# REPORT TITLE:

**Huddersfield Bus Station, Upperhead Row, Huddersfield HD1 2JN**

**Environmental Noise Survey**

# CLIENT DETAILS:

**Willmott Dixon Construction**

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| | | | | |

# 1 Summary

An environmental noise survey to determine the existing noise climate affecting the proposed refurbishment section of the Huddersfield Bus Station, Upperhead Row, Huddersfield HD1 2JN has been commissioned by Willmott Dixon Construction.

The noise survey also includes the existing background at the nearest noise sensitive receptors which have the potential to be affected by the new plant item(s) which are proposed to operate at the Bus Station.

This report also includes indoor ambient noise levels measurements and reverberation time assessment in the Travel Centre, and in the Concourse.

# 2 Introduction & Site Description

This report presents acoustic design parameters and a noise survey assessment for the refurbishment areas at Huddersfield Bus Station, the noise survey also includes the existing background at the nearest residential dwellings which have the potential to be affected by the noise emission from the new plant unit(s) which are proposed at the Bus Station.

The noise climate affecting the proposal and the nearest residential dwellings are constant road traffic, and mechanical external units (air conditioning, and condensers) serving the adjacent and nearby business premisses. The figure overleaf shows the noise measurement locations.

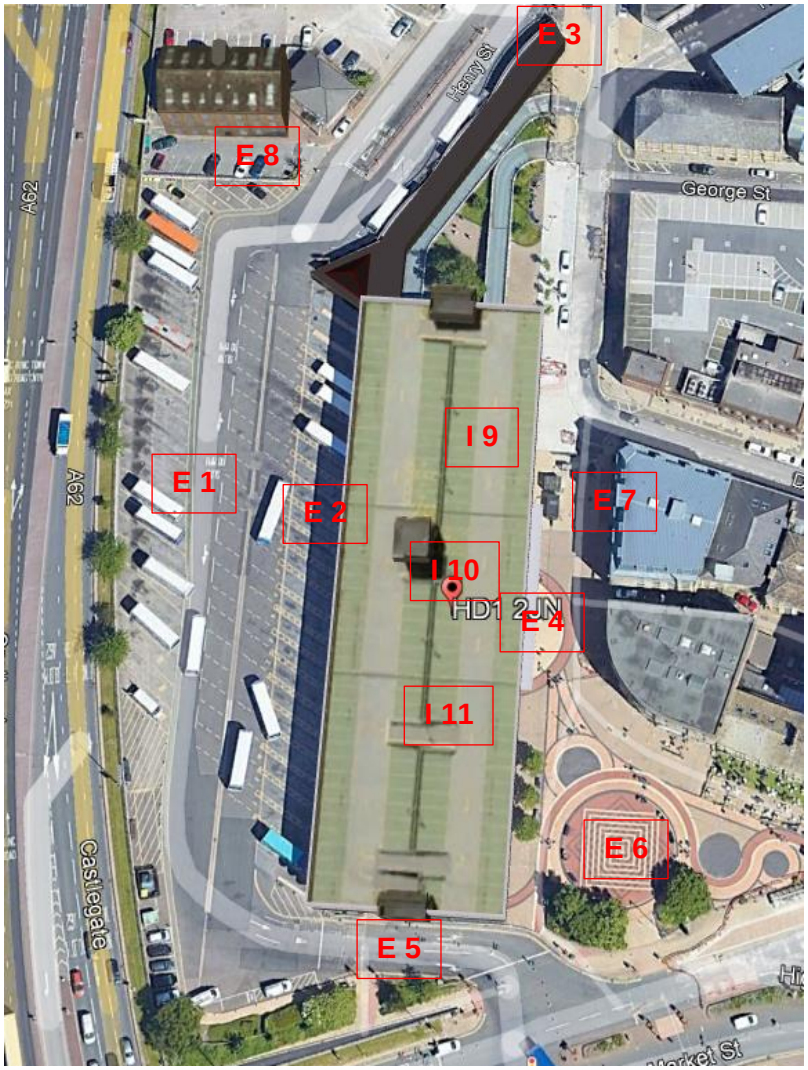


*Figure 1. Continuous Logging Location:*

E1, E2, E3, E4, E5 recorded the existing noise levels around the bus station.

E6 recorded the typical noise levels at Macauley Square (one of the location options being considered for the site office during the refurbishment works).

E7 and E8. Recorded the noise levels at the nearest residential dwellings which have the potential to be affected by the operation of the bus station.

I9, I10, and I 11 recorded the internal noise levels in the travel centre, and in the concourse.

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# 3 Criteria

## 3.1 BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*

This BS recommends a minimum ambient noise levels in non-domestic buildings, table 6 extracted from this BS is included below for reference.

Table 6 **Typical noise levels in non-domestic buildings**

| Activity | Location | Design range dB $L_{Aeq,\ T}$ |
|---|---|---|
| Speech or telephone communications | Department store<br>Cafeteria, canteen, kitchen | 50 – 55 |
| | Concourse<br>Corridor, circulation space | 45 – 55 |
| Study and work requiring concentration | Library, gallery, museum | 40 – 50 |
| | Staff/meeting room, training room | 35 – 45 |
| | Executive office | 35 – 40 |
| Listening | Place of worship, counselling, meditation, relaxation | 30 – 35 |

The above recommended noise levels apply to steady sources, such as those due to road traffic, mechanical services or continuously running plant, and should be the noise level in the space during normal hours of occupation but excluding any noise produced by the occupants and their activities. The time period, T, should be appropriate for the activity involved (e.g. 08.00 to 17.00 for office). If the noise is fairly steady, it might not be necessary to measure for the whole of the relevant time period to establish the typical outdoor level.

Based on the recommended levels in table 6, the internal noise levels in the concourse should not exceed 55 dBA, and 45 dBA in the travel centre.

## 3.2 British Standard 4142:2014 + A1:2019. *Methods for rating and assessing industrial and commercial sound.*

This standard sets out a methodology for the assessment of noise from factories, industrial premises or fixed installations and sources of an industrial/commercial nature.

The procedure contained in BS4142 for assessing the impact is to compare the measured or predicted noise level from the source in question, the ‘specific noise level’, at the assessment position with the correct background noise level for the worst-case time of operation.

Where the noise contains a ‘distinguishable, discreet, continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks or clatters), or if the noise

is irregular enough to attract attention' then a range of correction factors can be added to the specific noise level as appropriate to obtain the 'rating level'.
As this is a prescriptive report prior to plant installation, overall rating noise levels will be specified for the new installation. Compliance with the rating value will be necessary to provide evidence that significant adverse impact has been avoided as required by the NPSE.

To assess the impact, the measured background noise level is subtracted from the rating noise level. BS4142 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 source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessment and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (See Clause 8) from the rating level (see Clause 9) and consider the following.

a) Typically, the greater the difference, the greater the magnitude of the impact.

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around 5dB is likely to be an indication of an adverse impact, depending on the context.

d) 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.

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would

occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

3) 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, such as;

i) Façade sound insulation treatment

ii) Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and Acoustic screening.

For rating purposes if the noise source is tonal, impulsive or otherwise distinctive in character, a rating correction may be applied depending on the severity of the character. The standard states that a difference between the rating level and the background level 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 +5 dB is likely to be an indication of an adverse impact, depending on the context, and where the rating level does not exceed the background level it is an indication of a low impact, depending on the context. Setting rating noise level criteria equal to the lowest measured background noise levels obtained during the day, evening and night establishes a robust assessment as contributing, at worst, a low impact which suggests compliance with the aims of the NPSE.

The noise rating (NR) is a graphical method for assigning a single-number rating to a noise spectrum, is in common use for rating noise from ventilation systems. To obtain a rating, the noise spectrum is superposed on a family of NR contours. The NR of the spectrum corresponds to the value of the first NR contour that is entirely above the spectrum.

# 4. Noise Survey Details

## 4.1 Survey

The noise survey was carried out between Tuesday 6th and Wednesday 7th February 2024 to measure representative noise levels affecting the bus station, and the nearest noise sensitive receptors.

The noise survey comprised of 11 attended monitoring locations on site which are described in detail below.

- Noise measurement location E1.

The sound level meter was tripod mounted at 1.5 m above ground levels, and 3 m from any reflective surface. This location recorded the noise levels at the western boundary of the bus station.

The figure below shows the measurement location.

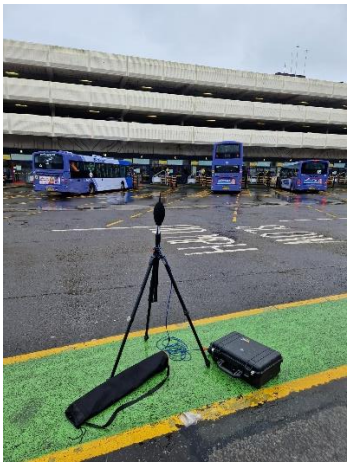

*Figure 2. Noise measurement location E1*

- Noise measurement location E2.

The sound level meter was tripod mounted at 1.5 m above ground levels, and 1 m from the bus station external glazed facade. This location recorded the noise levels affecting the bus station western elevation.

The figure overleaf shows the measurement location.

*Figure 3. Noise measurement location E2.*

- Noise measurement location E3.

The sound level meter was tripod mounted at 1.5 m above ground levels, and 3 m from any reflective surface. This location recorded the noise levels at the northern boundary of the bus station.

The figure below shows the measurement location.


*Figure 4. Noise measurement location E3*

- Noise measurement location E4.

The sound level meter was tripod mounted at 1.5 m above ground levels, and 1 m from the bus station external glazed. This location recorded the noise levels affecting the bus station eastern elevation.

The figure overleaf shows the measurement location.


*Figure 5. Noise measurement location E4*

- Noise measurement location E5

The sound level meter was tripod mounted at 1.5 m above ground levels, and 3 m from any reflective surface. This location recorded the noise levels at the southern boundary of the bus station.

The figure below shows the measurement location.

*Figure 6. Noise measurement location E5*

- Noise measurement location E6

The sound level meter was tripod mounted at 1.5 m above ground levels, and 3 m from any reflective surface. This location recorded the noise levels at the proposed location of Willmott Dixon site office.

The figure overleaf shows the measurement location.

*Figure 7. Noise measurement location E6.*

- Noise measurement location E7.

The sound level meter was tripod mounted at 1.5 m above ground levels, and 1 m from the residential building external façade. This location recorded the noise levels affecting the nearest noise sensitive receptor located on Dunda Street.

The figure below shows the measurement location.

*Figure 8. Noise measurement location E7*

- Noise measurement location E8.

The sound level meter was tripod mounted at 1.5 m above ground levels, and 1.5 m from the residential building external façade. This location recorded the noise levels affecting the nearest noise sensitive receptor located on Henry Street.

The figure overleaf shows the measurement location.

*Figure 9. Noise measurement location E8*

- Noise measurement location I 9.

The sound level meter was tripod mounted at 1.5 m above ground levels, and at least 1.5 m from the internal walls. This location recorded the noise levels in the travel centre.

The figure below shows the measurement location.

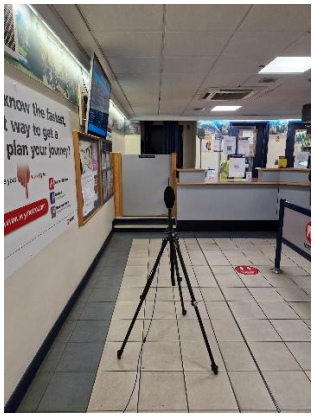

*Figure 10. Noise measurement location I9.*

- Noise measurement location I 10.

The sound level meter was tripod mounted at 1.5 m above ground levels, and at least 3 m from any reflective surface. This location recorded the noise next to Stand J.

The figure overleaf shows the measurement location.

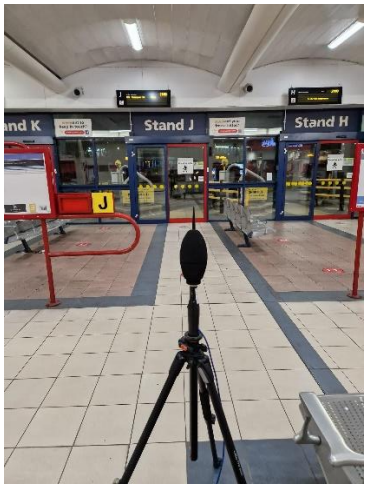


*Figure 11. Noise measurement location I 10.*

- Noise measurement location I 11.

The sound level meter was tripod mounted at 1.5 m above ground levels, and at least 3 m from any reflective surface. This location recorded the noise next to Stand Q.

The figure below shows the measurement location.


*Figure 12. Noise measurement location I 11.*

Noise measurements were made with a calibrated precision grade sound level meter which achieves the requirements of BS EN 61672:2013. The survey was carried out in accordance with the principles of BS 7445: Parts 1-3, 'Description and Measurement of Environmental Noise', British Standard BS4142: 2014+A1:2019: Methods for rating and assessing industrial and commercial sound.

## 4.2 Equipment

- Svantek 140 precision grade sound level meter. Serial number 1407673.
- Norsonic Sound Calibrator 1251. Serial number 32199.
- Environmental wind shields.

The sound level meter was calibrated before and after the survey. No significant drift was noted between the two reference checks.

## 4.3 Weather

In order to evaluate the weather conditions two weather check measurements were undertaken on site. During the weather checks, it was noted that the climatic conditions were stable during the whole measurement period. During the visits, the sky was partly covered.

Table 1. Weather condition.

| | °C | Wind speed m/s | Relative Humidity % |
|---|---|---|---|
| 15:00 PM Monday | 7 | 0.8 | 90 |
| 23:30 PM Monday | 3 | 1.0 | 95 |

The weather condition was taken using a Pocket weather tracker KESTREL 4500.

Conditions were considered conducive to environmental noise measurement.

# 5 Survey Results

The measurement survey at all monitoring locations comprised of consecutive measurement periods in terms of the most relevant standards and guidelines.

The tables below show the period noise levels measured at all monitoring locations. These have subsequently been used as the basis for establishing the dominant noise levels across the site.

Table 2. Measured continuous noise level.

| Time | Period $L_{Aeq,\ T}$ dB | $L_{A90,T}$ dB Minimum Background |
|---|---|---|
| **E 1** | | |
| 12:20 PM to 12:45 PM | 72 | 62 |
| **E 2** | | |
| 12:49 PM to 1:15 PM | 69 | 63 |
| **E 3** | | |
| 1:20 PM to 1:45 PM | 68 | 59 |
| **E 4** | | |
| 1:50 PM to 2:30 PM | 66 | 59 |
| **E 5** | | |
| 2:35 PM to 3:15 PM | 70 | 58 |
| **E 6** | | |
| 3.20 PM to 3.55 PM | 61 | 55 |
| **E 7** | | |
| 4:00 PM to 4:40 PM | 63 | 57 |
| 7:00 PM to 8:00 PM | 58 | 55 |
| 11:00 PM to 12:00 AM | 54 | 51 |
| **E 8** | | |
| 4:45 to 5.45 PM | 63 | 57 |
| 8:05 PM to 9:05 PM | 59 | 56 |
| 12:05 AM to 1:05 AM | 52 | 48 |
| **I 9** | | |
| 9:10 PM to 9:15 PM | 50 | 48 |
| **I 10** | | |
| 9:20 PM to 9:25 PM | 51 | 45 |
| **I 11** | | |
| 9:30 PM to 9:35 PM | 49 | 46 |

The external noise levels measured around the bus station are mainly traffic noise from the nearby road network, busses arriving and leaving the bus station, and people noise.

The nearest residential dwellings are affected by the following noise sources:

E 7 adjacent to the bus station: road noise, people noise, and plant noise from the air conditioning, and condensers located externally serving the adjacent business premisses.

E 8. Road noise, and mechanical plant noise from the adjacent restaurant.

# 6 Indoor ambient noise levels.

The main purposes of the internal noise measurements are to assess the sound reduction provided by the existing bus station building envelope, and the noise emission from the mechanical services (air conditioning).

Internal noise levels affecting the bus station are based on the requirements specified in table 6 of BS 8233:2014.

Table 6. Internal Noise levels.

| Position | Measured $L_{Aeq}$ dB | Recommended acoustic criteria $L_{Aeq}$ dB | Exceedance over the recommended acoustic criteria |
|---|---|---|---|
| I 9 Travel centre | 50 | ≤45 | +5 |
| I 10 Concourse | 51 | ≤55 | -4 |
| I 11 Concourse | 49 | | -6 |

The air condition units installed in the ceiling have a noise emission which are above the recommended acoustic criteria.

The measured noise levels in the concourse are below, and therefore compliant with the criteria recommended by the relevant acoustic guideline.

# 7 Noise from Fixed Installations and Mechanical Plant

Noise levels generated by mechanical plant and experienced by local receptors depends upon a number of variables, the most significant of which are considered to be as follows:

Noise generated by plant or equipment used on site, generally expressed as sound power

levels (SWL)

- Distance between the noise source and the receptor.
- Attenuation due to ground absorption, atmospheric and barrier effects.
- Periods of operation of the plant on the site, known as its “on-time”.

It is possible that the proposal will include installations of ventilation and mechanical plant. However, at this stage, no information is available with regards to the fixed installations and mechanical plants that are to be installed as part of the proposed development.

Consequently, it is not possible to present an inclusive assessment of the noise effects of such plant. However, in order to ensure that background noise levels at the nearest noise sensitive receptors do not increase significantly as a result of the development, design noise limits for electrical and mechanical plant have been provided.

The noise limits have been based on achieving 10 dB below the quietest background noise level recorded during the noise survey.

| Table 7. Noise Limit for Fixed Installations of Mechanical Plant, $L_{Ar,Tr}$ (dB) | | |
|---|---|---|
| Noise sensitive receptor | Daytime | Night-time |
| E 7 Dunda Street | 45 | 41 |
| E 8 Henry Street | 46 | 38 |

If fixed installations and mechanical plant are designed to achieve the above-mentioned noise limits at the nearest residential receivers, complaints will be minimised.

There are a number of measures that can be introduced to control noise from the mechanical and fixed plant installation associated with the proposed development. Consideration should be given to reducing noise at point of generation (e.g. by selecting quieter plant) or containment of noise generated (e.g. by insulating buildings which house machinery and/or providing purpose-built barriers around the site).

# 8 Reverberation time assessment.

A total of four reverberation time measurements were completed along the concourse, and in the travel centre to evaluate the room acoustic. The measurements were completed using the impulse response method by bursting large balloons.

The recommended reverberation time in the Travel Centre is ≤1.0 seconds, and in the concourse is ≤2.0 seconds respectively.

The table below includes the reverberation time (T30) along the frequency of interest.

| 9. Measured RT. | | | | |
|---|---|---|---|---|
| | 500 Hz | 1 kHz | 2 kHz | $T_{mf}$ |
| Travel Centre | 0.8 | 0.9 | 1.0 | 0.9 |
| Concourse | 1.3 | 1.2 | 0.9 | 1.1 |

As can be seen from the results table above, the measured reverberation time is compliant with the criteria recommended by the relevant acoustic guideline.

The existing reverberation time in the concourse is low, and therefore considered an ideal situation for the intelligibility of the public address system. The Speech Intelligibility describes the clarity and distinctiveness of the preserved information when transmitted across a PA system.

# 9 Conclusion

An external and internal noise assessment at Huddersfield Bus Station, Upperhead Row, Huddersfield HD1 2JN, has been completed.

Existing external and internal noise levels have been assessed in this report. Additionally, the existing reverberation time in the travel centre, and in the concourse have been investigated.

Maximum noise criteria from mechanical plant to avoid noise nuisance at the nearest noise sensitive receptors are also discussed in this report.