



The City Pub Company Ltd.

# 1-2 Market Place, Reading

Noise impact assessment report

297098-01(00)

MAY 2018

**RSK**



## RSK GENERAL NOTES

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**Author** Francis Goodall  
Acoustic Consultant

Signature 

Date: 18/05/2018

**Technical reviewer** Mark Underhill

Signature 

Date: 18/05/2018

**Project manager** Francis Goodall  
Acoustic Consultant

Signature 

Date: 18/05/2018

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This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

## EXECUTIVE SUMMARY

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RSK has carried out a noise assessment in relation to the proposed re-development of 1-2 Market Place, Reading for The City Pub Company Ltd, in order to support a planning application. The proposed re-development includes provision for bar/restaurant areas and a number of hotel guestrooms.

Within the overall noise assessment is an appraisal of plant noise, patron noise egress from the proposed roof terrace bar, and the likely façade sound insulation performance requirements.

In order to inform the various aspects of the noise assessment, an environmental noise survey has been carried out at the site which is also detailed within this report.

The assessment considers noise survey work carried out at an existing City Pubs venue from a previous City Pubs project worked on by RSK, which quantified noise levels from external drinking areas.

A number of recommendations are made within the report. Pending the adoption of these measures, it is recommended that the scheme should be approved for planning with relation to noise considerations.

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# 1 INTRODUCTION

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This report details the noise assessment work carried out by RSK in support of the planning application for the re-development of 1-2 Market Place, Reading.

The report considers the following aspects:

- Plant noise assessment;
- Patron noise egress assessment, with respect to the proposed rooftop terrace bar; and
- Initial façade sound insulation performance requirements.

In order to carry out the assessments and quantify the noise environment in the vicinity of the application site, an environmental noise survey has been carried out by RSK and is detailed within this report.

Recommendations are made with respect to required mitigation measures, and pending the adoption of said measures, it is recommended that the planning application for scheme should be approved with respect to noise.

A glossary of terms is included within Appendix 1 for reference,

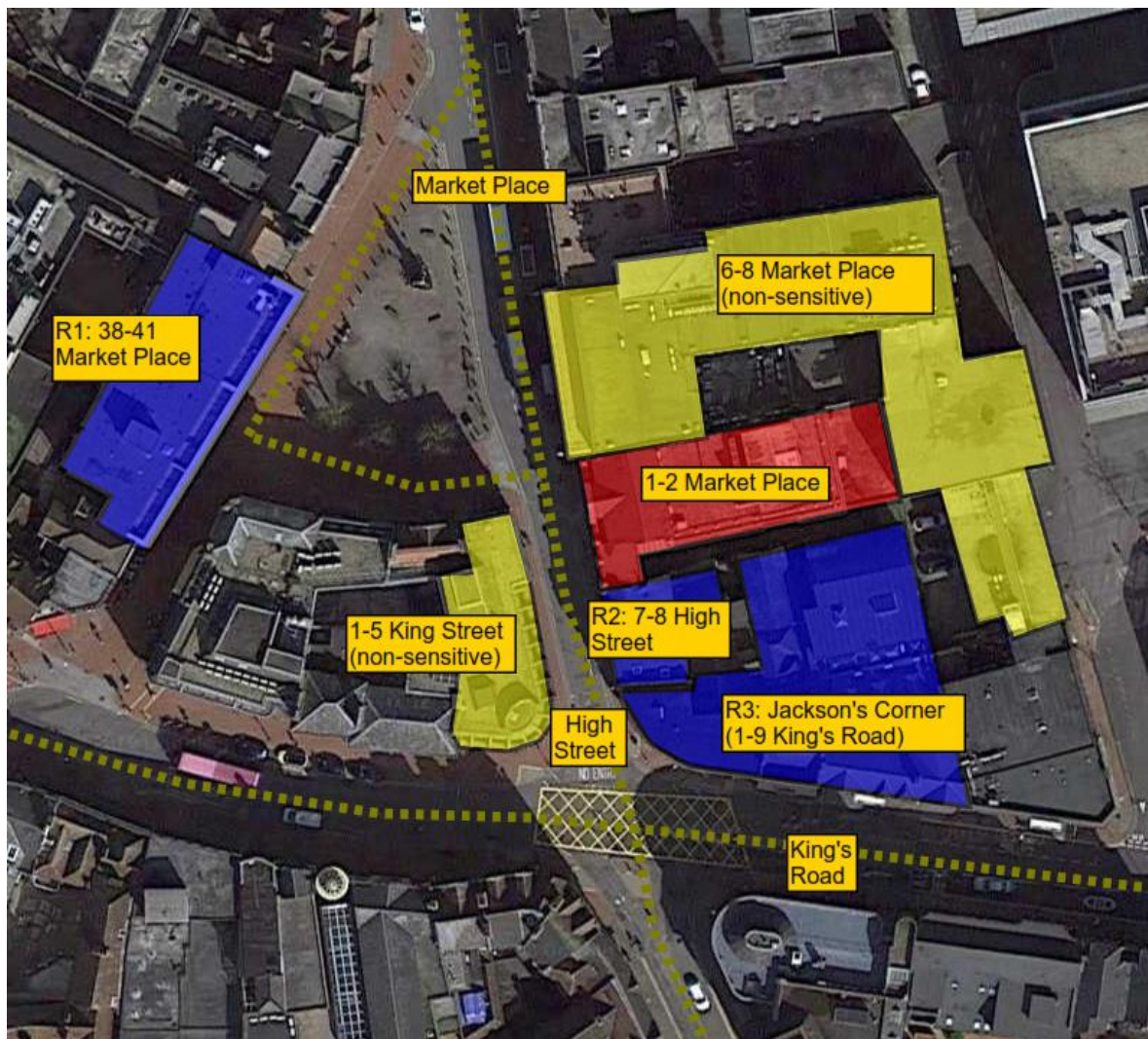
## 2 SITE AND SURROUNDINGS

The site is located at 1-2 Market Place, Reading.

The site is bounded by 6-8 Market Place to the north and east, 7-8 High Street and Jackson's Corner to the south, High Street/Market Street to the west with 1-5 King Street on the opposite side of the road, and 38-41 Market Place on the opposing side of Market Place Square.

The nearest noise sensitive premises, as shown in Figure 1, are:

- R1 – 38-41 Market Place – West – residential
- R2 – 7-8 High Street – South – residential
- R3 – Jackson's Corner – South (consented residential under construction)



**Figure 1 Site and surroundings**

The site has been used as a bank to date, and is proposed to be renovated and refurbished to include provision for a ground floor bar/restaurant, hotel rooms, back of house areas and a rooftop bar/terrace.

The application site includes a restaurant/bar on the Ground Floor, hotel guestrooms on Levels 1&2, a bar on Level 3 including roof terrace extending from the Level 3 bar towards the rear of the building, separated from the adjacent plant area. The basement is to include patron facilities and back of house areas.

External plant and building services terminations are located mainly on the roof. Air handling plant is included within the plant room, along with condenser units on the roof, and extract fan outlets from the Level 3 bar and Ground Floor.

## 3 LEGISLATION AND GUIDANCE

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### 3.1 BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound'

Based on previous project experience, in the absence of specific plant noise requirements within Reading Council's planning policy guidance and with respect to the relevant standards and guidance, the external plant noise assessment detailed in this report has been carried out in accordance BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'.

BS 4142: 2014 describes the methods for rating and assessing noise from industrial or commercial sources, including manufacturing processes, fixed installations and plant equipment, loading of goods and sound from mobile plant.

The standard is applicable for the purpose of assessing sound for existing noise sensitive receptors from new or redeveloped industrial sites and at proposed new dwellings, through the determination of a rating level of an industrial or commercial noise source.

The standard does not determine the suitability of the site for future residential development, however it does provide an indication on the impact of industrial noise at proposed dwellings,

Where certain acoustic features are present at the assessment location, a character correction should be applied to the specific sound level to give the rating level to be used in the assessment.

- A difference of around +10 dB 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 adverse impact depending on the context.
- 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.

The noise criteria for this assessment are such that the cumulative noise level from proposed plant does not exceed 10 dB below the representative background noise level at nearby noise sensitive receptors

### 3.2 BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

British Standard (BS) 8233 establishes internal ambient noise levels for dwellings based upon occupancy patterns which are derived from World Health Organisation (WHO) guidelines for community noise. These are summarised in Table 1 below:

**Table 1 Summary of internal ambient noise level criteria for dwellings**

| Activity                   | Location         | 07:00 - 23:00       | 23:00 - 07:00      |
|----------------------------|------------------|---------------------|--------------------|
| Resting                    | Living room      | 35 dB $L_{Aeq,16h}$ | ---                |
| Dining                     | Dining room/area | 40 dB $L_{Aeq,16h}$ | ---                |
| Sleeping (daytime resting) | Bedroom          | 35 dB $L_{Aeq,16h}$ | 30 dB $L_{Aeq,8h}$ |

### 3.3 World Health Organisation: Guidelines for Community Noise

The 1999 WHO '*Guidelines for Community Noise*' state that in a dwelling the critical effects of noise are on annoyance, speech interference and sleep. The Guidelines present a set of values for the onset of health effects from noise exposure within specific environments. The guideline values are typically set based upon the lowest levels of noise that affect health (critical health effect) for general populations. However, outdoor guideline values for annoyance have been set as daytime levels below which the majority of the adult population will be protected from becoming moderately or seriously annoyed.

The document provides a review of studies which looked at noise impacts on communities, one of which was sleep disturbance and the use of the  $L_{max}$  descriptor (fast time constant).

In brief, the WHO Guidelines look to introduce a number of different theories and potential advisory limits for sleep disturbance assessments. Much of the findings are based on a combination of scientific studies and the correlation of the average noise levels required to sleep and the relative  $L_{max}$  value.

The document summarises that where internal  $L_{Amax}$  noise levels are above 45 dB(A) more than 10-15 times per night, the chance of sleep disturbance are increased.

### 3.4 BS 7445-1,-2,-3 'Description and measurement of environmental noise. Guide to quantities and procedures'

The three-part standard BS 7445 provides the framework within which environmental noise should be quantified. Part 1 (2003) provides a guide to quantities and procedures and Part 2 (1991) provides a guide to the acquisition of data pertinent to land use. Part 3 (1991) provides a guide to the application of noise limits.

BS 7445 also refers to a further standard, BS EN 61672, which prescribes the equipment necessary for such measurements. Whilst BS 7445 does not prescribe the meteorological conditions under which noise measurements should or should not be taken, it does (part 2, paragraph 5.4.3.3) recommend that in order:

*“...to facilitate the comparison of results (measurements of noise from different sources), it may be necessary to carry out measurements under selected meteorological conditions which are reproducible and correspond to quite stable propagation conditions.”*

These conditions include:

- Wind speed not exceeding 5 m/s (measured at a height of 3 to 11 m above the ground);
- No strong temperature inversions near the ground; and
- No heavy precipitation.

### **3.5 Patron noise egress**

There are no specific criteria for noise from external drinking areas, therefore the assessment has been based on an audibility basis relative to ambient noise levels.

Due to the nature of patron noise, eg a ‘hubbub’ of sound, suitable levels of audibility are proposed on the basis that an increase of no more than 3 dB(A) above the average ambient noise level. To achieve this, the noise from the external terrace should not exceed the measured ambient noise levels.

## 4 SOURCE DATA

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The following source data, including plant information, plans and drawings was used to carry out the noise assessment for 1-2 Market Place, Reading.

- Drawings 3172.110 – 114 Rev A (proposed – subsequently updated)
- Mechanical services drawings:
  - CP9497-00.pdf
  - CP9497-01.pdf
  - CP9497-02.pdf
  - CP9497-03.pdf
- Mechanical services datasheets:
  - ACM150T.pdf
  - AHU.pdf
  - ARNet Document.pdf – attenuator schedule
  - HRU.pdf
  - KEF01.pdf
  - KEF02.pdf
  - KEF03.pdf
  - Lo-Carbon Centra T.pdf
  - REYQ-P8(9)Y1B\_Databook.pdf
  - REYQ-T7Y1B\_Databook.pdf
- Schedules:
  - CP9497-SH-M01.pdf
  - CP9497-SH-M02.pdf
  - CP9497-SH-M05.pdf
- Jackson's Corner Planning Application design information
  - Elevations
  - Layouts
  - Sections

## 5 NOISE SURVEY

In order to establish the baseline noise climate in the area, RSK has undertaken a noise survey at 1-2 Market Place in accordance with the guidance set out within BS 7445. This is considered representative of the nearby noise sensitive receptors as well as the application site itself.

### 5.1 Methodology

The following methodology was used to carry out the survey.

#### 5.1.1 Survey duration

The survey was carried out between 21 and 26 February 2018. Unattended measurements were carried out continuously at two locations (L1 and L2) throughout the entire period. These were supplemented by simultaneous attended sample measurements on the 21 February at one location (S1).

#### 5.1.2 Measurement locations

##### 5.1.2.1 Location L1

Location L1 was at the front of 1-2 Market Place, facing Market Place Square. The microphone was positioned 1 m from the facade outside of a 3<sup>rd</sup> floor window, and as such the measurements are considered to be façade measurements. This location is considered representative of receptor R1 as well as the front of 1-2 Market Place itself.

An image showing the position of measurement location L1 is included within Figure 2.



**Figure 2 Measurement location L1**

#### 5.1.2.2 Location L2

Location L2 was at the rear of the building, on the upper level roof. The measurement position is considered representative of the rear facades of the application site, as well as the rear-facing facades of receptors R2 and R3 (i.e. those most exposed to proposed plant installations), which are noted to be 7-8 High Street and Jackson's Corner respectively.

The microphone was mounted approximately 1.2-1.5 m above the finished roof level, and was at least 3.5 m from any other acoustically reflective surface. As such, the measurement position is considered to be free-field.

An image showing the position of measurement location L2 is included in Figure 3.



**Figure 3 Measurement location L2**

#### 5.1.2.3 Location S1

Short-term attended monitoring was carried out at ground level at the front of the application site. Daytime measurements were carried out over a period of one hour, and were co-located directly below measurement location L1.

The measurements at location S1 were synchronised with the logger at Location L1 in order to quantify the change in noise level with height at the front façade of the building.

The measurements at this position are considered to be façade measurements.

### 5.1.3 Survey observations

Observations on the noise climate were made at locations L1 and L2 during deployment and collection of the measurement equipment during daytime hours.

The noise environment at Locations L1 and S1 was largely dominated by road noise, particularly that of the nearby King's Road to the south of the site and less frequent vehicle pass-bys on Market Place.

The noise environment at Location L2 was also largely dominated by noise from King's Road, as well as contributions from more distant roads in the area. Plant on nearby existing buildings also contributed to the noise environment at Location L2, although not as significant as noise from road traffic.

### 5.1.4 Equipment

The equipment used and calibration information is presented in Table 2. Calibration certificates for all equipment used can be provided if requested.

**Table 2 Noise measurement equipment**

| Equipment              | Make | Model | Serial no. | Calibration expiry date | Calibration certificate no. |
|------------------------|------|-------|------------|-------------------------|-----------------------------|
| Sound level meter      | Rion | NL-52 | 453835     | 06/03/2019              | TCRT17/1053                 |
| Pre-amp                | Rion | NH-25 | 43877      | 06/03/2019              | TCRT17/1053                 |
| Microphone             | Rion | UC-59 | 07251      | 06/03/2019              | TCRT17/1053                 |
| Sound level meter      | Rion | NL-52 | 453840     | 27/11/2019              | TCRT17/1778                 |
| Pre-amp                | Rion | NH-25 | 43601      | 27/11/2019              | TCRT17/1778                 |
| Microphone             | Rion | UC-59 | 07600      | 27/11/2019              | TCRT17/1778                 |
| Sound level calibrator | Rion | NC-74 | 34378202   | 24/11/2019              | TCRT17/1773                 |

### 5.1.5 Weather conditions

During the survey, the temperature ranged from -2 to 7 degrees Celsius, with wind speeds of less than 5 m/s and no precipitation for the duration of the survey.

## 5.2 Results

### 5.2.1 Location L1

The noise levels measured at Location L1 are presented in Table 3 and <sup>1</sup> Measurement over a partial daytime period due to start and end of survey.

Table 4. Full measurement data is presented in Appendix 1.

**Table 3 Location L1 - Daytime (07:00 - 23:00)**

| Date                              | Highest $L_{AFmax}$ (dB) | $L_{Aeq,16hr}$ (dB) | Average $L_{AF90,16hr}$ (dB) |
|-----------------------------------|--------------------------|---------------------|------------------------------|
| Wednesday 21/02/2018 <sup>1</sup> | 88                       | 62                  | 52                           |
| Thursday 22/02/2018               | 92                       | 63                  | 52                           |
| Friday 23/02/2018                 | 92                       | 63                  | 55                           |
| Saturday 24/02/2018               | 92                       | 60                  | 52                           |
| Sunday 25/02/2018                 | 90                       | 59                  | 49                           |
| Monday 26/02/2018 <sup>1</sup>    | 93                       | 62                  | 53                           |

<sup>1</sup> Measurement over a partial daytime period due to start and end of survey.

**Table 4 Location L1 – Night time (23:00 – 07:00)**

| Date                          | Highest $L_{AFmax}$ (dB) | $L_{Aeq,8hr}$ (dB) | Average $L_{AF90,8hr}$ (dB) |
|-------------------------------|--------------------------|--------------------|-----------------------------|
| Wednesday night 21-22/02/2018 | 86                       | 56                 | 44                          |
| Thursday night 22-23/02/2018  | 90                       | 58                 | 46                          |
| Friday night 23-24/02/2018    | 92                       | 60                 | 47                          |
| Saturday night 24-25/02/2018  | 90                       | 56                 | 46                          |
| Sunday night 25-26/02/2018    | 87                       | 59                 | 45                          |

Based on statistical and modal analysis of the distribution of  $L_{AF90}$  measurement results, the representative daytime and night time background noise levels at Location L1 are  $L_{AF90,16hr}$  51 dB and  $L_{AF90,8hr}$  45 dB respectively.

The average daytime and night time ambient noise levels at Location L1 are  $L_{Aeq,16hr}$  62 dB and  $L_{Aeq,8hr}$  58 dB respectively.

Measurements at Location L1 are considered to be façade measurements. As such, no façade correction is required.

A typical  $L_{AFmax}$  value at Location L1 is taken as  $L_{AFmax}$  75 dB.

### 5.2.2 Location L2

The noise levels measured at Location L2 are presented in Table 3 and <sup>1</sup> Measurement over a partial daytime period due to start and end of survey.

Table 4. Full measurement data is presented in Appendix 1.

**Table 5 Location L2 - Daytime (07:00 - 23:00)**

| Date                              | Highest $L_{AFmax}$ (dB) | $L_{Aeq,16hr}$ (dB) | Average $L_{AF90,16hr}$ (dB) |
|-----------------------------------|--------------------------|---------------------|------------------------------|
| Wednesday 21/02/2018 <sup>1</sup> | 78                       | 53                  | 51                           |
| Thursday 22/02/2018               | 79                       | 54                  | 52                           |
| Friday 23/02/2018                 | 82                       | 55                  | 53                           |
| Saturday 24/02/2018               | 76                       | 54                  | 52                           |
| Sunday 25/02/2018                 | 80                       | 54                  | 51                           |
| Monday 26/02/2018 <sup>1</sup>    | 80                       | 55                  | 52                           |

<sup>1</sup> Measurement over a partial daytime period due to start and end of survey.

**Table 6 Location L2 – Night time (23:00 – 07:00)**

| Date                          | Highest $L_{AFmax}$ (dB) | $L_{Aeq,8hr}$ (dB) | Average $L_{AF90,8hr}$ (dB) |
|-------------------------------|--------------------------|--------------------|-----------------------------|
| Wednesday night 21-22/02/2018 | 72                       | 48                 | 45                          |
| Thursday night 22-23/02/2018  | 77                       | 50                 | 47                          |
| Friday night 23-24/02/2018    | 73                       | 49                 | 46                          |
| Saturday night 24-25/02/2018  | 67                       | 49                 | 46                          |
| Sunday night 25-26/02/2018    | 77                       | 50                 | 47                          |

Based on statistical and modal analysis of the distribution of  $L_{AF90}$  measurement results, the representative daytime and night time background noise levels at Location L2 are  $L_{AF90,16hr}$  52 dB and  $L_{AF90,8hr}$  46 dB respectively.

The average daytime and night time ambient noise levels at Location 2 are  $L_{Aeq,16hr}$  54 dB and  $L_{Aeq,8hr}$  49 dB respectively.

Measurements at Location L2 are considered to be free-field measurements. As such, a façade correction of 3 dB is required in order to convert these into façade noise levels.

A typical  $L_{AFmax}$  value at Location L1 is taken as  $L_{AFmax}$  68 dB.

### 5.2.3 Location S1

The noise levels measured at Location S1 are presented in Table 7

**Table 7 Location S1 – measurement results**

| Date/time           | $L_{AFmax}$ (dB) | $L_{Aeq,15mins}$ (dB) | $L_{AF90,15mins}$ (dB) |
|---------------------|------------------|-----------------------|------------------------|
| 21/02/2018 14:44:24 | 82               | 67                    | 57                     |
| 21/02/2018 14:59:24 | 84               | 68                    | 57                     |
| 21/02/2018 15:14:24 | 89               | 67                    | 58                     |
| 21/02/2018 15:29:24 | 85               | 68                    | 58                     |

Measurements at Location S1 are considered to be façade measurements.

### 5.2.4 Summary of results

**Table 8 Summary of noise survey results**

| Measurement location | Typical background noise level, $L_{AF90,T}$ (dB) |                            | Ambient noise level, $L_{Aeq,T}$ (dB) |                                      |
|----------------------|---------------------------------------------------|----------------------------|---------------------------------------|--------------------------------------|
|                      | Daytime (07:00 – 23:00)                           | Night time (23:00 – 07:00) | Daytime (07:00 – 23:00)               | Night time (23:00 – 07:00)           |
| L1                   | 51                                                | 45                         | 62                                    | 58 (75 <sup>1</sup> )                |
| L2                   | 55 <sup>2</sup>                                   | 49 <sup>2</sup>            | 57 <sup>2</sup>                       | 52 <sup>2</sup> (68 <sup>1,2</sup> ) |

<sup>1</sup> Typical  $L_{AFmax}$  (dB) measured during the period

<sup>2</sup> Includes +3 dB façade correction

Analysis of the simultaneous samples at S1 and unattended measurements at L1 suggests a drop-off in noise level with height of approximately 5 dB from Ground floor to the 3<sup>rd</sup> floor. This would suggest the following relationship between the measured noise level at the unattended monitoring position L1 and the predicted noise at different floor levels:

- Ground floor = Position L1 + 5 dB
- 1<sup>st</sup> floor = Location L1 + 4 dB
- 2<sup>nd</sup> floor = Location L1 + 2 dB
- 3<sup>rd</sup> floor = Location L1

Due to the nature of the noise environment at the rear of the building, based on on-site observations, the noise level is not expected to vary significantly between different floor levels or facades. As such, the noise level measured at Location L2 is considered representative of all rear facades, from Ground to 3<sup>rd</sup> floors.

## 6 CRITERIA

### 6.1 Operational plant noise criteria

Based on the noise levels measured during the unattended noise survey at the site, the criteria for plant noise at each of the identified nearby noise sensitive receptors are presented in Table 9. The criteria are based on the guidance within BS 4142:2014 as discussed in Section 3.1, in order to achieve a rating level of 10 dB below the representative background noise level.

**Table 9 Operational plant noise criteria**

| Receptor                | Operational plant noise criteria, $L_{Aeq,T}$ (dB) |                            |
|-------------------------|----------------------------------------------------|----------------------------|
|                         | Daytime (07:00 – 23:00)                            | Night time (23:00 – 07:00) |
| R1 - 38-41 Market Place | 41                                                 | 35                         |
| R2 - 7-8 High Street    | 45                                                 | 39                         |
| R3 - Jackson's Corner   | 45                                                 | 39                         |

### 6.2 Patron noise egress criteria

It is assumed that the outdoor areas would only be open during the daytime hours, ie between 07:00 – 23:00.

As a result, the proposed patron noise egress criteria is proposed to be  $L_{Aeq}$  57 dB at Receptor R3, which is being assessed as the most exposed sensitive receptor to the open roof terrace.

### 6.3 Internal ambient noise level criteria

Based on the guidance in BS 8233 and the WHO Guidelines for Community Noise, discussed in Sections 0 and 3.3 respectively, the following internal ambient noise level criteria for sensitive space are proposed in Table 10.

**Table 10 Internal ambient noise level criteria**

| Room type       | Criteria            |                    |                  |
|-----------------|---------------------|--------------------|------------------|
|                 | Daytime             | Night time         |                  |
|                 | $L_{Aeq,16hr}$ (dB) | $L_{Aeq,8hr}$ (dB) | $L_{AFmax}$ (dB) |
| Hotel guestroom | 35                  | 30                 | 45 <sup>1</sup>  |

<sup>1</sup> Criteria not to be exceeded more than 15 times per night

## 7 OPERATIONAL PLANT NOISE EGRESS ASSESSMENT

### 7.1 Calculation basis

Noise from operational plant has been assessed in accordance with BS 4142:2014 discussed in Section 3.1 against the criteria set out in Section 6.1.

The calculations are based on the mechanical ventilation information from McCulloughs, as well as mechanical schedules, and architectural information as set out in Section 4.

Based on the known proposed uses of the spaces within the application site, the following assumptions have been made with regards to plant operation times. The assumed plant operation is presented in Table 11.

**Table 11 Assumed plant operation**

| Code             | Plant items                | Daytime operation<br>(07:00 – 23:00) | Night time operation<br>(23:00 – 07:00) |
|------------------|----------------------------|--------------------------------------|-----------------------------------------|
| AHU01            | Air handling unit 01       | ✓                                    | ✓                                       |
| HRU01            | Heat recovery unit 01      | ✓                                    | ✓                                       |
| KEF01,02,03      | Kitchen extract fans 01-03 | ✓                                    |                                         |
| CU01,02,03,04,05 | Condenser units 01-05      | ✓                                    | ✓                                       |
| EF01,02,03       | Extract fans 01-03         | ✓                                    |                                         |
| EF04,05,06       | Extract fans 04-06         | ✓                                    | ✓                                       |
| SF01             | Supply fan 01              | ✓                                    |                                         |

The assessment assumes that the proposed plant contains no tonal or temporal characteristics. Should this not be the case, additional penalties as per the guidance within BS 4142 may need to be applied.

## 7.2 Calculation summary

The calculation procedure accounts for the following factors:

- Source sound power level (incl. attenuator selection as per schedule);
- Source directivity;
- Attenuation losses due to ductwork;
- Distance from source to receptor;
- Screening between the source and receptor, including walls around plant items; and
- Acoustic feature corrections.

## 7.3 Results

The results of the calculations are presented within Table 12 and Table 13 respectively.

**Table 12 Plant noise assessment results - daytime**

| Plant item |          | Noise contribution at receptor (dBA) |     |     | Additional attenuation required (dBA) |
|------------|----------|--------------------------------------|-----|-----|---------------------------------------|
|            |          | R1                                   | R2  | R3  |                                       |
| AHU01      | Inlet    | 1                                    | 4   | 6   | 0                                     |
| HRU01      | Supply   | 16                                   | 19  | 21  | 0                                     |
| HRU01      | Extract  | 9                                    | 11  | 14  | 0                                     |
| KEF01      | Outlet   | 13                                   | 20  | 33  | 0                                     |
| KEF02      | Outlet   | 14                                   | 21  | 34  | 0                                     |
| KEF03      | Outlet   | 12                                   | 19  | 32  | 0                                     |
| CU01       | Breakout | 32                                   | 44  | 47  | 12                                    |
| CU02       | Breakout | 30                                   | 40  | 42  | 12                                    |
| CU03       | Breakout | 35                                   | 44  | 46  | 12                                    |
| CU04       | Breakout | 19                                   | 29  | 29  | 3                                     |
| CU05       | Breakout | 20                                   | 31  | 35  | 3                                     |
| EF01       | Extract  | 9                                    | 36  | 23  | 0                                     |
| EF02       | Extract  | 4                                    | 36  | 26  | 0                                     |
| EF03       | Extract  | -25                                  | 7   | 7   | 0                                     |
| EF04       | Extract  | -28                                  | -13 | -9  | 0                                     |
| EF05       | Extract  | -28                                  | -12 | -8  | 0                                     |
| EF06       | Extract  | -8                                   | -15 | -21 | 0                                     |
| SF01       | Supply   | -1                                   | 36  | 31  | 0                                     |

| Plant item                                    | Noise contribution at receptor (dBA) |           |           | Additional attenuation required (dBA) |
|-----------------------------------------------|--------------------------------------|-----------|-----------|---------------------------------------|
|                                               | R1                                   | R2        | R3        |                                       |
| <b>Total (without additional attenuation)</b> | <b>38</b>                            | <b>49</b> | <b>51</b> |                                       |
| <b>Target noise level</b>                     | <b>41</b>                            | <b>45</b> | <b>45</b> |                                       |
| Exceedance                                    | 0                                    | 4         | 6         |                                       |
| <b>Total (with additional attenuation)</b>    | <b>22</b>                            | <b>42</b> | <b>42</b> |                                       |
| Criteria met?                                 | ✓                                    | ✓         | ✓         |                                       |

**Table 13 Plant noise assessment results – night time**

| Plant item                                    |          | Noise contribution at receptor (dBA) |           |           | Additional attenuation required (dBA) |
|-----------------------------------------------|----------|--------------------------------------|-----------|-----------|---------------------------------------|
|                                               |          | R1                                   | R2        | R3        |                                       |
| AHU01                                         | Inlet    | 1                                    | 4         | 6         | 0                                     |
| HRU01                                         | Supply   | 16                                   | 19        | 21        | 0                                     |
| HRU01                                         | Extract  | 9                                    | 11        | 14        | 0                                     |
| CU01                                          | Breakout | 32                                   | 44        | 47        | 12                                    |
| CU02                                          | Breakout | 30                                   | 40        | 42        | 12                                    |
| CU03                                          | Breakout | 35                                   | 44        | 46        | 12                                    |
| CU04                                          | Breakout | 19                                   | 29        | 29        | 3                                     |
| CU05                                          | Breakout | 20                                   | 31        | 35        | 3                                     |
| EF04                                          | Extract  | 0                                    | 0         | 0         | 0                                     |
| EF05                                          | Extract  | 0                                    | 0         | 0         | 0                                     |
| EF06                                          | Extract  | 0                                    | 0         | 0         | 0                                     |
| <b>Total (without additional attenuation)</b> |          | <b>38</b>                            | <b>48</b> | <b>50</b> |                                       |
| <b>Target noise level</b>                     |          | <b>35</b>                            | <b>39</b> | <b>39</b> |                                       |
| Exceedance                                    |          | 3                                    | 9         | 11        |                                       |
| <b>Total (with additional attenuation)</b>    |          | <b>27</b>                            | <b>37</b> | <b>39</b> |                                       |
| Criteria met?                                 |          | ✓                                    | ✓         | ✓         |                                       |

## **7.4 Discussion**

The currently proposed plant with additionally proposed attenuation discussed below results in the proposed operational plant noise criteria likely being met.

Additional attenuation is required to the Condenser Units 01 – 05. This would be in the form of either a localised enclosure to each unit, or re-selection of the plant such that the source sound power level of each Condenser Unit is reduced by the amount required as per Table 12 and Table 13.

The additional mitigation required is expected to be easily achieved by an acoustic enclosure. Example manufacturers for these can be provided if required. These also take into account other considerations such as maintenance access, air flow and thermal requirements.

## 8 PATRON NOISE EGRESS ASSESSMENT

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### 8.1 Assessment basis

The assessment of patron noise egress is based on measured data of noise levels from other City Pubs venues.

Noise was measured at The Phene pub in London on Friday 10 November 2017, representative of a busy evening typical of any given week.

Noise levels were measured on a nearby balcony, and an adjacent road directly overlooking the external drinking area of The Phene.

Noise levels were measured at around  $L_{Aeq,15mins}$  65 – 70 dBA.

Based on the relatively close proximity of the overlooking consented sensitive premises at Jackson's Corner, the noise levels at those facades are predicted to be similar to the those measured at The Phene.

### 8.2 Results

Based on a review of the architectural information provided, including that of the neighbouring Jackson's Corner, it is understood that even with a typical 3 m high solid imperforate balustrade around the terrace area, line-of-sight between the terrace and the upper level Jackson's Corner residences would be maintained, and as such the proposed noise criteria of  $L_{Aeq}$  57 dB would be likely to be exceeded by around 10 - 15 dB at receptor R3.

It is considered that there is already sufficient screening between the proposed terrace and receptors R1 & R2 to mitigate patron noise egress to an acceptable level.

### 8.3 Discussion

Current options are understood to include the potential for a noise barrier surrounding the terrace, with a returned cover section over part of the terrace.

It is recommended to include this as part of the design. Subject to an architectural review, it is currently estimated that covering the nearest half of the terrace to Jackson's Corner at a height of 3.0 m above finished floor level would comfortably break line-of-site between the terrace and apartments.

This is predicted to provide the necessary screening to reduce the patron noise egress to a suitable level.

It is also recommended to include an acoustically absorptive lining to the inside of the wall to the north of the terrace. This is to prevent reflections of patron noise from this wall impacting on the residences at Jackson's Corner.

## 9 INITIAL FAÇADE SOUND INSULATION ASSESSMENT

### 9.1 Calculation basis

In order to predict the required sound insulation performances for the facades of sensitive spaces within the proposed development, ie hotel guestrooms, the external noise levels as measured during the survey have been assessed, in conjunction with the internal ambient noise level criteria as per Section 6.3.

The following assumptions have been made as part of the calculation procedure:

- A conservative estimate of +2 dB is assumed for the room correction
- The guestrooms are understood to be mechanically ventilated, and as such openable windows are assumed to not be part of the ventilation strategy

The following formula is used to determine the façade sound insulation required:

$$SRI = L1 - L2 + 10 \log S/A$$

Where L1 is the measured external façade noise level, L2 is the target internal noise level, and  $10 \log S/A$  (room correction) is +2 dB.

### 9.2 Calculation summary

The calculations take account of the outdoor noise levels as per the noise survey, which are presented in Table 14.

**Table 14 Outdoor facade noise levels**

| Location                     | Daytime             | Night time         |                  |
|------------------------------|---------------------|--------------------|------------------|
|                              | $L_{Aeq,16hr}$ (dB) | $L_{Aeq,8hr}$ (dB) | $L_{AFmax}$ (dB) |
| Rear facades<br>All levels   | 57                  | 52                 | 68               |
| Front façade<br>Ground floor | 67                  | 63                 | 80               |
| Front façade<br>Level 1      | 66                  | 62                 | 79               |
| Front façade<br>Level 2      | 64                  | 60                 | 77               |
| Front façade<br>Level 3      | 62                  | 58                 | 75               |

Spectral analysis of the ambient noise level data shows a typical frequency spectrum associated with road noise. As such, an  $R_w + C_{tr}$  specification is recommended in order to mitigate internal ambient noise levels.

Frequency analysis of the maximum noise levels measured shows stronger higher-frequency content, likely that of a siren. As such, the  $R_w$  descriptor is recommended for sound insulation performances where maximum noise levels are critical.

### 9.3 Results

The initial façade sound insulation assessment results in the recommended façade sound insulation performances for facades to guestrooms are included within Table 15.

Current plans indicated that guestrooms are included only on Levels 1 & 2, however façade sound insulation performances are presented for all locations should this change throughout the design.

It should be noted that both  $R_w$  and  $R_w + C_{tr}$  values should be achieved by the proposed façade build-up.

**Table 15 Recommended minimum facade sound insulation values for guestrooms**

| Façade                       | Recommended minimum façade sound insulation |            |
|------------------------------|---------------------------------------------|------------|
|                              | $R_w + C_{tr}$ (dB)                         | $R_w$ (dB) |
| Rear facades<br>All levels   | 24                                          | 25         |
| Front façade<br>Ground floor | 35                                          | 37         |
| Front façade<br>Level 1      | 34                                          | 36         |
| Front façade<br>Level 2      | 32                                          | 34         |
| Front façade<br>Level 3      | 30                                          | 32         |

### 9.4 Discussion

The recommended minimum façade sound insulation performances in Table 15 are realistically achievable for the development.

The requirements for specific glazing may be relaxed further as the design develops, subject to a detailed façade sound insulation assessment taking into account areas of glazing, masonry, spandrel panels etc.

Noise levels within light wells are expected to be significantly below that of the external facades, and as such standard thermal double glazing is likely to be sufficient for controlling noise ingress into hotel guestrooms.

## 10 RECOMMENDATIONS

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In order to mitigate potential noise issues associated with the proposed re-development of 1-2 Market Place, Reading, the following measures above the current proposals are recommended.

### 10.1 Partial covering of roof terrace

In order to mitigate against potential noise disturbance at the nearby noise sensitive premises, particularly Jackson's Corner, it is proposed to cover the southern half of the roof terrace with a solid imperforate wall and cover, providing the necessary screening to reduce patron noise egress to an acceptable level.

This is discussed further in Section 8.3 and would be subject to an architectural review to determine the precise extents of coverage required to break line-of-sight to Jackson's Corner residences.

### 10.2 Acoustic absorptive treatment to terrace walls

It is recommended to include a layer of acoustically absorptive material to the inside of the northern terrace wall. This is in order to prevent reflections of noise from the terrace impacting on the nearby noise sensitive premises.

A 50 mm mineral fibre panel, with appropriate weather-proofing and robustness would be suitable in this location.

Decorative walls such as 'green' walls, ie utilising vegetation may not provide the required acoustic absorption and would require further review to determine their suitability.

### 10.3 Enclosures/re-selection of condenser units

The plant noise assessment results in the requirement for the reduction in noise level of the rooftop external condenser units.

This can be done either by re-selecting the plant items with makes/models with lower source noise levels.

Alternatively, it is recommended to include enclosures around the condenser units to provide the necessary attenuation as recommended in Section 7.4. These can be specified as bespoke items, with a number of manufacturers with solutions on the market. Such enclosures can be made bespoke for the units in question, and take into account air-flow, maintenance and thermal requirements etc.

## 11 CONSLUSIONS

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RSK have carried out a noise assessment in relation to the proposed re-development of 1-2 Market Place, Reading.

The noise assessment includes consideration of plant noise egress, patron noise egress from the proposed roof terrace bar, and an initial assessment of the required façade sound insulation performances to meet the relevant internal ambient noise level criteria.

Internal ambient noise levels are considered to be realistically achievable with the recommended sound insulation performances, which are not considered particularly onerous, with scope for reductions in performance requirements pending a detailed design review with respect to proposed façade materials and areas of glazing etc.

Recommendations are made for partial covering of the proposed roof terrace, the inclusion of acoustic absorption to the inside of specific identifies walls within the roof terrace, and providing enclosures to condenser units/re-selecting these units.

Pending the adoption of the outlined control measures, it is recommended that the proposed re-development is suitable for planning approval with respect to noise.

## 12 GLOSSARY

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**Façade correction** – A correction of 3 dB applied to account for the reflection of noise from an acoustically hard surface such as a facade

**Free-field** – a measurement carried out at least 3.5 m away from any acoustically reflective surface (aside from the ground)

$L_{Aeq}$  – the continuous A-weighted equivalent sound pressure level

$L_{AF90}$  – the sound pressure level which is exceeded for 90% of the measurement period

$L_{AFmax}$  – the maximum noise level measured within the period, for example a single noise event

$R_w$  – The weighted sound reduction index

$R_w + C_{tr}$  – The weighted sound reduction index with the traffic spectrum correction

# APPENDIX 1

## NOISE SURVEY DATA

The noise data collected during the survey at positions L1 and L2 is presented in Figure 4 and Figure 5 respectively.

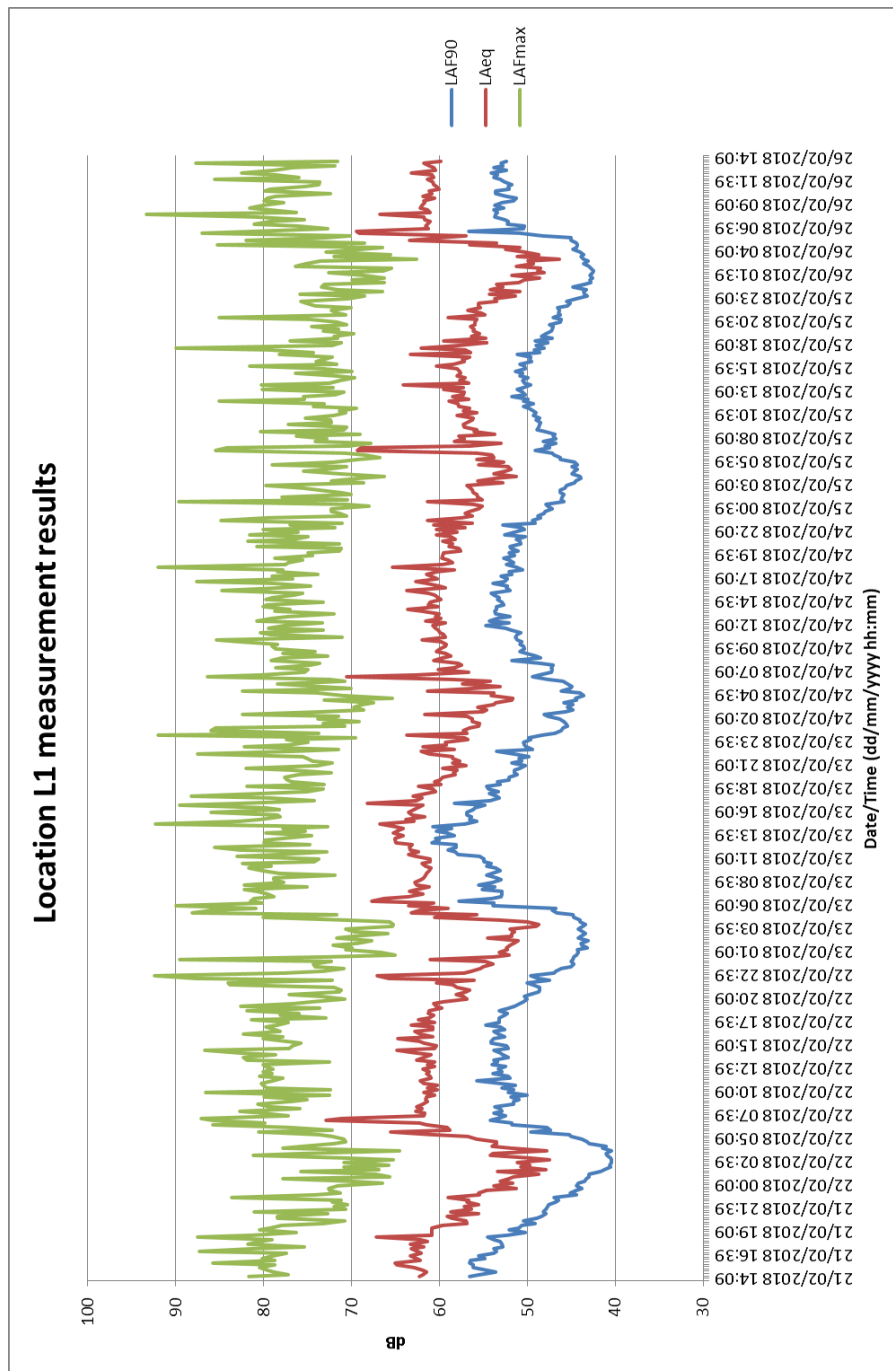
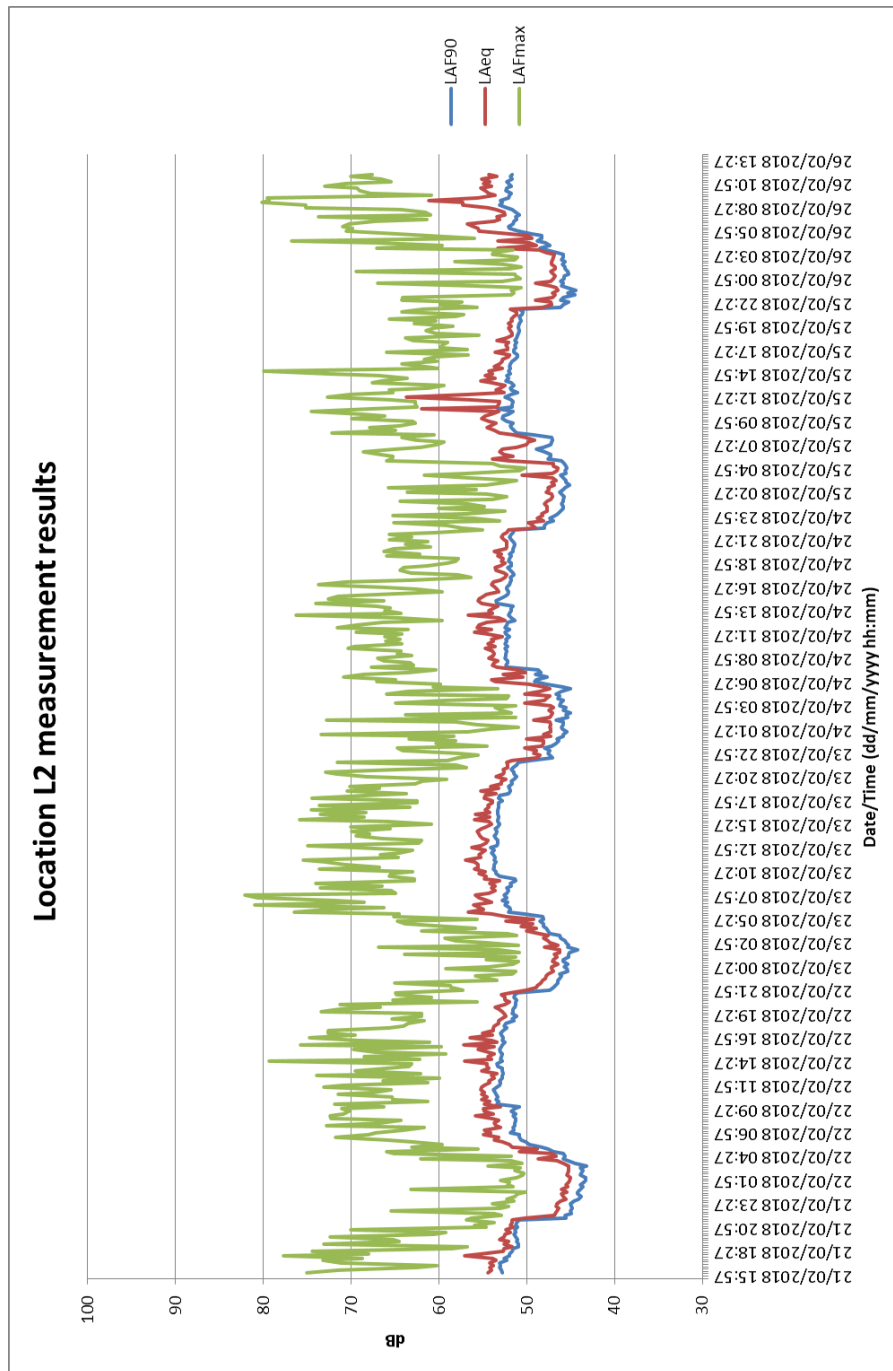


Figure 4 Location L1 noise survey data



**Figure 5 Location L2 noise survey data**