**Monitoring Location 1:** Noise from road traffic on Strand Street. External plant from commercial premises on Strand Street. Occasional aircraft. Seagulls.

**Monitoring Location 2:** Noise from road traffic on Strand Street and occasionally on Red Cross Street. External plant from commercial premises in the vicinity of the site. Seagulls.

**Monitoring Location 3:** Noise from road traffic on Strand Street and Red Cross Street. External plant noise from commercial premises in the vicinity of the site. Seagulls.

**Monitoring Location 4:** Noise from road traffic on Strand Street and Red Cross Street. Noise from a document shredding vehicle.

**Monitoring Location 5:** Noise from road traffic on Strand Street. Plant noise from within the premises of Travelodge Hotel.

**Monitoring Location 6:** Noise from road traffic on Strand Street and Red Cross Street. Noise from external plant. Seagulls.

**Monitoring Location 7:** Noise from road traffic on Strand Street and occasional road traffic on Salthouse Quay. Noise from people on Salthouse Quay. Noise from birds and seagulls during the daytime period.

- 3.1.13 Noise from vehicles accessing and leaving the existing carpark on the proposed development site has been removed from the measured data for Monitoring Location 3.
- 3.1.14 Noise from people on Salthouse Quay has been removed from the measured data for Monitoring Location 7. In addition, noise from nearby parked vehicle with an idling engine has also been removed.

## **4 NOISE IMPACT ASSESSMENT**

### **4.1 Demolition and Construction**

- 4.1.1 The construction phase assessment has been carried out for existing sensitive receptor ESR1. A noise impact at all other existing sensitive receptors may be felt, but will be less than the assessed location.

#### ***Noise from Earthworks and Construction Phase Activities***

- 4.1.2 During the earthworks and construction phase, any work carried out at the proposed development is likely to generate noise that may propagate beyond the proposed development boundary.
- 4.1.3 At this stage, detailed information regarding the nature and timescales of activities likely to take place during the earthworks and construction phase are not known. Activities on the site, which could give rise to construction noise impacts include (but are not limited to):
- Site preparation i.e. demolition, ground excavation, levelling of ground, trenching, trench filling, unloading and levelling of hardcore and compacting filling; and
  - Construction of the proposed redevelopment including piling, construction of access roads, fabrication processes e.g. planing, sanding, routing, cutting, drilling and laying foundations.
- 4.1.4 In addition to the earthworks and construction activities, vehicle movements to and from the proposed development have the potential to generate noise at existing sensitive receptors, in the immediate vicinity of the local road network.
- 4.1.5 At this stage, detailed traffic data relating to the likely numbers of construction vehicles is not available. However, the number of construction vehicles is not considered to be significant relative to the existing flows on the major road links within and surrounding the development site. It is therefore considered that the level of road traffic noise at sensitive receptor locations will not change significantly, due to construction vehicles during the construction phases of the development, and this impact has not therefore been considered further.
- 4.1.6 At this stage, the contractor likely to undertake the enabling and construction works is not known. However, it is considered that the enabling and construction works are likely to be restricted to daytime hours, i.e. between 0700 and 1800 hours Monday to Friday and 0800 to 1300 hours on a Saturday. Based on the ambient noise levels measured during the daytime period, the appropriate category value has been

determined for each of the sensitive receptor, as detailed in Table 4. Details of the noise survey carried out at the sensitive receptors are set out later in this chapter.

<b>Table 4: Construction Noise Significance</b>				
<b>Receptor</b>	<b>Average Measured Noise Levels(dB LAeq)</b>	<b>Ambient Noise Level Rounded to the nearest 5dB(A) (dB LAeq)</b>	<b>Appropriate Category Value A, B or C in accordance with BS5228-1</b>	<b>Noise Level above which activities of the Construction Phase may cause a significant impact at the Receptor (dB LAeq)</b>
ESR1	72	70	C	75

- 4.1.7 The earthwork and construction phase activities have the potential to generate short term increases in noise levels, above those recommended in BS5228-1. The levels of noise received at the receptors closest to the proposed development would depend on the plant sound power levels, the distance to the properties, the presence of screening or reflecting surfaces and the ability of the intervening ground to absorb the propagating noise.
- 4.1.8 The distance to the nearest noise sensitive receptor to the development, as detailed in Table 2, will vary depending on the phase of the development under construction. Given the potentially small distances between the construction activities and the hotel, noise levels at the receptor may occur above that detailed in Table 4. It is therefore recommended that mitigation measures be put in place that will reduce the scale of the potential effect. Details are set out in section 6 of this report.

### ***Vibration from Earthworks and Construction***

- 4.1.9 The earthworks and construction works have the potential to increase vibration levels at residential properties in the vicinity of construction phases of development during the proposed working hours.
- 4.1.10 Wardell Armstrong's archives contain field trial measurements of ground vibration associated with types of plant likely to be used at the proposed development. The representative, measured levels, made by Wardell Armstrong using a Vibrock B801 Digital Seismograph, are set out in Table 5.

<b>Table 5: Measured Vibration Levels of Plant Under normal Operating Conditions (Figures in ppv mm per second)</b>			
<b>Plant Type</b>	<b>Distance from Source</b>		
	<b>10m</b>	<b>20m</b>	<b>30m</b>
25-30 tonne excavator	0.175	0.075	Background

25 tonnes dumptruck (Volvo A25)			
Loaded	1.000	0.150	Background
Empty	0.225	0.050	Background
Dozer	1.050	0.400	Background
Vibrating roller Drum			
Vibrator on	4.470	3.270	2.350
Vibrator off	0.500	0.150	0.050
Loading shovel	1.025	0.150	Background

4.1.11 The distance to the nearest sensitive receptor to the proposed construction works, as detailed in Table 2, will vary depending on the phase of the development under construction. As a worst case scenario, earthworks and construction works may potentially take place adjacent to the existing hotel.

4.1.12 At this distance, it is possible that vibration due to the operation of various construction plant, and in particular a vibratory roller, may be above the threshold of complaint. However, the vibration levels are highly unlikely to be above the threshold of structural damage and this would occur for only limited periods during the works, i.e. when activities take place at the development phase boundaries.

4.1.13 In addition to the earthworks and construction works described, it is possible that piling will be required. At this time the type(s) of piling, which would be used at various locations across the site, is not known and it is likely that the contractor responsible for undertaking the works at the site would decide the method of piling.

4.1.14 BS5228-2 recognises that the most common form of vibration associated with piling is the intermittent type derived from conventional driven piling. The intensity of vibration disturbance, which may be registered at a receptor, will be a function of many factors. These are set out in BS5228-2 and include:

- Energy per blow or cycle;
- Distance between source and receptor;
- Soil structure interaction i.e. nature of connection between soil and structure being monitored; and
- Construction of structure and location of measuring points e.g. soil surface, building foundation and internal structural element.

4.1.15 At this stage detailed information regarding the above is not known. It is not therefore possible to assess the potential impacts of vibration generated by piling activities. To minimise the potential for vibration to be generated by piling it is recommended that careful consideration is given to the type of piling to be used. For example auger bored piles would be preferable to driven piles with regards to a reduced potential for noise

and vibration to be generated. However, it is recognised that the piling process will need to be selected on the basis of the strata to be encountered, the loads to be supported and the economics of the system.

- 4.1.16 Once the precise building locations, ground conditions for each location and type(s) of piling are confirmed, vibration levels could be estimated and recommendations for control made as appropriate.

## 4.2 Existing Noise Levels

- 4.2.1 To provide a robust assessment of the existing ambient noise levels adjacent to Strand Street the shortened assessment method, as detailed in section 2.3 of this report has been used to calculate  $L_{A10,16\text{Hour}}$  from a consecutive 3-hour measurement at monitoring location 1. The assessment is shown below in Table 6;

Table 6: Measured Noise Levels at Monitoring Location 1 (Figures in dB(A))	
Time	Measured $L_{A10}$
1157 - 1257	74.2
1257 – 1357	73.6
1357 – 1457	73.7
Average $L_{A10,3\text{Hour}}$	73.8
$L_{A10,18\text{Hour}}$	72.8
$L_{Aeq,16\text{Hour}}$ Daytime (Calculated in accordance with TRL)	70.6

- 4.2.2 Noise levels have been measured and calculated for proposed receptors closest to Strand Street. The calculated  $L_{Aeq,16\text{Hour}}$  has been compared to the measured  $L_{Aeq}$  to determine the level to be used for the assessment of noise for internal and external areas of proposed residential dwellings. To ensure a robust assessment, the higher level is used for this assessment.
- 4.2.3 The measured noise levels for each monitoring location have been divided into daytime (0700-2300 hours) and night-time (2300-0700 hours) categories.
- 4.2.4 The results for each of the monitoring locations are presented in Table 7.



Table 7: Average Daytime and Night-time Noise Levels		
Time	Monitoring Location	Measured Noise Level (Figures in dB L <sub>Aeq</sub> )
0700-2300	1	72*
2300-0700		68
0700-2300	2	65
2300-0700		60
* The predicted level, using CRTN, calculated at monitoring location 1, is lower than the measured level at peak daytime transportation times. Therefore, the higher measured level has been used for this assessment.		

- 4.2.5 Based on the results obtained, a robust assessment can be made of the noise levels at the site and of the mitigation necessary to achieve the required noise levels at the development.
- 4.2.6 The maximum noise levels, measured during the night-time period of the survey, are summarised in Table 8.

Table 8: Summary of the Maximum Night-time Noise Levels (Figures in dB L <sub>Amax</sub> )	
Monitoring Location	Maximum Measured Noise Level
1	89
2	86

### 4.3 BS8233 Assessment of Daytime Noise Levels in Outdoor Living Areas

- 4.3.1 The measured noise levels, as detailed in Table 7 indicate that the noise levels affecting the development site at ground level are between 65dB L<sub>Aeq</sub> and 72dB L<sub>Aeq</sub>. However, the proposed development comprises self-contained apartments and only includes outdoor living areas only at 15<sup>th</sup> floor level and above.
- 4.3.2 The L<sub>Aeq</sub> at ML1, which was measured at 72dB, has been distance corrected for the 15<sup>th</sup> floor terraces using accepted calculation methods. The height of the proposed 15<sup>th</sup> floor terraces will be approximately 36m above ground level, which will give a reduction of approximately 6dB due to distance attenuation. Terraces will also be screened from Strand Street by the edge of the proposed building, which will provide approximately 10dB of additional attenuation. Taking the attenuation into consideration, it is likely that the noise levels from the local road network would be approximately 56dB(A) within outdoor living areas on the 15<sup>th</sup> floor and above.
- 4.3.3 BS8233 includes guidance design criteria for external noise in which it is recognised

that in areas of high noise such as city centres or urban areas adjoining the strategic transport network a compromise between elevated noise levels and convenience of living or effective land use may be warranted.

- 4.3.4 The proposed development site is located in an urban area, close to major transport links. It is considered that the predicted noise levels of 56dB in outdoor living areas is acceptable and should not be a reason for refusal of this proposed development. Therefore, no mitigation would be required for outdoor living areas.

#### **4.4 WHO and BS8233 Assessment of Daytime Noise Levels in Living Rooms and Bedrooms**

- 4.4.1 Before internal noise levels can be calculated 3dB(A) must be added to the freefield measured levels to allow for the reflection of noise from the proposed façades of the apartment block when the building is in place.
- 4.4.2 The measured daytime noise levels, as detailed in Table 6, have been used to determine the noise levels likely at the façades of the apartment block in the vicinity of the monitoring locations during the daytime period.
- 4.4.3 The calculated noise levels at the façades of the proposed apartment block, together with the level of attenuation required to achieve 35dB  $L_{Aeq}$  in the living room and bedroom areas in accordance with BS8233 (2014) and WHO (1999), are summarised in Table 9.

<b>Table 9: Façade Noise Level at Properties in the Vicinity of the Monitoring Locations and Level of Attenuation Required to Achieve the Internal Daytime Noise Limit (Figures in dB(A))</b>		
<b>Residential Properties</b>	<b>Noise Level at the Façade of the Property</b>	<b>Level of Attenuation Needed to Achieve 35dB <math>L_{Aeq}</math> in Living Room and Bedroom Areas</b>
Facades in the western part of the development site ie Monitoring Location 1	75	40
Facades in the northern, eastern and southern parts of the development site ie Monitoring Location 2	68	33

#### **4.5 Assessment of Night-time Noise Levels in Bedrooms**

- 4.5.1 The measured night-time noise levels, as detailed in Tables 7 and 8, have been used

to determine the noise levels likely at the façades of the apartment block during the night-time period.

- 4.5.2 Before internal noise levels can be calculated 3dB(A) must be added to the freefield measured levels to allow for the reflection of noise from the proposed facades of the apartment block when the building is in place.
- 4.5.3 The calculated noise levels at the façades of the apartment block, together with the level of attenuation required to achieve 30dB  $L_{Aeq}$  and 45dB  $L_{Amax,f}$  in the bedrooms, are summarised in Table 10.

<b>Table 10: Façade Noise Level at Properties in the Vicinity of the Monitoring Locations and Level of Attenuation Required to Achieve the Internal Night-time Noise Limit (Figures in dB(A))</b>			
<b>Residential Properties</b>	<b>Noise Level at the Façade of the Property (<math>L_{Aeq}</math>)</b>	<b>Maximum Noise Level at the Façade of the Property (<math>L_{Amax}</math>)</b>	<b>Level of Attenuation Needed to Achieve the Noise Limits in Bedrooms</b>
Facades in the western part of the development site ie Monitoring Location 1	71	92	47
Facades in the northern, eastern and southern parts of the development site ie Monitoring Location 2	63	89	44

#### **4.6 Industrial/Commercial Noise Assessment (BS4142)**

- 4.6.1 Site observations indicate that noise from deliveries associated with the adjacent Tesco Express and commercial premises on Red Cross Street are audible at the proposed development site during the daytime and night-time periods. Therefore, a BS4142 assessment has been undertaken to determine the significance of the commercial noise at the proposed dwellings.

##### ***Selection of the Background Noise***

- 4.6.2 Section 8 of BS4142 provides guidance on the selection of the background sound to be used in the assessment. BS4142 states that the background sound levels used for the assessment should be representative of the period being assessed (i.e. daytime or night-time periods), and that there is no “single” background sound level.
- 4.6.3 Therefore, some assessment of the measured noise levels is required to select the

most appropriate and representative background sound level. An assessment has been carried out based upon the measured noise levels during the day and night-time periods.

### ***Analysis of Background Data***

#### ***Daytime***

- 4.6.4 The sensitivity of the receptor changes throughout the day, and therefore the assessment of the daytime period has been divided into two parts. The first assesses the measured data between 1157 hours and 1457 hours on the 8<sup>th</sup> June 2016 (daytime), at monitoring location 1. The second assesses the measured data between 2003 hours and 2300 hours on 29<sup>th</sup> June 2016 (evening), at monitoring location 7 (representative of the proposed development, well away from sources of commercial noise).
- 4.6.5 For the purpose of this assessment, the background noise level of 59dB L<sub>A90</sub> measured at monitoring location 1 (over the period 1157-1457) on 8<sup>th</sup> June 2016, shown in Appendix B, is considered to be typical of the background noise levels during the daytime period at the proposed development site. The background noise level is the average of the L<sub>A90</sub> levels taken during this period to ascertain the typical background level.
- 4.6.6 The later part of the evening, between 2000 hours and 2300 hours, is considered to be more noise sensitive. For the purpose of this assessment, a consistent background noise level of 53dB L<sub>A90</sub>, was measured at monitoring location 7, shown in Appendix B. This background level is considered to be representative of the noise level during the later part of the evening, at the proposed development site.

#### ***Night-time***

- 4.6.7 For the purposes of this assessment, the measured noise level from monitoring location 7, which was measured in the absence of any industrial noise, is considered representative of the background noise level at the proposed development site, during the night-time period.
- 4.6.8 The noise levels are elevated between 0000 hours and 0100 hours. Therefore, to provide a more robust assessment, the data measured during this time period has been removed from the assessment.
- 4.6.9 Analysis of the measured data in 15 minute periods, shown in Appendix B, between 0100 hours and 0300 hours on the 30<sup>th</sup> June 2016 shows that the noise levels are between 45dB L<sub>A90</sub> and 50dB L<sub>A90</sub>.

4.6.10 To determine the background noise level to be used in this assessment, the statistical average of the  $L_{A90}$  has been calculated. For the purpose of this assessment, the background noise level of 45dB  $L_{A90}$  measured at monitoring location 7 (over the period 0100-0300) on 30<sup>th</sup> June 2016 is considered to be typical of the background noise levels during the quietest part of the night.

#### ***Existing Commercial Noise Sources***

4.6.11 Noise associated with the adjacent commercial premises on Red Cross Street, near to the north western boundary of the development site, includes noise sources which may affect future sensitive receptors;

- Noise from deliveries to the adjacent Tesco Express Convenience Store and other commercial premises on Red Cross Street; and,
- Noise from external plant located on nearby commercial buildings off Red Cross Street and Strand Street.

4.6.12 Site observations indicate that deliveries to nearby commercial premises take place during the day and night-time periods. External plant is audible during the daytime and night-time periods, but is more noticeable during the night-time period due to a lower background noise level at the development site.

4.6.13 Noise from the external plant at the Travelodge Hotel was not audible at the proposed development site. Therefore, this noise source has not been assessed further.

#### ***Deliveries***

4.6.14 The measured delivery noise level of 63dB  $L_{eq}$  at Monitoring Location 2 between 0637 hours and 0642 hours on 23<sup>rd</sup> June has been used as the specific noise level of deliveries at the Tesco Express store for the daytime and night-time assessment. To allow the assessment of noise from deliveries, then noise from cars passes on Red Cross Street, has been removed from the measured data.

4.6.15 To provide a robust assessment in accordance with BS4142:2014, it has been assumed that deliveries take place for the full 1 hour assessment period during the daytime and the full 15 minutes assessment period during the night. Furthermore, in accordance with BS4142, it is considered that 3dB should be added to the specific noise level to allow for intermittent changes in noise level.

#### ***External Plant at rear of Victoria House (James Street)***

4.6.16 Victoria House is located on James Street to the north of the proposed development. During the night-time monitoring period, small window fan units, on the southern

façade of Victoria House were audible at the northern boundary of the proposed development.

4.6.17 A specific source measurement the fan units was taken at Monitoring Location 4. The measured noise level of 47dB  $L_{eq}$  at 0146 hours on the 30<sup>th</sup> June 2016 has been used as the specific noise level of external plant noise at Victoria House, for the night-time assessment. Noise from the external plant at Victorian House is not audible during the daytime due to the higher background noise levels, therefore a BS4142 assessment has not been carried out for the daytime period.

4.6.18 The measured levels are considered to be representative of normal operations and therefore an on-time correction has not been applied.

4.6.19 An assessment of the tonality of the external plant noise has been undertaken using the one-third octave objective method. This method indicates that there is no tonal element to the noise from the external plant, therefore no penalty for tonality has been applied to the measured level.

#### 4.7 Assessment of Commercial Noise Levels

##### Daytime

4.7.1 In accordance with BS4142, the specific daytime noise level from the commercial premises in the vicinity of the proposed development site has been compared with the measured background noise level, shown in Table 11.

Table 11: BS4142 Assessment of commercial noise in the vicinity of the proposed development site, during the daytime (Figures in dB(A)).		
Receptor	Deliveries at Tesco Express	
	Daytime	Evening
Specific Noise Level (Incl. on-time correction where applicable)	63	63
Acoustic Correction Feature	+3	+3
Rating Level	66	66
Background Noise Level (dB $L_{A90}$ )	59	53
Excess of rating over background level	+7	+13

4.7.2 The results of the BS4142 assessment in Table 11 indicate that noise from deliveries at Tesco Express is likely to be an indication of an adverse impact, during the daytime. During the evening, noise from deliveries at Tesco Express is likely to be an indication of a significant adverse impact. However, BS4142 states that the acceptability of this

level depends on the context.

### Night-time

- 4.7.3 In accordance with BS4142, the specific night-time noise level of the commercial premises in the vicinity of the proposed dwellings has been compared with the measured background noise level, shown in Table 12.

Table 12: BS4142 Assessment of commercial noise in the vicinity of the proposed development site, during the night-time (Figures in dB(A)).		
Receptor	Deliveries at Tesco Express	External Plant at Victoria House
Specific Noise Level (Incl. on-time correction where applicable)	63	47
Acoustic Correction Feature	+3	0
Rating Level	69	47
Background Noise Level (dB L <sub>A90</sub> )	45	45
Excess of rating over background level	+18	+2

- 4.7.4 The results of the BS4142 assessment in Table 11 indicate that noise from deliveries at Tesco Express is likely to be an indication of a significant adverse impact, during the night-time. Noise from external plant at Victoria House is an indication of an adverse impact at the proposed development. However, BS4142 states that the acceptability of this level depends on the context.

### BS4142 Context Assessment

- 4.7.5 The results of the above BS4142 assessments for day and night-time commercial noise indicate that the predicted noise levels likely are likely to cause an adverse or significant adverse impact, during periods of the day and night-time.
- 4.7.6 BS4142:2014 States; *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound sources exceeds the background sound level and the context in which the sound occurs"*.
- 4.7.7 The first requirement of this statement has been determined within the noise impact assessment section above. To determine the context in which the industrial sound will reside, three factors must be considered, these are;

- The absolute level of sound;



- The character and level of the residual sound compared to the character and level of the specific sound; and;
- The sensitivity of the receptor.

### ***Absolute Level of Sound***

- 4.7.8 The impact of a given difference between rating level and background noise level will depend upon whether the residual sound level is low or high.
- 4.7.9 In order to assess the deliveries at the Tesco Express store and external plant at Victoria House in the context of their environment and that of the proposed sensitive receptors, the predicted sound levels from both noise sources have been added to the measured, average ambient noise levels at the proposed development.
- 4.7.10 The results for each existing receptor location for day and night-time periods are detailed within Tables 13 and 14 respectively.

<b>Table 13: Context Assessment at Proposed Sensitive Receptors on Red Cross Street - Daytime Deliveries, between 0700 and 2300 hours Figures in dB L<sub>Aeq</sub></b>	
<b>Receptor</b>	<b>Proposed Receptors Adjacent to Red Cross Street - Deliveries at Tesco Express</b>
Average residual sound level over the noise monitoring period i.e. Existing sound level without deliveries.	64
Predicted Specific Noise i.e. Operational noise level of deliveries only.	63
Total absolute level of sound i.e. Existing sound level plus deliveries.	67
Difference between existing ambient sound levels and predicted future sound levels.	+3

<b>Table 14: Context Assessment at Proposed Sensitive Receptors on Red Cross Street – Night-time Deliveries and Plant, between 2300 and 0700 hours Figures in dB L<sub>Aeq</sub></b>		
<b>Receptor</b>	<b>Proposed Receptors Adjacent to Red Cross Street</b>	
	<b>Deliveries at Tesco Express</b>	<b>External Plant at Victoria House</b>
Average residual sound level over the noise monitoring period i.e. Existing sound level without deliveries or plant.	60	60

Predicted Specific Noise i.e. Operational noise level of deliveries and plant only.	63	47
Total absolute level of sound i.e. Existing sound level plus deliveries and plan.	65	60
Difference between existing ambient sound levels and predicted future sound levels	+5	0

4.7.11 Table 13 and 14 show that during deliveries periods at Tesco Express the noise levels attributable to the process have the potential to increase the absolute level of sound by 3 and 5 dB(A) during the day and night-time respectively. This is an indication that the noise levels from deliveries will be perceptible at receptor locations fronting Red Cross Street.

4.7.12 The noise levels attributed to external plant at Victoria House has no effect on the total ambient noise levels at the proposed sensitive receptor locations. This is an indication the noise levels from external plant at Victoria House would be inaudible at receptor locations fronting Red Cross Street.

#### ***Character and Level of Residual Sound Compared with the Specific Sound***

##### ***Tesco Express Deliveries***

4.7.13 The character of the residual noise during the daytime and night-time is dominated by road traffic noise on Strand Street, which contains low to mid frequency noise. The specific noise of deliveries at Tesco Express also contains low to mid frequency noise, but also contains intermittent bangs.

4.7.14 Table 13 and 14 indicate that, when present noise from deliveries at Tesco Express is likely to be audible during the day and night-time period.

##### ***External Plant Victoria House***

4.7.15 The specific noise of external plant at Victoria House contains low to mid frequency noise. This is not out of context with the surrounding environment which is dominated by road traffic on Strand Street.

#### ***Sensitivity of Receptor***

4.7.16 The sensitivity of the receptor changes throughout the day, with the night-time and evening periods being more sensitive due to the occupants' need for quiet for rest and relaxation.

4.7.17 The proposed development is to consist of apartments and therefore receptors would be indoors and benefit from the attenuation provided by the building envelope. Therefore, the building envelope design must be taken into consideration when

considering the sensitivity of a receptor during the day and night-time.

### ***Summary of BS4142 Assessment***

4.7.18 Taking context into consideration, the results of the BS4142 assessment in Table 11 indicate that noise from deliveries at Tesco Express are likely to have an adverse impact, during the day, evening and night-time. Therefore, mitigation measures will be required to ensure that future residents are protected from delivery noise at the Tesco Express store.

4.7.19 Noise from external plant at Victoria House is inaudible during the daytime and more than 10dB(A) lower than the night-time ambient noise levels. This is a clear indication of a low impact at the proposed development when considering context.

### ***Uncertainty***

4.7.20 To reduce measurement uncertainty, the following steps have been taken:

- The background noise measurement location was selected to be representative of the background noise level at the closest proposed receptors to Tesco Express and Victoria House. In accordance with guidance, the microphone was mounted on a tripod 1.5m above the ground. Monitoring locations were also more than 3.5 metres from any other reflecting surfaces;
- The background noise measurements were taken during dry and calm weather conditions;
- The daytime and night-time background noise measurement was undertaken during, what is considered to be a representative period;
- The daytime and night-time background noise measurement was undertaken in accordance with the reference period required by BS4142;
- The results of each measurement period were reported to the nearest 0.1dB; and;
- Noise measurements were made using a Class 1 integrating sound level meter.

### ***Assessment of Noise from the Proposed Commercial Units***

4.7.21 The operational activities associated with the commercial units at the proposed development site have the potential to generate noise at existing and proposed sensitive receptors. Activities that are likely to take place and which have the potential to generate noise include:

- Ancillary noise sources including noise from external plant/fans;
- Noise break-out from proposed units;
- Deliveries and/or collections of goods, including HGVs; and
- Additional vehicle movements around external areas and on the local road network.

4.7.22 At this stage, Wardell Armstrong does not have any information relating to the future ancillary noise sources, traffic data or hours of operation associated with the proposed commercial units. It has not therefore been possible to estimate the level of noise, likely to be generated by activities associated with the Employment site, at the existing sensitive receptors.

4.7.23 Therefore, appropriate noise limits for activities associated with the Employment site are recommended in accordance with BS4142, and are based on the background noise survey undertaken at the two locations considered representative of existing sensitive receptors in the vicinity of the proposed commercial units.

#### *Daytime*

4.7.24 The daytime background noise level measured at monitoring location 1 of 59dB ( $L_{A90, 1 \text{ hour}}$ ), is considered representative of the typical daytime noise levels at existing and proposed sensitive receptors.

4.7.25 To ensure that noise from the proposed commercial units does not impact adversely upon receptors during the daytime, it is recommended that daytime noise levels generated by the commercial units should not exceed a free field rating level of 59dB ( $L_{Aeq, 1 \text{ hour}}$ ) at 1m from any proposed noise source, or exceed the free field background noise levels at receptor locations, during any period of the daytime. This is an indication that the specific sound sources would have a low impact on existing and proposed sensitive receptors, depending on context.

#### *Evening*

4.7.26 The evening background noise level measured at monitoring location 7 of 53dB ( $L_{A90, 1 \text{ hour}}$ ), is considered representative of the typical evening noise levels at existing and proposed sensitive receptors.

4.7.27 To ensure that noise from the proposed commercial units does not impact adversely upon receptors during the evening, it is recommended that evening noise levels generated by the commercial units should not exceed a free field rating level of 53dB ( $L_{Aeq, 1 \text{ hour}}$ ) at 1m from any proposed noise source, or exceed the free field background noise levels at receptor locations, during any period of the evening. This is an

indication that the specific sound sources would have a low impact on existing and proposed sensitive receptors, depending on context.

#### *Night-time*

- 4.7.28 The night time background noise level measured at monitoring location 7 of 45dB (L<sub>A90</sub>, 15 mins), is considered representative of the typical night-time noise levels at existing and proposed sensitive receptors.
- 4.7.29 To ensure that noise from the proposed commercial units does not impact adversely upon receptors during the night-time, it is recommended that night-time noise levels generated by the commercial units should not exceed a free field rating level of 45dB (L<sub>Aeq</sub>, 15 minutes) at 1m from any proposed noise source, or exceed the free field background noise levels at receptor locations, during any period of the night-time. This is an indication that the specific sound sources would have a low impact on existing and proposed sensitive receptors, depending on context.
- 4.7.30 Mitigation measures will be incorporated into the design of the proposed commercial units, to ensure the noise impacts of the premises achieve acceptable levels at existing and proposed sensitive receptors.

## 5 NOISE ATTENUATION SCHEME

### 5.1 Construction Phase

#### *Noise from Earthworks and Construction Phase Activities*

- 5.1.1 To reduce the potential impact of noise levels generated by the construction phase of the development, at existing receptor locations in the immediate vicinity of the site, mitigation measures will be put in place.
- 5.1.2 In addition, best working practice will be implemented during each phase of the earthworks and construction works at the site. The construction works will follow the guidelines in BS5228-1 and the guidance in BRE Controlling particles, vapour and noise pollution from construction sites, Parts 1 to 5, 2003.
- 5.1.3 The following measures will be put in place to minimise noise emissions:
- When works are taking place within close proximity to those sensitive receptors identified, screening of noise sources by temporary screen may be employed;
  - All plant and machinery should be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers;
  - Site staff should be aware that they are working adjacent to a residential area and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios;
  - A further measure to reduce noise levels at the sensitive receptors would include, as far as possible, the avoidance of two noisy operations occurring simultaneously in close proximity to the same sensitive receptor;
  - Adherence to any time limits imposed on noisy works by the Local Authority;
  - Implement set working hours during the week and at weekends;
  - Ensure engines are turned off when possible; and
  - Should earthworks/earthworks and construction activities need to be carried out during night-time hours, the local authority could include a planning condition which requests advance notice and details of any night working to be provided.
- 5.1.4 The noise impacts of earthworks and construction phases, with the implementation of best working practice and restriction on working hours, are considered to be generally negligible, with only brief periods of minor adverse impacts.

## ***Vibration from Earthworks and Construction***

- 5.1.5 At this stage it is not proposed to introduce any specific vibration mitigation measures to any receptors. However, as with noise from earthworks and construction works, working practices should be implemented to prevent unnecessary vibration at all receptors as much as possible.
- 5.1.6 To keep groundborne vibration to a minimum the following measures, as referred to in BS5228-2, should be put in place:
- Substitution: Where reasonably practicable plant and or methods of work likely to cause significant levels of vibration at the receptors identified, should be replaced by less intrusive plant/methods of working; and
  - Vibration Isolation of plant at source: This may prove a viable option where the plant is stationary (e.g. a compressor, generator) and located close to a receptor.
- 5.1.7 In relation to piling, should it be required, there are a number of measures which can be implemented, depending upon the type of piling chosen. BS5228-2 indicates that mitigation might include: use of alternative methods, removal of obstructions, provision of cut-off trenches, reduction of energy input per blow, reduction of resistance to penetration. Continuous flight augering would cause minimal vibration even very close to the piling operation.
- 5.1.8 As the construction programme and methodologies become more defined it is suggested that earthworks and construction vibration be reconsidered and that a detailed strategy for control be implemented.
- 5.1.9 The vibration impacts of earthworks and construction phases, with the implementation of best working practice, are considered to be generally negligible, with only brief periods of minor adverse impacts.

## **5.2 Glazing Requirements for Daytime in Bedrooms and Living Room Areas**

- 5.2.1 When assessing daytime noise levels in living rooms, the noise attenuation provided by the overall building facade should be considered. To mitigate noise levels, the composition of the building facade can be designed to provide the level of attenuation required. Glazing is generally the building element which attenuates noise the least, so the proportion of glazing in a building facade is an important consideration when assessing overall noise attenuation.
- 5.2.2 Based on the initial drawing provided by Leach Rhodes Walker Architects, Wardell Armstrong have undertaken break-in calculations for the most sensitive living room



type. The following assumptions have been made;

*Living Room*

- Façade Surface Wall Area =  $1.5\text{m}^2$  (Two leaves of 102.5mm brickwork, 50mm cavity, rigid wall ties)
- Façade Surface Window Area =  $7.5\text{m}^2$
- Façade Vent = None
- Room Volume =  $60\text{m}^3$

- 5.2.3 The noise attenuation requirements for living rooms during the daytime in properties in different areas of the site are summarised in Table 9. Prediction calculations indicate that for living room areas located on the west façade, closest to and with a direct line of sight to Strand Street, laminated glazing, such as 16.8/16/16.8, should ensure that internal noise guideline levels are met with the windows closed.
- 5.2.4 Prediction calculations indicate that for living room areas located in the northern, western and southern facades, laminated glazing, such as 10/12/6pvb would need to be installed to ensure recommended guideline internal noise levels are met with the windows closed. It is important to note that living rooms located on the northern and southern facade but have a clear line of sight to Strand Street are likely to require the higher specification detailed above for living rooms fronting Strand Street. Detailed break-in calculations can be found in (Appendix D).
- 5.2.5 Alternatively, a secondary glazed system as detailed within, The City of Liverpool Report – Noise Control Requirements for Residential and Other Developments in the City Centre (Appendix E), could be implemented within all the living rooms. However, it should be noted that secondary glazing systems require deep window reveals which may not be suitable for this development.
- 5.2.6 With windows open, the attenuation provided by the all façade will be approximately 15dB(A). This would allow the recommended internal noise guideline levels to be exceeded in living rooms.
- 5.2.7 On occasions, this may be acceptable to a resident, but when quiet conditions are required, the resident should be able to close the windows whilst maintaining adequate ventilation. Some form of acoustic or mechanical ventilation would therefore need to be installed in living rooms.
- 5.2.8 Appropriate glazing and ventilation will be incorporated into the detailed design of the development to ensure that the noise guideline values are met in all noise sensitive

rooms during the daytime period.

### **5.3 Glazing Requirements for Night-time in Bedroom Areas**

5.3.1 The noise attenuation requirements for bedrooms across the site are summarised in Table 10.

5.3.2 Based on the initial drawing provided by Leach Rhodes Walker Architects, Wardell Armstrong have undertaken break-in calculations for the most sensitive bedroom type. The following assumptions have been made;

#### *Bedroom*

- Façade Surface Wall Area =  $1.5\text{m}^2$  (Two leaves of 102.5mm brickwork, 50mm cavity, rigid wall ties)
- Façade Surface Window Area =  $3.5\text{m}^2$
- Façade Vent = None
- Room Volume =  $35\text{m}^3$

5.3.3 Prediction calculations indicate that for bedrooms located on the western façade, closest to, and with a direct line of sight to Strand Street, laminated glazing such as 12.8/16/16.8 should ensure that internal noise guideline levels are met with the windows closed.

5.3.4 Prediction calculations indicate that for bedrooms located on the northern, eastern and southern facades, laminated glazing such as 10/12/6pvb should ensure that internal noise limits are met, with the windows closed. It is important to note that bedrooms located on the northern and southern façade, but have a clear line of sight to Strand Street are likely to require the higher specification detailed above for bedrooms fronting Strand Street. Detailed break-in calculations can be found in (Appendix D).

5.3.5 Alternatively, a secondary glazed system as detailed in, The City of Liverpool Report – Noise Control Requirements for Residential and Other Developments in the City Centre, could be implemented within the plots. However, it should be noted that secondary glazing systems require deep window reveals which may not be suitable for this development.

5.3.6 With windows open, the attenuation provided by the façade will be approximately 15dB(A). This would allow the recommended internal noise guideline levels to be exceeded in bedrooms. Acoustic ventilation would therefore need to be installed.

5.3.7 Appropriate glazing specifications have been provided Appropriate glazing and

ventilation will be discussed with the relevant environmental health officers at Liverpool City Council and incorporated into the detailed design of the development to ensure that the noise guideline values are met in all noise sensitive rooms during the night-time period. The

#### **5.4 Acoustic Ventilation Requirements**

- 5.4.1 It is recommended that the acoustic or mechanical ventilation proposed at the site should, as a minimum, comply with Building Regulations 2000 Approved Document F1 Means of Ventilation and British Standard BS5925 1991: "Code of Practice for Ventilation Principles and Designing for Natural Ventilation". Acoustic ventilation is only recommended for noise sensitive rooms, which are bedrooms and living/dining rooms.
- 5.4.2 The implementation of the recommended glazing together with appropriate acoustic or mechanical ventilation should ensure that the required internal daytime and night-time noise limits are achieved.

#### **5.5 Industrial/Commercial Noise**

##### ***Existing Noise Sources***

- 5.5.1 Mitigation measures are required to attenuate noise levels from deliveries, located near to the north eastern boundary of the development site.

##### ***Detailed Assessment of Tesco Express Deliveries***

- 5.5.2 Observations made during the noise survey indicate that noise from deliveries to a nearby Tesco Express store are audible during the day and night-time at the proposed development site. Therefore, further investigation has been undertaken to determine the acceptability of noise from external plant and deliveries inside living room and bedroom areas in proposed dwellings located near to Red Cross Street during the day and night-time.
- 5.5.3 To assess the possibility of annoyance being caused by deliveries at the nearest proposed apartment on Red Cross Street, the noise spectrum has been plotted against Noise Rating (NR) Curves. It is generally accepted that NR30 and NR25 represent a good standard for indoor noise levels in living rooms and bedrooms, during the day and night-time respectively.
- 5.5.4 To assess the possibility of annoyance being caused by deliveries, the measured one third octave band noise levels have been adjusted for the degree of attenuation provided by laminated glazing, such as 10/12/6.4pvb, and assessed against standard noise rating curves. The assessment is shown for the nearest proposed dwellings in

the northern part of the site, closest to the Tesco Express delivery area.

- 5.5.5 The measured noise levels of the deliveries were measured on the proposed development site, therefore no distance correction for source location is required. The noise levels have been compared to the level of attenuation provided by the glazing (Appendix C).
- 5.5.6 When the noise spectrum for Tesco Express deliveries are plotted against NR Curves, the highest octave band noise level is below the contour for NR25 during the day and night-time, with laminated glazing, such as 10/12/6.4pvb, in place (Appendix C).
- 5.5.7 During the daytime, NR25 would be a higher standard than NR30, which is usually considered to be a good standard within living rooms and it is accepted that NR25 represents a good standard for indoor noise levels in bedrooms during night-time. This is a good indication that with mitigation measures in place the potential noise impact from deliveries at the Tesco Express store would be insignificant during all of the day and night-time periods.
- 5.5.8 Prediction calculations indicate that for living room and bedrooms located closest to, and with a direct line of sight of Red Cross Street, laminated glazing such as 10/12/6pvb would ensure that internal noise levels meet NR25, with the windows closed. However, with windows open, the attenuation provided by the façade will be approximately 15dB(A). Acoustic ventilation would therefore need to be installed.
- 5.5.9 The glazing specification detailed within this section is consistent with the recommended glazing and ventilation requirements for road traffic noise at facades fronting Red Cross Street. Therefore, no additional mitigation requirements are needed to attenuate commercial noise at the proposed development.
- 5.5.10 Alternatively, a secondary glazed system as detailed within, The City of Liverpool Report – Noise Control Requirements for Residential and Other Developments in the City Centre, could be implemented within the plots. However, it should be noted that secondary glazing systems require deep window reveals which may not be suitable for this development.

### ***Operational Phase***

- 5.5.11 Mitigation measures will be incorporated into the design of the proposed commercial units to ensure that noise impacts from the premises achieve the limits presented within this assessment. It is considered that mitigation measures may include local screening of any noise sources, careful selection of plant and/or timing of operational activities.

## **6 CONCLUSIONS**

6.1.1 Wardell Armstrong has carried out a noise assessment for the proposed residential development located at Strand Street, Liverpool.

6.1.2 To establish baseline noise levels an attended noise survey has been carried out. This report assesses the results of the noise surveys carried out in accordance with current guidance and includes recommendations for noise mitigation as appropriate.

### **6.2 Construction Phase Noise and Vibration**

6.2.1 The activities carried out during the earthworks and construction phase of the development will have the potential to generate short term increases in noise levels above the recommended noise limits, set in accordance with current guidance, at existing and proposed sensitive receptors surrounding the site. The use of heavy plant associated with the earthworks and construction works also has the potential to give rise to ground borne vibration. This would occur temporarily and only for short periods.

6.2.2 To minimise the potential impact of construction works, mitigation measures will be put in place. These will include the restrictions on working hours, the implementation of temporary screening, and best working practice where possible.

6.2.3 In addition to earthworks it is possible that piling will be required. At this stage detailed information regarding the type of piling has not been confirmed. To minimise the potential for vibration to be generated by piling it is recommended that careful consideration be given to the type of piling used.

6.2.4 With the implementation of best working practice and restriction on working hours, the noise and vibration impacts of earthworks and construction phases, will be generally negligible, with only brief periods of minor adverse impacts likely in the short term at local level.

### **6.3 Operational Phase**

6.3.1 The dominant noise source, which will potentially affect the residents of the proposed residential development, is road traffic on Strand Street.

6.3.2 In policy terms, there is no presumption against development in places with high noise levels, provided that the noise can be adequately mitigated taking into account the economic and social benefits of the proposed scheme.

6.3.3 The existing resultant noise levels have been assessed against the guideline values

suggested by the World Health Organisation and BS8233. It should be remembered that the internal guideline values are health-based and are therefore relatively inflexible; however adequate noise mitigation is relatively straightforward to engineer. The external guideline values are based on amenity and allow noise to be balanced against any benefits which flow from the location of the proposed scheme.

- 6.3.4 Proposed apartments on the 15<sup>th</sup> floor upwards will have external terraces. The proposed development site is located in an urban area, close to major transport links. It is considered that a predicted noise levels of 56dB in outdoor living areas is acceptable and should not be a reason for the refusal of this proposed development.
- 6.3.5 The noise assessment indicates that for living room and bedroom areas located closest to and with a direct line of sight to Strand Street, laminated glazing, such as 16.8/16/16.8, should ensure that internal noise guideline level is met with the windows closed.
- 6.3.6 The noise assessment indicates that for living room and bedroom areas located in the northern, eastern and southern areas of the site, laminated glazing, such as 10/12/6pvb would need to be installed to ensure recommended guideline internal noise levels are met with the windows closed.
- 6.3.7 Living rooms and bedrooms located on the northern and southern façade, but have a clear line of sight to Strand Street are likely to require the higher specification as detailed for sensitive rooms fronting Strand Street.
- 6.3.8 Appropriate glazing specifications have been provided within this report to achieve internal noise requirements during the day and night-time periods. However, glazing and ventilation options will be explored by the developer and agreed with Liverpool City Council prior to finalising the design. The final design for the glazing and ventilation will ensure that the noise guideline values are met in all noise sensitive rooms during the day and night-time periods.
- 6.3.9 Mitigation measures will be incorporated into the design of the proposed commercial units to ensure that noise impacts from the premises achieve the limits presented within this assessment.

**Appendix A**  
**Noise Monitoring Results**

## Appendix A

### Noise Monitoring Results

Monitoring Location 1 – The Strand – approximately 8m from The Strand						
Time	L <sub>Aeq</sub> (dB)	L <sub>A</sub> min (dB)	L <sub>A</sub> max (dB)	L <sub>A90</sub> (dB)	L <sub>A10</sub> (dB)	Comments
08/06/2016 – Daytime						
1157-1257	70.4	52.2	93.3	58.7	74.2	Noise from road traffic on The Strand. Occasional noise from people walking past. Occasional aircraft. Noise from seagulls.
1257-1357	69.7	53.2	91.1	58.1	73.6	
1357-1457	69.9	53.6	85.6	59.1	73.7	
23/06/2016 – Night-time						
0455-0515	64.3	42.3	79.2	47.9	69.2	Noise from road traffic on The Strand. Noise from seagulls. Distant plant noise
0544-0604	68.5	44.8	80.8	53.5	73	
0652-0700	71.6	53	88.5	57	76.5	
23/06/2016 – Daytime						
0700-0713	71.4	53.8	85.8	58	76.1	Noise from road traffic on The Strand. Occasional noise from people walking past. Occasional aircraft. Noise from seagulls.
0736-0756	72.9	53.9	89.4	59.7	76.5	
0818-0838	72.2	56.7	92.4	60.6	75.5	
0902-0922	71.3	54.9	80.6	59.7	74.9	
0945-1005	70.7	53.3	87.7	58.5	74.6	

Monitoring Location 2 – Red Cross Street						
Time	L <sub>Aeq</sub> (dB)	L <sub>A</sub> min (dB)	L <sub>A</sub> max (dB)	L <sub>A90</sub> (dB)	L <sub>A10</sub> (dB)	Comments
<b>23/06/2016 – Night-time</b>						
0519-0539	56.6	42.5	70.9	45.6	60.7	Noise from road traffic on The Strand. Occasional noise from road traffic on Red Cross Street and carp park. Noise from seagulls. Plant noise from Victoria House (very quiet)
0606-0626	60.1	47.4	75.5	51.6	63.2	
0636-0651	63.6	49.5	85.8	53.5	66.4	Noise from road traffic on The Strand. Occasional noise from road traffic on Red Cross Street and carpark. Noise from seagulls. Noise from delivery
<b>23/06/2016 – Daytime</b>						
0714-0734	66.9	50.7	92.1	57.4	67.4	Noise from road traffic on The Strand. Occasional noise from road traffic on Red Cross Street and carpark. Noise from seagulls.
0757-0817	63	52	75.4	56.1	65.3	
0840-0900	64.1	54.9	82	57.5	65.5	
0924-0944	64.3	54.3	83.4	56.9	65.7	



Monitoring Location 3 – Rear of Existing Car Park						
Time	L <sub>Aeq</sub> (dB)	L <sub>A min</sub> (dB)	L <sub>A max</sub> (dB)	L <sub>A90</sub> (dB)	L <sub>A10</sub> (dB)	Comments
<b>23/06/2016 – Night-time</b>						
0435-0450	54	41.5	69.7	44.3	57.5	Noise from road traffic on The Strand. Occasional noise from road traffic on Red Cross Street and carpark. Noise from seagulls. Noise from distant plant.
<b>23/06/2016 – Daytime</b>						
1035-1135	57.4	51.6	79.4	53.3	59.5	Noise from road traffic on The Strand. Occasional noise from road traffic on Red Cross Street and carpark. Noise from seagulls. Noise from distant plant. Noise from distant construction (very quiet)
1135-1235	57.3	51.2	70.6	53.3	59.2	

Monitoring Location 4 - Specific Source Measurement – External Plant at Victoria House						
Time	L <sub>Aeq</sub> (dB)	L <sub>A min</sub> (dB)	L <sub>A max</sub> (dB)	L <sub>A90</sub> (dB)	L <sub>A10</sub> (dB)	Comments
<b>08/06/2016</b>						
0146	47.3	46.8	48.4	47	47.4	

Monitoring Location 5 – Background Noise Measurement - Salthouse Quay						
Time	L <sub>Aeq</sub> (dB)	L <sub>A</sub> min (dB)	L <sub>A</sub> max (dB)	L <sub>A90</sub> (dB)	L <sub>A10</sub> (dB)	Comments
29/06/2016 – Daytime						
2003-2103	61.3	50	76.6	53.3	64.7	Noise from road traffic on The Strand. Occasional road traffic on Salthouse Quay. People on Salthouse Quay. Noise from seagulls and birds. Occasional low level aircraft.
2123-2200	61.2	49.1	78.7	52.7	64.5	
2200-2300	60.9	49.7	79.5	52.5	64.4	
30/06/2016 – Night-time						
0000-0015	58.7	46.7	71.3	50.5	62.5	Noise from road traffic on The Strand. Occasional road traffic on Salthouse Quay.
0015-0030	58.3	46.7	67.5	49.3	62.3	
0030-0045	57.5	46.3	73.4	48.8	61.2	
0045-0100	57.9	45.3	72.8	49.1	61.6	
0100-0115	55.7	43.3	66.6	45.7	59.9	
0115-0130	56.3	43.8	68.5	46	60.6	
0130-0145	55.5	42.9	67.6	45.9	59.9	
0145-0200	55.3	43.6	71	45.4	58.8	
0200-0215	56.3	42.7	70	45.2	60.6	
0215-0230	57.4	43.1	78.9	44.7	58.8	
0230-0245	53.9	42.8	67.1	45.2	57.9	
0245-0300	54.6	42.9	75.8	44.8	58.5	

**Appendix B**  
**Background Noise Levels**

## Daytime Background Noise Levels

File 061718\_160608\_115632000

Start 08/06/2016 11:57

End 08/06/2016 12:57

Channel	Type	Wght	Unit	Leq	Lmin	Lmax	L90	L10
Solo 061718	Leq	A	dB	70.4	52.2	93.3	58.7	74.2

File 061718\_160608\_115632000

Start 08/06/2016 12:57

End 08/06/2016 13:57

Channel	Type	Wght	Unit	Leq	Lmin	Lmax	L90	L10
Solo 061718	Leq	A	dB	69.7	53.2	91.1	58.1	73.6

File 061718\_160608\_115632000

Start 08/06/2016 13:57

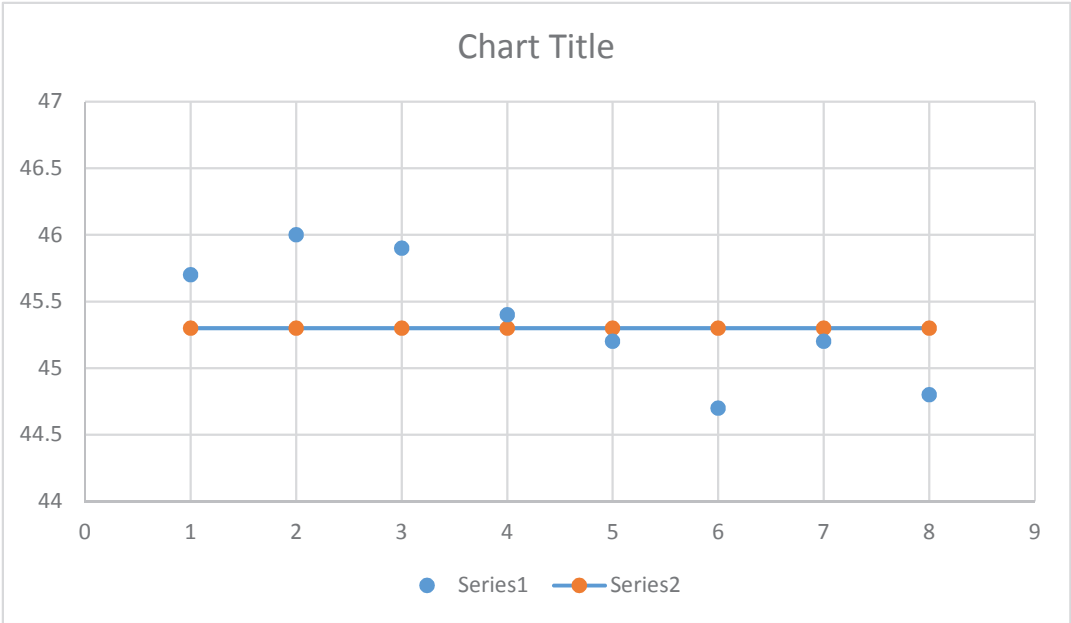
End 08/06/2016 14:57

Channel	Type	Wght	Unit	Leq	Lmin	Lmax	L90	L10
Solo 061718	Leq	A	dB	69.9	53.6	85.6	59.1	73.7

	Leq	Lmin	Lmax	L90	L10
1157-1257	70.4	52.2	93.3	58.7	74.2
1257-1357	69.7	53.2	91.1	58.1	73.6
1357-1457	69.9	53.6	85.6	59.1	73.7

Night-time Background Noise Levels

File	0000-0300 Night-time Background Edited					
Periods	15m					
Start	30/06/2016 00:00					
End	30/06/2016 03:00					
Location	Solo 061718	Solo 061718				
Weighting	A	A				
Data type	Leq	Fast Max				
Unit	dB	dB				
Period start	Leq	Lmin	Lmax	L90	L10	
30/06/2016 01:00		55.7	43.3	66.6	45.7	59.9
30/06/2016 01:15		56.3	43.8	68.5	46	60.6
30/06/2016 01:30		55.5	42.9	67.6	45.9	59.9
30/06/2016 01:45		55.3	43.6	71	45.4	58.8
30/06/2016 02:00		56.3	42.7	70	45.2	60.6
30/06/2016 02:15		57.4	43.1	78.9	44.7	58.8
30/06/2016 02:30		53.9	42.8	67.1	45.2	57.9
30/06/2016 02:45		54.6	42.9	75.8	44.8	58.5
Overall		56.7	42.7	78.9	46	60.7

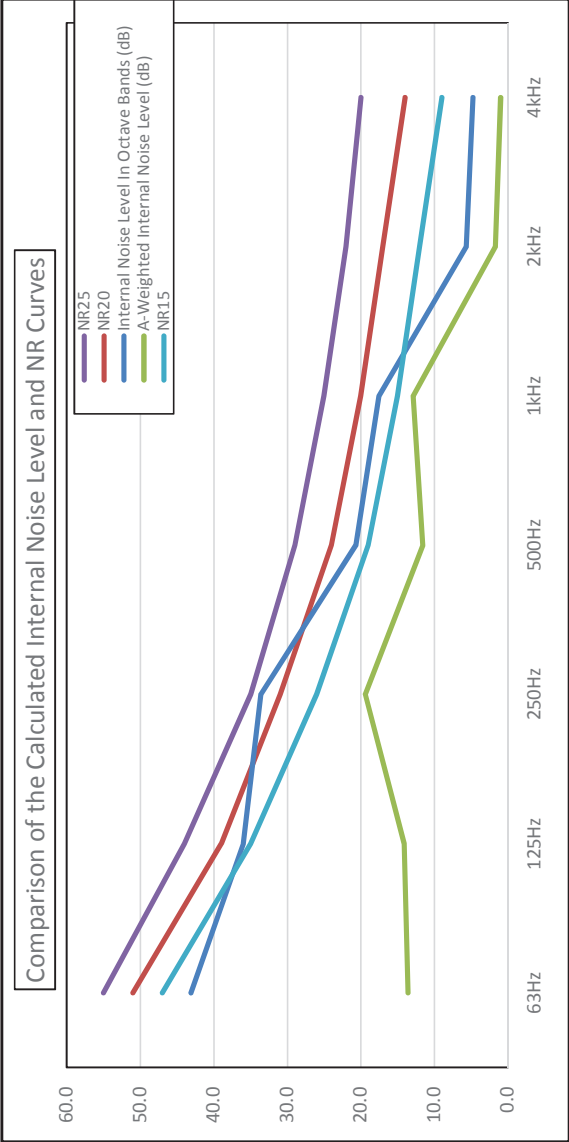


**Appendix C**  
**Noise Rating Curve Assessment**

Job Number	LE13526
Date	21st July 2016
Location	N/A
Day / Night	Day & Night

Table 1E - Noise Break-in in One Third Octave Bands			
Frequency (Hz)	Source Data - 3rd Octave	Attenuation Provided By 10/12/6.4pvb Glazing	Resultant Internal Noise Level (dB)
50Hz	61.5	22.0	39.5
63Hz	62.8	23.0	39.8
80Hz	58.0	25.0	33.0
100Hz	57.8	25.0	32.8
125Hz	56.2	26.0	30.2
160Hz	56.1	26.0	30.1
200Hz	54.7	23.0	31.7
250Hz	55.0	27.0	28.0
315Hz	53.6	31.0	22.6
400Hz	53.2	35.0	18.2
500Hz	52.8	38.0	14.8
630Hz	53.0	40.0	13.0
800Hz	54.9	42.0	12.9
1kHz	54.9	42.0	12.9
1.25kHz	53.5	41.0	12.5
1.6kHz	51.9	50.0	1.9
2kHz	51.5	51.0	0.5
2.5kHz	50.4	52.0	0.0
3.15kHz	46.4	56.0	0.0
4kHz	43.3	60.0	0.0
5kHz	40.5	65.0	0.0
A-Weighted	62.8	35.8	27.0

Table 2E - Comparison with NR Curves					
Frequency (Hz)	Internal Noise Level In Octave Bands (dB)	NR15	NR20	NR25	A-Weighted Internal Noise Level (dB)
63Hz	43.1	47.0	51.0	55.0	13.6
125Hz	36.0	35.0	39.0	44.0	14.1
250Hz	33.6	26.0	31.0	35.0	19.4
500Hz	20.7	19.0	24.0	29.0	11.6
1kHz	17.5	15.0	20.0	25.0	12.9
2kHz	5.6	12.0	17.0	22.0	1.7
4kHz	4.8	9.0	14.0	20.0	1.0



## **Appendix D**

### **Break-in Calculations**

Octave Band Composite SRI Break In Sheet

INPUT DATA



Project:

Plot:

Plot Type:

Room:

Description:

Surface Area Wall:

Surface Area Glazing:

Number of vents:

Room Volume:

Room RT:

Ref	Description
Wall 1	Two leaves of 102.5mm brickwork, 50mm cavity,rigid wall ties
Glazing 31	12.8/16/16.8
Vent 23	No Vent
Source type 2	Free field line source

Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
Average Noise Level (dB)	73.1	75.0	69.9	68.3	67.5	70.6	64.3	55.2	46.3

SRI DATA

Total Façade Area	9.0	Effective Façade Area	9.0
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Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
SRI wall	25	31	37	42	52	60	63	68	68
SRI Glazing	14	27	34	41	47	53	61	68	68
SRI Spandrel	20	21	34	40	45	47	45	52	52
D <sub>ne</sub> Vent	100	100	100	100	100	100	100	100	100

T <sub>wall</sub> X S <sub>wall</sub>	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T <sub>glazing</sub> X S <sub>glazing</sub>	0.299	0.015	0.003	0.001	0.000	0.000	0.000	0.000	0.000
T <sub>vent</sub> X S <sub>vent</sub>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Composite T	0.034	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
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Composite SRI (dB)	15	27	34	41	48	54	61	68	68
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BREAK IN CALCULATIONS

Reflection Corrected									
Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
External Noise Level (dB)	76	78	72	71	70	73	67	58	49
Composite SRI	15	27	34	41	48	54	61	68	68
Surface Area Correction	10	10	10	10	10	10	10	10	10
Absorption Correction	13	13	13	13	13	13	13	13	13
Source type correction	3	3	3	3	3	3	3	3	3
Distance Correction	0	0	0	0	0	0	0	0	0
Screening	1	1	1	1	1	1	1	1	1

RESULTS

Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
Internal Noise Level (dB)	62	51	39	30	23	20	6	-10	-19
A weighted	22	25	23	22	20	20	7	-9	-20
Internal Noise Level dB(A)	30								



## Octave Band Composite SRI Break In Sheet

### INPUT DATA



Project:	The Strand
Plot:	North/East/South Facades
Plot Type:	Apartment
Room:	Living Room
Description:	ML2 - Red Cross Street

Surface Area Wall	1.5
Surface Area Glazing	7.5
Number of vents	0
Room Volume	60.0
Room RT	0.5

Ref	Description
Wall 1	Two leaves of 102.5mm brickwork, 50mm cavity,rigid wall ties
Glazing 16	10/12/6.4 pvb
Vent 23	No Vent
Source type 2	Free field line source

Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
Average Noise Level (dB)	70.6	69.8	64.4	61.2	61.5	60.4	56.3	50.4	42.8

## SRI DATA

Total Facade Area	9.0	Effective Façade Area	9.0
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[illegible][illegible]

Composite T	0.027	0.007	0.002	0.001	0.000	0.000	0.000	0.000	0.000
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Composite SRI (dB)	16	22	28	30	37	42	43	53	53
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## BREAK IN CALCULATIONS

Reflection Corrected

Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
External Noise Level (dB)	73	72	67	64	64	63	59	53	45

Composite SRI	16	22	28	30	37	42	43	53	53
Surface Area Correction	10	10	10	10	10	10	10	10	10
Absorption Correction	13	13	13	13	13	13	13	13	13
Source type correction	3	3	3	3	3	3	3	3	3
Distance Correction	-1	-1	-1	-1	-1	-1	-1	-1	-1
Screening	0	0	0	0	0	0	0	0	0

## RESULTS

[illegible]

## Octave Band Composite SRI Break In Sheet

### INPUT DATA



Project:	The Strand
Plot:	West Façade
Plot Type:	Apartment
Room:	Bedroom
Description:	ML1 - Strand Street

Surface Area Wall	1.5
Surface Area Glazing	3.5
Number of vents	0
Room Volume	35.0
Room RT	0.5

	Ref	Description
Wall	1	Two leaves of 102.5mm brickwork, 50mm cavity,rigid wall ties
Glazing	31	12.8/16/16.8
Vent	23	No Vent
Source type	2	Free field line source

Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
Average Noise Level (dB)	66.5	69.3	66.6	63.7	63.0	66.2	59.9	50.2	40.0
Maximum Noise Level (dB)	77.8	82.5	91.0	85.3	80.4	78.7	80.4	77.5	65.7

## SRI DATA

Total Façade Area	5.0	Effective Façade Area	5.0
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[illegible][illegible]

Composite T	0.029	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
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Composite SRI (dB)	15	28	35	41	48	54	62	68	68
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## BREAK IN CALCULATIONS

Reflection Corrected									
<b>Frequency (Hz)</b>	<b>32</b>	<b>63</b>	<b>125</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>2000</b>	<b>4000</b>	<b>8000</b>
External Noise Level (dB)	69	72	69	66	66	69	62	53	43
Maximum External Noise Level (dB)	80	85	93	88	83	81	83	80	68

Composite SRI	15	28	35	41	48	54	62	68	68
Surface Area Correction	7	7	7	7	7	7	7	7	7
Absorption Correction	11	11	11	11	11	11	11	11	11
Source type correction	3	3	3	3	3	3	3	3	3
Distance Correction	0	0	0	0	0	0	0	0	0
Screening	1	1	1	1	1	1	1	1	1

## RESULTS

[illegible][illegible]

# Octave Band Composite SRI Break In Sheet

## INPUT DATA



wardell  
armstrong

Project:	The Strand
Plots:	North/East/South Facades
Plot Type:	Apartments
Room:	Bedroom
Description:	ML2 - Red Cross Street

Surface Area Wall	1.5
Surface Area Glazing	3.5
Number of vents	0
Room Volume	35.0
Room RT	0.5

Ref	Description
Wall	1
Glazing	16
Vent	23
Source type	2
	Two leaves of 102.5mm brickwork, 50mm cavity,rigid wall ties
	10/12/6.4 pvb
	No Vent
	Free field line source

Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
Average Noise Level (dB)	68.7	67.9	60.7	56.6	55.3	56.6	52.6	46.5	39.2
Maximum Noise Level (dB)	82.7	88.5	78.6	69.4	72.2	69.9	68.8	63.6	57.1

## SRI DATA

Total Facade Area	5.0	Effective Façade Area		5.0					
Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
SRI wall	25	31	37	42	52	60	63	68	68
SRI Glazing	15	21	27	29	36	41	42	52	52
SRI Spandrel	20	21	34	40	45	47	45	52	52
D <sub>ne</sub> Vent	0	0	0	0	0	0	0	0	0
T <sub>wall</sub> X S <sub>wall</sub>	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T <sub>glazing</sub> X S <sub>glazing</sub>	0.111	0.028	0.007	0.004	0.001	0.000	0.000	0.000	0.000
T <sub>vent</sub> X S <sub>vent</sub>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Composite T	0.023	0.006	0.001	0.001	0.000	0.000	0.000	0.000	0.000
Composite SRI (dB)	16	22	28	30	38	43	44	54	54

## BREAK IN CALCULATIONS

Reflection Corrected									
Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
External Noise Level (dB)	71	70	63	59	58	59	55	49	42
Maximum External Noise Level (dB)	85	91	81	72	75	72	71	66	60
Composite SRI	16	22	28	30	38	43	44	54	54
Surface Area Correction	7	7	7	7	7	7	7	7	7
Absorption Correction	11	11	11	11	11	11	11	11	11
Source type correction	3	3	3	3	3	3	3	3	3
Distance Correction	-1	-1	-1	-1	-1	-1	-1	-1	-1
Screening	0	0	0	0	0	0	0	0	0

## RESULTS

Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
Internal Noise Level (dB)	54	47	34	28	19	15	10	-6	-13
A weighted	14	21	18	19	16	15	12	-5	-14
Internal Noise Level dB(A)	26								
Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000
Internal Noise Level (dB)	67	67	51	40	35	28	26	11	4
A weighted	28	41	35	31	32	28	27	12	3
Maximum Internal Noise Level dB(A)	43								

**Appendix E**  
**The City of Liverpool Report**  
**Noise Control Requirements for Residential**  
**and Other Developments in the City Centre.**

## AGENDA ITEM



The City of Liverpool

<b>REPORT TO:</b>	Planning Committee
<b>DATE:</b>	October 2000
<b>REPORTING OFFICER:</b>	Head of Planning, Transportation & Building Surveying/Head of Environmental Health Services
<b>CONTACT OFFICER:</b>	Brian Boardman – Planning (Tel: 233 5627) Antony White – Environmental Health (Tel: 225 4930)
<b>SUBJECT:</b>	Noise Control Requirements for Residential and Other Developments in the City Centre
<b>WARD:</b>	Everton & Abercromby

### PURPOSE OF REPORT:

To seek Committee approval for noise insulation requirements within the City Centre for residential conversion and new build schemes and for uses within Classes A3 and D2 of the Town and Country Planning (Use Classes) Order 1987.

### RECOMMENDATION:

That:-

- i. the requirements given in Annex 2 be approved for the purposes of development control within the City Centre.
- ii. for the purposes of the requirements the City Centre be defined as that area shown on the plan included in this report at Annex 3;
- iii. the Head of Planning, Transportation & Building Surveying, in association with the Head of Environmental Health Services, report back to the Committee in a period of 12 months on how the requirements are operating, together with the need for any revisions.

## **INFORMATION:**

1. Policy H3 of the Deposit Draft Unitary Development Plan promotes the concept of City Centre living which is considered desirable for a number of reasons:-
  - it assists in urban regeneration by providing a new use for otherwise redundant buildings and involves the greater use of existing infrastructure;
  - the provision of additional housing stock which addresses the growing need for accommodation for smaller households;
  - it creates a more lively, interesting and secure City Centre with the social, economic and physical benefits this brings;
  - it constitutes a sustainable form of development by reducing the need for travel, involves the recycling of buildings and reduces pressure to develop on greenfield sites.
2. In order to ensure and maintain the success of City Centre living it is essential to deal with the issue of noise, particularly in relation to the development of a 24 Hour City and the night time economy. During the day city centre noise levels tend to be dominated by high traffic volumes while at night noise levels are maintained by traffic, including taxis and noise emanating from commercial activities. In the early hours noise levels appear to be dominated by the “comings and goings” associated with late night bar and club activity. The need to consider the environment in city centre living is recognised in policy H3 which refers to developments providing adequate safeguards for the amenity and health of future residents. It is not sufficient to say that people who choose to live in the City Centre do so in full knowledge of the potential for a noisy environment. To ensure the success of a City Centre living policy, and the benefits this can bring, measures must be taken to make certain that noise does not become a source of complaint for future residents and to minimise the potential for sleep disturbance as far as practicable. Not only would noise have a potential for blight on the amenity of residents but could have an adverse affect on the operation of business uses and hinder the development of a 24 hour City and the night time economy.
3. The achievement of a satisfactory outcome means applying appropriate safeguards for the provision of noise insulation in residential schemes and also applying noise controls to those night time uses that are a potential source of nuisance to residential occupiers. The imposition of controls to pubs, clubs and other entertainment uses is directed to preventing noise transmission to upper floors and to adjoining premises, which are used for residential purposes, or mixed use developments, and to some extent controlling noise breakout to the surrounding areas. This latter requirement has to be balanced against the need to create and encourage a lively street scene within the City Centre. What cannot be controlled is the noise of pedestrian and vehicular traffic generated by late night entertainment uses hence the need to pay special attention to the noise mitigation

measures for residential uses, although there may be occasions where further A3/D2 uses may be refused if the activity within a particular area would significantly add to existing background levels. Particular care has to be taken in those areas of the City Centre that adjoin the traditional residential areas since dwellings in these areas will not have the noise mitigation measures in place which will be applied to new City Centre living developments.

4. While the requirements referred to have been operated for some years in the City Centre, both in relation to residential conversions and to entertainment uses, it is preferable to have them formally approved to establish a firm policy base. This will assist in connection with any appeals and also to provide a date from which the requirements can be rigorously enforced.
5. The requirements should be limited to a defined area of the City Centre (as shown on the Plan included as Annex 3). This is because there are areas of traditional housing on the periphery which will not be suitable for the development of the night time economy and the requirements will not need to be applied as a matter of course. The need to protect these areas from noise breakout from entertainment uses where these adjoin the City Centre proper however is referred to in paragraph 3 above.
6. The technical background to the requirements is included in this report at Annex 1 but broadly speaking their aim is to ensure that with residential uses the building envelope is treated to resist the passage of sound. The opening of windows can clearly cause noise penetration that would negate these measures and therefore an important part of the requirements is to provide mechanical ventilation to allow for rapid ventilation of rooms without the need to open windows. Windows would in most cases still be capable of being opened but the occupiers would have the choice of keeping them closed.
7. Objections may be made to the provision of mechanical ventilation on the grounds of cost of installation and that it is not a 'sustainable' requirement in that it involves use of energy resources to power the mechanical ventilation. With regard to the costs of implementation all new developments are required to comply with Building Regulations 'U' value requirements (i.e. the method of measuring the mean rate of loss of heat from a structure to ensure energy conservation) and therefore the cost of providing glazing to the specifications indicated is not prohibitive. While conversion schemes do not have the same requirements from the Building Regulations point of view, depending on the nature of the scheme, there have been no indications in the schemes that have been dealt with so far that this requirement has proved prohibitive.
8. Whilst there has been more resistance to the provision of mechanical ventilation the Building Regulations requires mechanical ventilation for kitchens, bathrooms and w.c's where these are internal and incapable of ventilating by opening windows. This can be added to in order to provide a full mechanical ventilation system. There is no doubt that there is an additional cost to developers but as the provision of mechanical ventilation is key to the control of noise it is considered that these additional costs are justified and necessary. This is supported by PPG24 which states in its general principles that where it is not possible to

separate noisy and noise sensitive land uses local planning authorities should consider whether it is practicable to control or reduce noise levels, or to mitigate the impact of noise, through the use of planning conditions or planning obligations. In any event in terms of the advantages to a developer it is far easier to install such systems at the outset than to have to fit them later when complaints arise.

9. The issue of sustainability and mechanical ventilation must be seen in the round; while mechanical ventilation systems do require energy consumption this must be set against the advantages of having a successful City Centre living policy with its positive sustainable aspects of reducing travel and reuse of redundant buildings rather than meeting housing needs on greenfield sites.
10. As with all policies there will be circumstances where the requirements can be relaxed if justified, for example developments which have an internal courtyard, and the requirements as drafted give a degree of flexibility. This is however subject to an applicant providing an acoustic report to set out the measures that are needed in such circumstances. Listed building and buildings in conservation areas must also receive detailed attention to ensure that any proposals do not adversely affect the character of a building or the appearance of a conservation area.
11. It is therefore recommended that the requirements as given in Annex 2 be confirmed for the purposes of development control and that a further report be made to this Committee in 12 months on their operation and the need for any revisions. If approved a leaflet will be produced to give technical advice to developers to assist in the preparation of applications.

#### **EQUAL OPPORTUNITIES IMPLICATIONS:**

No implications.

#### **FINANCIAL IMPLICATIONS:**

None.

#### **BACKGROUND PAPERS:**

None

### **ANNEX 1 – TECHNICAL REPORT**

#### **1. Introduction**

- 1.1 During the day City Centre noise levels tend to be dominated by high traffic volumes, which are due in particular, to buses. Other contributions come from the general “comings and goings” of people. At night high noise levels are maintained by traffic including taxis and by noise emanating from commercial



premises. In the early hours noise levels appear to be dominated by the “comings and goings” associated with late night bar and club activity. The impact of “comings and goings”, whilst difficult to express numerically, should not be underestimated.

- 1.2 An increase in the number of residents in and visitors to the City Centre and the development of the late night economy and the 24 Hour City will lead to further increases in the general noise level. Planning Policy Guidance No.24, Planning and Noise, contains the Government’s advice for dealing with noise issues. Its most fundamental guidance is that the planning system should ensure that noise sensitive developments are separated from major sources of noise. It also advises that noise sensitive development “should not normally be permitted in areas which are – or are expected to become – subject to unacceptably high levels of noise”. PPG24 does allow however for such co-location to take place provided noise is mitigated using conditions or planning obligations.
- 1.3 In order to satisfy the conflicting aims of having a vibrant City Centre and of providing accommodation that secures reasonable living conditions for residents, it is essential that all new residential accommodation in the City Centre is provided with noise mitigation measures.

## 2. **Residential Development – Noise Insulation Package**

### 2.1 **Insulation**

For residential premises mitigation will generally require that the building envelope is treated to resist the passage of sound. In the main this will require treatment of the windows and external doors, as walls and roofs of traditional construction are likely to provide satisfactory levels of sound insulation. In this respect it is preferable to have secondary glazing fitted with panes of different thickness and a gap between the panes of a minimum of 100mm. All gaps should be well sealed and the reveals should be lined with an absorbent material. A suitable specification for secondary glazing is contained in schedule 1 of the Noise Insulation Regulations 1975. Briefly these Regulations describe a double window having well sealed inner and outer panes in which, for a gap between the inner and outer pane of 200 mm, an inner pane thickness of 4 mm is satisfactory and for a gap of 100 mm an inner pane thickness of at least 6mm is required. Where it is not possible to achieve this specification (eg. because the window reveals will not permit such a gap) then a reduced gap may be permitted or thermal double glazing having panes of 6mm and 10mm thickness and a minimum of a 12mm gap between.

#### 2.1.1 **Costs**

It is noted that all new build residential development in the U.K. is provided with double glazing to comply with Building Regulations ‘U’ value requirements. The Building Regulations stipulate requirements for the conservation energy in buildings. As a part of this the envelope of the building must be designed to resist the loss of heat. To this end the Regulations specify the permissible

thermal transmittance of the structure, the U value (the U value gives a good indication of the mean rate of loss of heat from the structure). In order to meet the specified U value limit, careful attention has to be paid to the windows, which tends to mean, in new dwellings, that double-glazing is necessary. The additional cost therefore, of providing glazing to the specification indicated above is not considered prohibitive.

## 2.2 **Ventilation**

As glazing has a key role in the sound insulation of the building envelope, it is imperative that the windows are kept in the closed position. This is indicated by Annex 6 Paragraph 6 of PPG 24 where it is stated “ To provide adequate sound insulation against external noise it is necessary to keep closed those windows and ventilators which have not been designed to provide sound insulation”. It continues by stating that “ Therefore alternative methods of providing ventilation and control of summertime temperatures must be considered”. It is clear therefore that careful consideration must then be given to the ventilation requirements of the premises because opening a window permits traffic and other noise nuisance into a building. Requirement F1 of the Building Regulations states that “there shall be adequate means of ventilation provided for people in the building”. In particular it requires that provision is made for both rapid ventilation (to rapidly dilute, when necessary, pollutants and water vapour produced in habitable rooms) and background ventilation (to make available over long periods of time a minimum supply of fresh air for occupants and to disperse where necessary residual water vapour). These aims are normally most readily achieved by a window of opening area of 1/20<sup>th</sup> of the floor area and air bricks respectively, but this option will not be available to a property which is to be sound insulated.

The Building Regulations permit alternative means of ventilation to be employed; one form of which is mechanical ventilation. Any such system will still need to be treated acoustically to ensure that it does not provide an acoustic path into the dwelling which would compromise the insulation of the remainder of the façade.

There are a number of ways of providing a mechanical ventilation system but only one appears to have been designed specifically for noise insulation of dwellings. This system is specified by the Noise Insulation Regulations 1975. It involves the installation into all habitable rooms of a ventilator unit (containing a fan) and a permanent ventilation opening or openings allowing the acoustically controlled passage of air between outside and inside. The specification in schedule 1 of the Noise Insulation Regulations covers air flow rates, controls and acoustic treatment.

A distinct advantage of the system is that it permits simple occupier control of ventilation in each habitable room.

Other systems can include whole house or whole buildings central air handling units and ducts distributing air to individual accommodation units. Expert advice should be sought on the advantages and disadvantages of the various systems.

**Developers should be aware however that some form of acoustically treated mechanical ventilation will be required which meets the performance requirements, both acoustic and air handling, indicated in the Noise Insulation Regulations 1975.** Air bricks and simple passive ventilators alone are not sufficient; neither is opening a window.

Proposals must pay particular attention to the airflow rates of the scheme, their controllability, self-noise generation of the system and the attenuation measures built in to the building façade air inlets and outlets. It is perhaps important to emphasise that these requirements do not prohibit the installation of openable windows but they ensure that the occupants do not have to rely solely on an opening window to satisfy their ventilation needs.

### 2.2.1 Costs

It is noted that the latest Building Regulations, Part F, in certain cases require quite extensive mechanical ventilation systems to be provided in the form of extract fans (ducted where necessary) for kitchens, bathrooms and w.c's. There is a trend also for new flats and houses to be provided with a master en-suite shower room in addition to a family bathroom. There is therefore already a statutory requirement for significant mechanical ventilation. Carefully selected proprietary whole house ventilation units, available from a number of manufacturers, can therefore provide a competitively priced total solution. For example, it is estimated that the difference between the cost of providing a balanced flow whole dwelling ventilation system and the cost of providing individual extract fans servicing a dwelling having a kitchen, bathroom and separate w.c. would be negligible. (This comparison assumes a requirement for ducted fans and notes that the central system requires only one power supply point).

## 3. Mixed Developments – Noise Control Measures

Whilst it is one thing to insulate properties against external noise it is quite another to insulate against noise arising from other parts of the same building. As part of its strategy for the City Centre the City Council will consider permitting developments containing pubs and clubs in the same buildings as residential dwellings provided adequate measures are in place to control noise. Part E of the Building Regulations, "Resistance to the Passage of Sound", stipulates requirements for sound insulation for party walls and floors separating dwellings.

It emphasises that the specifications provide reasonable levels of insulation against normal domestic noise. Noise arising from pubs and some other commercial uses however, cannot be described as normal domestic noise and as such the party walls and floors must provide insulation in excess of that given in the Building Regulations. This is recognised in Annex 7 Paragraph 10 of PPG 24 where it is indicated that the performance standards demanded by the Building Regulations are not adequate for mixed developments. There is a practical limit arising from both physical and financial implications to the amount of insulation which can be provided as structure borne noise paths tend to limit the amount of sound attenuation achievable. It is not possible therefore to give a general

specification for all circumstances which may arise, and indeed some buildings and arrangements of accommodation will not be suitable for such a mixed use. All that can be done at the earliest planning stages is to indicate to developers, a design criterion for internal noise levels in the dwellings which their proposals will be expected to achieve.

The design criterion which is to be used is that noise generated within the commercial premises must not give rise to noise levels in the dwellings which exceed a Noise Rating (NR) of 30. This is based upon the maximum noise level in each octave band. The Noise Rating provides an octave band spectrum of noise levels which facilitates the design of noise control measures. The value of NR30 corresponds approximately with the noise criteria proposed for bedrooms by both the WHO and BS8233 ie:-

- (a) the WHO guideline, based on limited data, is 35dB(A) and
- (b) the BS8233 criterion is an  $L_{aeq,T}$  of between 30 and 40 dB

Note: As a rule of thumb.

$$\underline{dB(A) = NR/NC + 5 \text{ dB}}$$

Information on the spectral content of the noise is important as the human ear is not equally sensitive to noise in different frequency bands and insulation of lower frequencies is much more difficult to achieve than insulations of higher frequencies.

As a guide to developers at the feasibility stage of projects, it is likely that the achievement of this design criterion will require the input of professional advice from competent consultants, as the cost of necessary noise control measures will not be insignificant. Typical control measures will probably include the following:-

- (a) treatment of dwellings as indicated above;
- (b) insulation of the façade of the commercial premises involving treatment of windows and keeping doors closed (use of lobby systems also);
- (c) mechanical ventilation and or air cooling/air conditioning of the commercial premises to compensate for the lack of natural ventilation and cooling provided by openings in the building envelope;
- (d) provision of additional party wall/floor insulation over and above Building Regulation performance standards comprising sufficient additional mass and or independent leaf structures to meet the criterion in the dwellings as indicated above and to allow the commercial premises to generate noise at their desired level;

- (e) the provision of noise limiting devices on all amplification equipment so that desired noise levels are not exceeded either inadvertently or intentionally and also the provision of devices capable of reducing levels in frequency bands found to cause particular annoyance;
- (f) the internal arrangement of accommodation to ensure that noise producing and noise sensitive areas are well separated.

The above list is not exhaustive and is offered only as a guide to some of the main considerations which must be addressed.

For some developments there may be serious reservations as to the feasibility of the project. In such cases, the developer will be required to submit an acoustic consultant's report as part of the planning application process. The report will be expected to investigate the feasibility of the project and will recommend noise control measures sufficient to achieve the design criteria. It will also be required to investigate the need for air cooling/conditioning of the commercial part of the premises as there would be further significant financial implications attached to such a need.

#### 4. **Commercial Entertainment Premises – Noise Control Measures ( and their relationship with other controls in particular Public Entertainment Licences)**

All developers proposing new commercial premises within the designated City Centre area should be aware of the implications of the City Centre living policy. They should be advised that the Council's adopted policies encourage mixed commercial and residential use and as such the developer must consider closely the need to incorporate noise control measures into the development at the start. This is the case even though at the time of application there may be no noise sensitive development in the immediate vicinity as the Council's policies will not prohibit future residential development occurring. The developer should be aware therefore that should sufficient noise control not be in place then it is possible that the new residents will complain about the commercial premises and oblige the EHS to take enforcement action. The Environmental Protection Act 1990 identifies that noise can be a Statutory Nuisance and it requires local authorities to investigate any complaints in their area. Where such nuisance is established then the legislation requires that the local authority must take action to stop it. It should be noted that it is well established that it is not a defence under the legislation to argue that the noise source was at the location prior to the arrival of the noise sensitive development. It is therefore apparent that should complaints arise then remedial work will be required and the cost of any remediation works at this stage is likely to be greatly in excess of that which would have been incurred at the development stage.

Certain types of entertainment such as dancing and live music are also likely to require a Public Entertainments Licence from the local authority. It should therefore be noted that the existence or likelihood of noise nuisance represents

sufficient grounds for the Council to refuse to grant or renew such a licence (or require remedial works to be carried out)

In all cases, new commercial entertainment places will be required to install a noise-limiting device to all amplification equipment. The requirement for this at the planning stage will allow the authority to set an acceptable level commensurate with any other noise control measures to be employed (e.g. sound insulation, building layout, speaker location etc) i.e. in general the greater the sound insulation provided then the greater will be the noise level set on the limiter. In addition the provision of the limiter will assist in any future action which might be needed to be taken under the legislative powers indicated above.

### **References**

Planning Policy Guidance Note 24 – Planning and Noise

Building Regulations; Ventilation: Approved Document F

Building Regulations; Resistance to Passage of Sound: Approved Document E

The Noise Insulation Regulations 1975 (SI.1975: 1763)

BS8233: 1987, Sound Insulation and Noise Reduction for Buildings

CIBSE Guide Volume A; Design Data

World Health Organisation ‘Guidelines for Community Noise’ 2000

## **ANNEX 2 – REQUIREMENTS**

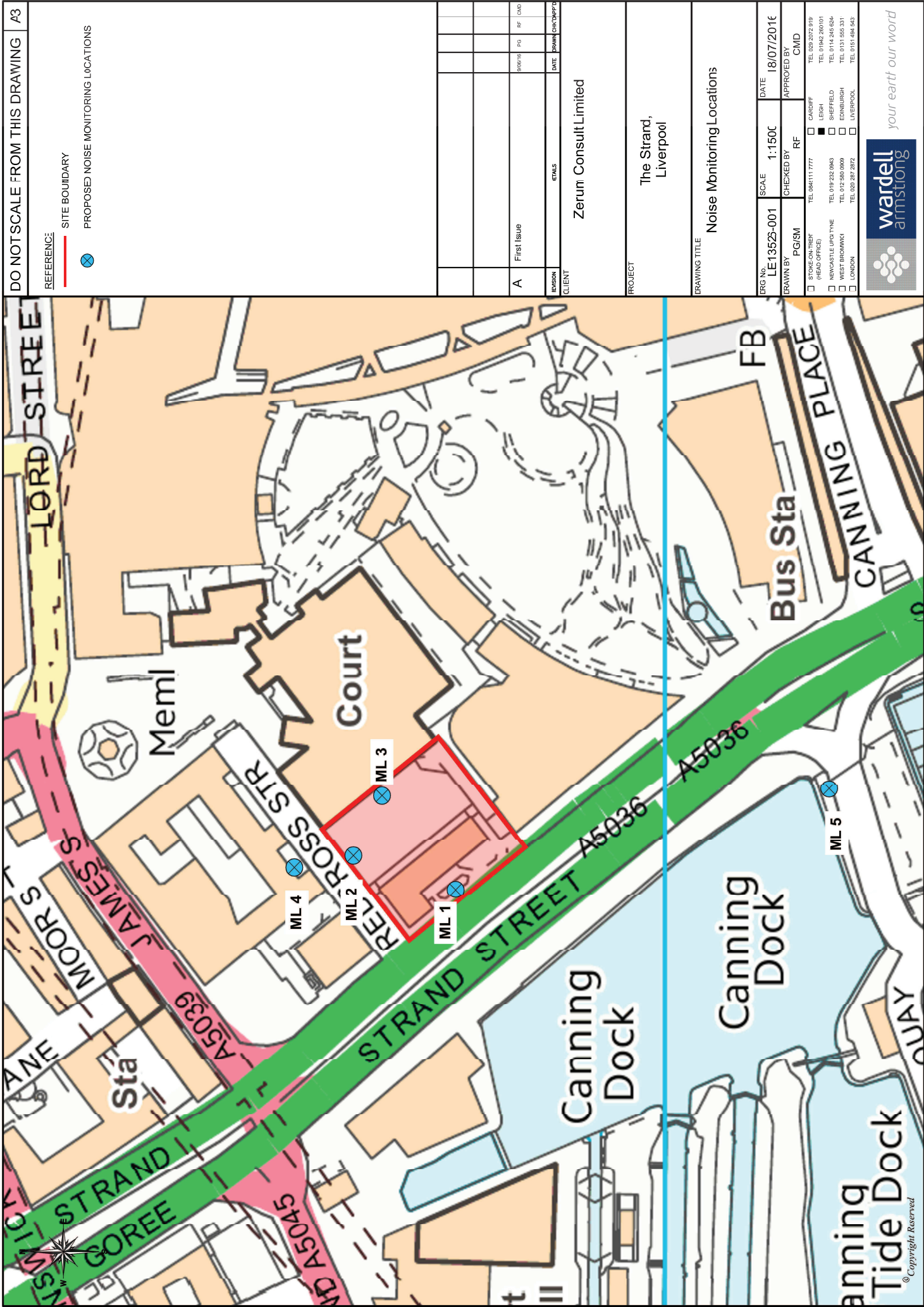
1. All residential conversion schemes, or new build residential developments, within the area of the City designated for the purposes of these requirements, shall be acoustically insulated prior to any occupation of the dwellings in accordance with details to be submitted and approved. Sound mitigation must take the form of a package of acoustic treatment to the windows of all habitable rooms in accordance with the specifications contained in the Noise Insulation Regulations, 1975, or double glazing (to the specification 10mm-12mm-6mm), and the provision of a scheme of acoustically attenuated mechanical ventilation to remove the need to open windows for rapid ventilation, which complies with the performance requirements of the Noise Insulation Regulations, 1975.
2. Exceptions may be made for this requirement for elevations where the building form is such that areas of the development are shielded from the external noise environment, taking into account both the existing, and the potential future, noise conditions. The exception will only be made where the developer has also provided a qualified acoustic consultant's report on the scheme with regard to any measures that would need to be taken to create a satisfactory acoustic environment on those areas of the development where the full standard was not likely to be required.
3. With regard to listed buildings and buildings within conservation areas the following will apply:-
  - Acoustic treatment in the form of double glazed windows will not be acceptable. Secondary glazing with a minimum 100mm air gap should be employed, with draught stripping where appropriate, suitably sited to avoid conflict with any internal features where relevant and finished in a suitable colour to minimise the visual impact.
  - Mechanical ventilation should be installed within a listed building in such a way so as not to adversely affect the character of the building, either internally or externally, or, in the case of buildings within conservation areas, any external grilles should be sited to minimise the visual impact on the building and the street scene.
  - Any scheme that is unable to meet these requirements will be taken as being an indication that the premises are unsuitable for conversion to residential purposes and will be refused permission accordingly.



4. Proposals for the change of use of premises or new build development for purposes within Classes A3 (Food and Drink) or D2 (Assembly and Leisure) of the Town and Country Planning (Use Classes) Order, 1987, either as part of a mixed use development or immediately adjoining existing residential accommodation, shall be acoustically insulated, prior to the use commencing, in accordance with details to be submitted and approved. The scheme of acoustic insulation shall be such that noise generated within the premises shall not give rise to noise levels within any adjoining dwellings, existing or proposed, exceeding Noise Rating (NR) of 30 based upon the maximum SPL in each octave band. Where appropriate, taking into account the nature of the structure of the premises, developers will be required to provide a qualified acoustic consultant's report to demonstrate that these requirements can be met and the method of achieving them. In addition a suitable condition will be attached to permissions, where relevant, to require noise limiting devices to be fitted to all amplified equipment.
5. In all other developments for commercial leisure uses the premises shall be provided with noise limiting devices to be fitted to all amplified equipment.
6. Applications for developments for residential purposes, purposes within Classes A3/D2 of the Town and Country Planning (Use Classes) Order, 1987 or developments with a combination of these uses will be expected to be accompanied on submission by the details of acoustic insulation, mechanical ventilation or other noise control measures unless the authority are satisfied that these details can be approved at a later date by means of a suitably worded condition.



**Drawing LE13526-001**  
**Noise Monitoring Locations**



DO NOT SCALE FROM THIS DRAWING

A3

REFERENCE:

SITE BOUNDARY

PROPOSED NOISE MONITORING LOCATIONS

ERG No.

LE13525-001

SCALE

1:1500

DATE

18/07/2016

DRAWN BY

PG/SM

CHECKED BY

RF

APPROVED BY

CMD

☐ STOKES-ON-TREAF (HEAD OFFICE)

☐ NEWCASTLE (PQ TYPE)

☐ WEST BROMWICH

☐ LONDON

☐ CARDIFF

☐ LEIGH

☐ SHEFFIELD

☐ EDINBURGH

☐ LIVERPOOL

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PROJECT

The Strand, Liverpool

DRAWING TITLE

Noise Monitoring Locations

PERSON

A

First Issue

DATE

18/07/2016

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