



**Independent Acoustic
Consultancy Practice**

Noise Impact Assessment

**Brother Engineering
Pontardawe**

6431/NIA1

Noise Impact Assessment

Project:	Brother Engineering
Site Address:	Alloy House Tawe Terrace Pontardawe Swansea SA8 4HA
HA Reference:	6431/NIA1
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Client:	Brother Engineering Ltd. c/o: Robert Bowen Planning & Development Ltd. Llangyfelach Swansea
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1. INTRODUCTION

We understand Brother Engineering are looking to submit a planning application for the 'Retention of use of premises as Engineering Workshop (Class B2) from Bus Depot (Sui Generic)' at Alloy House, Tawe Terrace, Pontardawe, Swansea, SA8 4HA.

It is understood Brother Engineering employ around 10 staff to work at the premises. Hours of operation are understood to be 0700-1800hrs Mon-Fri, 0700-1200hrs Sat.

This report has therefore been commissioned to determine existing background sound levels and predict noise levels from proposed activities and plant, allowing an assessment of the impact to be made.

2. CRITERIA

2.1 Planning Policy Wales

The Welsh Government's Planning Policy Wales (Edition 11) dated February 2021 sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters which together with PPW provide the national planning policy framework for Wales.

Reference to noise is made in Paragraph 6.74: Framework for Addressing Air Quality and Soundscape, which states that:

"6.74 The planning system should maximise its contribution to achieving the well – being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution. In doing so, it should consider the long – term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution".

Reference is also made to noise in Paragraphs 6.7.15 - 17:

"Location of Commercial, Industrial and other Potentially Polluting Development

6.7.15 For the purposes of this section, potentially polluting development includes commercial, industrial, energy and agricultural or transport infrastructure. Such development should be located in areas where there is low potential for public exposure, or where its impact can be minimised. Novel or new development types may potentially cause pollution and should be carefully considered, and where appropriate, decisions should be based on the precautionary principle.

6.7.16 Relevant considerations in making planning decisions for potentially polluting development are likely to include:

- location, including the reasons for selecting the chosen site itself;*
- impact on health and amenity;*
- effect of pollution on the natural and built environment and the enjoyment of areas of landscape and historic and cultural value;*
- impact on groundwater and surface water quality;*
- effect on biodiversity and ecosystem resilience, including where there may be cumulative impacts on air or water quality which may have adverse consequences for biodiversity and ecosystem resilience;*

- *the risk and impact of potential pollution from the development, insofar as this might lead to the creation of, or worsen the situation in, an air quality management area, a noise action planning priority area or an area where there are sensitive receptors; and*
- *impact on the road and other transport networks, and in particular on traffic generation, particularly where the proposed development is not transport infrastructure itself.*

6.7.17 *The location of potentially polluting development adjacent to sensitive receptors will be unacceptable where health and amenity impacts cannot be minimised through appropriate design and mitigation measures. It is the overall expectation that levels of pollution should be reduced as far as possible and for this reason the location of potentially polluting development should be taken into account as part of overall strategies in development plans to ensure it can be appropriately located and maximum environmental benefits can be gained through measures such as green infrastructure."*

2.2 Technical Advice Note (Wales) 11

The below summarises the advice given TAN11 (1997) regarding new noise generating developments.

"3. This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.

4. Local authorities should adopt a corporate approach and ensure close co-operation between planning and environmental health departments when considering noise and noise generating developments.

Development Control

Noise generating development

8. Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.

9. Noise characteristics and levels can vary substantially according to their source and the type of activity involved. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone will require

special consideration. In addition to noise from aircraft landing and taking off, noise from aerodromes is likely to result from engine testing as well as ground movements. The impact of noise from sport, recreation and entertainment will depend to a large extent on frequency of use and the design of facilities. Advice on assessing noise and on factors to consider in relation to the major noise sources including roads, railways, airports, industrial and recreational noise and their measurement is given in Annex B.

Noise from industrial and commercial developments

B17. The likelihood of complaints about noise from industrial development can be assessed, where the Standard is appropriate, using guidance in BS 4142: 1990. Tonal or impulsive characteristics of the noise are likely to increase the scope for complaints and this is taken into account by the "rating level" defined in BS 4142. This "rating level" should be used when stipulating the level of noise that can be permitted. The likelihood of complaints is indicated by the difference between the noise from the new development (expressed in terms of the rating level) and the existing background noise. The Standard states that, 'A difference of around 10 dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance'. Since background noise levels vary throughout a 24 hour period it will usually be necessary to assess the acceptability of noise levels for separate periods (e.g. day and night) chosen to suit the hours of operation of the proposed development. Similar considerations apply to developments that will emit significant noise at the weekend as well as during the week. In addition, general guidance on acceptable noise levels within buildings can be found in BS 8233: 1987."

TAN11 refers to BS 4142:1997 and BS 8233:1987. These have been superseded by BS 4142:2014+A1:2019 (see Section 2.3 below) and BS 8233:2014 (see Section 2.4 below).

2.3 British Standard 4142:2014+A1:2019

British Standard 4142:2014+A1:2019 "Methods for rating and assessing industrial and commercial sound", provides current guidance for the assessment of industrial noise affecting residential receivers.

This standard describes a rating method comparing L_{Aeq} noise levels from the industrial source with pre-existing background L_{A90} levels at the residential receiver. It advises at a difference (industrial noise - background) of:

- +10dB or higher, likely to be an indication of a significant adverse impact, depending on the context.
- A difference of + 5dB, 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.

A sliding scale of penalties can be applied to industrial/commercial sound levels which have acoustically distinguishing characteristics, including tonality, impulsivity and intermittency.

Tonality – A penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible.

Impulsivity – A penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it clearly perceptible, and 9dB where it is highly perceptible.

Other sound characteristics – Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied

Intermittency – If intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied.

BS 4142:2014 states under section 11;

“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.”

2.4 British Standard 8233:2014

British Standard 8233:2014 'Guidance on sound insulation and noise reduction for buildings' includes internal noise criteria of habitable rooms in residential dwellings, as shown below;

Table 2.1 – BS 8233:2014 Internal Ambient Noise Criteria for Habitable Rooms

Location	Desired		Reasonable *	
	07:00 to 23:00	23:00 to 07:00	07:00 to 23:00	23:00 to 07:00
Living room	35 dB $L_{Aeq,16hr}$	-	40 dB $L_{Aeq,16hr}$	-
Dining room/area	40 dB $L_{Aeq,16hr}$	-	45 dB $L_{Aeq,16hr}$	-
Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$	40 dB $L_{Aeq,16hr}$	35 dB $L_{Aeq,8hr}$

* NOTE 7 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 5dB and reasonable internal conditions still achieved."

3. SOUND SENSITIVE RECEIVERS

In order to set environmental noise limits, it is first necessary to define the existing ambient and background sound climate at the agreed nearest Sound Sensitive Receivers (SSRs).

Figure 3.1 below shows the development site and the closest existing SSRs.

Figure 3.1 – Site Plan Showing Nearest SSRs & Measurement Location

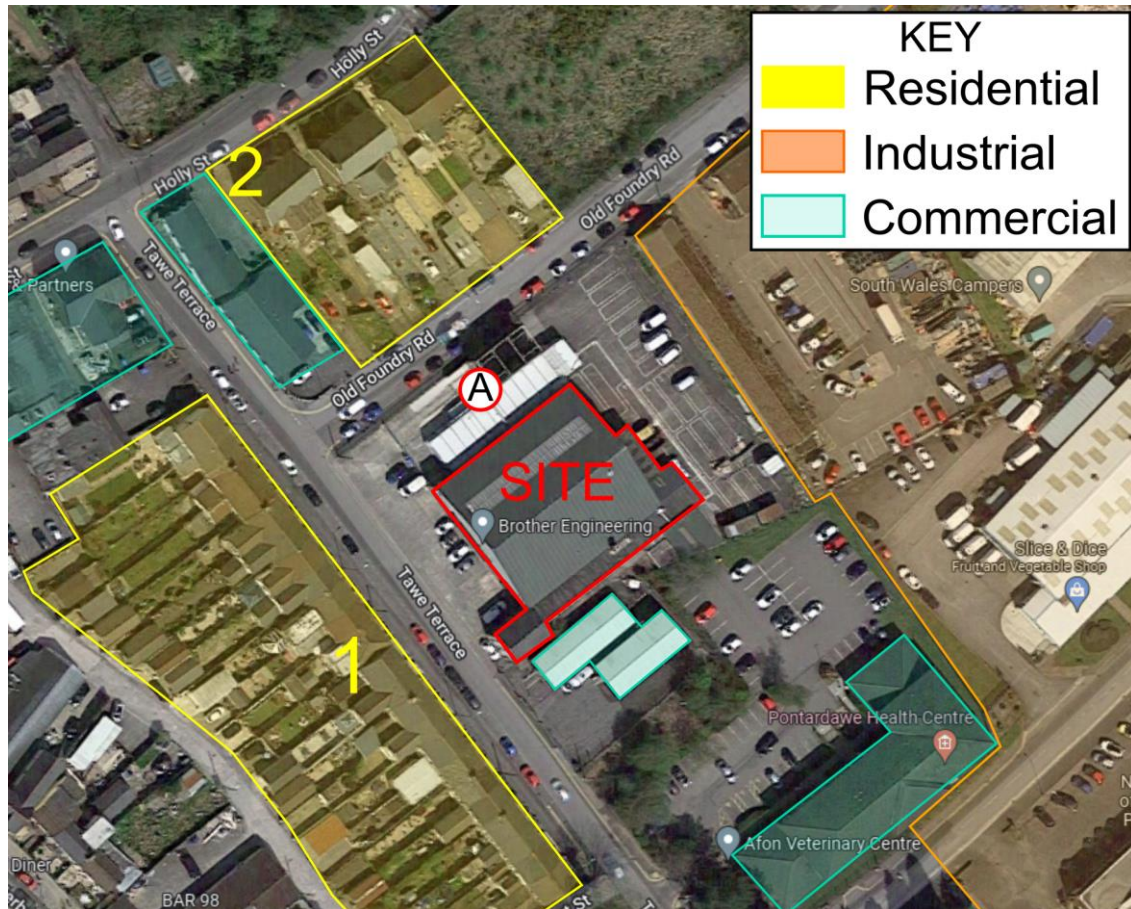


Table 3.1 – Nearest Sound Sensitive Receivers (Distance to Residential Façade)

SSR	Description	Distance (m)
1	Residential dwellings to the west of site, along Tawe Terrace	23
2	Residential dwellings to the north of site, along Holly Street	54

Note: There are commercial premises within the vicinity; which are not deemed as critical as the residential receivers. These include the 1358 Squadron Air Cadets building located immediately south of site, Pontardawe Health Centre to the south and Clee Tompkinson Francis Chartered Surveyors to the north. This assessment therefore focusses on the more critical residential receivers.

4. ENVIRONMENTAL NOISE SURVEY

4.1 Procedures

Continuous noise monitoring was carried out from 1415hrs on Friday, 25 February 2022 to 1345hrs on Monday, 28 February 2022 at position A.

Data including L_{Amax} , L_{Aeq} and background L_{A90} was logged at 15 minute intervals over the monitoring period, along with continuous audio and 100ms data to allow source identification and further detailed analysis of results if required.

Site plan in Figure 3.1 above shows the development site and continuous monitoring position used, namely:

Table 4.1 – Continuous Monitoring Location Details

Position	Description
A	Located on external pipework, approx. 2.5m above local ground height – free-field.

4.2 Meteorological Conditions

Approximate weather conditions are shown in time history graphs in Appendix B.

To summarise, the weather conditions during the monitoring period were mostly dry with an occasional breeze. On the Monday morning, heavy rain showers began from 0700hrs until the survey was collected. Survey data for this period has therefore been excluded.

4.3 Measurement Equipment

The following measurement equipment was used during the surveys:

Table 4.2 – Noise Monitoring Equipment List

Make	Description	Model	Serial Number	Last Calibrated	Certificate No.
Norsonic AS	Calibrator (113.97dB @ 999.14Hz)	1251	24202	17 August 2021	UCRT21/2006
NTi	Type 1 - Sound Level Meter	XL2-TA	A2A-14577-E0	22 June 2020	TCRT20/1313
	Preamplifier	MA220	7485	22 June 2020	TCRT20/1313
	Microphone Capsule	MC230	A15594	22 June 2020	TCRT20/1313

Measurement systems were calibrated before and after the surveys and no variation occurred.

Note: Copies of traceable calibration certificates for all equipment are available upon request.

4.4 Results

Time history graph in Figure B.5 of Appendix B shows L_{Amax} , L_{Aeq} and L_{A90} sound pressure levels measured at position A.

The following $L_{Aeq,1hr}$ noise levels were measured over the survey period at Position A;

Table 4.3 – Summary of Hourly $L_{Aeq,1hr}$ Noise Levels

Period	$L_{Aeq,1hr}$ (dB) at Position A		
	Friday 25/02/2022	Saturday 26/02/2022	Sunday 27/02/2022
0700-0800hrs	-	54.1	49.8
0800-0900hrs	-	53.8	51.8
0900-1000hrs	-	56.0	53.7
1000-1100hrs	-	56.5	53.9
1100-1200hrs	-	57.2	54.8
1200-1300hrs	-	57.3	54.3
1300-1400hrs	-	57.0	56.4
1400-1500hrs	64.6	55.5	54.4
1500-1600hrs	58.8	60.8	54.6
1600-1700hrs	55.7	55.0	63.5
1700-1800hrs	55.6	55.9	54.4

* Note: Rain showers occurred from 0700hrs Monday 28/02/2022 until the survey was collected – this data has therefore been excluded.

Graph in Figure B.6 of Appendix B show statistical analysis of background sound levels measured at position A, during Brother Engineering operating hours.

The following minimum consistent daytime background L_{A90} sound level has been determined;

Table 4.4 – Minimum Consistent Daytime Background L_{A90} Results

Period	Position A
Daytime (0700-1800hrs) $L_{A90,1hr}$ (dB)	48

The ambient and background sound climate at Position A was controlled by Tawe Terrace road traffic noise. Although the Brother Engineering site was operational over the survey period, noise levels from the site were not audible at Position A.

5. SOURCE SAMPLE MEASUREMENTS

5.1 Procedure

Noise measurements of plant and activities were undertaken on Friday, 25 and Monday, 28 February 2022 at the site to gather source data for use in the prediction model.

This consisted of internal measurements of general activity around workshop areas and external measurements of engineering noise breakout through the external building fabric.

Parameters logged included duration, $L_{Amax,F}$, L_{Aeq} , L_{A90} and third octave band spectra, along with continuous audio and 100ms data to allow detailed post analysis of results.

5.2 Equipment Used

The following measurement equipment was used during the surveys:

Table 5.1 – Equipment List

Make	Description	Model	Serial Number	Last Calibrated	Certificate No.
NTi	Type 1 - Sound Level Meter	XL2-TA	A2A-13022-E0	18 August 2021	TCRT21/1571
	Preamplifier	MA220	6853	18 August 2021	TCRT21/1571
	Microphone Capsule	MC230	A14127	18 August 2021	TCRT21/1571
Larson Davis	Calibrator (93.82dB / 113.83dB @ 1kHz)	CAL200	19047	19 August 2021	44427-19047-CAL200

Measurement systems were calibrated before and after the surveys and no variation occurred.

Note: Copies of traceable calibration certificates for all equipment are available upon request.

5.3 Results

The following details results of sample measurements undertaken at the Brother Engineering Workshop.

Table 5.2 – Source Sample Measurement Results

Description	Duration (secs)	Distance from Source (m)	L_{Aeq} (dB)
Bridgeport VMC 1500	50	1	73.9
Sweep along south-western building façade @ 1m from cladding	120	-	72.8
'Matchmaker' machine	60	1	73.2
'Matchmaker' machine - Air Discharge Noise	2.4	1	81.6
External measurement - @ 5m from north-eastern façade opening (door open). General workshop activity.	180	-	55.5
External measurement - @ 3m from south-western façade main roller-shutter door (closed). General workshop activity noise. (Tawe Terrace road traffic noise excluded from 10min measurement).	191	-	53.9
Sweep along south-western building façade @ 1m from cladding	300	-	69.8
Habor oil chiller unit (located next to Bridgeport VMC 1500)	71	1	72.8
General workshop activity - sweep near 'Matchmaker' machine	60	-	67.4
General workshop activity - sweep in front half of the workshop area	120	-	67.3
General workshop activity - first floor level storage area (front)	90	-	66.5
General workshop activity - first floor level storage area (rear)	30	-	67.6
General workshop activity - sweep in rear part of the building (Grinding Shop)	60	-	74.2
Bridgeport 'Interact 4' milling machine (located in rear half of CNC area).	48	-	74.7
General workshop activity - sweep along corridor between workshop/CNC area and storage / welding areas	150	-	66.4

Octave band data is included in Table B.1 of Appendix B.

5.4 Discussion

Results of the industrial noise audit indicate average sound levels within workshop areas to be around 65-75dB L_{Aeq} .

General workshop activities involved staff operating milling machines, lathes and other such plant within the workshop area. There did not appear to be any loud impulsive sounds emanating from any of the staff's activities (i.e. hammering noises etc.).

6. EXTERNAL BUILDING FABRIC

The building is constructed of single skin profiled metal cladding on a steel frame construction. The roof has a profiled metal sheet construction with roof lights to one half of the roof area.

There are a total 3no large door openings around the building – two of these have roller-shutter doors (SW façade) and the rear opening has a sliding steel door (NE façade).

Figure 6.1 – View of Workshop Area from SW Façade



Figure 6.2 – Brother Engineering Site



Outside the building, noise breakout from engineering activity was not clearly perceptible more than 3m from the building façade.

At the SW façade, industrial noise breakout was only perceptible in between vehicle pass-bys on Tawe Terrace.

Noise from engineering activity outside the North-western façade was not perceptible at all.

Figure 6.3 – Front SW Façade – Critical Roller-Shutter Door



Brother Engineering have confirmed that they do not open the front façade roller-shutter doors, except for deliveries.

The rear (NE) façade opening is sometimes open in warm weather.

7. ENVIRONMENTAL NOISE CRITERIA

A noise rating level criteria +5dB above the pre-existing background L_{A90} sound climate, at the SSRs is proposed.

This is deemed reasonable in the context of residential dwellings located in close proximity to a well-established industrial estate, for reasonable daytime hours.

Based on measured background sound levels (measured during Brother Engineering operational hours), the following operational noise criteria are therefore indicated, to be applied at the nearest residential SSRs:

Table 7.1 – Operational Noise Limits

Period	Position	
	SSR1	SSR2
Daytime (0700-1800hrs*) $L_{Ar,1hr}$ (dB)	53	53

Note: $L_{Ar,Tr}$ to be determined in accordance with British Standard 4142:2014+A1:2019.

**Brother Engineering operational hours.*

8. NOISE MODELLING

Our analysis has used the proprietary Predictor (v2021.1) computer modelling software, in conjunction with procedures of ISO 9613.

This model allows noise levels from noise sources (including building facades) to be predicted over large distances and varying terrain. Attenuation is included accounting for distance, air absorption, ground absorption and screening losses from site topography/local structures.

The analysis predicts resultant noise levels at the SSRs.

Drawings used in our assessment are referenced in Appendix E.

8.1 Source Plant Noise Data

Source noise data used in the model for the various items of plant and activities is detailed in Appendix C.1, taken from measured levels on site as discussed in Section 5.

8.2 Industrial Building

The industrial building has been modelled based on drawings referenced in Appendix E, detailing areas of wall cladding, roof, roller shutter doors, access doors and glazing/translucent panels.

Internal sound pressure levels measured within the building, along with octave band sound reduction performance figures for each building element are included in Table C.1 and Table C.2 of Appendix C respectively.

8.3 Noise Model Scenarios

General workshop activity noise, measured close to each façade of the site building, have been used as source noise levels in the one hour assessment period. Predicted sound reduction figures for the external building fabric are used to calculate the overall sound breakout.

At the north-eastern building façade (rear façade), the large steel door opening is modelled as being fully open to allow for a worst case, robust assessment. Noise breakout from the opening has been calibrated to the external measurement undertaken at 5m.

It was confirmed that the site receives an HGV delivery through the south-western façade roller-shutter door approximately once a week during daytime hours.

Noise from HGV deliveries to site are therefore not deemed critical and have not been included in this noise impact assessment.

8.4 Noise Model Results

Predicted levels at critical receiver locations are shown in Table 8.1 below;

Table 8.1 – Daytime Noise Map Predictions

Sound Sensitive Receiver (SSR)	Level Above Ground	Predicted Daytime $L_{Aeq,1hr}$ (dB)
SSR1 (Dwellings along Tawe Terrace)	1.5m	48
SSR2 (Dwellings on Holly Street)	1.5m	40

The noise map model in Figure C.1 of Appendix C shows the predicted daytime noise contour plot across the surrounding area to critical SSRs at 1.5m above local ground height.

9. ASSESSMENT OF INDUSTRIAL NOISE IMPACT

9.1 Assessment of Daytime Industrial Noise Impact

9.1.1 Acoustic Character Correction

Based on external sound measurements taken on site, there did not appear to be any perceptible tonal, impulsive or intermittent sounds emanating from the workshop. However, to allow for a robust assessment it is proposed to apply a +3dB acoustic character correction for the industrial sound being “readily distinctive against the residual acoustic environment”.

9.1.2 BS 4142:2014+A1:2019 Assessments

BS 4142 assessments for the daytime scenario are included in Table D.1 and Table D.2 of Appendix D.

Results of these are summarised in Table 9.1 below;

Table 9.1 – Predicted Daytime Rating Levels at SSRs

Sound Sensitive Receiver (SSR)	Predicted Daytime Rating Level at Ground Floor Level $L_{Ar,1hr}$ (dB)	Proposed Daytime Rating Level Limit $L_{Ar,1hr}$ (dB)	Daytime Background Sound Level L_{A90} (dB)
SSR1 (Tawe Terrace)	51	53	48
SSR2 (Holly Street)	43	53	48

Overall rating level of 51dB $L_{Ar,1hr}$ at ground floor level of the sound sensitive receivers are therefore indicated to fall below the proposed 53dB $L_{Ar,1hr}$ daytime noise criteria.

Absolute sound levels, predicted to residential receivers, are also shown to fall significantly below prevailing ambient L_{Aeq} sound levels.

9.1.3 Context

The context of the assessment is the retention of engineering activity on a well-established industrial site surrounded by residential dwellings during reasonable daytime hours.

It is understood Brother Engineering have not received any complaints from surrounding residents in regards to noise from their activities thus far.

It is also understood that the site, prior to it being an engineering workshop, was a bus depot; which apparently operated with its roller-shutter doors fully open. Activities within the depot were assumed to be similar to those found in a typical car garage (i.e. tyre changing, vehicle servicing etc.). Therefore, it is likely that site industrial noise level breakout, prior to Brother Engineering moving in, were higher at critical residential receivers (particularly dwellings along Tawe Terrace).

9.2 Discussion

A strict BS 4142 assessment has returned a “less likely adverse impact depending on context” outcome at the most critical Sound Sensitive Receiver (SSR1 – Tawe Terrace).

Based on the context outlined in section 9.1.3 above, the specific sound source is assessed as having a “low impact” to surrounding SSRs.

No additional sound mitigation measures to Brother Engineering’s site and activities are therefore deemed necessary.

10. GOOD PRACTICE GUIDE

BS 5228-1:2009+A1:2014 gives general information on control of noise at source.

A summary of practical measures in the choice and use of plant to reduce noise is given below:

- Avoid unnecessary revving of engines/plant and switch off equipment when not required.
- Ensure plant and vehicles are properly maintained, check silencers and bearings.
- If the noise is directional, point the source away from noise-sensitive locations.
- Minimise drop height of materials.
- Limit the use of particularly noisy plant or vehicles.
- Start-up plant and vehicles sequentially rather than together.

11. CONCLUSION

A noise impact assessment has been carried out for the retention of an engineering workshop at Brother Engineering, Alloy House, Tawe Terrace, Pontardawe, Swansea, SA8 4HA.

Continuous monitoring was undertaken over a weekend period in order to establish the prevailing ambient and background sound climate at a position representative of nearby sound sensitive receivers (SSRs). An industrial sound audit was also undertaken of Brother Engineering activity within the site warehouse.

Based on measured internal noise levels, a 3D noise model has been set up using propriety software in order to predict noise breakout through the site building fabric, back to the residential receivers.

BS 4142:2014+A1:2019 assessments have been undertaken based on predicted industrial sound levels at the SSRs. The outcome of the assessment, to the most critical receiver on Tawe Terrace, has returned a “less likely adverse impact, depending on context” outcome.

The contextual factors are set out and discussed in Section 9.1.3 of this report.

Based on the context outlined in section 9.1.3 above, the specific sound source is assessed as having a “low impact” to surrounding SSRs.

No additional sound mitigation measures to Brother Engineering’s site and activities are therefore deemed necessary.

APPENDIX A - ACOUSTIC TERMINOLOGY

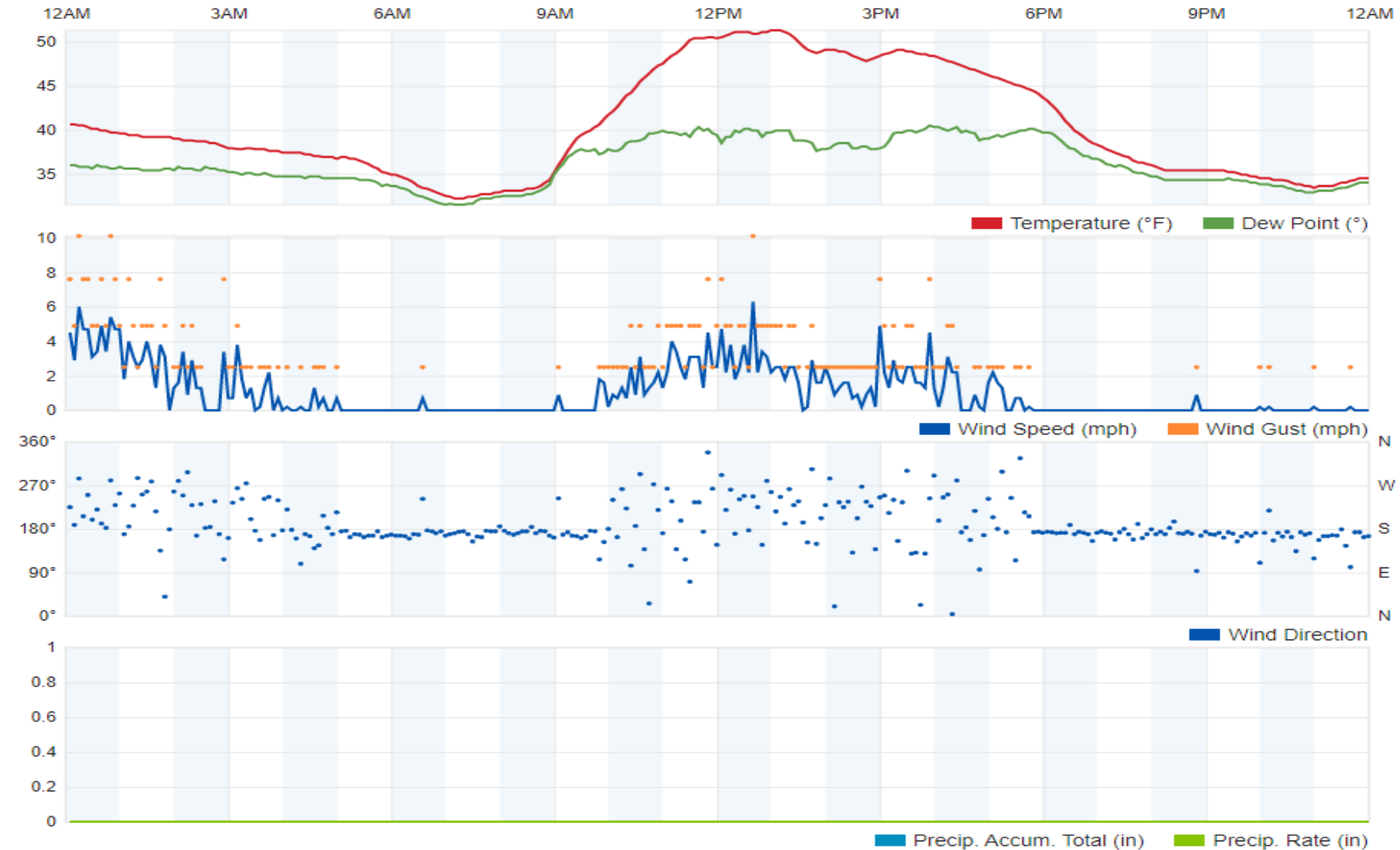
Human response to noise depends on a number of factors including loudness, frequency content and variations in level with time. Various frequency weightings and statistical indices have been developed in order to objectively quantify 'annoyance'.

The following units have been used in this report:

dB(A)	The sound pressure level A-weighted to correspond with the frequency response of the human ear and therefore a persons' subjective response to frequency content.
L_{eq}	The equivalent continuous sound level is a notional steady state level which over a quoted time period would have the same acoustic energy content as the actual fluctuating noise measured over that period.
L_{max}	The highest instantaneous sound level recorded during the measurement period.
L_{10}	The sound level which is exceeded for 10% of the measurement period. i.e. The level exceeded for 6 minutes of a 1 hour measurement - used as a measure of background noise.
L_{90}	The sound level which is exceeded for 90% of the measurement period. i.e. The level exceeded for 54 minutes of a 1 hour measurement - used as a measure of background noise.
$L_{Ar,Tr}$	The 'rating' level, as described in BS 4142:2014 – the specific noise plus any adjustment for the characteristic features of the noise.
SSR	Sound sensitive receiver

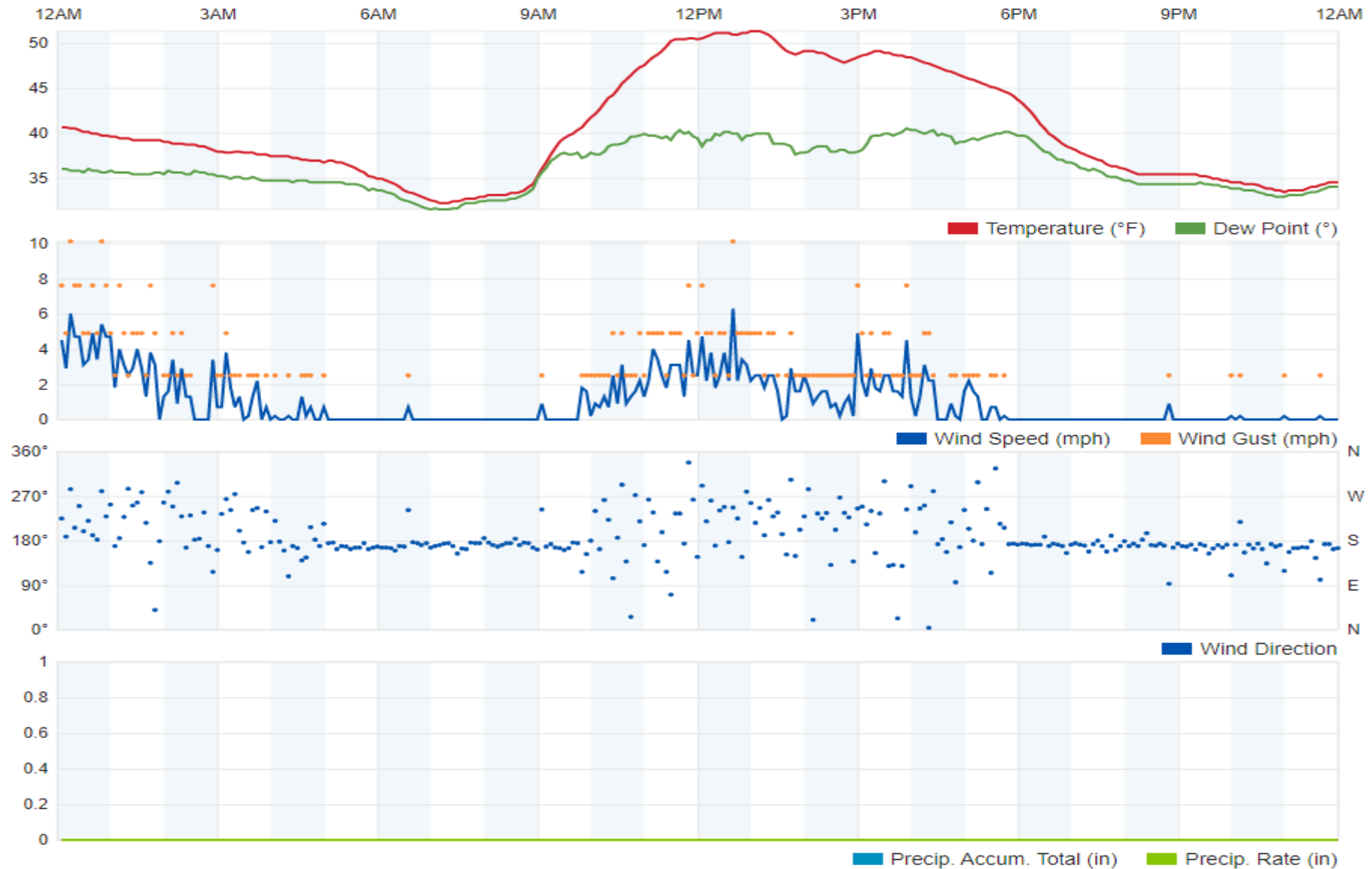
APPENDIX B - DIAGRAMS, GRAPHS AND TABLES

Figure B.1 – Approximate Weather History for Friday, 25 February 2022



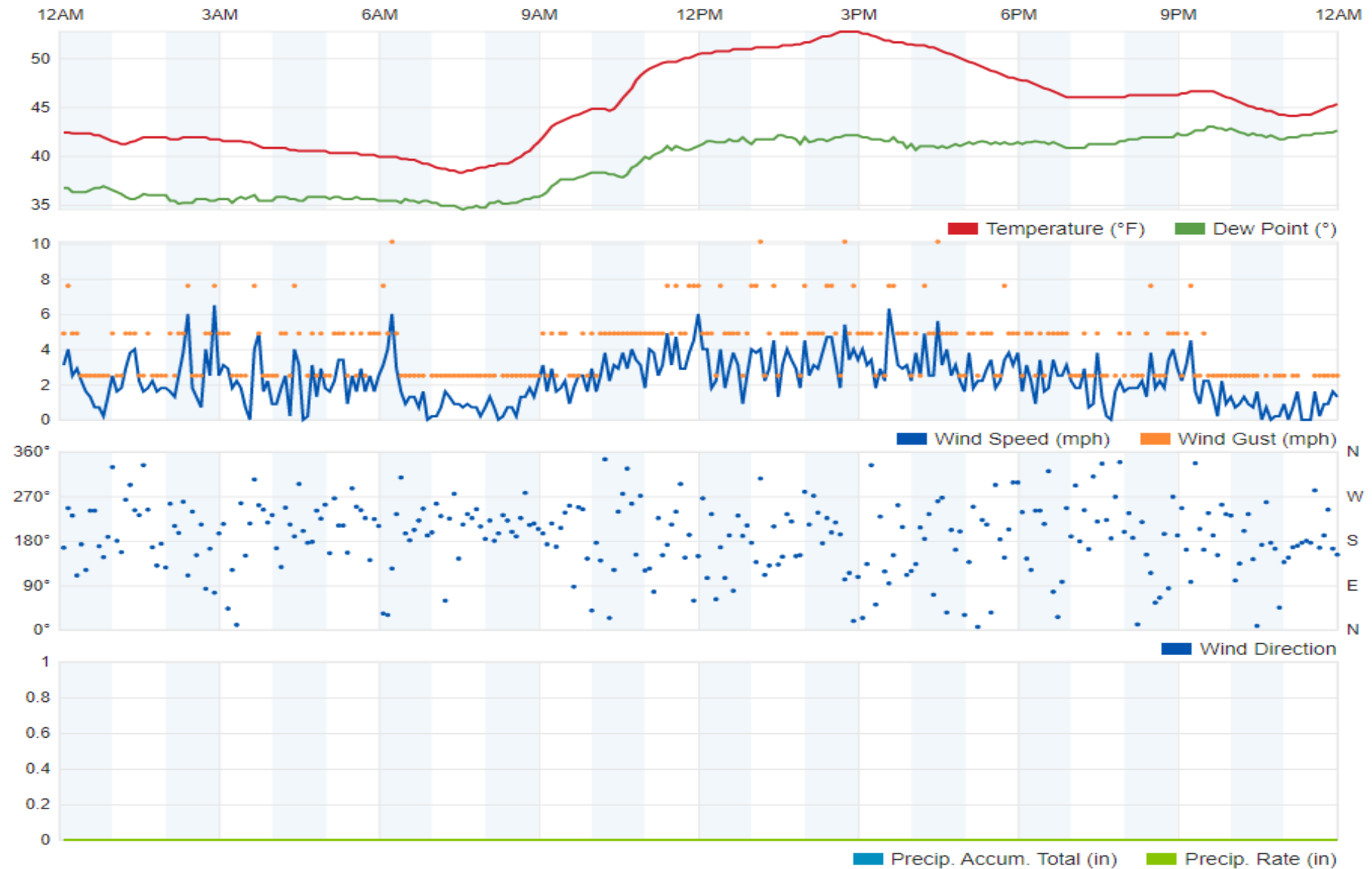
Note: Taken from www.wunderground.com - weather station IPONTARD4 located in Rhyd-Y-Fro [Elev 325 ft, 51.73 °N, 3.86 °W]

Figure B.2 – Approximate Weather History for Saturday, 26 February 2022



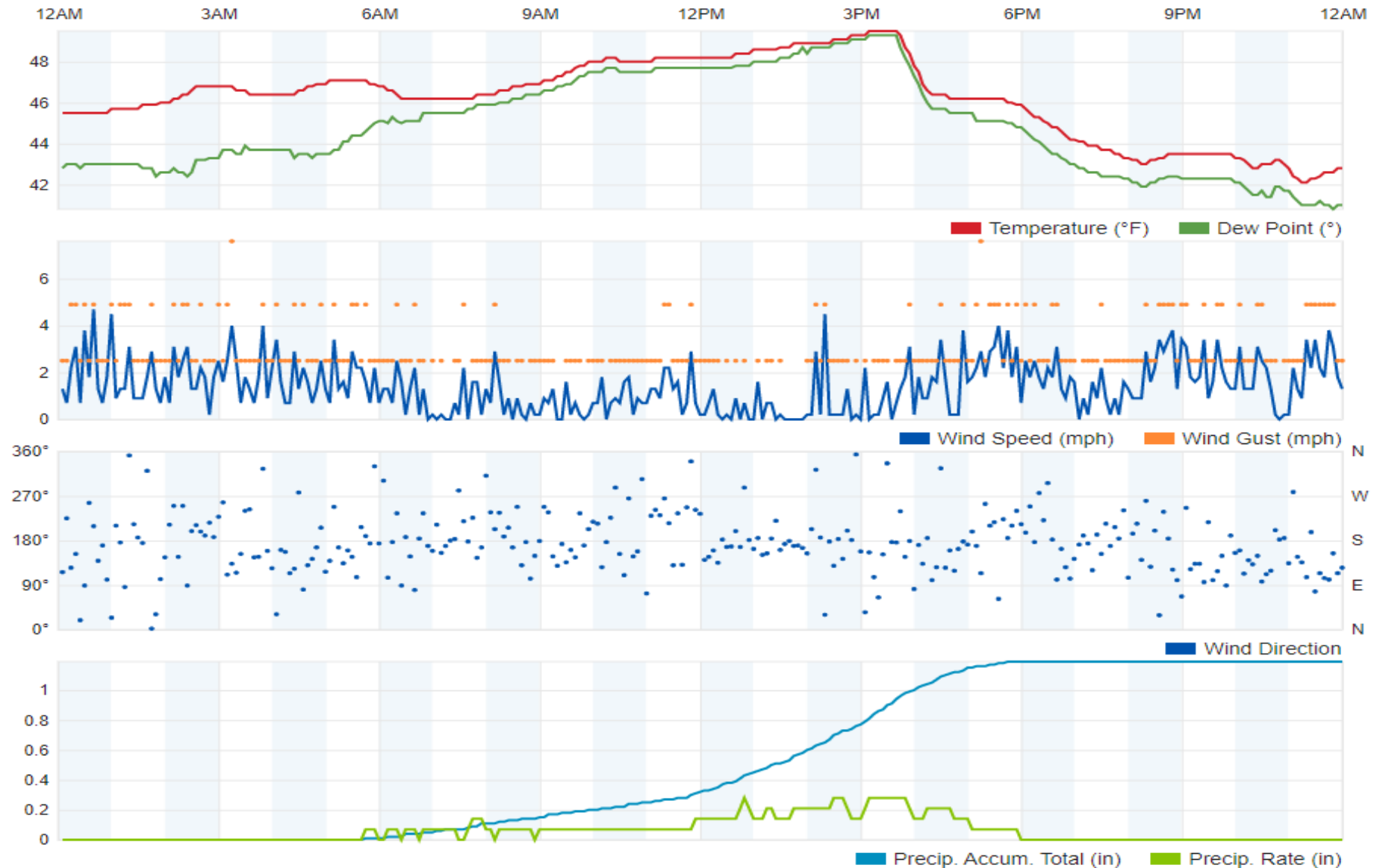
Note: Taken from www.wunderground.com - weather station IPONTARD4 located in Rhyd-Y-Fro [Elev 325 ft, 51.73 °N, 3.86 °W]

Figure B.3 – Approximate Weather History for Sunday, 27 February 2022



Note: Taken from www.wunderground.com - weather station IPONTARD4 located in Rhyd-Y-Fro [Elev 325 ft, 51.73 °N, 3.86 °W]

Figure B.4 – Approximate Weather History for Monday, 28 February 2022



Note: Taken from www.wunderground.com - weather station IPONTARD4 located in Rhyd-Y-Fro [Elev 325 ft, 51.73 °N, 3.86 °W]

Figure B.5 – Time History at Position A (Friday, 25 February 2022 to Tuesday, 28 January 2020)

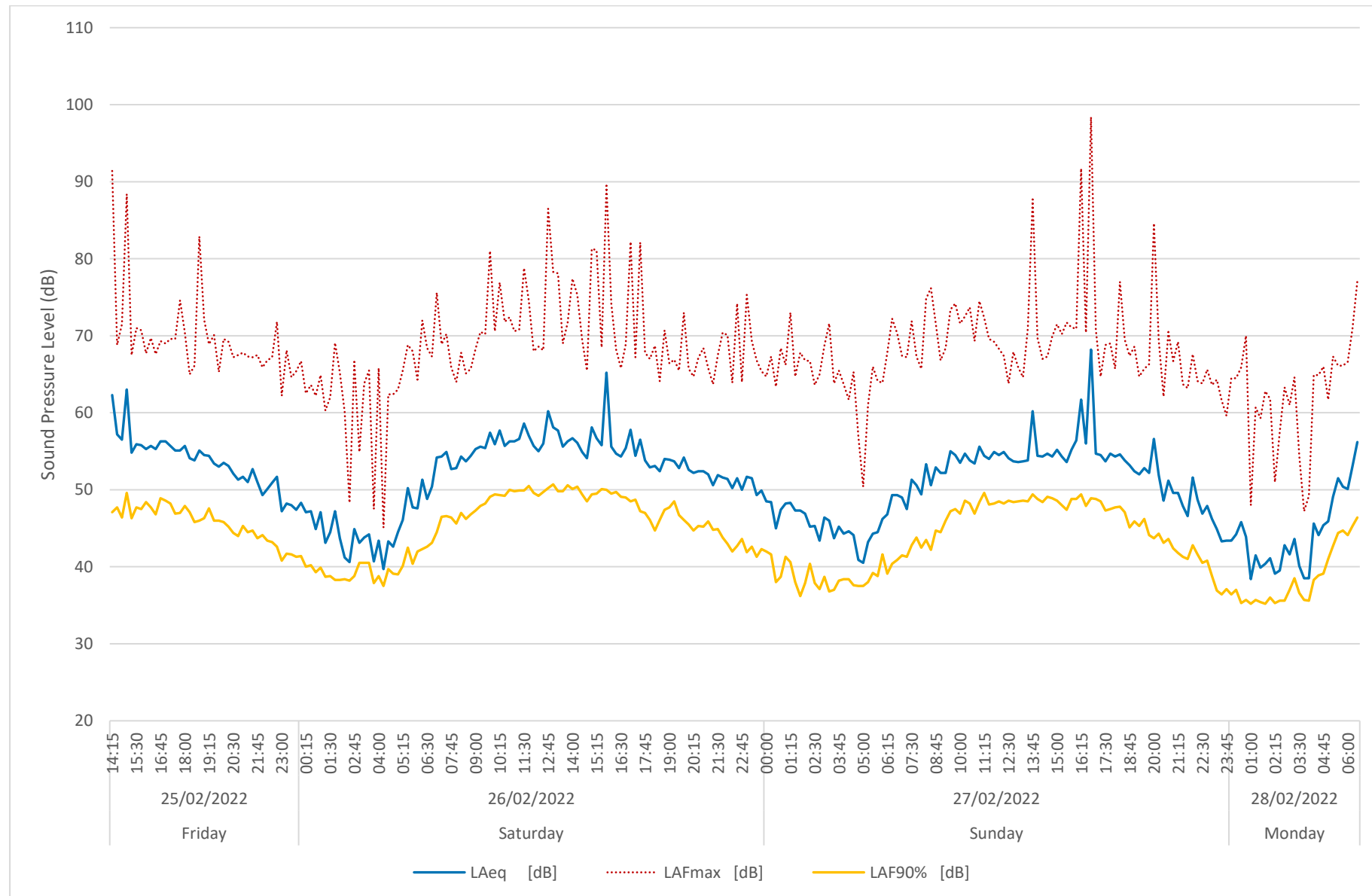
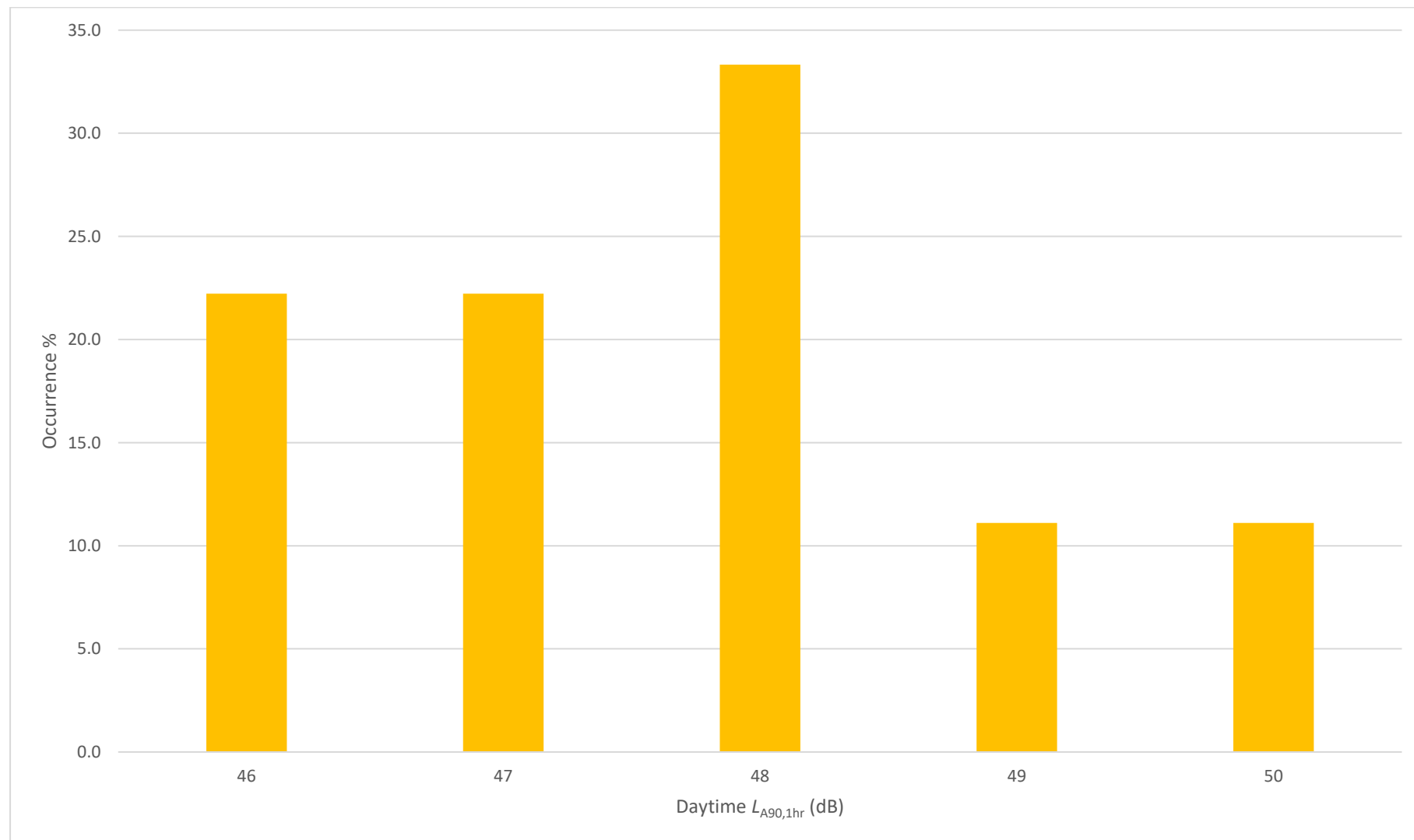


Figure B.6 – Statistical Analysis of Background Sound Levels Measured at Position A

Note: The above analysis is of the entire survey period (excluding Monday morning due to bad weather) during proposed operational hours of Brother Engineering.

Table B.1 – Source Sample Measurement Results including Octave Band Spectra

Description	Duration (secs)	Distance from Source (m)	L_{Aeq} (dB)	$L_{Amax,F}$ (dB)	L_{eq} at Octave Band Centre Frequencies (dB)							
					63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Bridgeport VMC 1500	50	1	73.9	77.1	70.5	73.1	72.4	69.3	70.2	66.2	60.5	56.6
Sweep along south-western building façade @ 1m from cladding.	120	-	72.8	81.4	74.2	72.7	69.2	67.6	67.8	65.3	62.5	63.8
'Matchmaker' machine	20	1	73.8	90.1	64.7	59.4	62.5	65.9	67.9	68.0	66.6	60.7
'Matchmaker' machine	60	1	73.2	92.1	63.5	59.9	62.9	65.1	66.6	68.4	65.4	59.1
Matchmaker' machine - Air Discharge Noise	2.4	1	81.6	86.5	64.4	62.1	61.8	65.1	64.8	70.0	77.5	77.9
External measurement - @ 5m from north-eastern façade opening (door open). General workshop activity.	180	-	55.5	60.5	59.1	53.8	51.8	52.7	51.0	47.8	43.8	36.1
External measurement - @ 3m from south-western façade main rollershutter door (closed). General workshop activity noise. (Tawe Terrace road traffic noise excluded from 10min measurement).	191	-	53.9	65.4	61.8	53.5	50.7	49.8	50.1	45.5	42.5	39.6
Sweep along south-western building façade @ 1m from cladding	300	-	69.8	75.1	64.3	68.8	66.7	66.4	64.1	63.9	57.9	55.0
Habor oil chiller unit (located next to Bridgeport VMC 1500)	71	1	72.8	75.1	65.2	72.6	70.5	69.5	66.1	67.1	60.6	59.3
General workshop activity - sweep near 'Matchmaker' machine	60	-	67.4	69.8	61.3	65.2	64.1	64.1	62.6	60.5	56.5	48.3
General workshop activity - sweep in front half of the workshop area	120	-	67.3	70.7	60.6	63.3	64.0	64.2	62.6	60.1	55.6	47.8
General workshop activity - first floor level storage area (front)	90	-	66.5	74.1	56.2	62.5	62.8	63.8	62.3	58.8	54.4	47.1
General workshop activity - first floor level storage area (rear)	30	-	67.6	82	58.8	62.0	61.5	63.4	62.2	61.4	58.0	51.9
General workshop activity - sweep in rear part of the building (Grinding Shop)	60	-	74.2	81.3	61.1	64.0	63.3	64.1	64.7	67.8	69.1	66.1
Bridgeport 'Interact 4' milling machine (located in rear half of workshop area).	48	-	74.7	80.4	61.1	70.3	69.6	73.1	70.8	64.8	64.3	55.3
General workshop activity - sweep along corridor between workshop/CNC area and storage / welding areas	150	-	66.4	75.6	54.7	60.6	61.9	63.2	62.0	61.5	66.7	66.9

APPENDIX C - NOISE MODELLING

C.1 Noise Model Input Data

Table C.1 – Internal Sound Pressure Level in Buildings

Building Façade	Measurement Used	L_p at Octave Band Centre Frequencies, Hz (dB)								L_{WA} (dB)
		63	125	250	500	1k	2k	4k	8k	
South-western	Sweep along south-western building façade @ 1m from cladding	74.2	72.7	69.2	67.6	67.8	65.3	62.5	63.8	78.6
North-western	General workshop activity - sweep along corridor between workshop/CNC area and storage / welding areas	54.7	60.6	61.9	63.2	62.0	61.5	66.7	66.9	72.5
South-eastern	General workshop activity - sweep near 'Matchmaker' machine	61.3	65.2	64.1	64.1	62.6	60.5	56.5	48.3	71.2
North-eastern (Northern half - including steel door opening) *	General workshop activity - sweep along corridor between workshop/CNC area and storage / welding areas	45.7	51.6	52.9	54.2	64.7	53.0	52.5	57.7	63.5
North-eastern (Southern half – areas above grinding shop extension)	General workshop activity - first floor level storage area (rear)	58.8	62.0	61.5	63.4	62.2	61.4	58.0	51.9	69.9
Main Building Roof	General workshop activity - first floor level storage area (rear)	58.8	62.0	61.5	63.4	62.2	61.4	58.0	51.9	69.9
Grinding Shop Facades	General workshop activity - sweep in rear part of the building (Grinding Shop)	61.1	64.0	63.3	64.1	64.7	67.8	69.1	66.1	74.7

* Note: The north-eastern façade sound emissions have been calibrated to the external measurement undertaken at 5m from the door opening.

Table C.2 – Sound Reduction Performance of Building Elements

Façade	Sound Reduction Index at Octave Band Centre Frequency (dB)							
	63	125	250	500	1k	2k	4k	8k
Metal Façade (Walls & Roof): 0.7mm corrugated steel plate (7kg/m ²)	5	10	16	19	21	24	24	24
Rear Building Façade Opening (Steel Door – Open)	0	0	0	0	0	0	0	0

C.2 Noise Model Contour Plots

Figure C.1 – Daytime Noise Model $L_{Aeq,1hr}$ Contours at 1.5m Height

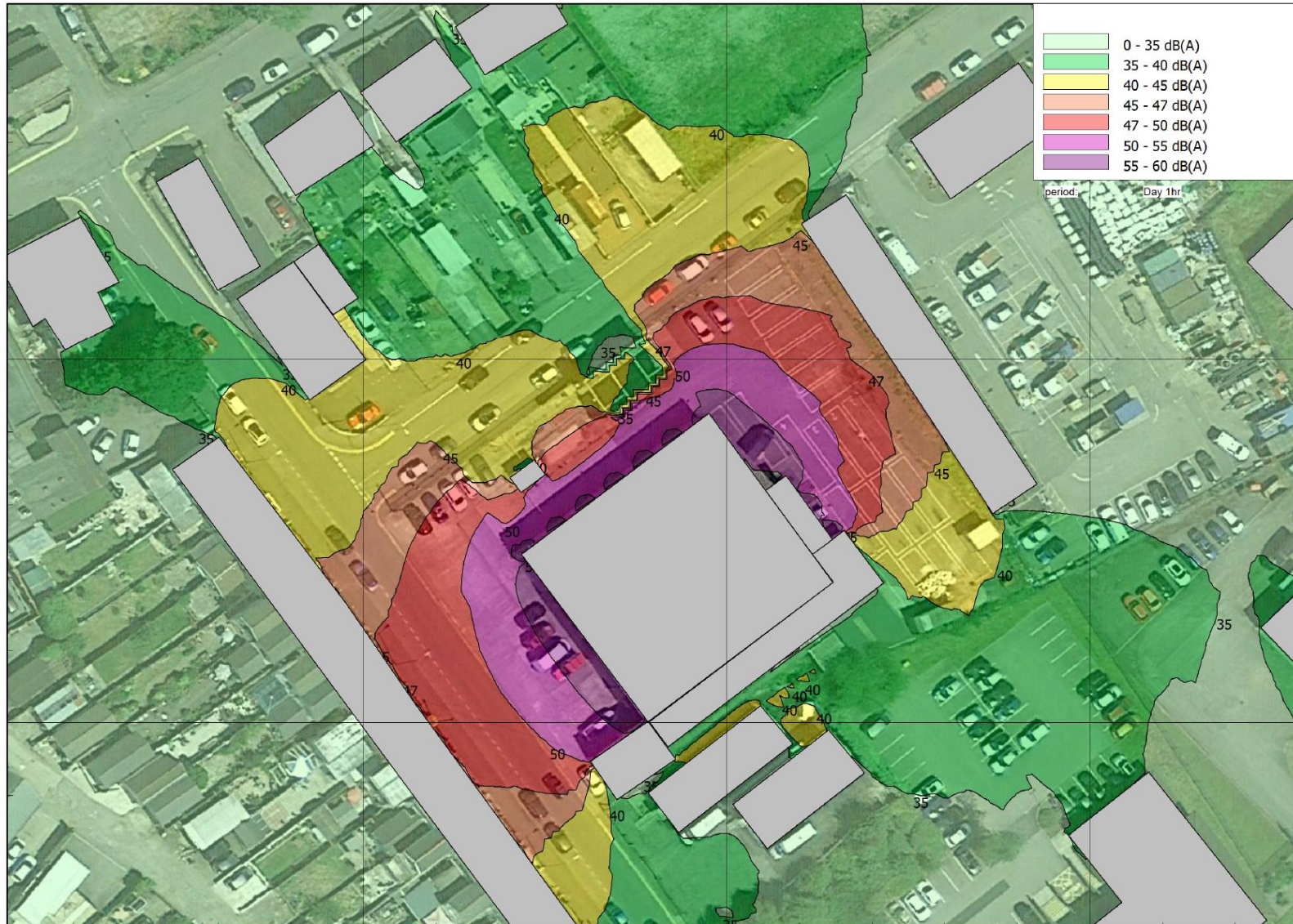


Figure C.2 – Daytime Noise Model $L_{Aeq,1hr}$ Contours at 1.5m Height (3D View from South-east)

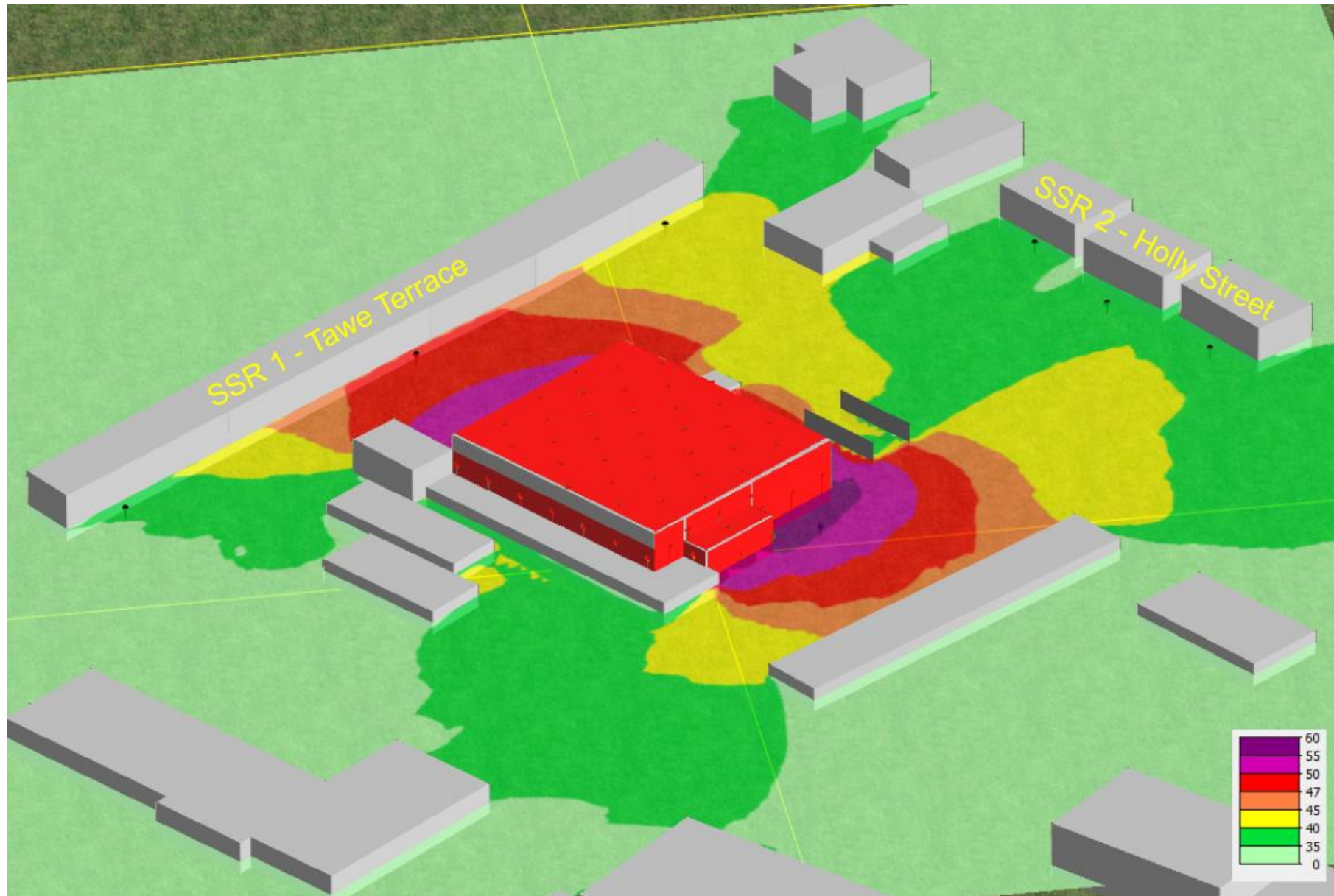
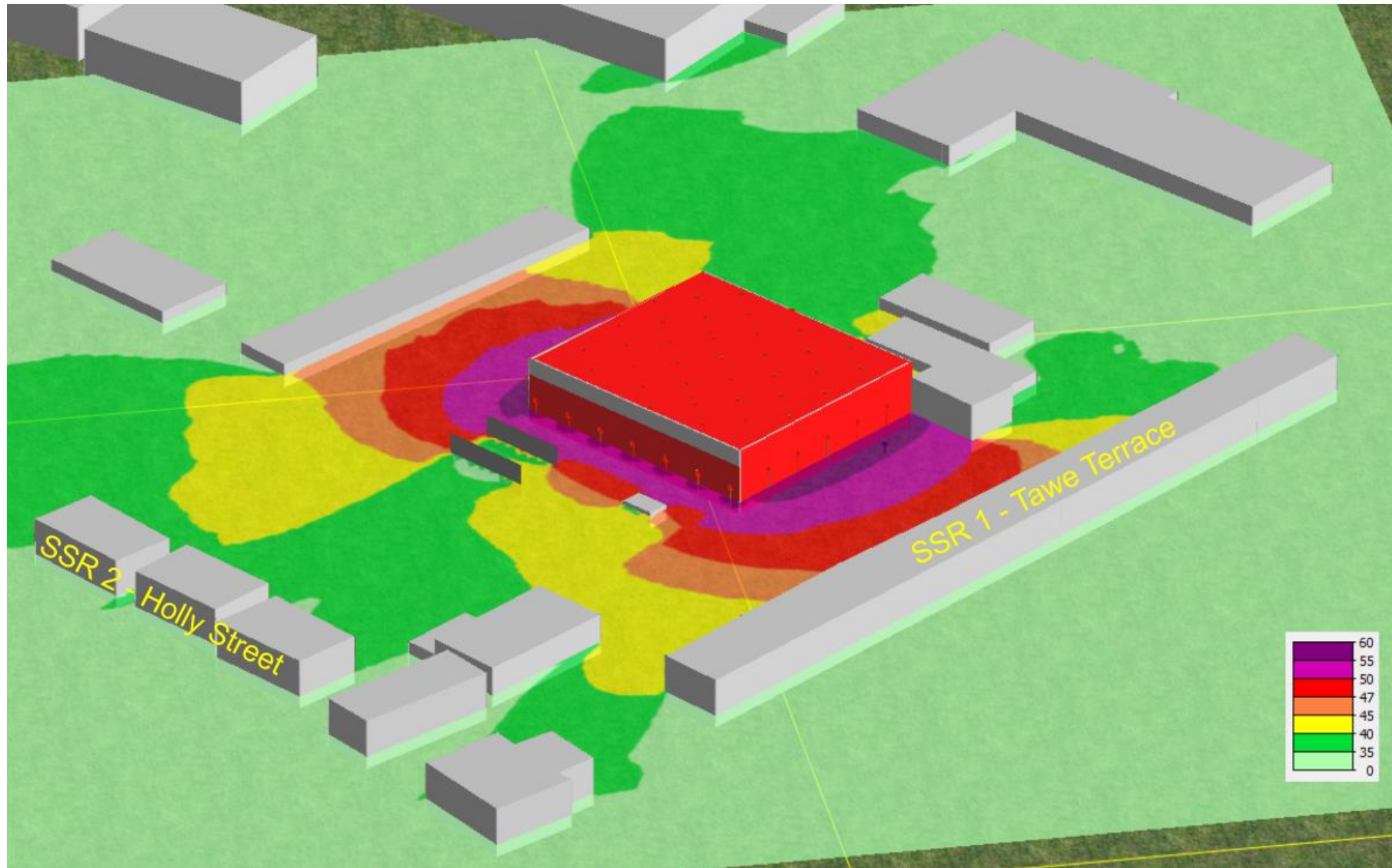


Figure C.3 – Daytime Noise Model $L_{Aeq,1hr}$ Contours at 1.5m Height (3D View from North-west)



APPENDIX D – BS 4142:2014+A1:2019 ASSESSMENTS

Table D.1 – BS 4142 Daytime Assessment at SSR1 (Tawe Terrace)

Results		Relevant Clause	Commentary
Predicted level at SSR1	$L_{Aeq} = 48\text{dB}$	7.3.2	Using ISO 9613 and measured source data
Residual sound level	$L_{Aeq} = \text{N/A}$	7.3.3	No residual correction as using predicted level
Background sound level (daytime)	$L_{A90(0700-1800\text{hrs})} = 48\text{dB}$	8.1.1 8.1.3 8.3	Background sound level measured at Position A
Assessment made during the daytime so the reference time interval is 1hr.		7.2	
Specific sound level calculated by correcting the ambient sound level to remove the contribution of the residual sound level.	$L_{Aeq,1hr} = 48\text{dB}$	7.3.4	No residual correction as using predicted level
Acoustic feature correction	3dB	9.2	Allowance of +3dB for specific sound being “readily distinctive against the residual acoustic environment”.
Rating Level	$(48 + 3) = 51\text{dB}$		
Background sound level (daytime)	$L_{A90(0700-2300\text{hrs})} = 48\text{dB}$	8.3	
Excess of rating over background sound level	$(51 - 48) \text{ dB} = 3\text{dB}$	11	
Assessment indicates adverse impact unlikely depending on context		11	At 3dB above background BS 4142:2014 advises: “is less likely to be an indication of an adverse impact, depending on the context”
Uncertainty of assessment		10	Uncertainty in background noise measurements is considered low. Source data has been measured at the site and the model calibrated.

Table D.2 – BS 4142 Daytime Assessment at SSR2 (Holly Street)

Results		Relevant Clause	Commentary
Predicted level at SSR1	$L_{Aeq} = 40\text{dB}$	7.3.2	Using ISO 9613 and measured source data
Residual sound level	$L_{Aeq} = \text{N/A}$	7.3.3	No residual correction as using predicted level
Background sound level (daytime)	$L_{A90(0700-1800\text{hrs})} = 48\text{dB}$	8.1.1 8.1.3 8.3	Background sound level measured at Position A
Assessment made during the daytime so the reference time interval is 1hr.		7.2	
Specific sound level calculated by correcting the ambient sound level to remove the contribution of the residual sound level.	$L_{Aeq,1hr} = 40\text{dB}$	7.3.4	No residual correction as using predicted level
Acoustic feature correction	3dB	9.2	Allowance of +3dB for specific sound being “readily distinctive against the residual acoustic environment”.
Rating Level	$(40 + 3) = 43\text{dB}$		
Background sound level (daytime)	$L_{A90(0700-2300\text{hrs})} = 48\text{dB}$	8.3	
Excess of rating over background sound level	$(43 - 48) \text{ dB} = -5\text{dB}$	11	
Assessment indicates low impact depending on context.		11	With no excess over background BS 4142:2014 advises: <i>“this is an indication of the specific sound source having a low impact, depending on the context”</i>
Uncertainty of assessment		10	Uncertainty in background noise measurements is considered low. Source data has been measured at the site and the model calibrated.

APPENDIX E - DRAWING LISTS

The following Brother Engineering Ltd. drawings and documents have been used in our assessment;

Table E.1 – Drawing List

Drawing Title	Drawing Number	Rev	Date
Bus Station Layouts 1-6	L002	-	November 2020